

Community-Led Sequential Rice-Fish Farming: A Climate-Resilient Model from Coastal Odisha

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Introduction: Battling Nature's Extremes in Coastal Agriculture

Coastal Odisha, particularly the Puri district, is one of the most climate-vulnerable regions in eastern India. Farmers here constantly face the wrath of nature in the form of erratic rainfall, cyclones, flash floods, and prolonged waterlogging. More than 70% of the district consists of low-lying areas that remain submerged during the monsoon months. In such conditions, rice the staple crop cannot be grown during the kharif season, forcing farmers to cultivate it only after floodwaters recede in Rabi. The kharif months often leave fields fallow and farmers jobless, leading many to migrate to cities for wage labor.

To address this crisis, a new farming model was introduced under the NICRA-TDC project in 2021-22 in Jatipura, a small village with 72 households in Puri district. Instead of treating excess water as a curse, the project aimed to transform it into an opportunity through sequential rice-cum-fish farming, popularly known today as the Jatipura Model.

The Jatipura Model: Converting Waterlogging into Wealth

The Jatipura Model integrates rice cultivation with aquaculture and bund plantations, turning waterlogged areas into highly productive farming zones. A compact patch of 17 acres, owned by 17 small and marginal farmers, was chosen for the experiment. The embankments around the land were mechanically strengthened up to a height above the flood level recorded in the past 20 years, ensuring protection against inundation.

This system follows a sequential approach: fish are cultivated in monsoon months when fields are waterlogged, and once fish are harvested in December, farmers immediately sow rice on the nutrient-rich soil. The bunds (embankments) are simultaneously used for banana, vegetables, flowers, and even small livestock units, ensuring year-round productivity.

This diversification of farming activities reduces risks, optimizes the use of natural resources, and ensures a steady flow of income.

Land and Water Management

The 17-acre land parcel in Jatipura remains submerged from June to December every year. Instead of leaving it fallow, the project converted it into a multipurpose pond for aquaculture by raising the bund height. Farmers also planted climate-resilient banana variety *Patkapura* along 1 km of the embankment, intercropped with sweet corn, radish, cowpea, and marigold. These additional crops not only diversified income but also provided food security to the community.

A baseline study revealed the climate vulnerabilities faced by the village:

Table 1. Major Climatic Challenges in Jatipura

Hazard	Severity	Period of Occurrence	Crops Affected
Drought	Mild	April (1st fortnight)	Rice
Flood	Severe	July-September	Rice
Pests & Diseases	Severe	Feb-March	Rice
Sea Inundation	Severe	Aug-Sept	Rice

The average annual rainfall of Jatipura for last 30 years (1990-2020) is 1436mm and the monsoon (June to October) rainfall is 1249mm, which accounts for 84% of annual rainfall. The number of normal rainy days during kharif was 56. It was observed that surface water ponding starts from 3rd week of June and increases maximum upto 162cm in last week of August and reduces to surface level in December in the 17 acres compact patch of village Jatipura. So, there was a need to keep the water up to December, so that fish can be harvested in the last week of December and then farmer could go for rabi Rice crop. Renovation of bund up to 5ft was done by mechanical means under natural resource management up to length of 980m surrounding the compact patch of 17 acres. Then the farmers of the village engaged to prepare the bund for plantation of Patkapura variety of Banana which is suitable to the climate of the district and at the same time vegetable and floriculture crops.

The weekly rainfall, surface ponding and water table depth is presented in fig2. The steep rise and fall in water table may be due to its drainage into river Ratnachira during low flow period and quick recharge of ground water during high flow period.



Figure 1. Location Map and Resource Layout of Jatipura Village

Fish Farming: The Core of the Model

Fish farming was introduced as the primary activity during the monsoon season. Farmers prepared the fields following pond management practices—liming, manuring with cow dung, and fertilization. A variety of fish species like Indian Major Carps (Catla, Rohu, Mrigal), Amur Carp, Grass Carp (to control weed growth) and Scampi (freshwater prawns) were stocked in phases: A stocking density of 7,500 fingerlings per hectare was maintained, with species composition of 30:40:30. In addition, prawns were stocked at 15,000 per hectare. Feeding included cow dung-based pond manuring and floating feed pellets.

Table 2. Annual operational cost and net return of the 5.6 ha pond system (year 2023-24)

Input material	Quantity	Total Input Cost (Rs.)
Cost of fingerling production for stocking @Rs2/- per fingerling	51000	102000
Cost of ploughing by tractor @Rs.500 per hour	14h	7000
Cost of cow dung@ Rs.1300 per tonne	6tonne	7800
Cost of lime @ Rs.10 per kg	800kg	8000
Cost of pellet feed @Rs10per kg	6tonne	60000
Labour cost @Rs.100 per man day	180 man days	18000
Total cost		202800
Yield (q)		
Carp fish	21.8	348800
Weed fish	3.2	51200
Scampi	1.0	40000
Selling of fish	25.0	400000
Selling of Prawn	1.0	40000
Gross return		440000
Net return		237200

This significant profit encouraged farmers to embrace aquaculture wholeheartedly, creating livelihood opportunities during the otherwise unproductive kharif season.

Poultry and Duckery: Portable Livelihood Units

To further diversify, low-cost portable poultry and duckery units were introduced. Eight two-storied units were provided to farmers, each capable of rearing 60 birds. In total, 500 poultry birds (Kadakhnath, Vanaraja, Rhode Island Red) and 1,000 ducks (White Pekin, Khaki Campbell) were reared.

Table 3. Economics of Poultry System

Sl No	Item	Price (Rs)
1.	One day Chick cost	30/-
2.	Feed cost per bird	60/-
3.	Medicine cost per bird	10/-
4.	Maintenance cost per bird	10/-
Total expenditure incurred per bird		110
Per bird yield 1.8kg @Rs.130.00 per kg		234
Net profit per bird		124

The portable design ensured that birds could be shifted during floods, preventing losses.

Bund Plantation and Horticulture

The embankments surrounding the fish ponds were utilized for banana plantation. *Patkapura* bananas were planted along with seasonal vegetables and flowers. Lady's finger was less successful, but crops like radish, sweet corn, and marigold fetched good market prices. The first-year net return from vegetables alone was Rs.33,600, showcasing the potential of bund-based horticulture.

Mushroom and Vermicompost: Recycling Farm Resources

Community mushroom units (rice straw and oyster mushrooms) were set up using agricultural residues. The spent mushroom substrate was further recycled through vermicomposting, creating organic manure for fields. This closed-loop system reduced waste and lowered fertilizer dependency. Farmers earned from both mushroom sales and compost production.

Rice Cultivation: Benefiting from Fish Farming

After fish harvest in late December, rice (*Binadhan-11*) was directly sown. This climate-smart variety is saline- and submergence-tolerant, making it ideal for Puri's conditions. Since the soil was already enriched with fish biomass and manure, fertilizer use was reduced by 225 kg/ha compared to traditional practices, saving Rs.4,365 per ha. Average yield reached 51 q/ha, which was 9 q/ha higher than the previous practice.

System-Level Economics

The integration of fish, rice, poultry, horticulture, mushroom, and composting created a sustainable farming system.

Table 4. Year-wise Expenditure and Returns from Integrated System (6.05 ha)

Year	Input Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)
2021-22	8,26,150	12,05,640	3,79,490
2022-23	8,91,030	16,29,855	7,38,825
2023-24	11,25,084	24,31,150	13,06,066
Total	28,42,264	52,66,645	24,24,381

The model proved not just economically viable but also socially transformative, reducing seasonal migration and generating over 300-man days of employment.

Water Productivity

The water productivity of the system was estimated as the ratio of pond output in rupees to the volume of pond water for the year 2023. The total volume of water available in the pond assuming average depth of 1.5 m, is 86660 m³. Annual water exchange is approximately 68,461 m³. The total returns from the pond system alone were Rs.4,40,000 in the year 2023. This corresponds to a water productivity of Rs.2.83 per m³.

Conclusion: Lessons for Climate-Resilient Farming

The Jatipura Model showcases how community-based integrated farming can transform challenges into opportunities. By combining aquaculture, rice cultivation, horticulture, poultry, mushrooms, and composting, farmers optimized resource use, improved soil fertility, and achieved impressive profits. The system reduced migration, created jobs, and gained recognition from the district administration and agricultural extension networks. What makes this model remarkable is its scalability and replicability. Seasonally waterlogged lands across coastal Odisha and beyond can adopt this approach to ensure food security, income stability, and resilience against climate change. As farmers say in Jatipura today, “Water is no longer a curse, but a source of livelihood.”

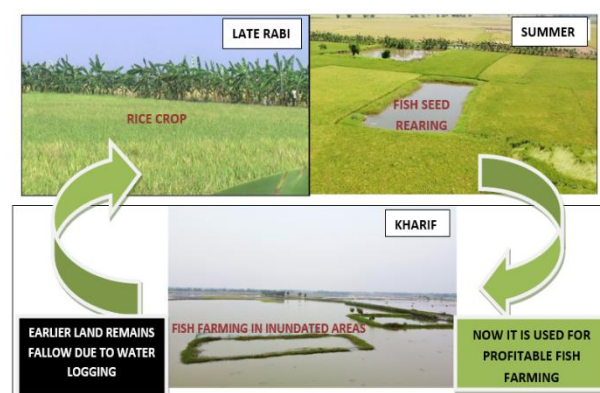


Fig 2: Sequential rice cum fish farming
