

## **Rice Farming for Food Security and Ecological Sustainability: A an Analysis of farmer's Awareness in Kerala**

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### **ABSTRACT**

Rice is the staple food for more than 60 per cent of people in the world and also it is the choice crop for millions of poor and small farmers for income and household food security. Surprisingly, in India while rice production has increased (CAGR=3.32), area under paddy cultivation has not increased since 2002-03 to 2013-14. Among Indian states, Kerala has witnessed vast changes in cropping pattern and land use pattern recently. The share of agricultural land devoted to food crops, including rice was 37.5 per cent in 1981 which fell down to 12.5 per cent in the year 2006. Thus, there has been a major change in use of land for cultivating food crops and non-food crops in Kerala. The situation warranted State Government to formulate a special legislation to stop filling up of paddy fields for other cash crops cultivation or nonfarm uses. In this scenario, an analysis of farmer's awareness regarding importance of paddy cultivation is very important. Present study was conducted in the state of Kerala among paddy farmers. Structured interview schedule was used for primary data collection. An ex-post facto research design was used for the study. Awareness of farmers regarding the importance of paddy lands in maintaining food security and ecological sustainability was measured using a test developed for the purpose. Secondary sources of information and expert opinion were used for developing items in the test. The test consisted of nine components and each component consisted of four sub questions. Reliability of test was calculated using Cronbach alpha test (Alpha=0.765). Majority (54.58%) of the respondents had medium level of awareness (awareness index between 0.94 & 0.33) which signified that majority of respondents had acquired medium level of awareness about the ecosystem services of wetlands. 25.41 per cent of respondents had low awareness (awareness index between 0.33 & 0.02) about importance of paddy lands in maintaining food security and ecological sustainability. There was no respondent with very low level of awareness. Only 56.25 per cent of respondents had awareness about the actual scenario of food deficit in Kerala. Sediment and nutrient retention function and water purification function of rain fed paddy lands were known to comparatively less number of respondents. The minimum awareness was observed in the component true value of wetland resources. Only 43 per cent respondents knew the "true value of wetland resources". Similarly water purification function is also unknown to majority of the respondents. Therefore, awareness generation should be given specifically concentrating this area, so that people start thinking rejuvenating the existing paddy fields.

**Keywords:** Paddy Land, Food Security, Ecology, Kerala, Awareness

Rice is the staple food for more than 60 per cent of people in the world and millions of poor and small farmers in India depend on paddy for income and household food security. India stands at number two in terms of rice production and its consumption. Consumer preference, production and area of rice in India are thus significant. But the scenario of rice in India is such that while production has increased (CAGR=3.32), area under paddy cultivation has not increased substantially from 2002-03 to 2013-14 (Commodity Profile for Rice, March 2015).

Among all Indian states, Kerala has witnessed vast changes in cropping pattern and land use pattern recently. The share of agricultural land devoted to food crops, including rice was 37.5 per cent in 1981 which fell down

to 12.5 per cent in the year 2006. Kerala state lost over 5 lakhs hectares of land under paddy cultivation between 1980 and 2007. The production reduced fifty per cent to 6,30,000 tonnes during the period (Kerala State Planning Board). Thus, there has been a major change in use of land for cultivating food crops and non-food crops in Kerala.

Economic non viability of rice cultivation, high population pressure on land, increasing habit of consumerism and inflow of foreign and other source of money have fastened the way to a shining real estate sector in Kerala (Nikhil Raj and Azeez, 2009). The gap between the demand and production of rice in the state has been showing an increasing trend in the past. There was only fifty per cent deficit in 1960s, but in 1990s it increased to

75 per cent. The deficit rose to 85 per cent in 2007-08. According to State Paddy Mission (2012) Kerala requires 3.9 million tonnes of rice for consumption. But the production, however, is a mere 625,000 tonnes. It is less than a 17 percent of its total food grain requirement. The mission states that, large-scale conversion of paddy fields had adversely affected the state's food security and ground water recharge. Thereby ecological sustainability of the state is under threat. Jayakumar and Velayudhan (2002) analysed the trend in area, production and productivity of important food crops and cash crops. Growth indices of various crops were computed from 1960-61 to 1999-2000. The study revealed that there was a significant decrease in growth of the area under rice and tapioca. Durga and Kumar (2013) through an analysis of time series data revealed that there is stagnation, large scale commercialization and instability in agricultural sector of Kerala, while Studies conducted at other parts of the country (Shakeel, 2013; Renu and Ashutosh, 2014) revealed that at national level the scenario of growth rate was in favour of food grains during the last fifty years.

Rainfed paddy land is considered as a wetland having diverse ecosystem services in addition to its major role in maintaining food security of the region. Wetland paddy fields perform numerous important ecological processes that benefit man and society. Many of these functions provide goods and services, which are important to human society. Value of a wetland depends upon many factors. Location, adjacent environment, water source and quality, biological diversity etc. are some of the factors which determine the value of wetlands (Kanchan Chopra 1997). UN Millennium Assessment of Wetlands programme had studied Scenario of the shrinking of the wetlands and unawareness of the potential economic and ecologic benefits of the wetlands in India. Ecosystem service values of the rainfed paddy ecosystem of India were revealed from the study. Considering rainfed paddy area as 22 mha, the estimated value was Rs. 49 lakh crores. Total ecosystem service value of wetlands in India including rainfed paddy area was calculated as Rs. 124 lakh crores. Similarly, total value of wetlands and paddy fields currently in Kerala state was estimated as worth Rs. 122868 crores every year. So if we could conserve paddy land the state would get services worth Rs. 122868 crores annually which is more than annual budget of the state (Agriculture development policy draft -2013).

Rice farming thus, needs to be sustained for food security and ecological sustainability of wetlands despite the existence of problems like economic non-viability and labour scarcity. In this scenario, an analysis of farmer's awareness regarding importance of paddy cultivation is

very important to design appropriate agricultural development projects and create awareness campaigns of the state department of agriculture for farmers in view of its significance for food security. The present study was attempted to unravel the awareness level among farmers in respect to paddy being important for food security and ecological sustainability of the region.

## METHODOLOGY

Present study was conducted during 2013-14 in the state of Kerala using an ex-post facto research design. All the agro-ecosystems across the states were included in the sampling frame.. Those who own paddy land and are cultivating/not cultivating were included in the sampling frame. Structured interview schedule was used for primary data collection. Awareness of farmers regarding the importance of paddy lands in maintaining food security and ecological sustainability was measured using a test developed for the purpose. Secondary sources of information and expert opinion were used for developing items in the test. Nine components *viz.* (1) basic information (2) flood control function (3) groundwater replenishment function, (4) sediment & nutrient retention, (5) water purification, (6) reservoirs of biodiversity, (7) true value of wetland resources, (8) consequences on livelihood conditions and (9) Scenario of food deficit in Kerala were included in the final test. Each component consisted of four sub components in the form of questions. Therefore, total 36 items were present in the final test developed. Respondents were asked whether they were aware or not about each item. Score 1 was given for awareness or correct answer and score zero was given for non awareness or wrong answer. Awareness index was calculated from this for each respondent using the following formula

$$\text{Awareness index} = \frac{\text{Score obtained by the respondent} \times 100}{\text{Maximum score}}$$

Frequency and percent of awareness of people about each component was also recorded. Pre-testing was done and reliability of test was measured using Cronbach alpha test through SPSS. The collected data were coded, tabulated and analyzed using different statistical methods.

## RESULTS AND DISCUSSION

Awareness in this study was operationalised as the extent to which the respondents were familiar about ecosystem services of paddy lands. All natural ecosystems provide us with resources and processes. Services obtained from this processes and resources are termed as agro-ecosystem services.

Millennium Ecosystem Assessment (MA) defines ecosystem services (ES) broadly as “the benefits people obtain from ecosystems”. It includes provisioning (eg. food), regulating (eg. purification of water) and Supporting (eg. nutrient cycling and primary production, ground water recharging function) services. Ecosystem services provided by paddy lands are provision of food and maintenance of ecological sustainability. An attempt was made to test awareness of farmers regarding ecosystem services of wetlands. Through extensive survey of literature (eg. www.ramsar.org) and through discussion with environmental science experts, items in the awareness test were prepared. The test consisted of nine components and each component consisted of four sub questions. A pilot testing was done with the new awareness test developed. The reliability of test was calculated using Cronbach alpha test. The value obtained for alpha (0.765) indicated a good reliability of the test. Farmers' awareness about nine components such as (1) basic information (2) flood control function (3) groundwater replenishment function, (4) sediment & nutrient retention, (5) water purification, (6) reservoirs of biodiversity, (7) true value of wetland resources, (8) consequences on livelihood conditions and (9) Scenario of food deficit in Kerala are explained below.

Majority (83.3%) of the people are aware that the wet rice field can be described as a special type of wetland. One fifth area of Kerala state is covered with wetland is also known to many people (80%). Majority (70%) people know that wetlands have to be conserved for the benefit of entire society and Paddy ecosystems can have adverse effects on the environment when there is degradation in quality and quantity. Seventy per cent respondents were aware that any wetland can provide some measure of flood protection. They also consider the integration of rice; ditches and ponds in rural areas serve as a reservoir to control flooding. Majority (60%) had the experience of wetlands lowering flood peaks by temporarily holding water and by slowing the water's velocity and construction of roads by filling wet lands can create drainage problems in many of the agricultural lands.

Majority (75%) of the respondents are aware that Wetlands help in maintenance of water level in the wells used for drinking. respondents are well aware that, the wetlands function like sponges imbibing and storing storm water and runoff water, thus helping in maintaining the groundwater level of an area. Similarly, majority (70 %) knew that a sustainably managed paddy land is a reservoir of good water that replenishes the drinking water sources of the entire area. Compared to other items in this component, less people (55%) are aware that continued

reclamation can lead to acute water shortage in future than present.

Half of the respondents were aware that Wetland plays a crucial role in the natural cycling of sediments and nutrients and every time after rice cultivation, paddy soil organic matter increases. The statement Paddy field conversion had led to intensification of soil erosion and that affected the fertility of soil is known to 60 per cent of the people. Paddy field conversion had led to reduction in humus formation is known to 55 per cent of the respondents. Majority (55 %) of the respondents knew that wetlands are Natural water purifiers and rice paddies can clean up the water supply. Only half of the respondents are aware that Paddy lands protect water quality by trapping sediments and retaining excess nutrients and other pollutants. Majority of the respondents were unaware that using the purification capacity of wetlands even a system of sewage disposal can be developed. Surprisingly 90 per cent of the respondents were aware that rice-field habitats support a range of biodiversity, including internationally important populations of migratory water birds. Paddy land and their elaborate irrigation networks provide a home — or feeding ground — for tadpoles and dragonflies, salamanders, fish, water bugs, snakes, cranes, egrets and hawks was well known to all. They (85 %) had the experience of decreasing species such as tadpoles and dragonflies with decreasing area under paddy cultivation. Farmers (80%) were also aware that apple snails (*namachi*) the inhabitants of paddy which are eaten by the farm laborers and local village are under threat due to degradation of paddy land.

True value of wetland resources was unknown to many of the farmers. UN millennium ecosystem assessment has calculated the total value of services offered by the wetlands and paddy fields currently in the state almost as 1.23 lakh crores /year. Only 45 per cent of the farmers could guess the true value of wetlands at least near to this value. Only 47 per cent people could imagine that the actual benefit from any developmental ventures created through wetland reclamation is always less than that of services provided by wetland itself. Sixty per cent of the respondents were ignorant that paddy should be grown even in a most populated city and due to reclamation of paddy land the ecological system loses its quality irreversibly. Seventy per cent respondents were aware that poor and land less laborers are more adversely affected by wetland conversion and Paddy field conversion had led loss of direct and indirect employment to farm workers and rural women. Eighty per cent of the respondents opined that rural poor has lost access to nutrient rich low cost food

**Table 1: Distribution of respondents in respect to farmers' awareness regarding ecosystem services of paddy land**

N=240

S.No.	Statements	Respondents who were aware	
		f	%
<b>1. Basic information about wetlands</b>			
1	The wet rice field can be described as a special type of wetland	200	83.3
2	One fifth area of Kerala state is wetland	192	80.0
3	Wetlands has to be conserved for the benefit of entire society	168	70.0
4	Paddy ecosystems can have adverse effects on the environment when there is degradation in quality and quantity	156	65.0
	Overall awareness of Basic information about wetlands		74.5
<b>2. Flood control function of wetlands</b>			
5	Any wetland protection can provide some measure of flood	168	70.0
6	The integration of rice, ditches and ponds in rural area serve as a reservoir to control flood	168	70.0
7	Wetlands lower flood peaks by temporarily holding water and by slowing the water's velocity	144	60.0
8	Construction of roads by filling wet lands are creating drainage problems in many of the agricultural lands	144	60.0
	Overall awareness of Flood control function of wetlands		65.0
<b>3. Groundwater replenishment function</b>			
9	Wetlands help in maintenance of water level in the wells used for drinking	180	75.0
10	The wetlands function like sponges imbibing and storing storm water and runoff water, thus helping in maintaining the groundwater level of an area	156	65.0
11	A sustainably managed paddy land is a reservoir of good water that replenishes the drinking water sources of the entire area	168	70.0
12	Continued reclamation can lead to acute water shortage in future than present	132	55.0
	Overall awareness of Groundwater replenishment function		66.2
<b>4. Sediment &amp; nutrient retention</b>			
13	Wetland play a crucial role in the natural cycling of sediments and nutrients	120	50.0
14	Every time after rice cultivation, paddy soil organic matter increases	132	55.0
15	Paddy field conversion had led to intensification of soil erosion and that affected the fertility of soil	144	60.0
16	Paddy field conversion had led to reduction in humus formation	132	55.0
	Overall awareness of Sediment & nutrient retention		55.0
<b>5. Water purification</b>			
17	Wetlands are Natural water purifier	132	55.0
18	Rainfed paddy land can clean up the water supply	127	53.0
19	Paddy lands protect water quality by trapping sediments and retaining excess nutrients and other pollutants	120	50.0
20	Using the purification capacity of wetlands even a system of sewage disposal can be developed	72	30.0
	Overall awareness of Water purification		47.0
<b>6. Reservoirs of biodiversity</b>			
21	Rice-field habitats support a range of biodiversity, including internationally important populations of migratory water birds	216	90.0
22	Paddy land and their elaborate irrigation networks provide a home — or feeding ground for tadpoles and dragonflies, fish, water bugs, snakes, cranes, egrets and hawks	240	100.0
23	When rice fields disappear, species such as tadpoles and dragonflies that live in them decrease	204	85.0
24	Apple snails (namachi) the inhabitants of paddy which are eaten by the farm laborers and local village is under threat due to degradation of paddy and	192	80.0
	Overall awareness of Reservoirs of biodiversity		88.75
<b>7. True value of wetland resources</b>			
25	Total value of services offered by the wetlands and paddy fields currently in the state is almost 1.23 lakh crores/year	108	45.0
26	Actual benefit from any developmental ventures created through wetland reclamation is always less than that of services provided by wetland itself	113	47.0
27	It is highly recommended to conserve wetland paddy even if it is in a most populated city	96	40.0
28	Due to reclamation of paddy land the ecological system loses its quality irreversibly	96	40.0
	Overall awareness of True value of wetland resources		43.0
<b>8. Consequences on livelihood conditions</b>			
29	Poor and land less labourers are more adversely affected by wetland conversion	168	70.0
30	Paddy field conversion had led loss of direct and indirect employment to farm workers and rural women	180	75.0
31	The rural poor has lost access to nutrient rich low cost food materials which had been available in and around paddy fields	192	80.0
32	Conversion leads to further conversion	168	70.0
	Overall Awareness of Consequences on livelihood conditions		73.75
<b>9. Scenario of food deficit in Kerala</b>			
33	Kerala is importing more than 80 percent of its rice requirement from other states	168	70.0
34	Kerala state lost over 50000 hectares of land under Paddy cultivation between 1980 and 2007	132	55.0
35	Recently neighbouring states are putting restrictions on free flow of food materials outside	96	40.0
36	Kerala has highest deficit in food production	144	60.0
	Overall awareness of Scenario of food deficit in Kerala		56.25
	Overall awareness of Ecosystem services of wetlands		65.0%

Fried man test value = 586.429 df: 8, Significance level: &lt; 0.05

materials which had been available in and around paddy fields. Majority are also aware that Conversion of paddy lands leads to further conversion of it. Food deficit scenario in Kerala is also well clear to majority of the people. Seventy per cent knew that Kerala is importing more than 80 per cent of its rice requirement from other states. The loss of over 5, 00,000 hectares of land under paddy cultivation between 1980 and 2007 was known to 55 per cent of the respondents. Only 40 per cent people knew that neighboring states putting restriction on free flow of food materials outside. The most threatening fact viz Kerala has highest deficit in food production was known to 60 per cent respondents only.

Maximum awareness (Table 1) was reported by the awareness test component reservoir of bio-diversity. 88.75 per cent of respondents were aware about this very important function of wetland. The basic information about wetlands was known to 74.5 per cent of the respondents. 73.75 per cent respondents were aware about consequences of degradation of wetlands on livelihood conditions. Almost 66.25 per cent respondents were aware about ground water replenishment function of paddy lands and 65 per cent are aware about flood control function of paddy lands. Only 56.25 per cent of respondents had awareness about the actual scenario of food deficit in Kerala. Sediment and nutrient retention function (55%) and water purification function (47%) of rainfed paddy lands were known to comparatively less number of respondents. The minimum awareness was observed in the component true value of wetland resources. Only 43 per cent respondents knew the true value of wetland resources.

Friedman test was conducted in order to know whether there is significant difference between awareness about different components of ecosystem services. The result obtained for Friedman test indicated a statistically significant difference between the components within the awareness test.

#### Awareness index

Majority (54.58%) of the respondents had medium level of awareness (awareness index between 0.94 & 0.33) about importance of paddy lands in maintaining food security and ecological sustainability as depicted in figure 1. This result signified that majority of respondents acquired medium level of awareness about the ecosystem services of wetlands. Almost 25.41 per cent of respondents had low awareness (awareness index between 0.33 & 0.02) about importance of paddy lands in maintaining food security and ecological sustainability. There was no

respondent with very low level of awareness (awareness index below 0.02). Only 20 per cent had higher level (awareness index between 0.94 & 1.25) of awareness.

Maximum awareness was reported by the awareness test component reservoir of bio-diversity but only 56.25 per cent of respondents had awareness about the actual scenario of food deficit in Kerala. Sediment and nutrient retention function and water purification function of rainfed paddy lands were known to comparatively less number of respondents. The minimum awareness was observed in the component true value of wetland resources. Only 43 per cent respondents knew the true value of wetland resources

Friedman test revealed that there is significant difference between awareness about different components of ecosystem services. The major concern here is that true value of wetland resources unknown to majority of the respondents. Similarly water purification function is also unknown to majority of the respondents. Therefore, awareness generation should be given specifically concentrating this area, so that people start thinking rejuvenating the existing paddy fields.

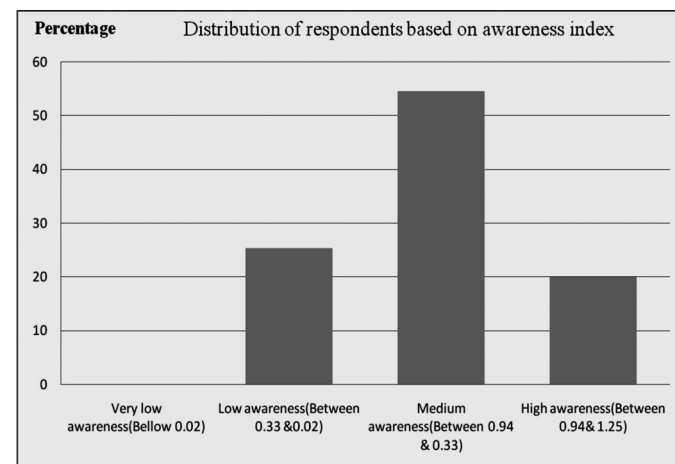


Fig 1: Distribution of farmers according to their awareness

## CONCLUSION

Majority of the respondents are aware that wetlands help in maintenance of water level in the wells used for drinking. Some had the experience of drying up of their wells years after filling of nearby paddy fields. Majority of the respondents were unaware that using the purification capacity of wetlands even a system of sewage disposal can be developed. It has actually happened in West Bengal ([www.ramsar.org](http://www.ramsar.org)). Surprisingly 90 per cent of the respondents were aware that rice-field habitats support a range of biodiversity, including internationally important

populations of migratory water birds. For them it is a regular scene occurring in paddy fields in particular seasons. Apple snails (namachi) the inhabitants of paddy which are eaten by the farm labourers and local villagers, is under threat due to degradation of paddy land. Farmers explained that there is huge reduction in number of apple snails in their surrounding paddy field.

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