Biodiversity Action Plan

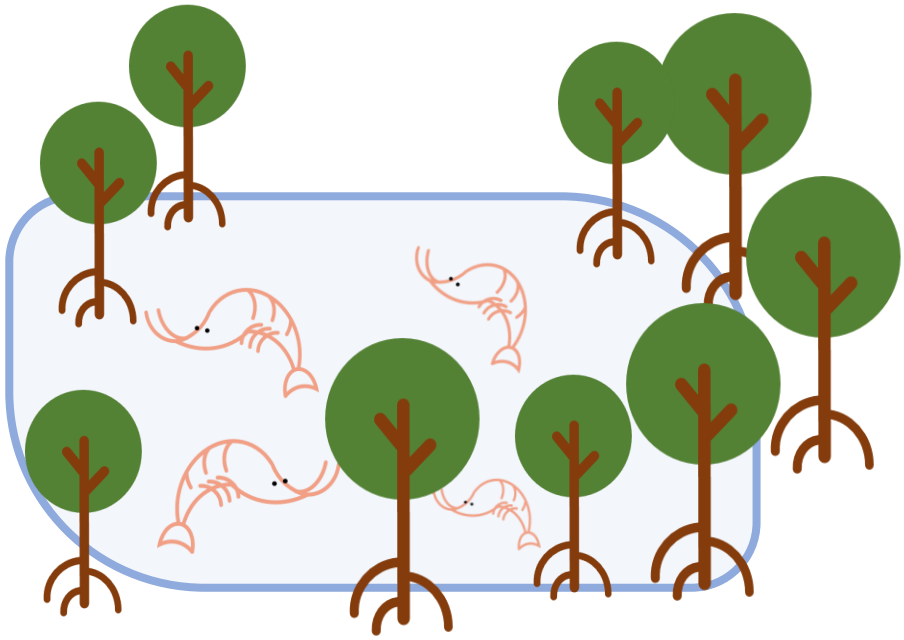
for

SUSTAINABLE AQUACULTURE IN MANGROVE ECOSYSTEM (SAIME)

In West Bengal, India

By: Nature Environment & Wildlife Society

Contents



1. Initial situation and objective

In response to the critical need to address the degradation of mangrove ecosystems in Southeast Asia, this document represents a collaborative effort between Global Nature Fund (GNF), Nature Environment and Wildlife Society (NEWS) and other partners within the framework of the BMZ-funded project, "Multi-stakeholder partnership (MSP) to strengthen transformative processes in the shrimp trade as a basis for the protection of mangrove ecosystems in Southeast Asia." The project deals with the intricate relationship between the shrimp culture and trade, a vital economic activity in the region, and the health of mangrove ecosystems. The overarching objective of this comprehensive guide is to facilitate the implementation of Biodiversity Action Plan (BAP) as an effective tool for promoting biodiversity in mangrove integrated aquaculture.

Delving deeper into the intricacies of the document, it is designed to cater to the diverse needs of local stakeholders, including landowners, producers including brackish water aquaculture farmers, processors, agents and traders involved in the brackishwater aquaculture industry. By offering practical insights and applicable strategies, the guide seeks to empower these stakeholders to adopt sustainable practices that not only enhance biodiversity in aquaculture settings but also contribute to the overall protection of mangrove ecosystems, thus creating a better thriving and resilient coastal community.

Through this initiative, the document aspires to bridge the gap between environmental conservation and economic activities, fostering a harmonious relationship where the prosperity of the shrimp trade synergizes with the long-term well-being of mangrove ecosystems. As an essential resource, it endeavors to be a catalyst for positive change, encouraging transformative processes that uphold the principles of ecological sustainability in the pursuit of economic prosperity.

2. Introduction to Mangrove forests (biodiversity, importance, threats)

Mangroves in Southeast Asia are of paramount importance, serving as critical ecosystems with far-reaching implications. They are teeming hubs of biodiversity, offering shelter and sustenance to various species, and playing a pivotal role in the region's ecological balance. Beyond this, they provide essential coastal protection, acting as a natural defense against erosion, storm surges, and tsunamis. Their significance extends to the fight against climate change, as they serve as effective carbon sinks, helping to reduce atmospheric carbon dioxide levels. Furthermore, these mangrove ecosystems support the fisheries industry, serving as nurseries for numerous commercially important fish species, while also being a source of livelihood for countless coastal communities. Their contribution to tourism, recreation, and the preservation of cultural traditions cannot be understated. Additionally, mangroves improve water quality, acting as natural filters, and enhance nutrient cycling.

Southeast Asia, encompassing 33.8% of global mangrove forests, faces a critical environmental challenge marked by the extensive destruction of these ecosystems, particularly driven by the rapid expansion of shrimp farming since 1980. South Asia, contributing 7% to the global mangrove cover, is not exempt from this trend. Recent data, as per Thomas et al. (2017) and Giri et al. (2015), accentuates the scale of the issue, revealing that 52% of deforested mangroves, equivalent to 1.89 million hectares, have been lost due to the

unsustainable practice in coastal aquaculture. A staggering 1.4 million hectares, accounting for the majority, can be attributed specifically to shrimp culture.

India, among the 12 countries which have been significantly impacted, has witnessed alarming mangrove destruction due to the rapid expansion in the shrimp farming, as documented by FAO (2007), UNEP (2014), and Ahmed et al. (2018). The Sundarban, a fragile ecosystem, has been particularly affected, facing intensive pressure on mangrove areas due to population growth and increased human activity since the 20th century. Population data from Ghosh et al. (2015) reveals a substantial rise, with a 286% increase from 1951 to 1991, attributing the conversion of agricultural land and mangroves to aquaculture farms to escalating population pressure and unwise resource utilization.

The Indian Sundarban, a vast mangrove forest in the Bay of Bengal, provide critical ecosystem services. They act as a natural coastal buffer, protecting against erosion and storms. The region is a biodiversity hotspot, supporting endangered species and local livelihoods through fishing. Additionally, the Sundarban play a vital role in carbon sequestration and water purification. They also attract tourism, offer medicinal plants, and hold cultural significance for local communities. Protecting this unique ecosystem is essential to preserve these valuable services and address environmental challenges.

The intertwined relationship between the economic prosperity of the shrimp sector and the ecological health of mangrove ecosystems underscores the urgency for effective Biodiversity Action Plans (BAPs). These plans must not only address the ecological impact of shrimp farming but also consider the socio-economic factors driving the industry, ensuring a balanced and sustainable approach to coastal development in South and Southeast Asia.

3. About the SAIME project: aims, partners and project areas

The collaborative venture of the Global Nature Fund (GNF), Naturland e.V., Nature Environment and Wildlife Society (NEWS), and Bangladesh Environment and Development Society (BEDS) converge in the implementation of the project named "Multi-stakeholder partnership (MSP) to strengthen transformative processes in shrimp trade as a basis for the protection of mangrove ecosystems in South Asia" with a prime focus on "Sustainable Aquaculture in Mangrove Ecosystem (SAIME)."

This initiative aims to cement the cause of mangrove ecosystem protection and conservation in the Sundarban, a critical ecological region, by establishing sustainable brackish water aquaculture practices around the mangrove ecosystem. Central to the project is the integration of multi-stakeholder partnership counting farmers as prime co-actor, fostering an overarching approach to conservation.

The overarching goal of the SAIME project is intricate and multifaceted. It aspires to cultivate a functioning multi-stakeholder partnership that not only advocates for the sustainable management of mangroves but also ensures their special protection. This is to be achieved through the establishment of consolidated

dialogue structures and interaction mechanisms along the culture and value chain of brackishwater aquaculture with black tiger shrimp as a candidate species. The project's scope extends beyond environmental considerations to encompass the socio-economic dimension, with a specific focus on securing the livelihoods of women shrimp seed collectors, fishermen, and fish farmers in both India and Bangladesh. This initiative is particularly strategic in addressing the challenges posed by climate change, especially, in the face of rising sea levels. The project envisions the creation of a community-based, conservation-linked and climate-adaptive livelihood model in the transboundary Sundarban. This innovative approach is designed to enhance the resilience of local communities, enabling them to navigate the uncertainties brought about by climate change.

The predominant goal of the SAIME project is to act as a catalyst for transformative processes in brackishwater poly-species aquaculture value chain with a special focus on shrimp. These processes are geared towards conserving the delicate balance between human activities, aquaculture practices, and the conservation of vital mangrove ecosystems in transboundary Sundarban.

4. Benefits of the SAIME approach: for consumers, society and businesses.

The SAIME approach, aimed at restoring the delicate ecological balance between shrimp based brackish water aquaculture and mangroves in Sundarban, brings forth a multitude of benefits for coastal community, consumers, businesses, and society at large:

For Consumers

Enhanced Acceptability to high-quality produce emphasizing the sustainability and environmental responsibility associated with the shrimps and finfishes sourced from the project.
Sustainable Seafood Choices by consumers through positioning Sundarban shrimps and finfishes as a responsibly sourced option.
Traceability and Transparency in the brackishwater aquaculture supply chain by seeking information about the origin and production practices of their food.
Positive Environmental Impact on mangrove ecosystems to support products that contribute positively to conservation efforts.
Promotion of Local Communities through supporting sustainable shrimp production as well as empowering local communities and connecting consumers with a story and background behind the product they choose.
Contribution to Climate Resilience through climate-adaptive aquaculture practices, aimed at building resilience in the face of climate change-induced challenges, align with consumer expectations for climate-resilient and responsibly produced food.
Alignment with Corporate Social Responsibility (CSR) Values by making the Sundarban shrimps and finfishes an attractive choice for socially and environmentally conscious consumers.
Educational Opportunities about the importance of mangrove ecosystems, sustainable aquaculture practices, and the positive impact of their choices on the environment and local communities.
Market Differentiation by providing a unique selling proposition for Sundarban shrimps and finfishes in the domestic as well as export market.

Ensuring food safety of the consumers enabling produce from good aquaculture practice (GAP).

For Society:

Livelihood Security by promoting a gradual shift from capture to culture fisheries, particularly in the face of the decline of estuarine fisheries.
Increased Ichthyofaunal Diversity by reducing anthropogenic pressure on riverine fishing and destruction of by-catch while catching wild shrimp larvae for stocking. This is a crucial ecological benefit that positively impacts the overall health of the aquatic ecosystem in the Indian Sundarban.
Community-Based Conservation-Linked Livelihood to develop a resilient model principled on community-based conservation around mangroves in the Indian Sundarban.
Mangrove Ecosystem Restoration is vital for maintaining the ecological balance, preserving habitat, and supporting the diverse flora and fauna that rely on mangrove environments.
Blue Carbon Emissions Reduction to increase the scope of reducing blue carbon emissions by enhancing mangrove health and preventing their destruction.
***Enhancement* of ecosystem services** to offer benefits from different ecosystem services such as improved water quality, habitat provisioning, and flood control by forming bio-shield etc. These services are essential for sustaining the socio-economic condition through a functioning ecosystem benefiting the Sundarban coastal community.
Climate Change Adaptation and Mitigation to build resilience among the vulnerable coastal communities who face the brunt of the environmental challenges.

For Businesses:

Increased Income for Fish Farmers by optimizing the productivity of relevant species and building resilience in the face of changing environmental conditions.
Domestic Market Connectivity to expand economic opportunities for local businesses, facilitating the export of shrimp produced through a community-owned value chain system adopting GAP.
Establishment of a Community-Owned Value Chain to ensure that the benefits of shrimp sale in domestic market and export market are distributed more equitably, directly benefiting marginal fish farmers in the Indian Sundarban.

In summary, the SAIME approach goes beyond the immediate goals of aquaculture and export promotion. It represents a comprehensive strategy that intertwines economic prosperity with ecological sustainability and community well-being, making it a transformative initiative for the Sundarban region.

5. CBEMR and IMA - Approaches to successful mangrove restoration.

The transformative concept of Community-Based Ecological Mangrove Restoration (CBEMR), spearheaded by the Mangrove Action Project (MAP) in 2005, stands as a beacon of success in rejuvenating not only the biodiversity but also the vital functionality of mangrove ecosystems. Going beyond conventional restoration methods, CBEMR intricately weaves together the restoration of specific ecosystem traits and the emulation of natural functions. At its core, CBEMR places a strong emphasis on the proactive engagement of local communities affected by mangrove degradation, empowering them to be stewards of their own ecological heritage. This approach ensures that communities are active participants in every phase of the restoration journey- from collaborative planning and hands-on implementation to vigilant monitoring and continuous follow-up efforts.

A distinctive feature of CBEMR is its commitment to reinstate the hydrological conditions essential for natural regeneration, a critical component often overlooked in conventional restoration practices. Moreover, CBEMR incorporates a visionary approach with built-in long-term monitoring and evaluation mechanisms. This ensures ongoing assessment of progress, allowing for adaptive management and corrective actions when needed. An outstanding achievement of CBEMR is its ability to restore a more biodiverse and natural species composition, fostering resilience and sustainability that surpasses the results achieved through traditional, single-species hand planting.

In the face of the escalating impacts of climate change, particularly the global sea level rise (SLR), Integrated Mangrove Aquaculture (IMA) emerges as a groundbreaking, ecosystem-based climate adaptive livelihood strategy. IMA represents a symbiotic relationship between mangrove restoration and aquaculture, offering a sustainable alternative to the environmentally harmful practices associated with commercial shrimp farming. This visionary approach encourages fish farmers in the Indian Sundarban to adopt sustainable ecosystem-based aquaculture methods. Notably, the two models of IMA- basic IMA with 5% to 10% integration of mangroves in the farm area and standard IMA with 25% to 30% integration of mangroves - showcase a commitment to maximize the co-benefits of this integrated system.

Crucially, IMA addresses the environmental concerns associated with commercial shrimp farming by promoting extensive poly-culture of shrimp and fin fish, eliminating the need for supplementary feed. The strategic use of hatchery-produced shrimp seeds, particularly *Penaeus monodon*, as candidate species underlines the innovation embedded in IMA practices as it reduces the exploitation of wild stock in one hand and restricts the chances of WSSV (White Spot Syndrome Virus) disease occurrence. By intertwining mangrove restoration with aquaculture, IMA not only provides a sustainable livelihood for local communities but also contributes to the broader global effort to mitigate the impacts of climate change and promote environmentally responsible practices. This visionary and impactful approach positions CBEMR and IMA as cornerstones in the journey towards a more sustainable and resilient future for mangrove ecosystems and the communities that depend on them.

5.1. METHODS AND MEASURES FOR THE PROTECTION AND PROMOTION OF BIODIVERSITY IN IMA VIA A BAP APPROACH

In the pursuit of sustainable Integrated Mangrove Aquaculture (IMA), a robust Biodiversity Action Plan (BAP) serves as the guiding framework, employing multifaceted methods and measures for the protection and promotion of biodiversity. Initial steps involve meticulous site selection and zoning, conducting ecological assessments to minimize the negative impact on existing mangrove ecosystems, and implementing zoning measures for aquaculture activities. Mangrove restoration efforts are seamlessly integrated within the IMA framework, emphasizing the conservation of existing mangrove areas. The selection and diversification of native and economically viable shrimp and fin fish species, coupled with ecosystem-based aquaculture practices, contribute to biodiversity enhancement. Effective water health management systems and quality monitoring ensure optimal conditions for both mangroves and the fish species. Community engagement and capacity building initiatives empower local communities, fostering a sense of ownership and awareness. Ongoing biodiversity monitoring, research endeavors, while habitat enhancement and the creation of artificial structures promote diverse marine life. Adaptive management strategies, public awareness campaigns, and strategic collaborations with governmental bodies and other CSOs further reinforce the BAP's effectiveness. Ultimately, this holistic approach positions IMA as a pioneering model for sustainable aquaculture practices that harmonize with biodiversity conservation objectives.

Table 1: Detailed description of requirements and criteria for integration into existing practice of IMA (Integrated Mangrove Aquaculture) practice

Requirements and Criteria for integration into existing practice	**Immediately**	**In a year Long-term**	**Long-term in X years**	**Key figures / indicators**
Farm management ● Name and the details of the micro and macro benthic species available in the water spread area (describing the IUCN red list category) ● Classification and documentation of periphyton species ● Documentation of mangrove species available in the surrounding areas and the faunal species dependent on them. ● How much water spread area is shared by the algae		**Yes**	**Yes**	List of available flora and fauna at a specific location in each year
● Develops a catalogue identification and categorization of relevant and ecologically important/keystone species found in the aquaculture farms.		**Yes**		List of available flora and fauna at a specific location in each year

● Categorization of beneficial as well as pathogenic microorganisms found in and around the farm environment ● Name and the details of available planktons/periphytons/microorganisms and macrobenthos in the farm which can potentially affect the fish and shrimp growth (describing the IUCN red list category)				
● Provides a methodology for prioritizing measures that take into account the diversification of the farm areas in order to achieve the highest possible ecological value.		**Yes**		Measure the biodiversity indices of the particular site location
Monitoring of the IMA farms based on the recording of the initial situation (baseline), which should be realized in year one. Based on the monitoring results, the standard organization / company identifies: • which measures are implemented and with what frequency. • existing hurdles / challenges in implementing the measures.		**Yes**		Monitoring plan for the maintenance of habitats and ecological structures in place? **Yes / No**
Preservation and restoration of mangroves in the farm areas ● Plantation in the farm areas ● Regular monitoring and replantation activities ● Using only saplings of native species for restoration activities ● Production of natural saplings in the farm areas ● Carrying out maintenance measures of ecological structures (maintenance of fences, trimming of shoots, repairing the dykes or embankments, replantation activities to maintain plant density etc.)	**Yes**			List of protected and endangered animal and plant species present on the farmland? **Yes / No** In case of occurrence of protected / endangered species: Does the BAP contain measures to protect these species? **Yes / No**
● Methods should be followed to control the harmful microalgae and planktons in the farm area ● Prohibiting the use of fertilizers and chemicals to control the natural enemies				Whether any synthetic pesticides or chemicals are used in the farms? **Yes / No**

in the farmyard and adopting biocontrol measures instead • Probiotics/medicines used in the pond which has effect on the biodiversity of ponds				**If yes:** On what concentration/dose in the farms? **If yes:** Does the farm have a plan to avoid the application of pesticides / fertilizers during the culture practice? **Yes / No**

5.2. Establish the initial situation (baseline). If appropriate, define a baseline set and BPT (Biodiversity Performance Tool).

Agriculture and aquaculture are the primary economic activities in the peripheral areas of Sundarban Reserve Forest. The initial situation in these areas of Sundarban Reserve Forest is characterized by the dominance of agriculture and aquaculture as the primary economic activities, with significant conflict arising from the indiscriminate expansion of shrimp-farming. The brackish water aquaculture, particularly the cultivation of black tiger shrimp (*Penaeus monodon*), has emerged as a predominant land use, leading to salinization of paddy fields and freshwater sources. Over the past two decades, driven by high profitability, shrimp aquaculture has experienced rapid growth in the inhabited areas of the Sundarban Biosphere Reserve, contributing to the conversion of coastal wetlands, mangroves, and croplands into shrimp farms. This trend is mirrored in the Indian Sundarban, where a considerable expansion has been transformed, posing a threat to mangrove ecosystems.

In response to these challenges, Sustainable Aquaculture in Mangrove Ecosystem (SAIME) emerges as a strategic intervention to mitigate trade-offs between conservation and livelihood improvement, implemented at Chaital (Minakhan Block, North 24 Parganas) and Madhabpur (Kultali Block, South 24 Parganas) in the southern part of West Bengal of Indian Sundarban, addresses the pressing need to integrate the ecological benefits of mangroves into brackish water aquaculture. The Chaital SAIME site has witnessed the conversion of mangrove land to agricultural land to aquacultural land for intensive and semi-intensive shrimp farming, while the Madhabpur IMA site features traditional 'Bhasabandha' fishery (aquaculture practice in creek adjacent low-lying land) practices, with raised pond beds due to siltation.

To establish the baseline for the Biodiversity Action Plan (BAP), the first crucial step is the baseline assessment, providing an overview of the context, biodiversity status, threats, and opportunities. Conducted through a baseline survey by an expert from NEWS or an external consultant, this assessment is vital in shaping the subsequent BAP. Identifying and assessing the baseline, as well as the potential for biodiversity in the farm, forms the foundation for a BAP. The Biodiversity Performance Tool (BPT) serves as a valuable instrument to evaluate the strengths and weaknesses of a farm in terms of functional biodiversity, enabling continuous improvements in biodiversity conservation. The indicators used in this assessment will focus on criteria such as the landscape environment, aquaculture practices, and the socio-economic system of the farm. This systematic collection of data based on these indicators will not only establish the baseline but also

inform the formulation of goals and targets within the BAP, facilitating a strategic and informed approach to the protection and promotion of biodiversity in the IMA context.

For initial screening the following indicators should be taken into consideration:

Table 2: Criteria for description of the farm and associated culture practice

CRITERIA FOR DESCRIPTION OF THE FARM AND ASSOCIATED CULTURE PRACTICE		
For landscape environment	**Indicators**	**Expanded explanation**
Ecologically valuable areas	Records of ecologically valuable areas of the farm	Is the farm situated in a valuable area such as a protected area, primary (natural) ecosystem, or other biodiversity hotspot, such as a High Conservation Value Area (HCV Area)?
Map of ecological structures/areas	Available map with ecological structures/areas on the farm	Does the farm have a map that identifies and locates important ecological features, such as forests, wetlands, and riparian areas?
Ecosystem habitat	Name of the ecosystem habitat	What type of ecosystem is present on the farm? This could include forests, grasslands, wetlands, or aquatic ecosystems.
Natural/semi-natural habitats	Whether any natural/semi-natural habitats are present on and in the surrounding areas of the farm?	What type of natural or semi-natural habitats are present on the farm and in the surrounding areas? This could include forests, woodlands, grasslands, wetlands, hedgerows, and other areas that support biodiversity.
Habitat area	How large the habitat area is (in ha or km)?	What is the total area of natural and semi-natural habitats on and around the farm?
Ecological structures	Details of the availability of the ecological structures (rows of trees; single tree; buffer zones along water bodies; dry stone wall; nesting boxes for birds; refuges for insects; dead wood piles; others) on the farm	What types of ecological structures are present on the farm? This could include rows of trees, hedgerows, buffer zones, nesting boxes, insect refuges, and deadwood piles.
Biotope corridor	Details of the existence of the Biotope corridor of the farm	Does the farm have a biotope corridor, which is a strip of land that connects different habitats and allows for the movement of plants and animals?
Biodiversity risks	Description of the farm-specific potential risks to biodiversity: risks emanating from the aquaculture activity as well as risks coming from the immediate surroundings (e.g. roads with heavy traffic, noise,	What are the potential risks to biodiversity on and around the farm? These risks could come from the aquaculture activity itself, or from other activities in the surrounding area, such as roads, industry, and agriculture. How

	pollution from untreated sewage or (illegal) waste dumps). Whether the farm has a direct or only indirect influence on the reduction of risks.	does the farm manage these risks?
Biodiversity risk analysis	Does the farm have a biodiversity risk analysis?	Has the farm conducted a biodiversity risk assessment to identify and evaluate potential risks to biodiversity?
Grazing practices	Grazing practices at the farm	How are livestock grazed on the farm? Are grazing practices sustainable and designed to protect biodiversity?
Protected and endangered species	If the farm/cooperative is located in the neighborhood of protected areas, it has an overview of the key protected and endangered species and their habitats (Forest; lake; river; stream; scrubby area; other) occurring in the region.	What protected and endangered species are present in the region around the farm? What habitats do these species need?
Exchange with biodiversity experts	Regular exchange with biodiversity experts or CSOs or any nature conservation authorities with the farmers	Does the farm have regular communication with biodiversity experts, CSOs, or nature conservation authorities? This can help the farm owners to learn about best practices for managing biodiversity.
Document on protected and endangered species	Existing document on an overview of the protected and endangered species occurring in the farm as well as in the region	Does the farm have a document that provides an overview of the protected and endangered species occurring on the farm and in the region? This document can help the farm to manage its activities in a way that minimizes impacts on these species.
Composition of pre-existing flora and fauna	Composition of Pre-existing flora and fauna (describing the IUCN red list category)	What types of plants and animals are present on the farm? Are any of these species protected or endangered?

Table 3: Criteria for monitoring the aquaculture farms and description of Mangrove Integrated Aquaculture practice

For monitoring the aquaculture farms	**Indicators**	**Expanded Explanation**
Site selection	Was the site selected based on criteria such as water quality, water availability, and ecological sensitivity?	Is the farm located in a suitable area for aquaculture? This includes factors such as water quality, water quantity, and the presence of sensitive ecosystems.
Species selection	Are the species being farmed appropriate for the local environment and market conditions?	Are the species being farmed native to the area and are they in demand by the market?

Stocking density	Are the fish being stocked at a density that is appropriate for the species and the culture system?	Overstocking can lead to stress, disease, and mortality. It is important to stock fish at a density that allows them to thrive.
Water quality management	Are there measures in place to manage water quality, such as aeration, filtration, and water exchange?	Water quality is essential for the health and well-being of fish. It is important to have measures in place to manage water quality and ensure that it is within the optimal range for the species being farmed.
Disease prevention and management	Are there measures in place to prevent and manage disease, such as biosecurity, and regular health checks?	Disease can have a devastating impact on aquaculture operations. It is important to have measures in place to prevent and manage disease, and to respond quickly if an outbreak does occur.
Waste management	Are there measures in place to manage waste from the farm, such as solids removal, water treatment, and recycling?	Aquaculture waste can pollute the environment if it is not properly managed. It is important to have measures in place to collect, treat, and dispose of waste in a sustainable manner.
Monitoring and evaluation	Is the farm monitored and evaluated regularly to identify and address any potential problems?	It is important to monitor and evaluate aquaculture operations on a regular basis to identify and address any potential problems. This includes monitoring water quality, fish health, and production performance.

For the description of Mangrove Integrated Aquaculture practice	**Indicators**	**Expanded Explanation**
Mangrove integration	Are mangroves planted or protected within or adjacent to the aquaculture ponds?	Mangroves play an important role in Integrated Mangrove Aquaculture (IMA) by providing a variety of benefits, including water quality improvement, habitat for fish contributing to nutrition, and other aquatic organisms, and coastal protection.
Mangrove species selection	Are the mangrove species planted or protected appropriate for the local environment and the aquaculture system?	Different mangrove species have different tolerances to salinity, tidal inundation, and other environmental conditions. It is important to select mangrove species that are well-suited to the local environment and the aquaculture system.
Mangrove management	Are there measures in place to manage the mangroves, such as planting, thinning, and pruning?	Mangroves require management to maintain their health and productivity. It is important to have measures in place to manage the mangroves and ensure that they are providing the desired benefits to the aquaculture system.

Integrated management	Are the mangrove and aquaculture components of the system managed in an integrated manner?	Integrated management is essential for the success of MIA systems. This includes considering the interactions between the mangrove and aquaculture components and managing them in a way that maximizes benefits and minimizes risks.

5.3. The Initial Situation (Baseline)

The Biodiversity Action Plan (BAP) is developed based on a thorough understanding of the farm or cooperative's baseline. This involves documenting or mapping farm-specific data relevant to biodiversity. Maps, created through GIS or hand-drawn methods, serve to visually represent the farm's layout, aiding in the identification of ecological hotspots as well as potential zones for IMA. These maps also play a crucial role in raising awareness and motivation among stakeholders, providing a tangible understanding of the ecosystem. The BAP, rooted in this baseline, is then tailored to implement measures for the effective protection and enhancement of biodiversity in the aquaculture farms. The criteria for initial monitoring are listed below:

Table 4: Criteria for documentation of the biodiversity in existing practice.

Criteria for documentation of the biodiversity in existing practice	**Immediately**	**In a year**	**Long-term in 10 years**	**Key figures / indicators**

The farm / the cooperative
• Collecting the data related to the natural and ecological structure of the farm area including the surrounding regions for better identification of prospective water bodies which can be used for IMA practice.
• This should include the following parameters:
  • Total Farm area of each farm.
  • Available land record of the farm.
  • Google earth map of the farm along with the geographical location.
  • Whether the farm is leased in or self-owned
  • Water quality parameters mainly salinity, pH, Nitrate, Nitrite, Ammonia etc.
  • Type of farming practice adopted by the aquaculture farm (Extensive/Semi-intensive/Intensive)
	Yes			Identification of prospective sites/farms for mangrove restoration and integration.
				Verification: Whether the areas are marked on the map as potential site for mangrove integration.
				
				Yes/No

• Water spread area of the farm to identify the available area for mangrove integration • Source of water of the farm (Mangrove Creek/Sea/Groundwater) • Frequency of water exchange in the farm • Classification of species found abundantly around the farm				
• ensures that – as far as possible – the natural flora, fauna and overall biodiversity is maintained and monitored			**Yes**	Whether the habitat is suitable for mangrove restoration? **Yes/No** Categorization: The potential brackish water resources are marked in the map with water quality parameters/ areas of the farm. **Yes/No**

5.4. Establishment of SAIME Biodiversity Action Plan (BAP):

The primary objective of the Biodiversity Action Plan (BAP) within the Sustainable Aquaculture in Mangrove Ecosystems (SAIME) initiative is to prevent or minimize adverse impacts on the biodiversity of SAIME farms and simultaneously restore the mangrove ecosystem of Sundarban. The main targets of the BAP are to bring positive changes in the SAIME farms in respect of biodiversity conservation after ten years of implementation.

Table 5: Set of criteria for establishment of the Biodiversity Action Plan (BAP)

Criteria	Immediately	In a year	Long-term in 10 years	Key figures / indicators
The farm / the cooperative • records all ecologically valuable structures / areas in and around the farm (own areas and leased areas) or of the members of the cooperative. In addition, the ecologically significant areas in the immediate vicinity are recorded**. These significant areas include the natural habitat for different species, breeding ground of different		**Yes**		Baseline report available, e.g. by recording the current situation with the Biodiversity Performance Tool? **Yes / No** Map with ecological structures / areas on the

fish species, areas with ample natural resources from mangrove area etc. ** When creating maps of smallholder farms or cooperatives (landscape level), the map can also be drawn by hand. If mapping requires a lot of time, for example, because land ownership is not clearly regulated, then a simple representation of the structures and areas is also sufficient.				farm / cooperative and in the surrounding area? **Yes / No**
• collects further farm-specific information: • Land used for aquaculture practices (fish, shellfish cultivation, polyculture, integrated mangrove aquaculture etc.) • Potential land which can be converted into IMA farms: · Intertidal zones · Areas that are fed with brackishwater · Agricultural lowlands with saline intrusion due to natural calamities • Coastal biotopes.	**Yes**			Map with • Areas used for aquaculture practices • Potential land which can be converted into IMA farms **Yes / No**
• describes the IMA farm-specific, potential risks to biodiversity: risks emanating from the aquaculture activity as well as risks coming from the immediate surroundings (e.g., using antibiotics and fertilizers for farming practices). Furthermore, the fishers describe whether the farm has a direct or only indirect influence on the reduction of risks.		**Yes**		Risk analysis for biodiversity? **Yes / No**

• If the farm / cooperative is located in the vicinity of or in protected areas (e.g. Sundarban), the farm management has an overview of the protected and endangered key species and their habitats* occurring in the region. If necessary, experts are involved (e.g. nature conservation authority, regional CSO, scientific institution, experienced persons from the local community). * As seen e.g. in National Lists of Threatened Species, IUCN Red Lists, and species lists of High Conservation Value (HCV) areas.		**Yes**		Is the farm / cooperative in or in the neighbourhood of a protected area or HCV Area? **Yes / No** If so: Does the management of the farm / cooperative have an overview** of protected / endangered species in the region? **Yes / No** Is the farm / cooperative in regular contact with biodiversity experts, e.g. CSOs, nature conservation authorities? **Yes / No** ***Detection: A list of species should be provided that occur in the surrounding area. There is no claim of completeness.***

5.5. General Aspects of Biodiversity Management in Tropical Aquaculture: No-Net-Loss Approaches

Biodiversity management in tropical aquaculture represents a critical endeavor in balancing the socio-economic benefits of aquaculture with the conservation of diverse ecosystems. A prominent strategy gaining traction is the implementation of no-net-loss approaches, aiming to ensure that the overall biodiversity in an area remains at least constant if not enhanced, despite the development of aquaculture activities. Several key aspects contribute to the effective management of biodiversity in tropical aquaculture:

Table 6: Some key aspects to monitor the effective management of biodiversity in tropical aquaculture

PROTECTION OF MANGROVE ECOSYSTEM, COASTAL BIOTOPE AND TIDAL MUDFLATS				
Requirements and Criteria for integration into existing practice	**Immediately**	**In a year**	**Long-term in 10 years**	**Key figures / indicators**
The standard organization / the company • prohibits the conversion of mangrove ecosystem into agricultural/aquaculture lands.	**Yes**			
• supports and defines sustainable use of the natural and restored ecosystems, protected areas and High Conservation Value areas – if management is not explicitly prohibited by law.	**Yes**			
• supports the farmer / cooperative through, e.g. • free provision of experts for counselling. In countries of the Global South, it may be difficult to find experts and pay for the costs. Even CSOs cannot cooperate for free in the long run. It may be possible to find suitable experts in the local community. • regular exchange with the nature conservation authority and/or nature conservation organizations (at least once a year).	**Yes**			
● knowing and respecting the restrictions associated with the culture practices in the mangrove adjoined areas.	**Yes**			Does the farm is in a protected area? **Yes / No** If yes: Does the farm / cooperative take into account the management

				plan of the protected area? **Yes / No** Proof: The head/owner of the farm/cooperative knows the management plan and the relevant regulations. **Yes / No**
The farm / the cooperative • establishing a map of the coastal biotopes and the intertidal mudflat areas for better monitoring and maintenance. ● water bodies, as well as periodically or occasionally water-bearing water bodies, whereby the minimum width of the buffer zones always exceeds the legal requirement. For permanently flowing water bodies, the minimum width of the buffer zone is within the defined range of the concerned authorities			**Yes**	Whether there is a continuous connection among the farm areas? **Yes/No** **If yes:** What is the distance from the nearest mudflat? **If yes:** What is the rate of water exchange in the farms? **If not near to coastal biotope:** What is the distance and the source of brackish water into that area?
ensures that inappropriate material (plastic bottles, CPPs (cast polypropylene), CPP packaging or containers, medicines, animal manure , agriculture run-off) does not enter the farm water	**Yes**			Evidence of responsible storage and disposal of materials and packaging? **Yes / No**

NURTURING THE INDIGENOUS SPECIES AND PREVENTING THE INTRODUCTION AND SPREAD OF INVASIVE ALIEN SPECIES (NEOBIOTA)				
Requirements for standard organizations / companies		**Immediately**	**In a year**	**Long-term in 10 years**
Inform the fishers and the community members about the decline of indigenous species population and the impact of Invasive Alien Species (IAS) on the native species.		**Yes**		
Support the Socio-economic structure of the farm through capacity building: ● training material on IAS and their control, as well as references to existing websites and further information. ● providing experts free of charge to advise on how to deal with IAS. It may be possible to find suitable experts in the local community. • training to impart knowledge on the decline of indigenous population and encouraging them to culture the native species to maintain the regional biodiversity.		**Yes**		
Criteria	**Immediately**	**In a year**	**Long-term in 10 years**	**Key figures / indicators**
Supporting the socio-economic structure associated with the IMA farms	**Yes**			● Whether the farms are registered under the appropriate authority and they have the enrolment card ● Does the farmers group/farmer/the farm manager have knowledge on the importance of biodiversity ● Are they trained in the biodiversity management

				● The aquaculture species harvested by the farmers
The farm / the cooperative • identifies invasive alien species (IAS) on its farmland and reports the occurrence to the competent nature conservation authority and / or the regional CSO. • undertakes measures to control or combat IAS on the farm land.	**Yes**			Have IAS been identified on the farmland? **Yes / No** If so: Has the authority been informed? **Yes / No** Does the BAP contain measures to control or combat IAS?
The standard organization / the company • explicitly points out that threatened, declining and protected animal and plant species (see IUCN Red List as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora CITES) must not be collected and protected areas must not be affected.	**Yes**			
requires the farm / cooperative to comply with all government regulations (e.g., license for collection). If the state regulations do not provide sufficient protection, criteria must be developed and applied that go beyond the state regulations.				Is documentation on compliance with government regulations available? **Yes / No**

5.6. Measures to Minimize Negative Impacts in SAIME Farms:

While implementing the Biodiversity Action Plan (BAP) within the Sustainable Aquaculture in Mangrove Ecosystems (SAIME) initiative, it is imperative to implement concrete actions to minimize negative impacts. Both farmers and the implementing organization can undertake the following measures to ensure the sustainability of SAIME farms and mitigate adverse effects on the surrounding areas:

✓ ***Water Exchange and Depth Management:*** **Action:** after exchange should be done regularly in the SAIME farms every 15 days during the full moon and new moon phases. A minimum water depth of 3 -4 ft. should be maintained in the farms. **Rationale:** This practice supports optimal water quality and dissolved oxygen levels, essential for the health of aquatic ecosystems.
✓ ***Stocking Density Control and Use of SPF Organic Shrimp Seeds:*** **Action:** Reduce stocking density at SAIME farms and introduce hatchery-bred Specific Pathogen-Free (SPF) organic black tiger shrimp seeds. **Rationale:** Lower stocking density minimizes stress and disease susceptibility, while SPF organic seeds contribute to disease prevention and overall health and reduce the pressure on wild stock.
✓ ***Elimination of Exogenous Feed and Application of Mustard Oil Cake (MOC):*** **Action:** Prohibit the use of exogenous feed at SAIME farms and introduce Mustard Oil Cake (MOC) to stimulate plankton growth. **Rationale:** By relying on natural food sources and promoting plankton growth, the need for artificial feed is reduced, minimizing the input cost and environmental impacts.
✓ ***Chemical-Free Practices and Lime Application:*** **Action:** Strictly avoid the use of chemicals in SAIME farms and employ lime to maintain water quality. **Rationale:** Chemical-free practices safeguard biodiversity, and lime application contributes to stabilizing pH levels, supporting a healthy aquatic environment.
✓ ***Water Quality Monitoring:*** **Action:** Conduct regular measurements of water quality parameters at distinct intervals in SAIME ponds. **Rationale:** Continuous monitoring ensures that water quality remains within acceptable limits, providing an early warning system for any deviations.
✓ ***Leaf Litter Impact Study and Beneficial Microorganism Identification:*** **Action:** Undertake a comprehensive study on the impact of leaf litter on nutrient dynamics in SAIME farms and identify beneficial plankton for shrimp and fish growth. **Rationale:** Understanding the role of leaf litter and promoting beneficial plankton species contributes to nutrient cycling and enhances overall ecosystem health.

These measures collectively form a proactive and holistic approach to safeguarding the ecological balance within SAIME farms. By adopting these practices, both farmers and implementing organizations contribute to the broader goals of biodiversity conservation and sustainable aquaculture, aligning with the overarching objectives of the SAIME initiative.

5.7. Measures to Create Potential Biodiversity in IMA Farms and Surrounding Areas:

Key Points	Action	Elaboration
1. ***Land Shaping for Pond Embankment Expansion and Mangrove Plantation***	Undertake land shaping activities to strengthen pond embankments and create islands within IMA farms for the purpose of mangrove plantation.	Altering the landscape through land shaping provides opportunities to increase mangrove coverage mangrove habitats, promoting biodiversity by creating diverse ecosystems within the farm.
2. ***Fencing for Sapling Protection***	Install fencing around IMA farms to protect mangrove saplings from grazing and external disturbances.	Fencing safeguards newly planted saplings, ensuring their undisturbed growth and contributing to the successful restoration of mangroves.
3. ***Mangrove Sapling Plantation***	Actively engage in the plantation of mangrove saplings within IMA farms to restore and enhance mangrove habitats.	The intentional planting of mangrove saplings serves as a proactive measure to restore habitats, supporting biodiversity and ecological balance.
4. ***Monitoring of Sapling Survival and Growth***	Implement a monitoring system to track the survival and growth of planted saplings within IMA farms, assessing the success of mangrove restoration efforts.	Regular monitoring ensures accountability and provides valuable data on the effectiveness of the restoration activities, allowing for adaptive management.
5. ***Minimization of Wild-Collected Shrimp Seeds and Introduction of SPF Organic Seeds***	Minimize the stocking of wild-collected shrimp seeds and prioritize the stocking of hatchery-bred Specific Pathogen-Free (SPF) organic black tiger shrimp seeds at IMA farms.	This measure safeguards the diversity of the ecosystem by reducing reliance on wild-collected seeds and promoting the use of sustainable, disease-resistant alternatives.
6. ***Quantification of Algal Biodiversity***	Conduct a quantitative assessment of algal biodiversity at SAIME farms to identify and promote species beneficial to aquaculture	Understanding and quantifying algal biodiversity aids in promoting a healthy and balanced aquatic environment, contributing to the overall success of aquaculture
7. ***Quantification of Microbial Diversity***	Quantify microbial diversity at SAIME farms, specifically focusing on species beneficial to aquaculture.	A thorough understanding of microbial diversity helps in fostering a microbial community that supports aquaculture practices, enhancing overall system resilience.
8. ***Survey of Changes in Floral Diversity***	Conduct surveys to track changes in floral diversity post-implementation of SAIME.	Assessing floral diversity provides insights into the impact of SAIME on

		plant species, aiding in the evaluation of ecological restoration efforts.
9. *Survey of Faunal Diversity Enhancement*	Conduct surveys to evaluate the enhancement of faunal diversity following the implementation of SAIME.	Monitoring faunal diversity provides valuable data on the success of biodiversity enhancement, offering insights into the health and resilience of the ecosystem.
10. *Avoidance of Invasive Alien Species*	Strictly avoid the introduction of invasive alien fish or shrimp species at SAIME farms.	Preventing the introduction of invasive species is crucial to maintain the integrity of local ecosystems and prevent disruptions to native biodiversity.
11. *Monitoring RET Species and Conservation Initiatives*	Monitor the population trends of Rare, Endangered, and Threatened (RET) species, implementing initiatives to conserve them.	Regular monitoring and conservation efforts are essential to safeguard and promote the survival of RET species within the SAIME framework.

These comprehensive measures collectively contribute to the creation of potential biodiversity within IMA farms and their surrounding areas. By actively implementing these actions, SAIME strives to enhance ecological resilience, restore habitats, and protect the diverse ecosystems essential for sustainable aquaculture practices.

5.8. Implementation and Monitoring of the Biodiversity Action Plan (BAP) at SAIME Farms:

To effectively implement and monitor the BAP at SAIME farms, the establishment of a robust Monitoring & Evaluation (M&E) system is imperative. This system will rely on the identification of two types of indicators: Performance Monitoring Indicators and Impact Indicators.

- ✓ ***Performance Monitoring Indicators:***

Definition: These indicators assess the performance and implementation of measures outlined in the BAP.
Elaboration: Performance indicators are essential for gauging the effectiveness of the strategies and actions undertaken to implement the BAP. They provide real-time feedback on the progress of each measure, facilitating adaptive management.

- ✓ ***Impact Indicators:***

Definition: Impact indicators are designed to evaluate the broader effects of the implemented measures on biodiversity.
Elaboration: These indicators focus on assessing the overall impact of the BAP on biodiversity within the SAIME farms. They measure changes in ecological health, species diversity, and habitat restoration, providing insights into the long-term success of the BAP.

✓ ***Data Collection Methods:***

Identification: After determining the indicators, appropriate data collection methods will be identified.

Elaboration: Choosing effective data collection methods is crucial for accurate monitoring. This may involve on-site observations, interviews, surveys, and the use of technology to collect quantitative and qualitative data.

✓ ***Implementation and Monitoring Table:***

Definition: A table outlining the implementation and monitoring plan for SAIME, specifying actions, responsible parties, timelines, and expected outcomes.

Elaboration: This table serves as a comprehensive guide for executing the BAP activities. It includes detailed information on each action item, who is responsible for its implementation, the timeframe for completion, and the anticipated outcomes.

5.9. Role of On-Site Partners (NEWS):

For the successful implementation of the BAP, on-site partner NEWS will collaborate closely with farmers, taking on specific responsibilities outlined in the table below:

Goal	Timeline	Measures	Name of the Indicator	Definition of the indicator	Type of indicator	Data collection methods	Responsibilities
Implementation of Sustainable Aquaculture in Mangrove Ecosystem (SAIME) to avoid or minimize the negative impact on the biodiversity of the SAIME farms	Long term (ten years)	The exchange of water at the SAIME farms at 15 days interval at the time of Full moon and no moon and maintaining the minimum depth of water 3-4 ft	Maintenance of water depth	Number of farms maintaining water depth	Performance Monitoring	Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		Decrease of the stocking density at the farms and stocking of hatchery-bred SPF organic black tiger	Disease in fish and shrimps	Disease outbreak in shrimp and fish		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers

		shrimp seeds at the farms to minimize the disease outbreak					
		No use of exogenous feed at the SAIME farms, Application of Mustard Oil Cake (MOC) to enhance the growth of planktons	Use of feed	Exogenous feeds are not used in hectares of farm area		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		No use of chemicals in the farms and application of lime to maintain the water quality	Use of chemicals	Chemicals are not used in hectares of farm area		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		Measurement of water quality parameters of the ponds at distinct intervals to maintain the water quality of the ponds	Monitoring of water quality	Number of farmers are measuring the pH and salinity of their farms		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		Study on the impact of leaf litter on nutrient dynamics in SAIME farms and find out the beneficial planktons for shrimp and fish growth	Leaf litter dynamics	Number of farms are studied the impact of leaf litter	**Impact Assessment**	Collection of report from CoEBE-IISER	CoEBE-IISER and NEWS

To restore the mangrove ecosystem of Sundarban through implementation of SAIME		Land shaping activities to expand pond embankment and create islands at the farms for the plantation of mangroves	Land shaping	Land shaping done in hectares of farm area		Maintenance of record by NEWS	NEWS
		Fencing at the farms to protect the saplings from grazing	Fencing at farms	Fencing structure created in hectares of farm area		Maintenance of record by NEWS	NEWS
		Plantation of mangrove saplings to restore the mangroves	Mangrove plantation	Mangrove structure created in hectares of farm area		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		Monitoring of survival and growth of the planted saplings at the farms and finding out whether there is natural regeneration of the mangroves	Monitoring of mangroves	Restoration of mangroves in hectares of mangrove area	**Performance Monitoring**	Maintenance of record by NEWS	NEWS
		Minimize the stocking of wild-collected shrimp seeds to protect the diversity of the ecosystem and stocking of hatchery-bred SPF organic black tiger shrimp seeds at the farms	Stocking of shrimp seeds	Number of hatchery-bred seeds stocked in the SAIME farms		Collection of data by NEWS from the farmers Diary maintained by the farmers	NEWS and farmers
		Quantification of the algal biodiversity at	Monitoring of algal biodiversity	Abundance of algal diversity in		Collection of report	CoEBE-IISER

		the SAIME farms which are beneficial to aquaculture		the SAIME farms		from CoEBE-IISER	and NEWS
		Quantification of the microbial diversity at the SAIME farms which are beneficial to aquaculture	Monitoring of microbial diversity	Number of microbes available in the SAIME farms		Collection of report from CoEBE-IISER	CoEBE-IISER and NEWS
		Survey of the changes in floral diversity after the implementation of SAIME	Monitoring of floral diversity	Number of flora increased/decreased after implementation of SAIME in the farms		Maintenance of record by NEWS	NEWS
		Survey of the enhancement of faunal diversity after implementation of SAIME	Monitoring of faunal diversity	Number of fauna increased/decreased after implementation of SAIME in the farms		Maintenance of record by NEWS	NEWS
		Avoid the introduction of invasive alien fish/shrimp species at the SAIME farms	aquaculture practice of invasive/alien species	Number of invasive/alien species available in the SAIME farms	**Impact Assessment**	Maintenance of record by NEWS	NEWS
		Find out the increased/decreased number of the RET species and initiatives taken to conserve them.	Restoration of RET species	Number of RET species restored in and near the SAIME farms		Maintenance of record by NEWS	NEWS

6. Participation of Companies in Integrated Mangrove Aquaculture (IMA) Mangrove Projects:

The participation of companies in IMA mangrove projects signifies a strategic collaboration between the private sectors and environmental conservation efforts. This involvement reflects a growing recognition among businesses of the importance of sustainable practices, environmental stewardship, and corporate social responsibility. Participation of companies in IMA mangrove projects includes and address several key aspects:

1. Corporate Social Responsibility (CSR):
Commitment to Sustainability: Companies participating in IMA mangrove projects often view CSR as an integral part of their eco-friendly identity. They recognize the impact of their operations on local ecosystems and are committed to contribute positively towards environmental conservation.

2. Economic and Ecological Synergy:
Balancing Profitability and Conservation: Companies understand the interconnectedness of economic activities and ecological health. IMA mangrove projects provide a platform for businesses to integrate profitable aquaculture practices with the restoration and conservation of mangrove ecosystems.

3. Biodiversity Conservation:
Enhancing Ecosystem Resilience: Companies engaged in IMA mangrove projects contribute to biodiversity conservation by actively participating in habitat restoration. The integration of aquaculture with mangrove ecosystems promotes ecological balance and enhances the resilience of these vital coastal habitats as well as for the coastal communities

4. Community Engagement:
Building Stronger Ties with Local Communities: Corporate participation in IMA mangrove projects often involves collaboration with local communities. This engagement fosters positive relationships, ensures social license to operate, and creates shared value for both the company and the communities in which they operate.

5. Risk Mitigation:
Addressing Environmental Risks: Companies recognize that environmental risks, such as climate change, natural calamities and habitat destruction, can have significant implications for their operations. Engaging in IMA mangrove projects is a proactive measure to address and mitigate these risks, creating more sustainable and resilient business practices.

6. Regulatory Compliance:
Aligning with Environmental Regulations: Companies participating in IMA mangrove projects demonstrate a commitment to complying with environmental regulations. This alignment helps them navigate regulatory frameworks more effectively and positions them as responsible stewards of the environment.

7. Scientific Research and Innovation:

Contributing to Advancements: Many companies involved in IMA mangrove projects invest in scientific research and innovation. This commitment leads to the development of best practices, innovative technologies, and sustainable aquaculture techniques that benefit both the company and the broader industry.

8. Brand Image and Market Differentiation:

Enhancing Reputation: Corporate participation in environmental conservation initiatives, such as IMA projects, enhances the company's brand image. Consumers increasingly value environmentally conscious businesses, and such initiatives provide a unique selling proposition, differentiating the company in the market.

9. Long-Term Planning and Legacy:

Investing in Future Sustainability: Companies engaged in IMA mangrove projects recognize the long-term benefits of preserving and restoring mangrove ecosystems. This strategic vision reflects a commitment to leaving a positive environmental legacy and contributes to the company's overall sustainability agenda.

10. Partnerships and Collaboration:

Multi Stakeholder Partnerships: Companies often engage in partnerships with CSOs, governmental bodies, and local communities to maximize the impact of IMA mangrove projects. Collaboration allows for shared resources, expertise, and a holistic approach to environmental conservation linked with livelihood development of the coastal communities.

7. Benefits and Significance of Corporate Participation in Integrated Mangrove Aquaculture (IMA) Projects:

Corporate participation in Integrated Mangrove Aquaculture (IMA) projects brings forth a multitude of benefits and holds significant implications for companies. The following points elaborate on the advantages and the importance of such participation, presenting various fields of action, potential options, and success factors.

✓ **Enhanced Corporate Social Responsibility (CSR):** **Importance:** Companies actively participating in IMA projects elevate their CSR profile. **Fields of Action:** Companies can contribute to habitat restoration, sustainable aquaculture, and community development.
✓ **Economic and Ecological Synergy:** **Advantages:** Businesses can integrate profitable aquaculture practices with mangrove conservation. **Fields of Action:** Balancing economic interests with ecological restoration, creating sustainable business models.

- ✓ **Biodiversity Conservation:**

Significance: Participation contributes directly to biodiversity conservation.
Fields of Action: Restoration of mangrove habitats, promotion of diverse ecosystems, and conservation initiatives.

- ✓ **Community Engagement and Shared Value:**

Benefits: Companies can build positive relationships with local communities.
Fields of Action: Collaborative projects, skill development, and creating shared value for both businesses and communities.

- ✓ **Risk Mitigation:**

Importance: Active involvement addresses environmental risks affecting operations.
Fields of Action: Implementing measures to mitigate climate change impacts and habitat destruction.

- ✓ **Regulatory Compliance:**

Advantages: Demonstrates commitment to environmental regulations.
Fields of Action: Aligning operations with local and international environmental standards.

- ✓ **Scientific Research and Innovation:**

Significance: Companies can contribute to advancements in aquaculture and environmental science.
Fields of Action: Investing in research, developing best practices, and innovative technologies.

- **Brand Image and Market Differentiation:**

Benefits: Enhances brand image and provides a unique selling proposition.
Fields of Action: Communicating environmental initiatives, marketing sustainable practices.

- **Long-Term Planning and Legacy:**

Importance: Reflects a commitment to future sustainability.
Fields of Action: Implementing strategies that consider long-term benefits and environmental legacies.

- **Partnerships and Collaboration:**

Advantages: Collaboration maximizes the impact of IMA projects.
Fields of Action: Building partnerships with CSOs, local communities, and governmental bodies.

Success Factors:

- ✓ **Holistic Approach:** Success hinges on adopting a holistic approach that considers social, economic and environmental dimensions.

- ✓ **Adaptive Management:** Flexibility and adaptive management are crucial for responding to changing environmental conditions and unforeseen challenges.

- ✓ **Stakeholder Engagement:** Engaging with stakeholders, including local communities, CSOs, and governmental bodies, fosters collaboration and ensures diverse perspectives are considered.

- ✓ **Continuous Improvement:** Commitment to continuous improvement in sustainability practices, informed by regular assessments and feedback loops.

The benefits and significance of corporate participation in IMA projects extend beyond mere environmental stewardship. They encompass economic resilience, community development, and the establishment of sustainable business practices. The success of such initiatives is contingent on a comprehensive and adaptive approach, engagement with stakeholders, and a commitment to ongoing improvement.

8. Summary:

A Biodiversity Action Plan (BAP) is an essential blueprint for the success of sustainable mangrove aquaculture projects, serving as a critical tool for preserving the delicate equilibrium between economic development by using bio-resources and the conservation of mangrove ecosystems. BAPs play a multifaceted role in ensuring the sustainability of these projects by promoting ecosystem resilience, guiding the adoption of sustainable practices, and mitigating risks associated with mono-culture. They underscore the importance of responsible environmental stewardship, advocating for the protection and restoration of mangroves, which are vital for habitat provision and water purification. Additionally, BAPs emphasize community engagement and benefits, supporting local livelihoods and food security while upholding socio-economic sustainability. Moreover, they facilitate compliance and accountability through monitoring and reporting mechanisms, holding aquaculture projects responsible for their environmental and social impact. Following a BAP not only ensures the environmental integrity of these projects but also provides an opportunity for international recognition and access to markets that value sustainability, enhancing both environmental and economic sustainability.

9. References:

1. Thomas N, Lucas R, Bunting P, Hardy A, Rosenqvist A, Simard M (2017) Distribution and drivers of global mangrove forest change, PLoS ONE 12(6). https://doi.org/10.1371/journal.pone.0179302

2. Chandra G, Jordan L, Sawaid A, Mani M, Faisal Mueen Q, Bruce P, David T. (2014). Distribution and dynamics of mangrove forests of South Asia, Journal of environmental management. 148. 10. 10.1016/j.jenvman.2014.01.020

3. Ali, MI., Mahmood, Z., Ahmad, M., Afzal, M., Munir, MA., Sharif, MN., and Shakeel, A. (2016). Genetic variability in *Cirsium arvense* under different environmental conditions. Bulletin of Biological and Allied Sciences Research 1 1:3.

4. FAO. 2007. Global Forest Resources Assessment 2010 – Specification of National Reporting Tables for FRA 2010. FRA Working Paper 135. Rome. Available at: www. fao.org/forestry/14119-1-0.pdf

5. United Nations Environment Programme (2015). UNEP 2014 Annual Report. https://wedocs.unep.org/20.500.11822/9420.

6. Ghosh A, Schmidt S, Fickert T, Nüsser M (2015) The Indian Sundarban mangrove forests: history, utilization, conservation strategies and local perception, Diversity, 7 (2) (2015), p. 149, 10.3390/d7020149

funded by:

BMZ Federal Ministry for Economic Cooperation and Development

german cooperation DEUTSCHE ZUSAMMENARBEIT

Project Partner:

Global Nature Fund

Naturland

NEWS www.naturewildlife.org

BEDS

supported by:

Mercedes-Benz

IMPRINT
Publisher: Global Nature Fund (GNF); Authors: XXX; Editorial Office: Ralph Dejas (GNF), Images: Ralph Dejas (GNF)
As of December 2023