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Farm Pond Ecosystem-a Nature-Based Solution to the Global Challenges of Small holder Farmers

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Abstract

Small holder farmers have been grappling with multiple challenges over the period across the globe. Broadly, these are categorized into three segments: social challenges, economic challenges, and environmental challenges. This paper emphasizes on farm pond ecosystem that emerges as the 'one size fits all' to global challenges faced by small holder farmers. It gives access to the water resources, creating an employment for the household and thus absorbing growing population pressure of natural land division. It gives easy access to women for water, provide nutrition to the family and creates employment. It helps to promote regular income of the farmers through pond based integrated farming technique by utilizing local available resources and knowledge by lowering input cost. It addresses water depletion through harvesting rainwater, check soil erosion & enhances biodiversity by generating vegetation around pond for economic activities. Such ecosystem approach leads to nature-based solution.

Keywords: Farm Pond, social challenges, economic challenges, environmental challenges, Integrated Farming System, Nature based Solution.

1. Introduction

Water and agriculture are indispensable part of agricultural livelihoods. Approx 70% fresh water is used for agricultural purposes and in low-income countries, agriculture accounts for 90% water withdrawals (Aug 23, 2023)[1]. It is well known among the agricultural communities (scientist, farmers, researcher, etc) that water is a crucial input for production. Growing population with food demand will be the major challenges (Goran Miladinov, 2023)[2] against the world. 50% increase in food demand will leads to another 15% of water withdrawal in agriculture, which is expected to be done by 2050 (FAO, 2020).

Small farm holder farmers (farm size less than 5 acres) are most vulnerable in this process of development in terms of access of resources, limited access to market, finance, technology, and climate change, who produces almost 75%-80% of the world food needs (Aug 6, Hannah)[3] or one third of the world food. Despite of these segments are deprived of and trapped in the vicious cycle of poverty. There are 600 million smallholder farmers around world (Sept 28, 2022)[4] and are the key stakeholder for global food security. 74% of the total smallholder farmers are from Asia and accounts for 60% of the agriculture

[1] https://blogs.worldbank.org/en/opendata/strains-freshwater-resources-impact-food-production-water-consumption
[2] https://www.frontiersin.org/journals/human-dynamics/articles/10.3389/fhumd.2023.1121662/full
[3] https://ourworldindata.org/smallholder-food-production
[4] https://www.weforum.org/stories/2022/09/smallholder-farmers-key-achieving-food-security/

production. Neena (2024) mentioned that according to the World Bank, nearly 300 million people in Asia live on less than $2.15 a day, and over 418 million are undernourished, including many who depend on farming for their livelihoods.

In India, smallholder farmers constitute of around 86%, who owns 33% of the total cultivated land, whereas 85% are marginal and small farmers as per NBARAD. Cropping intensity is 155.4% in India and 126% in Jharkhand as per ICAR report. Availability of water for agriculture is the major challenge along with access to knowledge & institution, increasing input costs, climate adversities, etc. MGNREGA has been instrumental in creating assets for the farmers in India and positive impact found by multiple researchers in their studies outcome. Creating ponds is one of them. Ponds have multiple uses and benefits in rural areas. It does not only harvest rainwater but also promotes fisheries as alternative source of livelihoods rather than crop cultivation (FAO, 2009).

2. Review of Literature

Small holder famers are the pillars for global food security. In India, 58% farmers are dependent on agriculture, on which 86% are smallholder farmers and thus agriculture remains the primary source of income for India's population (ICAR). They must be in the central to the planning in terms of any interventions locally. Small holder farmers face multiple challenges related to social, economic and environment. World population would reach eight billion people by end of 2025 and another two billion people in another 25 years in developing countries.

Globally, 60% rural population are dependent on their own production for food and close to 90% urban population are dependent on market for food supply and thus global food security is the challenge (Alex, 2021). Land areas and ownerships are decreasing drastically with growing population (Richard *et al*, 2023). It would be interesting to study the area of field bund (land demarcation line) would be more enough land with such natural division of land that could feed large number of population if utilized. Small land sizes either promoting disguised employment or forced migration to the cities among these farmers.

Increasing input cost, increasing market dependency of the farmers for inputs, less access to technical knowledge and market, decreasing soil fertility and increasing production cost have been the major economic challenges of the farmers (Neena, 2024) & (Mark et al). Rakesh *et al* advocates that fewer external inputs and integration of traditional knowledge and modern agriculture will improve agriculture productivity and lead to sustainable approach.

Sustainable natural resource management (Alex, 2021) is the biggest challenge and changing climate scenarios are the biggest challenge in Indian agriculture (Rakesh *et al*, 2019). Rakesh *et al* further describes about the ill effect of green revolution on land. Irregular occurrences of climatic events are known to everyone, and climate change has become reality.

Farm ponds have been multiple advantages for small holder farmers. It has multipurpose use for the community. It conserves rainwater and promote livelihoods for the farmers. It generates employments, provide nutrition, and improves ground water (FAO, 2009). Farm ponds had positive impact against adverse climate and enhanced crop productivity as per study conducted by IIT Delhi (July 8-12, 2024). In the same line, there are many studies conducted on Pond based integrated farming system by different universities and found that the income increases multi-fold of the farmer. Kapil *et al* (2020) found that integrated farming system is low-cost technology, cost effective, gives better economic return and also environmental friendly.

3. Objective of the study

- To study the social, economic, and environmental challenges of small holder farmers
- To understand the role of pond ecosystem in addressing challenges of smallholder farmers

4. Method of data collection

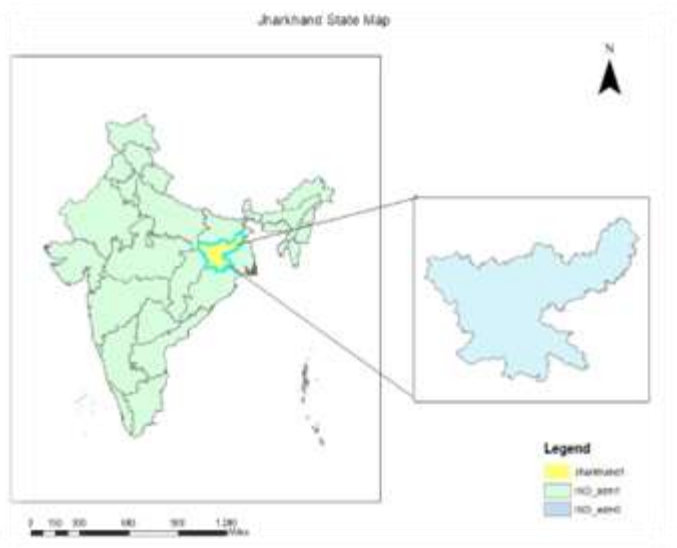
I. Primary data collection
(a)Purposive Sampling (b) Snowball sampling (c) Interview (d)Triangulation (e) Direct observation (f) Photography (g) Focused (h) group discussion (FGD).

II. Secondary data collection / desk research
(a) Articles (b) Journals (c) Books

5. Area of study

The study was conducted in the state of Jharkhand of India, which is known for abundant natural resources. It has undulated topography and the origin of Swarna Rekha river. The state population is primary dominated by tribal communities. The primary source of livelihood is agriculture. More than 70% of the population are dependent on agriculture. Tribal communities are also dependent on non-timber forest product (NTFP). Annual rainfall is more than 1100 mm as per Indian Metrological Department (IMD). For last few years, the precipitation is uneven and shifting as per reports. Temperature is reaching to 46 degrees in some of its districts. Annual income of per household is INR 58, 740 (NSSO,2019-20), forest cover is 29.76% (ISFR, 2021) and 34 aspirational block out of 264 as per Niti Aayog. The State department of agriculture has assessed that the food grain deficiency in the state is 14%, for other nutritional items like fruits, milk, and meat this deficiency is 69%, 43% and 35% respectively. For a state where a large population is poor, this deficiency is alarming as households are exposed to market forces to meet their nutritional demand.

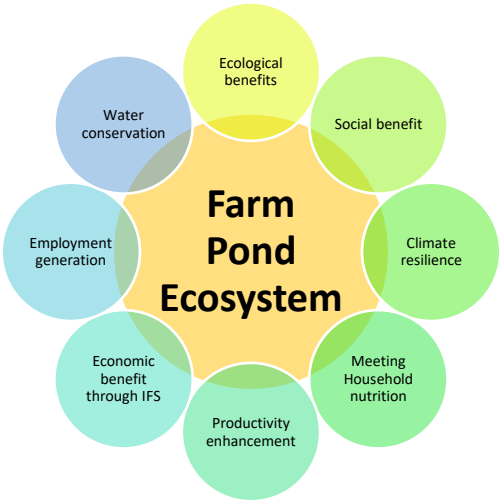
Sample size: Respondents are form different 21 blocks of three districts in Kolhan region. We have interacted with 557 farmers and visited their ponds.



map courtesy: Yamini Sinha (TERI)

6. Finding: analysis and discussion

Smallholder farmers are backbone for the global food security, but they are facing with multiple challenges in production process. They are struggling to survive through agriculture and are forced for migration. It is changing the demographic profile of the geography and thus, urban population is increasing. This situation has also left the cultivable land non-productive and slowly agriculture has become failed aspiration for the rural youth (Parth, 2021). Water is dependent variable in agriculture and rain is only the source of water. Farm pond is the best option for conserving water for small land holders. Utilization of pond ecosystems in a process addressing farmers challenges is the way to hold back farmers into farming to build production process sustainable.



Pic: Impacts of Farm Ponds

Farmers of Kolhan region has demonstrated this with the help of Tata Steel Foundation (TSF). The initiative of TSF has conserved millions of cubic feet water with marginal and small holder farmers and these farmers are earning in lakhs within pond ecosystem by adopting integrated farming system.

Broadly, this section will be analysing about the relevant and importance of pond and its ecosystem for smallholder farmers that how it addresses multiple environmental, social and economic challenges.

Farm pond- Solution for environmental challenges

Pond creates water recharge potential for ground water by harvesting runoff water of rainfall. In rainfed areas like Jharkhand, it filled up within 15 days of monsoon. Farm ponds requires less land. As per Bhupendra Singh (IIT Kharagpur, Land & water resources engineering and also my colleague) says that 23 decimal of water area (100ft*100ft*10 ft) requires approx. 72 decimals of land, which stores 23,00,000 litres of water or 2318 cubic metre in one time filling. Ponds are used in live saving irrigation of paddy and other kharif crops in prolong drought spells (Chandra *et al,* 2016). Ghaniram Mardi from East Singhbhum says that I had 1.5 acres of low land, where I used to cultivate paddy in Kharif only. But, after construction of pond, I cultivate around the year on and around pond. He further adds that I do cultivation on bunds through trellis method and produces number of vegetables even during high rainfall. My pond areas use to be green all around the year and I hardly affect by climate change unlike other farmers. Also, I rear duck and gets income from eggs, meat and sale fish from pond, he adds. In the first year, he earns 1.35 lakhs profit from his 13 decimals of pond. All the respondents agree that pond saves us from externalities in terms of climate adversities and income.

Akali Tudu (JTG, NGO) from Gurabanda says that the water table of the block has come up due to hundreds of ponds constructed. The dried hand pumps are now operational in summer season also. Ponds and its area are greener all around the year, which was also observed by the nature conservancy (2023) in their study on pond ecosystem.

Social benefits from pond ecosystem

Women interacts with water resources most for cooking, drinking, sanitation, and hygiene (water.org)[5]. The limited access of water put them in drudgery. Pond gives easy access to water for not only pond owner but other villagers too, Shanti Sidu from West Singhbhum adds. Pond based Integrated Farming System (IFS) is less labour intensive as it deals with multiple enterprises and also found by Barekal *et al* (2024) in his study in Vidarbha region, which address the disguised unemployment in rural areas. Villagers use to have recreational activities (gossips, swimming, etc) in the ponds too as per our observations.

Dasrath Deogam from West Singhbhum says I used to go to South India for livelihoods, but after constructing pond, earning INR 16,000 per month from pond. Ponds are instrumental in checking migration in rural pockets too. Pond based IFS allows women in the production process due to easy access to enterprises, resources & operations says Kamla Mahato. Pond based IFS is the solution to produce more food for the blasting population to meet global food demand. Small farms ponds have bigger impacts than physical measurements (Kiran, 2018).

Dubai Tudu says that we use to have eggs daily in our family now, which we could not think before due to low purchasing power. He has 90 ducks in his pond. 95% farmers have similar view on positive social benefit from pond as stated above. Studies have shown that fish farming has increased household income and improved per capita per day food consumption, calories, and protein intake compared to non-fish farm households (Romaza et al, 2022). Family having pond grows multiple things within their pond ecosystem, which are consume first and then sell in the local market or haat[6]. The market dynamics changes altogether with this. Villager says that we easily get fresh fishes anytime due to fish farming in our area. Farmer use to harvest fishes in festive season, which gives them premium prices too due live fish. This is how, pond completely changes the social dynamics of the locality.

Farm pond – a source of regular income

Farm pond is the bank for the farmers. Manmohan Singh deo and many other farmers says that pond is ATM (All Time Money) for us and smiles. It also acts as petty cash for us, Manmohan adds. All the farmers admits that their income has increased multi-fold from pond by doing fish farming and utilization of pond dyke effectively, which was also observed by Chandan (2024). Farmers are engaged in fish nursery farming, table fish rearing, utilizing pond embankment through trellis method of farming, rearing ducks and have planted fruit plants also. Farmers say that the IFS process reduces the cost of cultivation and gives regular income. All the farmers admits that they are earning more than INR 1.5 lakhs from pond ecosystem. Further, they add that pond is the source of regular income, we do not wait unlike other farmers. We sell duck eggs, vegetables, fingerlings, table fish from our pond and get income weekly or in alternative days, Ratilal Mahato says who lives in the adjacent area of Jharkhand and Odisha. The risk of loss has gone from this method of production. Pond based IFS process requires less water, utilizes all the pond area effectively and give better output than traditional method of agriculture. We grow better quality of vegetables on bund even in the rainy season, when crops damage in other field due to water logging as per all the farmers. Farmers are investing their earning in education of their children, creating household assets

[5] https://water.org/our-impact/water-crisis/womens-crisis/
[6] Weekly market in the rural areas is called 'Haat' in Jharkhand.

and most important, they are investing back in pond ecosystem. The income from IFS approach enhances the substantial of the household[7]. Farm pond substitutes both nature and farmers.

Pic: Integrated Farming System Pond (75'*75'*10) of Duryodhan Mahato

Conclusion

Small and marginal farmers are the backbone for global food security. They are struggling to deal with modern challenges of nature and society. Empowering them with resources and holding them back in agriculture is a prime responsibility for government, civil society and all the agricultural communities. Farm pond is the great example, which is addressing social-economic and environmental challenges of this segment. It has multiplying effects in changing the quality of life of small land holder farmers (in particular) and for society in general. Intangible impact is much more than measurable outcomes from the farm pond ecosystem and thus emerges as nature -based solution.

References

1. Barekar AM, Potkile, Deshmukh SN JP, Paslawar AN, Kankal DS and Morwal BS, 2024. Integrated farming systems model for resource management and rural employment in Vidarbha region under rainfed condition, international journal for advance biochemistry research 2024: 179-183
2. Brain Richard, Perkins Daniel, Ghebremichael Lula, White Mark, Goodwin Greg and Aerts, 2023. Mike The Shrinking Land Challenge, *ACS Agric. Sci. Technol*, 3, 152−157
3. Chand Ramesh, NABARD Research and Policy Series No. 6/2022
4. Debnath Chandan, 2024. Pisciculture with pond dikes' utilization for additional income and employment in Tripura, *Indian Farming 74* (07): 12-17; July *ICAR Research Complex for NEH Region, Umiam (Barapani), Meghalaya, 793 103*
5. FAO, 2009. How to feed the world 2050 (Rome 12-13 October), High-level expert forum
6. FAO, 2015. Challenges and Opportunities in a Global World
7. Neena Joshi, 2024, Smallholder farmers in Asia: challenges opportunities and the path to sustainable food production, Earth.org, December 27th

[7] https://india.mongabay.com/2021/11/integrated-farming-systems-emerge-as-possible-climate-adaptation-solution/

8. Khanum, R.; Schneider, P.; Al Mahadi, M.S.; Mozumder, M.M.H.; Shamsuzzaman, M.M., 2022. Does Fish Farming Improve Household Nutritional Status? Evidence from Bangladesh. Int. J. Environ. Res. Public Health, 19, 967.
9. McCalla Alex F.,2001. Challenges to World Agriculture in the 21st Century, agriculture and resource economics, University of California, Davis, Vol. 4, No. 3
10. Miladinov Goran (Independent Researcher, Skopje, North Macedonia) Impacts of population growth and economic development on food security in low-income and middle-income countries
11. Miller James W.,2009. Farm ponds for water fish and livelihoods, FAO
12. Nath Kapil Deb, Rajbangshi Pradeep, Borah Debasish and Saharia Prabitra Kumar, 2020. Doubling Farmers Income through Adoption of Integrated Farming System- A Case Study. J Krishi Vigyan (Special Issue): 59-62, Krishi Vigyan Kendra, Assam Agricultural University, Lalpool-784514, Udalguri, Assam, College of Fisheries, Assam Agricultural University, Raha-782103, Nagaon, Assam.
13. Rosegrant Mark W., Fan Shenggen, and Otsuka Keijiro, GLOBAL ISSUES INAGRICULTURAL DEVELOPMENT, Chapter-2
14. Sen Kiran Kumar, 2018. Impact of farm ponds on lives and livelihoods of farmers in Chikkaballapura District, Karnataka, VikasAnvesh Foundation (VAF), Pune.
15. Singh Rishikesh, Singh Hema and Raghubanshi Akhilesh Singh, 2019. Challenges and opportunities for agricultural sustainability in changing climate scenarios: A perspective on Indian agriculture, international Society for Tropical Ecology
16. The nature conservancy, Harnessing the potential of ponds in India through ecosystem approach, ICASS POLICY BRIE