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## Alternative green livelihood initiatives: an effective way to achieve the sustainable development goals at disaster vulnerable, Indian Sundarbans

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### Abstract

Indian Sundarban is the part of world's largest contiguous mangrove forest, delta and home to around 4.6 million people. Climate change induced natural disasters are rampant along its coasts destabilizing lives and livelihood in the region. Green alternative livelihood schemes addresses the Sustainability Development Goals (SDG), namely SDG-1 (No poverty), SDG-2 (Zero hunger), SDG- 8 (Decent work and economic growth), SDG-10 (Reduced inequalities) and it indirectly impart conservation of mangrove ecosystems (world's largest blue carbon sink) by reducing nature exploitive livelihood options (SDG- 13, Climate action). A project implemented at Indian Sundarbans, since 2017 introduced alternative livelihood options (Cycle Van transport, Van Repairing Shop, Grocery Shop, Tea Stall) to total 471 marginalized families who has been making 1,629.00 INR per month by 2021. External evaluation report indicated an average of 40472.50 INR annual income. As per this study, Tea stall is most profitable small business followed by Cycle Van transport, Grocery Shop and Grocery Shop.

**Keywords:** Alternative livelihood; Sustainable development goals; Sundarbans; Climate vulnerability; Rural development



## 1. Introduction

The Sundarbans Forest is the world's biggest estuarine mangrove forest, located in West Bengal (India) and Bangladesh's 24 Paraganas district. It is located at the convergence of the Ganges and the Brahmaputra rivers on the Ganges-Brahmaputra Delta. The Bay of Bengal merges with it as well. The forest consists of about 200 islands, and it is separated by about 400 interconnected tidal rivers, creeks and canals. It has a surface area of around 1 million hectares. Bangladesh accounts for 60% of the total, with the remaining 40% in India. The main area is of about 10,000 square kms. The climate is tropical, with a dry season from November to April and a wet monsoon season for the remaining year. About 1500 to 2000 mm of precipitation falls annually. Tropical cyclones and minor tidal occurrences are common during the monsoon season, wreaking havoc on the area. Flooding and wind damage have caused significant damage. Temperatures vary from season to season, with the mean lowest and maximum temperatures ranging from temperatures 12°C to 24°C and 25°C to 35°C.

Around the 19<sup>th</sup> century, the Sundarbans were only meagrely populated. Gradually, as the need for space to live and livelihood increased, people started occupying space and living in the Sundarbans. Low lying areas were cleared and started to be occupied. Agricultural practices were the most common livelihood practice of the area, but it is unclear whether it was done by the residents of the area or by the residents near present day Kolkata or both. There is also much evidence that the population was migratory in nature and never settled in the place permanently. There were also many attempts by the British to monetise the area and use it to its full potential. The area was divided into smaller plots and economically marginalized sections of the society were motivated to come in as residents to live and cultivate the area. Over the years, the boundaries of the mangrove forest were kept shifting eastward regularly [1]. In 1984, an area of about 1300 square km was made a UNESCO World Heritage Site in 1987 and a biosphere reserve in 2001. Human interference in these areas is strictly prohibited and leads to heavy fines and imprisonment accordingly [1,2]. These forests are situated over the active Ganges-Brahmaputra delta and hence, consist of a lot of rivers, streams and water bodies which act as nursery for a lot of fishes and aquatic life like the last two remaining species of the freshwater Dolphins. At the same time, around 3.5 million people depend on these forest covers for livelihood [2]. These forest covers also protects both the humans and the habitation from the cyclones and tidal surges which are quite regular in that area.

Over the past 2 decades, the Sundarbans have encountered many problems. Some of them are-

- Sea level rise- There has recently been a rise in the core areas of the Sundarbans which has affected the nearby human settlement. The rise in sea level has deprived the people of their main sources of livelihood - agriculture and fishing. A lot of agricultural land is being submerged under the water [3,4].
- Salinity- As the salinity of the Sundarbans water increases, so does the salinity of the rivers which are connected to it as the mangroves spread across the Ganges delta. The Ganges river's flow rate has been reduced, resulting in excessive saline water in upstream locations. The Sundarbans' high salinity zone is located in the south-western quadrant.
- Climatic conditions and pollution- the industries and factories of the nearby cities generate a lot of waste, which is usually discarded in the water untreated. Due to the discarded waste, the river Ganges does not carry around freshwater. Harbors which dispose mud also cause pollution. Along with the rise in temperature, precipitation is also on the rise. In recent years, the variability of climatic factors has increased. The increased storm speed and rainfall is caused by the warmer temperature.
- Natural Disasters- The Sundarbans are a disaster-prone area. They are mainly hit by cyclones. There are not adequate facilities of shelters for the residents. The cyclone Aila of 2009 entered the plains and damaged many areas. Many people were affected

due to the shortage of water supply and destruction of the agriculture land. A great deal of damage was caused to the property and crops due to the cyclones.

- Man-made disasters- There have been a gradual shift from organic methods of farming to using heavy doses of insecticides and pesticides to maintain quality and quantity of produce. This heavily affects the flora and fauna of the region. The dumping of untreated sewage and waste also created environmental problems. There have also been other problems such as oil spills which damage the aquatic wildlife and the building of a coal-fired power plant which will heavily damage the ecosystem.

The communities residing in the region is under socio-economic stress which have increased with repeated natural disasters battering the coastlines due to climate change impacts as well as dearth of green livelihood options [5-8]. Hence, the importance of alternative green livelihood schemes need to be popularized to help imparting sustainability to the local population and to address the Sustainability Development Goals (SDG), namely SDG-1 (No poverty), SDG-2 (Zero hunger), SDG-8 (Decent work and economic growth), SDG-10 (Reduced inequalities) and it indirectly impart conservation of mangrove ecosystems (world's largest blue carbon sink) by reducing nature exploitive livelihood options (SDG- 13, Climate action).

The research objective of this paper is to find alternative green livelihood solutions that impart sustainability and economic benefits to local population without impacting the fragile mangrove ecosystem. This article put forward a successful case study where 471 beneficiaries are trained, received support and practicing sustainable alternative livelihood to augment their annual income, through a rural development and resource conservation intervention project at Indian Sundarbans.

## 2. Case study

Major alternative livelihoods in the region are,

1. Eco-tourism- It is a kind of tourism which involves natural and threatened environments which support wildlife and conservation. It has boosted tourism in isolated places. It has a lot of potential as a livelihood option as the Sundarbans have a variety of natural attractions, global attention, and unique people, culture, and traditions. This livelihood option holds a lot of potential but is still much underutilised as it requires integrating the government's efforts with the local populations' willingness [9].
2. Transportation services- On the islands, cars and other motor vehicles are not popular. Most of the time, people get around by public transport, which is limited to auto rickshaws and other small vehicles. Transportation of the island does not contribute to the overall pollution at all due to these reasons. As we know, the Sundarbans are islands. So, the major means of transport are boats. Most of the times, these are normal traditional boats and not motor operated. These are operated by locals which charge a very meagre fees and carry around 10-12 people at a time.
3. Cattle and Poultry- Raising animals for their skin, food, and milk products, or to consume them as whole is regularly done along with farming. It is a good way to earn passive income and to earn some money off season. Milk production has been an increasing trend in the area. Chickens also produce eggs and can be sold as a whole themselves. Sheep and other cattle grow valuable wool which can be very profitable. Animal and cattle raising needs to be monitored regularly and regulated, so as to not permanently harm animals by overexploiting them [9].
4. Shops- Shops to sell vital goods are needed in every human inhabited area. There are hardly any luxury good sellers in these islands as most of it is not required. Shops only sell vital goods such as fruits, vegetables and other necessities.

A project was implemented at 3 Revenue Villages in Chhoto Mollakhali Gram Panchayet, 2 Revenue Villages in Amtoli Gram Panchayet, 7 Revenue Villages in Satjelia and Lahiripur Gram Panchayets of Gosaba Block, South 24 paraganas District, West Bengal with one of the objective of introducing green alternative livelihood to local community, between 1<sup>st</sup> October 2017 and 31<sup>st</sup> December 2021. The intervention area is depicted in Figure 1.

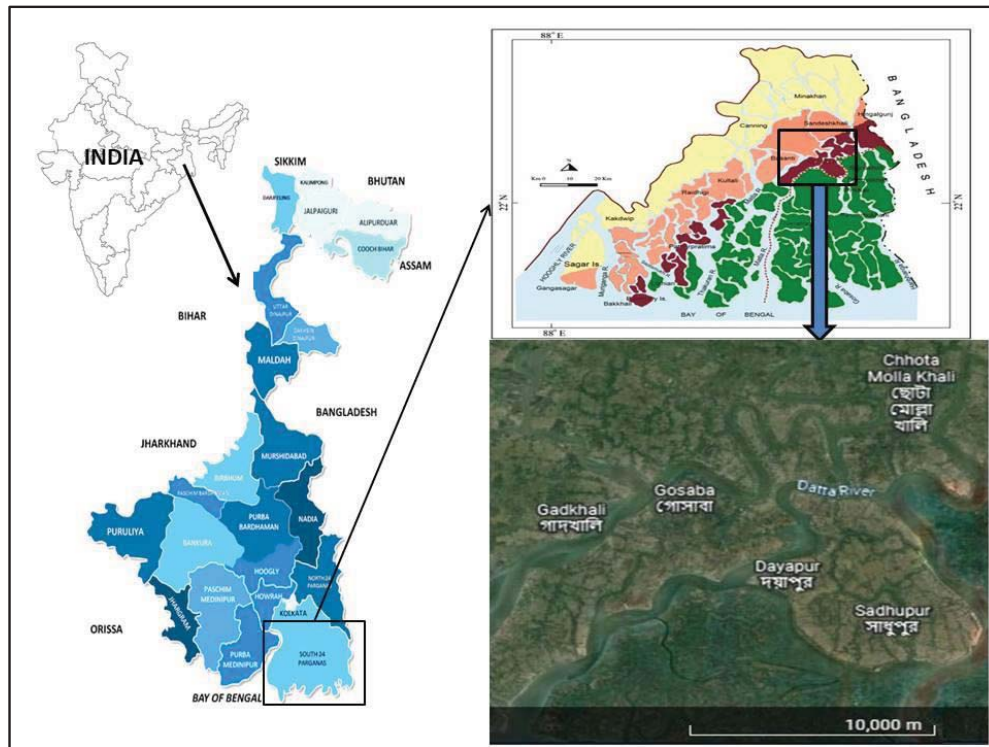


Figure 1. Intervention area zoomed out showing the north-eastern corner of Indian Sundarbans at Gosaba block in of South 24 Paraganas district, West Bengal, India.

The detail of alternative livelihood schemes introduced to the local population. From 2018 up to the end of 2020, total 471 numbers of beneficiaries were received support. The revenue village wise and trade wise breakup is given below in table 1a.

Table 1a: The revenue village and alternative livelihood support schemes introduced through the project

Sl.No	Name of the Revenue Villages	Name of The Trades				Total
		Cycle Van transport	Van Repairing Shop	Grocery Shop	Tea Stall	
1	Chhoto Mollakhali	67	2	17	8	94
2	Hentalbari	75	0	17	4	96
3	Kalidaspur	68	1	23	12	104
4	Amtoli	54	2	27	8	91
5	Moukhali-Chimta	41	4	28	13	86
	Total	305	9	112	45	471



Figure 2. Alternative livelihood options (a). Grocery shop (b). Income augmentation through carbon neutral cycle van transport, (c). The repair workshop for van is an added income for local experts (d). Women empowerment through tea stalls which is improving family's livelihood and imparting economic sustainability

In 2020, total 52 numbers of beneficiaries were received support to establish small business. During 2019, total 210 numbers of beneficiaries were received support for small scale business. In 2018, total 209 numbers of beneficiaries were received support for small scale business. The supports were in form of training and funding of their ventures through the sanctioned project. Few of alternative livelihood options are depicted in Figure 2.

Till December 2021, total 471 numbers of beneficiaries were received support for small business. The average monthly profit amount for this activity is 1,629.00 INR per month up to 2021 as per internal audits by implementation organization. Whereas as per the external evaluation team report, the average annual income of 4,0472.50 INR combining all the small business ventures as of January 2022 [10]. As per project evaluation presentation done by external agency, the trade wise profit has been elucidated in Table-1b.

The nationwide lockdown from end of March 2020 to end of April 2020 had a very negative effect on the average monthly profit amount of this trade. Further 55 beneficiaries of Kalidaspur who received support for small business were affected due to cyclone 'Amphan' in 2020. As per the observations of external agencies, Tea stall is most profitable small business followed by Cycle Van transport, Grocery Shop and Grocery Shop.

Table 1b: Average profit in the small business as per evaluation report of external agency [10]

Sl no	Trades	Average annual income (in INR)
1	Cycle Van transport	43556
2	Van Repairing Shop	36000
3	Grocery Shop	37048
4	Tea Stall	45286
Average		40472.50

### 3. Sustainability perspective

The endeavour has imparted sustainability to the population and in turn it also helped to achieve the SDG goals depicted in table 2.

Table-2. The achievement of SDG goals through alternative livelihood green options

SDG Goal Number	Goals	How alternative livelihood option achieved the goals
1	No poverty	The alternative livelihood options have given opportunities to augment the income of the beneficiaries. The paucity of employment options some time forces the socio-economically marginalized section of the society into the fold of abject poverty [6]. These are ready supply of liquid cash income that will help to cater socio-economic sustainability to the local population.
2	Zero hunger	With more liquid cash in hand, beneficiaries can spend on diversification of their nutritional needs and escape from the clutches of ,hunger' even during times of natural disaster and emergencies.
8	Decent work and economic growth	The beneficiaries have independence to set up their own ventures and don't have to rely on any other (previleiged section of the society) for their income. It developed self confidence and paved way for expanding their ventures for more economic growth.
10	Reduced inequalities	The livelihood schemes augment the economic standards of the community freeing them from the traditional divide of previledged section of the society having more economic sufficiency than the socio-economic marginalized section.
13	Climate action	With economic sifficiency through alternative livelihood, beneficiaries donot venture out into the deep forest areas to capture tiger prawn seed (detrmental to mangrove ecology) or venture out into the forest for resource exploitation. Mangrove forest is home to Royan Bengal Tiger and waterways infested with crocodile. Hence, a steady safe source of livelihood is always favoured over lefe risking, illegal exploitation of forest. This indirectly help the mangrove to be conserved, which is the world'd largestk. blue carbon sink. So blue carbon is sequestered by healthy mangroves, helping in ,climate action goal of SDG.

### 4. Other dimensions and options of alternative livelihood

Some other sustainable livelihoods options which have not been utilised yet and their success rates in other mangrove areas are-

#### 1. Energy Production from Forest and Agricultural Solid Waste-

Energy is needed in all aspects of life, be it agriculture, manufacturing or regular life. It is a scarce resource which is not available in abundance and therefore might be expensive. It needs to be used sensibly and rationally in every aspect of life. There are many places which generate waste. Agricultural activity also produces mass amounts of waste such as wood, wheat covers, maize cobs, leaves etc. This plant waste is called Biomass. The energy, which

is extracted from biomass, usually by burning it is called Bioenergy. The combined heat and power (CHP) generation and biomass co-firing with coal have been some of the most common industrial applications of thermal conversion technology in recent years. This method produces both heat and power. Biomass plants can be built in the area as they are a source of clean energy and only use plant and animal waste. This would provide a good source of employment for the local population. In the country of Zambia located in East Africa, about 75% of the cooking energy is derived from biomass. This proves that Biomass is a credible source of energy and can provide lots of employment [11].

## 2. Gender and Sustainable Natural Resources Management-

Gender issues exist in almost every aspect of life. It is common that there is a pay difference between men and women for the same job. In some cases, women are not allowed to be a part of the job at all. The common conception and belief since long has been that men are the primary earners and the women take care of the households. Women should also be included in work environments and people should be given work according to their skillsets and not their genders. Even the women who are engaged in household work can be motivated to work. They can work in the field of sewing clothes, knitting sweaters, selling food, making art, etc. Ignoring women and not letting them work is a huge liability for any place and can massively hold them back in economic and social ways [11].

## 5. Conservation Challenges

As a result of being a coastal area, the Sundarbans are extremely vulnerable to climate change, ocean, and other environmental problems. This makes alternative livelihood initiatives difficult in the region. There are also many human-induced problems in the area. Some of the major challenges are-

1. Climate Change repercussions- The Sundarbans are extremely vulnerable to natural disasters such as floods and cyclones. This causes heavy damage to the population and their infrastructure. Also, the level of the oceans and seas have been rising in the last decades, submerging land and low islands. Every year, this causes a considerable amount of habitat loss to the flora and fauna of the place.
2. Human-wildlife Conflict- Humans in the Sundarbans live in extremely close proximity to the mangroves and the biodiversity. Humans are also very much dependent on the biodiversity to earn their livelihoods. In almost every human and wild animal interaction, either or both of them lose their lives or sustain heavy damage. Specifically, the numbers of human and tiger interactions are extremely high. These incidents prompt foreign organisation interruptions.
3. Uncontrollable fishing- As the local population are not educated enough about the consequences of overfishing, it is a massive problem. The local fishermen fish on massive scales increasing their own, and the future generations long term problems. There is also uncontrollable collection of prawn seedlings which causes long term problems.

## 6. Conclusion

Sundarban is under severe climate vulnerability and natural disaster impacted. Looking into the geographical profile, the region has socio economic marginality where often conservation, environmental protection goals comes in conflict with livelihood scarcity. In view of that, an alternative livelihood option need to be popularize amongst local population to address the key SDG's namely, SDG-1,2 8, 10 and 13.

In view of this a socio-economic project imparted alternative livelihood trainings as well as support to 471 beneficiaries'. Between, 2018-21, the schemes has resulted in profit to local communities and able to fulfil the overall SDG goals. There are challenges regarding conservation, over-exploitation of



fishing resources, human-wildlife conflict, natural disaster vulnerabilities and gender inequalities at Indian Sundarbans, made it difficult to achieve all the SDG goals, but these are not an hurdle that cannot be overcome through coordinated action of state-centre and Non-profit organizations. As per this study, Tea stall is most profitable small business followed by Cycle Van transport, Grocery Shop and Grocery Shop. Other alternative livelihood processes that are gaining popularity in other parts of the world, such as energy production from agri- animal husbandry waste can also be implemented at Indian Sundarbans. Similar projects can also be adopted in any nature conservation, rural developmental initiatives for better results and to deliver the communities away from the clutches of poverty and under-development.

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### Author's contribution

Chowdhury, A: has conceptualized the idea, guided the implementation of the project presented as a case study and contributed in drafting of the manuscript. Dawar, A: has contributed the literature review associated with the article, as part of his internship program with Tagore Society for Rural Development (TSRD) undertaken between December 2021 to January 2022. Bhattacharyya, S: implemented the project that has been highlighted as a case study and contributed to the drafting of the manuscript. Naz, A: guided second author's internship program at TSRD and conceptualized, drafted, organized the manuscript.

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