

Pokkali Farming System Transition and Socio-ecological Sustainability

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ABSTRACT

The decline in indigenous farming systems worldwide poses a critique of the sustainability of socio-ecological systems. In this context, the study explored the transition of the indigenous *Pokkali* farming system (PFS) practised in the saline coastal wetlands of Kerala. A single-site case study method was selected for Ezhikkara Pachayath in the Ernakulam district of Kerala. Extensive fieldwork was conducted in Ezhikkara and primary data were collected through individual in-depth interviews and Focus Group Discussions (FGDs) with various stakeholders, utilizing a purposive sampling design. The findings revealed that despite having potential for achieving multiple SDGs, *Pokkali* farming in Ezhikkara is declining due to adverse social, economic, ecological, and policy-related externalities. Anthropogenic activities hurt the ecosystem, posing multifaceted socio-ecological challenges to local communities. The study highlights the transition in PFS in Kerala and its implications for socio-ecological sustainability in Kerala. A paradigm shift is necessary for a practice rooted in ecological justice that enhances the socio-ecological well-being of the community and the natural ecosystems, which sustains and supports us all.

Keywords: Farming, Indigenous, Pokkali farming system, Socio-ecological, Transition.

INTRODUCTION

Indigenous farming systems (IFS) have played a crucial role in providing various ecosystem services that support human life. IFS is characterized by principles such as the rotation of land use across space and time, the recycling of natural resources, minimal reliance on external energy inputs, and a miscellany of interconnected land-use patterns that reflect distinct social-ecological relationships (Tarafdar and Mazumder, 2020). *Pokkali* IFS is a dynamic wetland agriculture system that provides multiple ecosystem services, including food security, water security, microclimate regulation, local livelihoods, and biodiversity (Sreelatha *et al*, 2022), and extends across the Ernakulam, Alappuzha, and Thrissur districts of Kerala. *Pokkali* rice is perhaps the most resilient rice variety, capable of surviving the high salinity and acidity in coastal wetlands while contributing substantially to local food security, which is particularly valuable amidst rising sea levels (Jayan and Nithya, 2010). During the past two decades, the PFS has undergone more rapid change than in any comparable period in the history of *Pokkali* agriculture, resulting in the degradation of the *Pokkali* ecosystem, which has far-reaching implications that permeate every facet of the native community. While existing

studies focus on the biological and economic dimensions (Ranjith *et al*, 2019; Sreelatha *et al*, 2022) of the *Pokkali* PFS, there is a dearth of studies examining the implications of its transition on socio-ecological sustainability in Kerala. In this context, a single-site case study on *Pokkali* IFS was conducted in Ezhikkara Panchayath, Ernakulam District, Kerala.

MATERIALS AND METHODS

There are 236.63 ha of *Pokkali* fields in Ezhikkara panchayat, which are spread across five polders: Perumpadanna (49.9 ha), Kedamangalam, Nandiattukulam (26.5 ha), Central (76.23 ha), and South (84 ha) polders. Extensive fieldwork was conducted in Ezhikkara between 2023 and 2024, with primary data collected through individual in-depth interviews and Focus Group Discussions (FGDs) using a purposive sampling design that involved various stakeholders of PFS. Additionally, secondary data was sourced from multiple sources. The researcher's institution provided ethical approval for the study, and informed consent was obtained from all the research participants. The qualitative data were coded and analysed using the Atlas.ti software, and the secondary data were analysed manually using the content analysis method. Following this, the key themes were derived through thematic analysis.

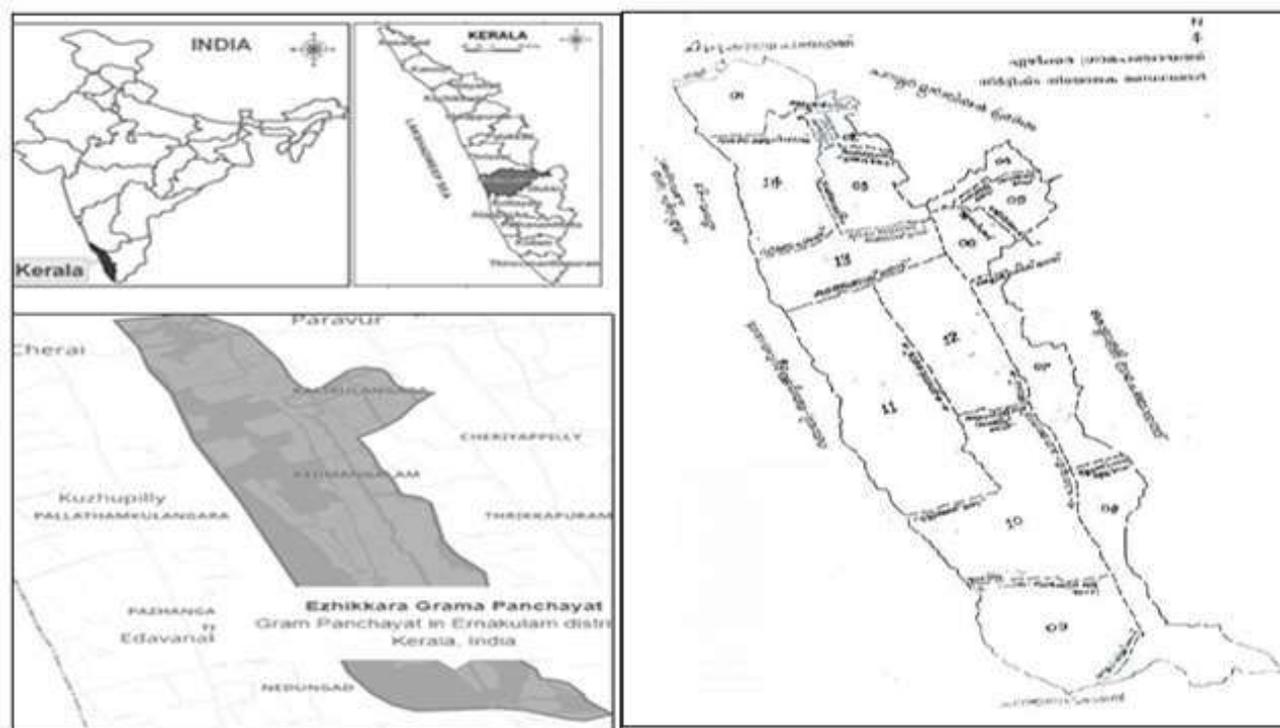


Fig. 1: Location of Ezhikkara Panchayath

Source: LSGD, Ezhikkara

RESULTS AND DISCUSSION

The study indicates that the *Pokkali* farming system has undergone significant transitions in the last two decades, resulting in the decline of the cultivated area under PFS as shown in Table 1. The number of farmers who grow *Pokkali* is also getting reduced each year. A decade ago, almost 239 farmers engaged in *Pokkali* farming in Ezhikkara. In 2024, only one farmer grew *Pokkali* and had a minimal harvest, indicating the alienation of traditional *Pokkali* farmers from the practice of increasing *Pokkali*.

Socio-economic factors contributing to the decline in PFS

Various social, cultural, and economic factors have played a key role in determining the dynamics of the PFS transition in Ezhikkara.

Transition in land use pattern

Land use changes in Ezhikkara are evolving due to intensive aquaculture, the cultivation of other rice varieties, and the fallowing of land.

Intensive aquaculture

The *Pokkali* rice fields have great aquaculture

potential as the farming system utilises the symbiotic nature between the paddy and fish culture. Traditional *Pokkali* farmers often compensated for their losses from paddy cultivation during the aquaculture season, and this method also helped to develop and maintain soil fertility in *Pokkali* lands. However, the whole scenario has now changed. The area under *Pokkali* farming has decreased significantly, with more land being cultivated for aquaculture. As shrimp farming offers higher profits, several farmers in Ezhikkara are transitioning entirely to shrimp farming, abandoning *Pokkali* cultivation. In our view, approximately 50% of the polders in this area are now under shrimp culture, with rice cultivation being largely abandoned (In-depth interview with local community member from Ezhikkara Panchayat, dated December 18, 2023). In 2024, twenty-six farmers from Ezhikkara Panchayath applied for aquaculture licenses covering 125.74 acres of *Pokkali* fields. Fifteen farmers received Rs 22,11,625 from aquaculture on 115.77 acres in Ezhikkara. The high profits from aquaculture are an economic motive for most traditional farmers to abandon paddy cultivation and opt for aquaculture or lease their lands to aquacultivators. The situation also resulted in the growth of aquaculture lobbies in Ezhikkara. State agencies support aquacultivators by extending the licensing period for aquaculture.

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Table 1: Decline in area under Pokkali paddy cultivation.

Year	Area under Pokkali paddy farming (Ha)
2017	100
2018	130
2019	150
2020	150
2021	65.2
2022	95.7
2023	90.9
2024	1.1

Source: Compiled from unpublished report given by Pokkali Land Development Authority, on 01-12-2023; Report from Ezhikkara agriculture office dated 8th May 2023; Interview with farmer from Ezhikkara, Ernakulam district, dated 9th December 2024.

Table 2: Social impacts of the decrease in PFS.

Social implications of the decline in PFS	Narratives from the field
Decline in indigenous knowledge and practice	With the decline of paddy farming, the scientific indigenous wisdom on PFS is disappearing and not being transferred to the upcoming generations, resulting in a knowledge gap across generations (In-depth interview with farmer from Perumpadanna polder, Ezhikkara Panchayath, dated 4 th February 2023)
Gendered livelihood loss and unemployment	The decline of Pokkali fields resulted in the unemployment of female labourers who were traditionally farm hands. However, age, health issues, lack of skill, location, and lack of transportation facilities in the Panchayat often prevent women from finding job opportunities elsewhere (In -depth interview with a woman agricultural labourer from Ezhikkara dated 13 th February 2024)
Class disparity of farmers	Over the last few decades, an agrarian transformation has occurred in Ezhikkara, creating a dichotomous agricultural society with a category of wealthy farmers who have benefited from the switch to year-round aquaculture and another segment of subsistence farmers whom the transformation process has marginalised (In -depth interview with farmer from Ezhikkara dated 23 rd February 2024)
Crop loss and financial constraints	Excessive rain causes waterlogging in Pokkali fields, resulting in crop loss. During 2023 -2024, we sowed seeds across 10 acres. Except for one or two farmers, the seeds of almost all others decayed due to the heavy rain. This resulted in severe financial losses for the farmers who needed loans and other forms of financial aid (In -depth interview with farmer from South Polder Ezhikkara, dated 4 th February 2023)
Increase in lifestyle diseases	I feel those who consumed Pokkali in my family have high bone density and good health. But our generation often consumes unhealthy food, which leads to multiple lifestyle diseases (In -depth interview with aqua cultivator from South Polder, Ezhikkara, dated 2 nd August 2023)

Fallowing of land

A significant area of the Pokkali wetlands has been left fallow for several years. Some fallowed

polders are occupied with mangroves and shrubs, affecting Pokkali farming. Legally, it is not possible to remove mangroves or destroy them.

Table 3: Ecological impacts of the decline in PFS.

Environmental impact of the decline in of PFS	Narratives from the field
Reduced soil fertility	When paddy was grown in Pokkali fields, the stubble of the paddy was left in the fields, thereby increasing soil fertility. With the decline in paddy farming, the soil became less fertile and more saline, significantly reducing the yield from nearby coconut trees. (In-depth interview with farmer from Ezhikkara dated 04 th February 2023).
Transition in soil properties	The soil properties of Pokkali lands have changed. In the past, the farmers used to dry the fields to strengthen the soil, every year before farming began. But nowadays, due to the untimely rain and high tidal waves, the fields are primarily swampy during field preparation and won't dry properly (In -depth interview with agricultural women labourer from Ezhikkara dated 13 th February 2023).
Increased soil salinity affecting water quality and causing damage to buildings	A significant issue with shrimp monoculture is that the fish lobby refuses to allow the saline water to flow out of the fields, even during rainy seasons. This makes the entire area saline. It disrupts the socio-ecological system of that specific region by affecting the water quality, buildings, houses, etc (In -depth interview with a scientist from Rice Research Station Vyttila dated 1 st October 2023).
Decline in biodiversity	Earlier, various crabs and small fish inhabited these fields. But it is not seen nowadays. It is the result of the decline in farming. (In depth interview with a board member of Palliyackal Bank dated 13 th October 2023).
Overgrowth of weeds	With the discontinuation of Pokkali farming, field management has stopped. The changes in climatic conditions and soil properties catalysed the growth of excessive weeds in Pokkali fields. Nowadays, when the fields are left fallow for a small period, they are occupied with different kinds of weeds (In-depth interview with farmer from Ezhikkara dated 25 th October 2023).
Reduced flood resilience	With the decline of farming, our fields are filled with excess silt, reducing the wetlands' water -holding capacity. Hence, we face flooding even during a slight rain (In -depth interview with a native from Ezhikkara, interview dated 30 th February 2024).

Labour scarcity in PFS

In *Pokkali* farming, mechanization is limited due to the natural conditions in the *Pokkali* wetlands. Labour scarcity is the foremost challenge in *Pokkali* farming. I have been farming for the last 32 years. Now, we don't get labourers. Earlier, plenty of labourers were there to do each task. Even if we stop them, they will fight among themselves to work in the fields. That time, 30 to 40 labourers entered the fields when only 20 were required (FGD with farmers from Ezhikkara dated 8th May 2023). Most polders in Ezhikkara lack both good farm roads and adequate transport facilities for transferring produce, resulting in transportation challenges and an enormous

workload for the labourers. Other factors include constraints on working long hours in marshy and waterlogged fields, the incidence of waterborne diseases, poor health conditions among mostly elderly farmers, the emergence of alternative livelihood sources, and the flourishing urbanisation in Ezhikkara, adjacent to Kochi, a vibrant economic hub.

Cost burden contributing to the decline in PFS

Various economic factors contributed to the cost burden of Pokkali farmers, reducing their engagement in farming. Farmers struggle to obtain a sufficient *Pokkali* rice procurement price. Currently, the State is not procuring *Pokkali* rice. Previously, the

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production cost of 1 Kg of *Pokkali* rice was around ₹80/Kg, whereas the government procurement rate for *Pokkali* rice was only ₹28/Kg. The Palliyackal Cooperative Bank in Ezhikkara procures the rice at Rs. 40 to 50 per Kilogram. However, despite its GI status, *Pokkali* rice still struggles to achieve a competitive market value compared to other GI-tagged varieties, which often command higher prices. Furthermore, the demand for increased labour wages also leads to a decline in PFS. Earlier, *pathamb* (a fixed amount of harvested rice) was given as wages, as food was scarce at the time. But with the emergence of a public distribution system, the *pathamb* system is replaced with cash wages. The high wages demanded by the labourers and lesser working hours put the farmers in severe financial trouble, as *Pokkali* farming is already non-profitable.

The high infrastructure costs due to frequent damage to the sluices are also one of the critical reasons for the decline of *Pokkali* farming in Ezhikkara. Since sluices are often made of wood, they require frequent maintenance. Repairing sluices involves the participation of many skilled labourers. Sluice work requires approximately Rs. 2,000 in wages per person. Constructing a sluice from scratch can cost around Rs. 1 lakh, beyond the means of many financially struggling farmers (In-depth Interview with the farmer from Central Polder, Ezhikkara Panchayat, dated 4th May 2023). Dykes, which are present in every field, are currently in a state of decay. If a dyke breaks, repairs can cost around two lakhs, further increasing the financial burden. Fields near the bunds face exceptionally high maintenance costs, as bund strengthening requires significant labour expenses.

Ecological factors contributing to the decline in PFS

Besides social factors, the ecological factors also lead to the decline of PFS.

Changes in rainfall patterns

The southwest monsoon and tidal action in the Arabian Sea are critical factors influencing PFS, and recent changes in rainfall patterns have had adverse impacts. The high salinity of waterlogged *Pokkali* fields caused by the high tides is washed off during the heavy southwest monsoon. In the absence of rain, the *Pokkali* field will dry due to the excess salinity, as the salt will not be washed out. Since the fields lie near the backwaters, they have high salinity and will be washed with rainwater. Without rain, farming cannot be successfully continued. Seeds are deposited only after

the saline content has been completely removed from the fields. One week of rain is enough to remove salt from the fields (In-depth interview with farmer from South Polder Ezhikkara dated 13th January 2024). The extreme heat also destroys the paddy crops in their milk stage. Moreover, the rising temperature resulted in labour scarcity, as most labourers were unwilling to work in hot atmospheric conditions. Due to the extreme heat, the labourers in the *Pokkali* fields work only 4 to 5 hours a day.

Bird attack in fields

The purple moorhen (Nellikozhy) has started attacking *Pokkali* paddy over the last three decades. In *Pokkali* fields, the purple moorhens are uncontrollable as the farmers can't enter the fields after a specific period of waterlogging. It comes in large numbers during the day and night, making a nest among the crops and destroying the entire crop by sucking the juice from the paddy plant's stems. (In-depth interview with farmer from Central Polder, Ezhikkara Panchayat, dated 4th May 2023). Earlier, when farmers in Ezhikkara grew *Pokkali* in broad areas, the attacks by these birds were less frequent. Since *Pokkali* is now grown over a small area, all the birds flock to that polder, resulting in significant crop loss for the farmers.

Pollution

The *Pokkali* lands in the south Polder of Ezhikkara are surrounded by several households that dump garbage, including plastic waste, into the polders, affecting cultivation practices. In addition, shrimp processing units in the area discharge their sewage into these *Pokkali* fields. The smoke from industries like FACT affects *Pokkali* plants. The excessive growth of water hyacinth also pollutes the *Pokkali* fields.

Social and ecological impacts of the decline in PFS

The decrease of PFS has created several socio-economic and cultural effects, which include a decline in indigenous knowledge and practices, livelihood loss and unemployment with a gendered dimension, class disparity of farmers, crop loss and financial constraints, an increase in lifestyle diseases, and a decline in recreational services (Table 2). Table 3 highlights the ecological impacts of the decline in PFS. The above section discusses the multiple ecological impacts of the SES transition in PFS.

The PFS is an environmentally sustainable way of farming that possesses the potential to

contribute to achieving various sustainable development goals (SDGs including SDG1 (No poverty), SDG2 (Zero hunger), SDG3 (Good health & well-being), SDG5 (Gender equality), SDG6 (Clean water and sanitation), SDG8 (Decent work & economic growth), SDG 10 (reduced inequalities) SDG 12 (responsible consumption & production), SDG 13 (Climate action), SDG 14 (Life below water), SDG 15 (Life on land). However, in Ezhikkara, the PFS faces significant transitions due to adverse social, economic, ecological, and policy-related externalities. Unscientific land use activities led to severe land degradation, rendering the fields unsuitable for Pokkali paddy cultivation and disrupting the environmental balance. With intensive aquaculture, the soil salinity of the Pokkali field increased, resulting in reduced land productivity and degradation of groundwater resources. The excessive salinity in the air and soil also causes damage to houses and buildings, posing a challenge to the community's social security.

Additionally, year-round aquaculture has reduced the percolation of rainwater into the ground, thereby increasing the risk of floods. The pollution of wetlands also affects human health and the biodiversity of these ecosystems (Lakshmi and Jayasree, 2020). Further, the rich biological diversity and associated ecological processes, which provide a range of ecosystem services and form the foundation of livelihoods for wetland-dependent communities, are also adversely affected. Although the discontinuation of paddy farming does not immediately impact aquaculture, in the long run, it will reduce the yield from aquaculture, thereby creating economic challenges for its growers. Anthropogenic challenges and their adverse impacts are often experienced by ecosystems, which encompass communities. When profit takes precedence, environmental and human well-being are usually ignored. The decline of the Pokkali farming system emerges as a multifaceted socio-ecological issue. Ecological degradation resulting from the decline of Pokkali farming has led to social injustice and inequity.

CONCLUSION

The paper argues that the current socio-political system failed to prioritise socio-ecological justice in the context of Pokkali. The study underscored the need for comprehensive policy

formation and interdisciplinary interventions to address environmental concerns in the Pokkali ecosystem by considering their ripple effects across various societal contexts.

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