

# Whose habitat? Exploring human-tiger conflict in the riskscapes of the Indian Sundarbans

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## Abstract

The Indian Sundarbans, the world's largest littoral mangrove stretch, draws attention in scientific discourses, being an ecosystem vulnerable to global climate change and a biodiversity hotspot governed under institutionalized protected area management. The Sundarbans are well-known as the world's only coastal mangrove habitat of the man-eating Royal Bengal Tigers. This UNESCO World Heritage Site often features in media coverage and popular discourse due to a surging number of human-tiger conflicts. Whenever such incidents happen, the popular narratives project them as an outcome of community intrusion and illegality, violating the norms of reserved and protected areas. Remedial measures often call for a stricter imposition of conservation rules. This article exposes the limits of such portrayals. Introducing the conceptual framework of riskscapes, it argues that to understand the human-tiger conflict, it is necessary to explore the comprehensive risk situation and the multiple risk entanglements in the Indian Sundarbans. Through ethnographic explorations on the Gosaba block, we present the human-tiger conflict as a node to assess multiple risk imaginaries and their production, development, and mutual entanglements. Further, we demonstrate the gradual marginalization of the community in the composite impact of these plural risk imaginaries. We suggest the necessity of localized livelihood generation informed by the existing risk ensemble and anchored to local community aspirations.

**Key Words:** Riskscapes, human-tiger conflict, Indian Sundarbans

## Résumé

Les Sundarbans indiens, la plus grande étendue littorale de mangroves au monde, constituent un écosystème vulnérable au changement climatique mondial et un haut lieu de biodiversité régi par une gestion institutionnalisée des zones protégées. Les Sundarbans sont connus pour être le seul habitat côtier de mangroves au monde où vivent les tigres royaux du Bengale, réputés pour être des mangeurs d'hommes. Ce site classé au patrimoine mondial de l'UNESCO fait régulièrement la une des médias en raison du nombre croissant de conflits entre les hommes et les tigres. Chaque fois qu'ils se produisent, les récits populaires les

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présentent comme le résultat d'une intrusion de la communauté et d'une illégalité, violant les normes des zones réservées et protégées. Les mesures correctives préconisent souvent une application plus stricte des règles de conservation. Cet article expose les limites de ces descriptions. En introduisant la notion de « riskscapes », il soutient que pour comprendre les conflits entre les humains et les tigres, il est nécessaire d'explorer les multiples enchevêtrements de risques dans les Sundarbans. Grâce à des explorations ethnographiques dans le bloc de Gosaba, le conflit entre les humains et les tigres révèle des imaginaires de risque ainsi que leur production, leur développement et leurs enchevêtrements mutuels. Nous démontrons la marginalisation progressive des communautés sous l'impact composite de ces imaginaires de risque pluriels. Nous suggérons la nécessité de créer des moyens de subsistance localisés, fondés sur l'ensemble des risques existants et ancrés dans les aspirations des communautés locales.

**Mots clés:** Riskscapes, conflit entre les humains et les tigres, Sundarbans indiens

## Resumen

Los Sundarbans indios, la mayor extensión de manglares litorales del mundo, son un ecosistema vulnerable al cambio climático global y un punto caliente de biodiversidad gestionado como área protegida. Los Sundarbans son el único hábitat costero de manglares del mundo donde habitan los tigres de Bengala, conocidos por devorar seres humanos. Este sitio declarado Patrimonio de la Humanidad por la UNESCO aparece en los medios de comunicación debido al creciente número de conflictos entre humanos y tigres. Las narrativas populares los describen como resultado de la intrusión de la comunidad y la ilegalidad, violando las áreas protegidas. Las medidas correctivas exigen una imposición más estricta de las normas de conservación. Este artículo expone los límites de tales descripciones. Al introducir los «riskscapes», sostiene que el conflicto entre humanos y tigres tiene múltiples entrelazamientos de riesgos. Las exploraciones etnográficas en el bloque Gosaba muestran imaginarios de riesgo y su producción, desarrollo y entrelazamientos mutuos. Demostramos la marginación gradual de las comunidades y los riesgos a los que se enfrentan. Sugerimos la necesidad de generar medios de vida localizados, basados en el conjunto de riesgos existentes y anclados en las aspiraciones de la comunidad local.

**Palabras clave:** Riskscapes, conflicto entre humanos y tigres, Sundarbans indios

## 1. Introduction

As our boat was moving through the forest creeks towards Satjelia on a mild winter morning, we found some pieces of red clothes tied up with the stems of some of the mangrove trees at different places. Later, the local people informed us that those are tied as markers of human casualties by tiger attacks to alert future visitors about the chance of encountering a tiger. The next day, our destination was Kumirmari Island village. While the boat was approaching the island, we saw a concrete statue of a Royal Bengal Tiger (*Panthera tigris tigris*) on the entry gate of the jetty. Such observations led us to realize the tiger's significance in the cognitive and socio-cultural space of the Sundarbans.

None of us holds a Boat License Certificate (BLC) here. We have to thus illegally trespass into the forest. We do have a tremendous fear of tigers as well as forest officials! If the officials could arrest us, they would confiscate our collections from the forests. We are poor people. We have to work arduously to secure a square meal. Otherwise, how could we make ends meet or feed our children?

That is how Nitai Sardar (name changed) was expressing his despair on a fine January morning at Tipligheri area from Lahiripur *gram panchayat*<sup>2</sup> (GP) in Gosaba block. Northern breezes were blowing from the other side of the ring bund. Squatting on the concrete floor, he hunched forward and showed the wounds

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<sup>2</sup> Gram Panchayats (GPs) – the lower most administrative layer at the three-tier rural level administrative mechanism in India.

of tiger claws on the right side of his upper back. Fortunately, he had returned alive. That day Nitai went to the forest to collect *Nypa* leaves. Their boat was a larger one (which are usually utilized for collecting *Nypa*, *Nypa fruticans*). The tiger abruptly jumped. It tried to pull him out of the boat with its claws, but failed before falling into the water. While describing the incident, Nitai was literally sweating even on such a chilling winter morning. We could read the overwhelming trauma wrapping his skinny face. He added that during such encounters, out of immense fear and trauma, people forget to chant the name of the forest deity Bonobibi.<sup>3</sup> Nitai's life was saved from the tiger attack, but permanent injuries meant he was unable to do physically intensive work.

Amongst the 14 Gram Panchayats (GPs) of Gosaba block, 8 are located directly opposite the Sundarban Tiger Reserve (STR). The rivers *Gomdi*, *Gomor*, *Sajina*, and *Melmel* mark the boundaries between the villages and the forests. Most of the village households depend on forest resources and small-scale fishing in the rivers and forest creeks for their daily livelihoods. Moreover, extreme weather events like cyclonic floods hit the Sundarbans islands and affect the local agriculture-based livelihoods due to saline floodwater intrusion. Such cases result in more dependence on forest produce and fishing in the forest (Danda, 2007; Danda & Rahman, 2019). The chances of tiger attacks automatically rise. During the COVID-19 lockdown period, two severe cyclones, Amphan (2020) and Yaas (2021), hit the Indian Sundarbans back-to-back in consecutive years. Besides their direct effects on the life and livelihood of the inhabitants, they also impacted human-tiger conflict in the region. Between 2020 and 2021, human-tiger conflict in the Sundarbans appeared in mainstream media coverage regularly, with nearly 31 deaths reported (Mitra, 2021). The Sundarbans Tiger Reserve authority's record revealed 13 cases between 2020 and 2021, where 11 cases were registered in 2021 only (TV9Banglalive, 2022). Further, during the first couple of months in 2022, there were more than five cases reported where the victims came from the Gosaba block<sup>4</sup>, as revealed from the respondents during our fieldwork in March 2022.

Whenever such incidents take center stage, debates are generally sparked by the issue of protected area governance and the denial of local inhabitants' rights and access to their living landscapes. The Indian Sundarbans, a biodiversity hotspot of global repute and a UNESCO World Heritage site (Das *et al.*, 2023), is no exception. Scholarship on ecology and biodiversity conservation in the Indian Sundarbans often points to human activities and weather extremes as the cause of conflicts with tigers (Gopal & Chauhan, 2006; Jhala *et al.*, 2008; Loucks *et al.*, 2009; Das, 2017). It highlights the role of human alteration of the forested lands and other human activities, including the forest incursions, as responsible for habitat destruction, affecting the tiger's prey-predator ratio (Jhala *et al.*, 2008; Loucks *et al.*, 2009; Singh *et al.*, 2015). Extreme climatic events are often cited as an entry point for human-tiger conflict in the Indian Sundarbans, since the boundary between human habitation and forested area gets blurred during cyclonic inundations (Gopal & Chauhan, 2006; Das, 2017). Such studies advocate for more rigorous and strictly enforced conservation regulations.

On the other hand, the political ecology of conservation in the Sundarbans shows how a fortress type of conservation landscape is produced at the interface of biodiversity protection and the political economic dynamics of the state, at the cost of violating inherent rights and access for the local communities to forest resources (Ghosh, 2014; Sen & Pattanaik, 2017; Roy, 2020; Ghosh *et al.*, 2022). These works foreground the distance of the community from conservation governance, causing discord in human-wildlife cohabitation. They demonstrate how political-economic drivers of institutionalized conservation governance lead to an escalation of a range of livelihood risks for forest-dependent communities, which includes the risk of human-tiger conflicts. Local communities and their agency, aspirations, and knowledge should be integrated into governance and institution making (Ghosh *et al.*, 2023; Sen *et al.*, 2024). Anthropological research, while exploring the conservation issue of the Indian Sundarbans, highlights how less attention is given to the social life of the region in dealing with the major concerns of biodiversity management and ecological stress (Jalais, 2007). It shows how the modern global discourse of conservation, the iconography of the Royal Bengal

<sup>3</sup> Bonobibi – The folk deity of Sundarbans, believed to be the protectors of the forest and the forest-dependent people in Sundarbans.

<sup>4</sup> Block – Sub-district.

Tigers, and the neo-liberal politics of protected area management curtails the access and rights of local inhabitants (Jalais, 2014). A comparison among these three major theoretical frameworks centered on human-tiger conflict shows that whereas the conservationists have overlooked social concerns, the social scientists, whether political ecologists or anthropologists, have paid less attention to nature and ecology and some interrelated risks. There are clearly existing risks of diverse origins, producing a co-production of incidents like human-tiger conflicts.

We argue that to explore human-tiger conflict, a holistic theoretical framing is needed. We use the theoretical foundation of political ecology with a riskscape framework developed by Müller-Mahn & Everts (2013) to explore and understand human-tiger conflicts in the Indian Sundarbans (Müller-Mahn & Everts, 2018). The theoretical development of the concept of riskscapes traces its roots to the political ecology of risk and hazardscape (Mustafa, 2005; Müller-Mahn & Everts, 2013; Wescoat Jr., 2015). The concept of hazardscape presents a hazardous space as an imaginary landscape founded on societal practice and power relations (Mustafa, 2005; Wescoat Jr., 2015). The term riskscapes describes a temporal-spatial phenomenon that combines the material-physical dimension of risks and their perceptions across the social practices, power dynamics, and diverse agency and stakeholders (Müller-Mahn & Everts, 2018: 87). Riskscapes are an ensemble of multiple mental maps or imaginaries characterized by complex, multiple, and overlapping risk settings (Müller-Mahn & Everts, 2018). The concept helps to orientate existing discourses, representations, and the production of risks through different social practices (Müller-Mahn & Everts, 2018; Brochet & Guerrin, 2022). Further, a riskscape encompasses diverse risk imaginaries, gaining a collective understanding of a complex risk scenario and informing the perils and potential remedial directions of tackling risk (Müller-Mahn & Everts, 2018). We present the production and development of the risk of human-tiger conflict at the intersection of other existing riskscapes. These are produced as an outcome of different political and social practices over different temporal scales. We also demonstrate how the composite impact of existing riskscapes is pushing a particular community towards distant marginalization. Localized livelihood generation must be anchored to the aspirations, stakeholdership, and participation of the local community.

## 2. Study area and methodology

The Sundarbans is the world's largest stretch of littoral mangroves and a biodiversity hotspot of global repute, jointly shared between Bangladesh and India, located at the low-lying southernmost part of the Ganga-Brahmaputra-Meghna (GBM) Delta (Chowdhury *et al.*, 2016; Bose & Joshi, 2024). It is a UNESCO World Heritage Site hosting a diverse species of flora and fauna, and also globally well known for being a coastal mangrove habitat of the Royal Bengal Tiger (Gopal & Chauhan, 2006; Das *et al.*, 2023). The Sundarbans Royal Bengal Tiger is globally well known for preying on humans as well as an ability to swim long distances between islands and to migrate across the national border. They climb trees, and are adapted to intertidal shifts, habitat change, and lead an 'amphibious life' (Mallik, 2013).

The Indian Sundarbans (9,630 km<sup>2</sup>) spanning over 102 islands in the state of West Bengal, India, is partially inhabited and partially forested (WWF, 2017). This was gazetted as the Sundarban Biosphere Reserve (SBR) in 1989 (Das *et al.*, 2023). Some 54 islands (4,263 km<sup>2</sup>) out of 102 fall within the reserve forest area, which is governed by a three-tier protection mechanism divided into three regulation zones: 1. 'Sundarbans Reserve Forest' area (SRF), 2. 'Sanctuary' areas, and 3. the 'Core' area (Ghosh *et al.*, 2022). The Sundarbans Reserve Forest (SRF) area allows human entry with licenses and permissions issued by the government. In the sanctuary areas, no human activity other than State-sponsored tourism is permitted and the core area of the National Park attains the highest degree of protection: any kind of human activities are prohibited (Ghosh *et al.*, 2022). The rest of the 48 islands spanning over 5,367 km<sup>2</sup> host a large population of 4.5 million people (WWF, 2017; Bose & Joshi, 2024). This inhabited part is the transition zone and administratively divided into 19 Community Development (CD) Blocks (sub-districts) within the districts of North and South 24 Parganas in West Bengal (WWF, 2017).

The Sundarban Tiger Reserve (STR) has been operational since 1973. It encompasses 15 uninhabited forest blocks spanning over a geographical area of 2,585 km<sup>2</sup>, out of which 1,680 km<sup>2</sup> area is the forested

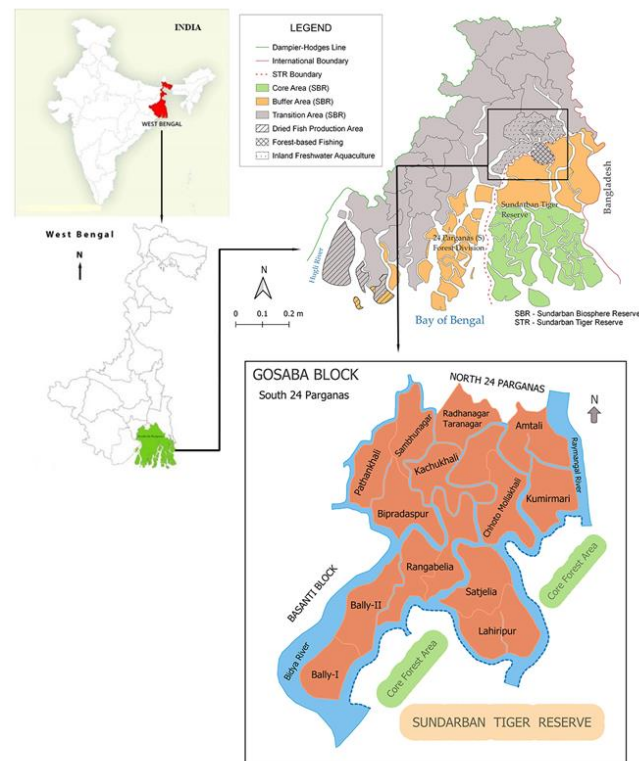
zone and the rest is water bodies (Chowdhury *et al.*, 2016). The STR comprises a core or wilderness zone, a primitive zone, a subsidiary wilderness zone, and a buffer zone that is home to a significant population of the critically endangered Royal Bengal Tiger (Chowdhury *et al.*, 2016).

The 102 islands across the Indian Sundarbans are bordered by networks of rivers, creeks, and rivulets. The delta geomorphology is fluid – neither land nor water, but a liminal-dichotomous space at the mercy of tidal changes (Lahiri-Dutt, 2014; Ghosh, 2004). Also, the region is vulnerable to the severe effects of recurrent tropical cyclones and storm surges, coastal erosion and land submergence, sea level rise, and rising temperatures (Hazra *et al.*, 2010; Brown & Nichols, 2015; Danda *et al.*, 2019; Saha *et al.*, 2022; Roy & Ghosh, 2024). These have implications for the lives and livelihoods of largely economically marginalized and socially vulnerable groups. Further, the degree of vulnerability and marginalization in the social life of the inhabitants are varied across different local patches, with a narrative of difference between upper-island people and lower-island people, and people living in the core or the periphery of an island (Jalais, 2014). The upper islands are to the north, where the delta-making process is more stable than the active deltaic part of the southern islands. The social life and the institutional approach to the inhabitants varies across these landscapes. The southern islands are more marginalized and vulnerable to hazards due to their remoteness, volatile delta geomorphology, and the lack of good governance at the institutional level to foster livelihood improvements and infrastructural support (Jalais, 2014; Mukhopadhyay, 2016).

Our study area – three selected forest-fringe Gram Panchayats (GPs) – Satjelia, Kumirmari, and Lahiripur, falls under the Gosaba block (22°16' N 88°80' E) (Map 1), from the eastern part of the Indian Sundarbans. Satjelia and Lahiripur GPs belong to the same island named Satjelia, and Kumirmari is one island village, one GP. According to the Census of India (2011) Gosaba block supports a total rural population of 246,598 people (125,910 male and 120,688 female). Satjelia, Lahiripur, and Kumirmari have a population of 18,081, 21,838, and 17,451 (Census of India, 2011). The Gosaba block is located on the other side of the Sundarbans Reserve Forest and the Sundarban Tiger Reserve (STR) (Chowdhury *et al.*, 2016). The remoter parts of the block are exposed to tropical cyclones, floods, land erosion and submergence, and tiger attacks (Mukherjee *et al.*, 2024). Gosaba is severely poverty-stricken and underdeveloped. Rain-fed mono-cropping is the principal livelihood activity, though groundwater irrigation-fed agriculture is increasingly common. Many villagers practice inland fishing in the household or common waterbodies (Gogoi *et al.*, 2020). However, they lag in terms of infrastructural support, technical know-how, and access to the market value chain. Many inhabitants depend on the forest for fishing and honey collection, but face tiger attacks. Multiple drivers, from the biophysical environment to conservation governance and enforcement, shape the risk exposure of Gosaba residents. Their community risks, vulnerabilities, deprivation, dispossession, and distress are mirrored across the Sundarbans.

We studied Satjelia, Kumirmari, and Lahiripur because all suffer tiger attacks, revealed in research visits in 2021. Also, the study areas had been severely devastated during the cyclone Amphan of 2020 (Ghosh, 2020). Further, the islands were affected by another cyclone, Yaas (2021), within a year. Both took place during the countrywide COVID-19 lockdown. The result was a growing dependence on the forest resources among the forest community.

Qualitative fieldwork was conducted between 2021 and 2022 by all the authors in the three communities. We conducted focus group discussions (FGDs), key informant interviews (KIIs), participant observation, and transect walks across the islands as well as informal interactions and one-to-one informal conversations. Respondents were interviewed through an inductive process to explore their subjective experiences of risks, vulnerabilities, and perceptions associated with human-tiger interface conflicts, including their escalation during the pandemic. Interviews and field notes were transcribed and documented to capture the narratives, observations, and subjective experiences of the respondents, and probed to uncover diverging meanings.



Map 1: Study Area (Gosaba block, Indian Sundarbans Delta). Source: Raktima Ghosh.

### 3. Results

At Lahiripur, while Nitai was elaborating on his story (in the Introduction), Minati Sardar (name changed) narrated her experience of encountering tigers. Minati and her father went to the forest creeks to catch crabs. Her father was pulling the net (locally termed 'Don', a traditional, benign net designed for catching crabs) from the boat when a tiger suddenly jumped and collided with it. Her father fell into the water, and the tiger took him from there. Minati also survived since she had fallen on the other side of the boat. While narrating his experience, Nitai mentioned that people possessing boat licenses can apply for compensation from the Forest Department if such a mishap occurs. Minati readily opposed this, informing him that the process was complex and tedious. That's why she didn't pursue compensation despite having a BLC. Additionally, it emerged from the conversations that forest-going individuals could lease a BLC at a certain cost from enlisted BLC holders. Prashanta Mondal (name changed) lost his mother in a tiger attack while gathering prawn seeds (broodstock) from a forest creek. He mentioned that only a few individuals can afford to lease BLCs. The cost for a season in the tiger reserve is INR 40,000-45,000 (US\$467-526). Fresh BLC issuance has been suspended for several years. Most marginalized fishers find it challenging to pay the upfront cost for leasing BLCs. As a result, they are forced to enter the forest, putting their lives at risk and facing denial of compensation if casualties occur from tiger attacks in that area.

From the rationale of protecting the core area from anthropogenic activities, the buffer zone of the STR has been divided into a recuperation zone and a multiple-use zone by the State Forest Department. Forest fishers (those fishing in the forest creeks and estuaries) can access the permitted water bodies under the jurisdiction of SBR with BLCs issued by the government (Sen & Patnaik, 2017). Studies show that within the STR, only 650 BLCs are operational out of the total 923 issued BLCs (Sen & Patnaik, 2017). The number of

available BLCs is far lower than the actual demand. The ownership of these BLCs is predominantly affluent local groups, including rich farmers and fishing enterprise middlemen, popularly termed *aratdaars* or *khotidaars*, whose ancestors were fishers (Sen & Pattnaik, 2017).

The narratives of livelihood struggles among the forest-fringe villagers in accessing forest resources reveal a conflicting picture of nature-society interactions within the realm of fortress-type conservation, which draws foundations in colonial forestry and the colonial calculus of rule (Danda, 2007; Guha 1985; D'Souza, 2006; Ghosh, 2014). Studies reveal that there are more than 0.22 million people residing in the northwestern part of the STR within 2 km of the buffer zone who are likely to be exposed to a high chance of encountering tiger conflicts, as most of them are forest-dependent (Sundaramoorthy, 2009). Furthermore, many of these conflicts remain under-reported, as people venture into the forest in extra-legal ways. Studies demonstrate that between 1985 and 2009, 789 people were victims of tiger attacks, with 666 of them dying, registering an average of 27.75 occurrences per year (Das, 2017). Over the span of 24 years (1985 – 2009), empirical records show that 59% of the tiger attack victims belonged to the Gosaba block (Das, 2017). According to the occupational profile, 80% of the victims were forest fishers, including crab collectors, followed by honey collectors (14%), woodcutters (5%), and forest staff (about 1%) (Das, 2017). In a few instances, people survived tiger attacks. However studies found that in only 13% of cases in human-tiger conflict did people return alive (Das, 2017).

In exploring the roots of increasing human-tiger conflicts, some studies indicate changes in the estuarine hydro-salinity of the forested rivers (Hendrichs, 1975). Global climate change also plays a role in shaping this situation. On the other hand, zoologists often point to the over-dependence on the forests (Das, 2017). Traditionally, the forest fringe dwellers in Gosaba are extensively dependent on forest resources, including forest fishing, which they popularly call *jongol kora* (forest venturing and collecting forest produce). Such practices have steadily increased in the aftermath of natural hazards like cyclones and coastal flooding. After cyclonic surges, saline water from the Sundarbans Rivers intrudes into farming lands and water bodies through embankment breaches (Roy & Ghosh, 2024). Global climate change plays an enabling role in triggering more frequent cyclones in this region. Therefore, more people venture into the forest once a cyclone strikes the islands. This was also observed in the cases of cyclones Amphan and Yaas (Ghosh, 2020; Mukherjee, 2020). Gosaba was one of the worst-affected blocks during Amphan (Ghosh, 2020). Moreover, the COVID-19 pandemic lockdown triggered a reverse migration of migrant workers from the Indian Sundarbans who had left in search of better income opportunities. Secondary sources show that about ten thousand migrant laborers from the Indian Sundarbans Delta were compelled to return during the COVID-19 lockdown, leading to increased dependence on forest resources and forest fishing (Mitra, 2021). As a result, there was an increase in incidents of tiger attacks (Mitra, 2021).

At least 25 people from here reported to be died due to Tiger attack in the last year (2020)! People compelled to rely more on forest resources as simultaneously being hit by Amphan and covid lockdown when many of the local folks had lost their job and returned to their native places. In the aftermath of frequent instances of encountering tiger-attacks, the propelling trend of venturing into the forest has found a recent decline.

Respondent Asit Mondal, a male forest fisher from Kumirmari, Gosaba, in an FGD

Asit Mondal (name changed), one of the respondents involved in forest fishing, was describing the scenario during an FGD in the courtyard of a village community centre in Kumirmari. There was debris from concrete pillars lying just next to the courtyard. One of the respondents informed us that previously it was a *pucca* community gathering space. That was toppled during Cyclone Amphan (2020). The respondents said most of the inhabitants in this area depend on monocropping, and some of them conduct inland fishing for domestic consumption. Due to recurrent cyclones, the island village was affected by saline water inundation through embankment breaching. The saline water intruded into their farmlands and water bodies, meaning livelihood losses. Many respondents said they had no options left other than to halt farming at least for 2-3

years and to migrate to work elsewhere. Similar things happened when cyclone Aila (2009) hit the region, as the respondents remember. Those who were unable to migrate had to rely on the forest for catching fish or crabs in the forest creeks and collecting honey, bee-wax, wood, *Nypa* leaves (locally popularized as *Golpata*) to secure some ready cash, selling their forest produce against a nominal investment. *Jongol Kora* entails risks of tiger attack or getting caught by the forest officials (if they are trespassing without a BLC). The same situation persisted after the cyclonic disruptions of Amphan (2020) and Yaas (2021). Additionally, the COVID-19-induced reverse migration made the situation worse and resulted in a spike in human-tiger conflicts.

We conducted another focus group with forest fishers at Budhbaar Bazar in Kumirmari. One of the veteran women fishers, Kajal Mandal (name changed), described how she and her husband survived a tiger attack. In January 2021, the couple entered the forest creek on a small boat to catch fish. Another person from their neighborhood joined them. He was not a traditional forest fisher, joining them out of necessity during the COVID-19 lockdown to generate income. The three of them were returning from Bhangakhali forest, casting the net from the boat, when they suddenly encountered a Bengal Monitor (*Varanus bengalensis*, a lizard up to 175cm in length) fleeing in front of the net. Her husband, drawing on his age-old expertise in forest fishing, anticipated that something might be hiding in the nearby jungle, so he decided not to move the boat further as it was amid low tide. A third person from their neighborhood started unloading the net with her husband while Kajal was busy sorting the fish. Suddenly, a tiger attacked the third man and dragged him into the forest. Later, the couple admitted that the local Panchayat Head mediated for a financial settlement; they could not have even retrieved the body themselves. Moreover, there was a high chance that the couple could have been sentenced by the forest authority for entering the forest without a BLC (the complex procedure of obtaining settlement is explained below for another case). Out of curiosity, we asked them why they would have been sentenced when someone from their end had died in a tiger attack. Kajal promptly replied,

Tigers belong to the Sundarbans Tiger Reserve, and people like us are the invaders in the eyes of the forest department.

The couple informed us that their ancestral homestead is located on the upper island of Sonakhali. They hardly had any assets, such as farming land and other belongings there, a few decades ago. They migrated downward and started venturing into the forest. Gradually, they managed to buy nearly 2.5 acres (1 ha) of farmland and house in Kumirmari. While reminiscing about their entire journey seeking livelihood sustenance, Kajal mentioned,

We managed all these livelihood supports and belongings by depending on the forest. How can we refrain from doing that?

Kajal's husband later added that taking risks has been an integral part of their daily livelihood. For them, dependence on the forest is the only way to secure income, and there are no other alternative opportunities for livelihood generation, as they perceive things. Anyone might survive the risks of tiger attacks, but no one could escape the forest officials if caught without a BLC. Due to the acute shortage and excessive rents of the BLCs, most marginal forest fishers try to avoid the patrolling boats and enter the forest without a license. If a fishing boat takes a simpler route to reach a permitted fishing area in less time, it must cross the wildlife sanctuary, which falls under the inviolate area of the buffer zone (Chacraverti 2014: 64). However, the Forest Department does not allow innocent passage through the inviolate and core areas of the forest. All respondents reported verbal abuse from the forest guards when found in a core conservation area during a passage, and some reported physical abuse. Forest fishers are often confronted by the forest guards even in the buffer zone, simply because the guards presume these fishers are retreating from restricted or core areas. Their boats, BLCs, fish catches, and fishing nets are confiscated, and heavy fines are instantly imposed.



Sometimes, forest officials seemed to be more terrifying than the tigers. Once we are caught, forest officials seize our catches, nets, spades, iron bars, and groceries required to cook meals on the boat. We are summoned to the Bagna bit office with a fine of INR 3000 to INR 4000 (US\$35-47). To earn an amount of INR 1000 (US\$11.70), we pay a fine of INR 3000-4000 once the forest officials catch us. If anyone falls prey to a tiger, their family cannot claim compensation as they are intruders in the eyes of forest officials.

Lakhan Sardar (name changed), a veteran forest fisher from the Budhbaar Bazar area, Kumirmari in a KII

Different amounts are charged for different types of fishing gear when officials catch a forest fisher and seize their boats. For a fishing net, they charge around INR 700 (US\$8.20). For 'Dons' (a benign net used to catch crabs), they charge INR 500 (US\$5.85). If they find a boat that has collected wood, the amount goes up to INR 1000.

The respondents perceive that cyclonic hazards and coastal surges have become more frequent and intense over time. In Satjelia, Kumirmari, and Tipligheri, villagers reflected their discontent and concern with the current system of embankments while responding to their risk exposures and vulnerabilities. They pointed out how the poor management and lack of proper planning of the embankment system have escalated their exposure to cyclonic surges and the subsequent salinization hazard affecting agriculture. The State Department of Irrigation and Waterways is responsible for flood management and the drainage system of the Indian Sundarbans. The local *gram panchayat* works as the executive agency on the islands.

Since the onset of Cyclone Aila (2009), perceived to be the most disastrous cyclone in recent times by islanders, the area still lacks an efficient embankment system. After Aila, funds were sanctioned by the central government for constructing embankments (popularly called 'Aila Embankment'), as devised and applied by the state. The state government was supposed to be the executing agency, but the work was not fully implemented due to the issues of land acquisition, which became a contentious political topic in West Bengal. A new ruling party came to power in West Bengal, gaining support from anti-land-grabbing movements. Consequently, the work on the Aila embankment was halted, and the funds were returned to the center. The risk of saline water intrusion became more serious when a tidal surge hit the island and caused coastal floods. The situation worsened during subsequent cyclonic floods, like Bulbul (2019), Amphan (2020), and Yaas (2021). As we have shown, villagers' reliance on forest-based resources has increased with these events, often entailing the risk of tiger attacks. In the erosion-prone riverbank locale, saline floodwater can persist for up to two weeks after cyclonic floods due to the weak embankment system. As the respondents from Kumirmari shared:

After Amphan (2020) and Yaas (2021), Saline water persisted even after 15 days. The embankment on this side is more vulnerable than the other side of the island. At the course of each of the high tides, fresh saline water entered this locale. If you even dig 2-3 meters deep inside the soil, you could find the traces of salinity. Therefore, we cannot even make a kitchen garden utilizing the minimal land share left after consistent erosion. We have no option other than venturing into the jungle despite being aware of the fact that we may encounter tiger conflicts.

Sunil Sardar (name changed), a young forest fisher from Tiplegheri, reported that many people migrated out after Cyclone Aila to seek jobs in various states, including Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, the Andaman Islands, and Delhi. He also went to Andhra with his father and worked as agricultural labor in the rice fields. However, after Cyclone Amphan (2020), they could not go anywhere for work due to the COVID-19 lockdown, and they depended on the forest again. Many respondents from other

islands shared similar reflections during the interviews. Sunil also mentioned the reverse migration of out-migrants during the Pandemic, illustrating how they became dependent on the forest after their agricultural lands and inland water bodies were repeatedly affected by saline water due to the two cyclones. This over-dependence on the forest increased their exposure to the risk of tiger attacks in the region. A migrant worker who became a forest fisher in Satjelia echoed this sentiment, saying,

We know that venturing into the forest entails the risks of tigers. What can one do when their agricultural fields are salinized and their household pond becomes salty? We have to feed our children. When the lockdown was declared, we were forced back from Bengaluru, where we were employed as construction workers. How could we rely solely on the government rationing system? We must venture into the forest to secure some income.

Through multiple informal interactions during fieldwork in Satjelia, Kumirmari, and Tipligheri, it became evident that vulnerable people lacking strong political connections faced discrimination in accessing disaster relief and compensation after Cyclone Amphan (2020). This correlated with the increasing dependence on the forest as they sought instant cash in the aftermath of disasters, leading to a rise in human-animal conflicts.

Forest-dependent individuals perceive that the number of human casualties in the forest's buffer zone often go unreported. They also believe many deaths in core areas are not reported due to fear of hefty fines and abuse. Such deaths cannot even be mourned publicly in the villages. The bodies of the deceased are often abandoned for fear of patrolling forest guards. If a fishing boat is spotted in the core area, these guards are exceptionally abusive. An accident in those areas results in further abuse directed at the other team members, regardless of whether the victim has survived or not. Deaths in core areas outnumber those in the buffer. If an accident occurs in the buffer area and the body is recovered, the crew on the boat and the family must go through procedures to claim compensation. First and foremost, before bringing the deceased to their family in the village, they must return to the forest office to inform them of the incident. The exact location of the accident must be provided. The forest guards accompany them to the accident site, inspect the area, and must be convinced (through remaining evidence such as the victim's clothes, blood spots, or the tiger's pugmarks) before confirming eligibility for compensation. However, cases where full compensation is granted are rare. For those whose loved ones cannot be recovered from a tiger attack, the family performs a different ritual: the spouse of the deceased shapes a flour dough into the form of a human body, and the flour dough is finally cremated in a pyre.

In the context of human-tiger conflict, the empirical accounts explored during fieldwork characterize the region as a contested landscape of multiple disruptive risks (Bahadur & Dodman, 2022) originating from various drivers. The evidence also demonstrates how different risk components from diverse sources (including bio-physical risks further amplified and altered by governance and global climate change, as well as risks related to forest conservation) contribute to the creation of multiple risk imaginaries characterizing the landscape from different perspectives. In terms of human-tiger conflicts, this study identifies the area as an ensemble of multiple risk imaginaries in mutual interactions. These risk imaginaries have been shaped by diverse socio-cultural practices influenced by various actors over time periods. Thus, we argue that to understand the ongoing discourse regarding human-tiger conflict, it is essential to explore and analyze the complex scenario arising from the interplay of different risk imaginaries or riskscapes to map potential concerns and solution pathways (Müller-Mahn & Everts, 2018).

#### 4. Discussion

The human-tiger conflict in the Indian Sundarbans highlights the importance of exploring how societal practices and political dynamics have contributed to the historical development of modern risk scenarios alongside the complex biophysical processes involved in various forms of risk production. It necessitates identifying the different risk imaginaries or riskscapes and their dynamics in shaping the current situation,

based on reviewing the role of historical social practices and political power relations in addressing this process of (risky)space-making. In this context, we believe that the conceptual framework of riskscapes, devised by Müller-Mahn & Everts (2013), holds relevance.

Concerning human-tiger conflict, our empirical accounts trace two principal riskscapes in operation: 1. The riskscape of saline water intrusion, and 2. The riskscape of forest intrusion. The development of these two riskscapes evolved in different ways across varying temporal scales and societal practices, leading to their current states. The foundational discourse of the first is rooted in the context of natural hazards and gradually underwent various transformations over time. Historically, natural hazards like tropical cyclones, tidal surges, and coastal inundation were prevalent in the Sundarbans' coastal deltaic geography, as revealed by the works of environmental historians and colonial records (Hunter, 1878; Pergiter, 1934; Ascoli, 1934; Chatterjee Sarkar, 2017). These sources detail the immediate and long-term implications of hazards for communities. Moreover, they illustrate how people cohabited with floods, viewing them as blessings for soil fertility and the rain-fed agricultural system in the land-water hybrid of the lower Bengal Delta (Lahiri-Dutt, 2014; Dewan, 2021).

Subsequently, colonial rule altered this perception by seeing floods as risks to their land-based revenue system (Hunter, 1875; D'Souza, 2002, 2006; Lahiri-Dutt, 2014). On one hand, they introduced hydrological interventions such as watertight embankments to separate land from water, disrupting the region's land-water hybridity (Lahiri-Dutt, 2014; Dewan, 2021). This contributed to sediment alteration in the lower Bengal Delta, resulting in issues like accretion loss and diminished riverbed navigability (Lahiri-Dutt, 2014; Bandyopadhyay, 2019; Rudra, 2019). On the other hand, a riverine, marshy, nomadic fishermen's land (Eaton, 1993) was transformed into a land-based revenue-generating agricultural system through the clearance of vast stretches of forest (Chatterjee Sarkar, 2017). Consequently, the natural hazard riskscape was transmuted into a flood riskscape, framing floods as risky phenomena before the commercialization of agriculture took off in the Sundarbans (Lahiri-Dutt, 2014). The colonizers served as agents of change, transforming the natural hazard riskscape into a flood riskscape.

In the post-colonial period, the inheritance of colonial hydrology continued to shape flood riskscapes. There were more risks of land erosion, submergence, and sea-level rise due to sediment alteration (Lahiri-Dutt & Samanta, 2013; Mehtta, 2018). Additionally, habitat formation from colonial reclamation and further demographic stress following the partition of Bengal caused the shrinkage of intertidal spaces on most of the islands protected by embankments (Rudra, 2019). Consequently, this increased the likelihood of transforming tidal currents into tall surges, with elevated risks of embankment breaches and coastal floods due to saline river water intrusion (Rudra, 2019). Moreover, the catalytic effect of climate change has made extreme weather events more frequent, rendering the Indian Sundarbans increasingly susceptible to cyclonic floods and sea-level rise, which has subsequent implications of erosion, subsidence, and notably, saline water intrusion into agricultural land and water resources (Hazra *et al.*, 2010; Brown & Nichols, 2015; Danda *et al.*, 2019; Roy & Ghosh, 2024; Bose & Joshi, 2024). Consequently, the flood riskscape has evolved into a riskscape of saline water intrusion, inflicting salinity on agricultural land and inland water bodies, directly affecting the farming and inland fishing livelihoods of the inhabitants and pushing them toward marginalization. The agency of transformation lies in global climate change, alongside institutional practices and the politics governing the fluidity of land and water, salt and sweet water, and the shifting images of the forest and the river (Mehtta, 2018; Bhattacharya, 2018; Mukhopadhyay, 2022).

The second riskscape of forest intrusion has also been produced by a series of transformations across different phases of risk production, shaped by multiple discourses and social practices. Initially, from the settlers' perspective, the dominant discourse focused on the risks associated with wild animals in dense forests. From early Brahminic settlements (from the 4th – 13th Century AD) and the arrival of Islamic Sufis to the inception of British colonial rule, the riskscape was characterized by the dangers of the wilderness (Niyogi, 1967; Eaton, 1993; Hunter, 1875; Pergiter, 1934; Ascoli, 1934; Chatterjee Sarkar, 2017).

Colonial governance led to widespread reclamation of forested lands for agriculture and settlements, driven by revenue interests (Hunter, 1875; Pergiter, 1934; Richards & Flint, 1990; Chatterjee Sarkar, 2017). As a collateral effect, this paved the way for human-tiger conflict due to habitat loss for tigers and alterations in prey-predator dynamics within the Sundarbans (Sen Nag, 2020). The colonizers needed to ensure that reclaimed estates were tiger-free to continue their revenue operations, promoting and incentivizing tiger hunts by employing hunters (Hunter, 1875; Pergiter, 1934). In the forested area, they introduced colonial scientific forestry, designating protected areas to facilitate sustainable resource extraction (MacKenzie, 1988; Guha, 1985; Rangarajan, 2005; Danda & Rahman, 2019; Ghosh *et al.*, 2022). They began to envision the forest as a riskscape of endangered ecology and biodiversity, consequently initiating a fortress-style protected area management model, at the expense of isolating forest-dependent inhabitants from access, rights, and stakeholderhood in forest management and its products (Sivaramakrishnan, 1999; Ghosh *et al.*, 2022).

The colonial forest governance exercised significant influence over these changes, a trend that persisted even after independence. As a result of colonial policies promoting tiger hunting and forest reclamation, tigers became an endangered species, leading to increased focus on tiger conservation once it was designated as the National Animal of India (Singh *et al.*, 2015). The Sundarbans Tiger Reserve and Project Tiger were established in 1973 (Sundarban Tiger Reserve, n.d.). Gradually, the combined influence of forest governance and global conservation movements advocated for pristine protected forests and wildlife devoid of human intrusion, viewing human intruders as potential risks. This resulted in the development of the riskscape of forest intrusion, wherein the principal discourse prioritizes the protection of forest resources and wildlife from the risks posed by human extraction and exploitation. As a counter-measure, strict rules, regulations, and patrolling were imposed within the forest.

The composite impact of the two intrusion riskscapes—1. Saline water intrusion, and 2. Forest intrusion – has culminated in the emergence of a third riskscape centered on human-tiger conflict. Empirical insights reveal that the dire consequences of the first riskscape compel the community to increasingly rely on forest resources. Consequently, the second riskscape becomes activated through stricter regulatory enforcement, resulting in heightened incidences of trespass. The mutual dynamics of these two riskscapes contribute to the production of human-tiger conflicts. The escalating instances of conflict further characterize the region as a human-tiger conflict riskscape (Figure 1). In this study, alongside the internal dynamics of the aforementioned riskscapes (saline water intrusion and forest intrusion), COVID-19 serves as a catalytic external driver, complicating their interactions and rendering the third riskscape more visible.

Within this riskscape framework, the context of human-tiger conflict illustrates that the community is confronted with a diverse array of risks. From the community's perspective, the first riskscape exposes them to multiple risks of post-cyclonic salinization and livelihood loss. The second riskscape labels them as criminalized resource extractors, exploiting protected forest areas. The third riskscape presents them with a broader risk of loss of life. As the first and second riskscapes deteriorate, they progressively activate the third riskscape at their intersection, thrusting the community into a precarious situation. But, in the Indian Sundarbans, discussions around human-tiger conflicts often treat each risks scenario distinctly. Occasionally, conversations focus more intensively on the second riskscape, questioning the ontology of intrusion (Jalais, 2014; Ghosh, 2014; Roy, 2020; Ghosh *et al.*, 2022). Such segmented perspectives become unable to recognize the interconnections and interactions among diverse risk systems or imaginaries in a risk ensemble. At this crossroads, the concept of riskscapes becomes instrumental in exploring interactions among multiple risk imaginaries within the risk ensemble of the Indian Sundarbans, assessing nodes of concern and potential directions for mitigation (Müller-Mahn & Everts, 2018).

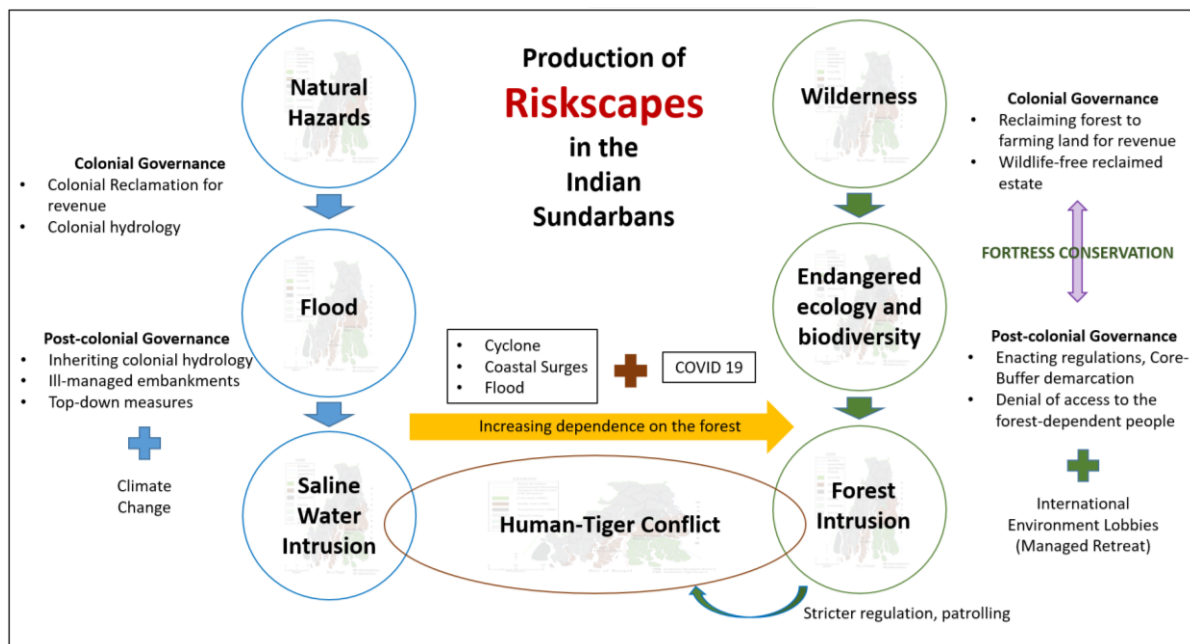


Figure 1: Production of riskscapes in the Indian Sundarbans. Source: Authors

## 5. Conclusions

This study has indicated that the alterations applied to the first riskscape are often top-down and neglect traditional community practices, a pattern also observed in the case of the second riskscape. Whereas the production, development, and evolutionary trajectory of the first riskscape enhances the community's social vulnerability, the same trajectory for the second one reshapes the dynamics of the community's relationship with nature and wildlife, particularly tigers. This coupled entanglement between the two, exacerbated by the enabling agency of COVID-19, amplifies the severity of the third riskscape, marking the landscape as a chokepoint (Cons, 2023). It is a chokepoint where the community is stifled by a convergence of multiple disruptive risks (Dodman & Bahadur, 2022). From the community's point of view, the third riskscape serves as an entry point to unfurl the intertwined risk systems of the Indian Sundarbans. It also foregrounds the community's continuing marginalization due to the outcomes of these diverse riskscapes. Thus, the riskscapes framework can be applied to suggest effective risk management and mitigation of human-tiger conflict are validated only when all three riskscapes are considered and studied together. In terms of risk mitigation, it indicates exploring the alternative localized livelihood opportunities rooted in community aspirations, simultaneously informed by all these existing and interacting riskscapes.

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