

Sustainability Challenges of Shrimp Farming on Coastal Lands: Archetypal Interplays of Disasters, Ecosystems and Livelihoods

Extended Abstract

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BACKGROUND

Some forms of peoples' livelihoods have evolved through their response to environmental changes. More specifically, they have evolved through their response to climate disasters. This inadvertently has ended up increasing people's vulnerability to climate risks, ecological degradation and economic uncertainty. Shrimp farming on the coastal landscapes of Odisha, India, is a case in point. Over the past four decades, farmed shrimp has become a market commodity. This has been enabled by the rapid conversion of coastal wetlands, agricultural land and mangroves into shrimp ponds. This is evident in regions such as Ersama block, Jagatsinghpur district, which is prone to cyclones, floods and salinity intrusion. Since the devastating 1999 Super Cyclone, the expansion of shrimp farming has been driven by market demand. It has attracted farmers and investors seeking quick profits. This growth, however, has weakened local ecological and economic stability. It has increased the overall vulnerability of community to mounting risks from climate disasters and ecological degradation.

Coastal communities face both rapid-onset disasters (cyclones, floods, storm surges, torrential rain and lightning) and slow-onset disasters (declining fish catch, soil salinisation and groundwater stress). Both these also mutually reinforce each another. Often communities receive untimely and inadequate relief support during these events. They have to rely on debt and out-migration to cope. These responses provide short-term relief but deepen long-term vulnerability.

APPROACH

This paper uses a participatory systems thinking approach to the sustainability challenges of shrimp farming on Odisha's cyclone- and flood-prone coasts. The shrimp farm production is conceptualised as a coupled social–ecological–economic system. It is structured by endogenous feedbacks (disease, soil salinisation, debt cycles, water degradation and depletion). It is shaped by exogenous triggers (cyclones, sea-level rise, regulatory shifts, market demand, market price, investments). The methodology combined desk research; field research (six Focus Group Discussions and five Key Informant Interviews with approximately 90–100 community members) and institutional participants (Govt departments). It also combined iterative causal loop diagramming validated with partner organisations (CYSO and SELCO Foundation). It concluded with the multi-actor systems convening in Bhubaneswar with gram panchayat representatives, local NGOs and CBOs, academicians and technical experts. This helped move from problem articulation to possible interventions that could be collectively implemented as programs.

KEY FINDINGS: THREE SYSTEM TRAPS

Using causal loop diagrams and archetypes, the study identifies key system traps that concentrate risks on marginalised coastal communities and erode their long-term resilience:

- **Tragedy of the Commons (Water and Human Health):** individual shrimp farmers benefit from expanding production. The environmental and health costs – chemical discharge, pond effluents and saline seepage into shared surface water and groundwater – are impacts felt

across the wider community. These eventually constrain both shrimp farming and community well-being.

- **Success to the Successful (Dominance of Shrimp over Alternate Livelihoods):** market demand, high prices and access to loans give shrimp farming economic advantages over fishing, crab collection, paddy cultivation and conservation-compatible livelihoods. This leads to rapid conversion of land and livelihood. It attracts capital, land and labour reinforcing shrimp's dominance over other livelihoods.
- **Fixes that Backfire (Amplification of Disasters and Side Effects):** expanding shrimp ponds initially serves as a coping strategy for income insecurity. The resulting land conversion weakens natural buffers such as mangroves and sand dunes. It intensifies water stress. It ultimately amplifies disaster impacts on both communities and the ponds themselves, turning the original livelihood fix into a source of higher vulnerability.

Across all three archetypes, short-term coping and income gains gradually produce delayed ecological, health, livelihood and disaster-related costs, pointing to the need for collective water governance, livelihood diversification, regulations in shrimp farming and restoration of coastal ecosystems.

The multi-actor systems convening identified three priority programme areas for resilience-building – sustainable shrimp farming, regenerative agriculture and climate-resilient habitats. Net-zero principles emerged as a cross-cutting theme. Next steps include community consultations, policy and scheme mapping, integration of Village Disaster Management Plans with Gram Panchayat Development Plans, and a multi-actor working group. This working group will potentially guide programme design while ensuring coordination, local ownership and long-term accountability.

CONCLUSION

The paper argues that acknowledging the likelihood of compounding climate shocks can reorient the shrimp sector away from risk reduction alone toward building coastal resilience. This can happen while still acting to reduce harm and expand livelihood options. Shrimp farming in coastal Jagatsinghpur is not only a livelihood response to environmental and economic stress. It is also part of a wider social–ecological system in which short-term coping strategies can deepen long-term vulnerability. The findings highlight the need to move beyond relief-oriented disaster management towards resilience-building approaches. These approaches address both rapid-onset and slow-onset risks. Supported by net-zero principles and a collaborative multi-actor coalition, sustainable shrimp farming, regenerative agriculture and climate-resilient habitats can help create more locally grounded, accountable and adaptive pathways for coastal resilience.

WAY FORWARD

A potential way forward is to tie up the future actionable with the four dimensions of the deep adaptation framework. These dimensions can be used as a means to engage with community. This could allow a more holistic way of understanding community perspectives and bringing them into the program design. E.g. Resilience – how would we safeguard food security, build social cohesion and cultural ties through adaptive infrastructure, develop early warning systems and diversify livelihoods. Relinquishment – how can we phase retreat the ponds from the most vulnerable zones and halt new approvals in ecologically critical belts. Restoration – how can we implement large-scale mangrove afforestation, wetland rehabilitation and revival of traditional water management. Reconciliation – what dialogues are needed, between whom, what degree of compensations and joint planning is needed to rebuild trust where conflicts have arisen.