PADDY LAND CONVERSION IN KERALA AND ITS ECOLOGICAL RESILIENCE

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Abstract

Kerala, famous for its green landscapes and exciting culture, faces a looming threat that strikes its ecological sustainability - the conversion of valuable paddy lands. Traditionally famous for its rice cultivation, these lands are now rapidly reducing due to various developmental activities, posing a serious risk to the fragile ecosystem of Kerala and leads to the loss of biodiversity. The ecological services provided by paddy fields, such as flood control, water purification, and soil preservation, are exceptional. The paddy land conversion in Kerala jeopardizes these essential functions, leaving Kerala to environmental disasters like floods, soil erosion, and water scarcity. The cultural and social structure of Kerala is extremely interwoven with paddy fields. They not only provide livelihoods for farmers but also hold vast cultural significance, contributing to Kerala's identity. Their loss threatens traditional farming practices, agricultural heritage, and the socio-economic well-being of communities which depends on rice cultivation. The issue requires a holistic approach and immediate action. Implementing strict regulations to protect paddy lands, promoting sustainable agricultural practices, encourage farmers with incentives, encouraging urban development on non-agricultural lands are essential steps. The conservation of Kerala's paddy lands is not just an environmental concern; it is a moral commitment to preserve the state's ecological resilience, cultural heritage, and the well-being of its inhabitants. It's high time to prioritize conservation efforts and policy interventions to ensure that Kerala's invaluable paddy lands persist to thrive, sustaining both nature and communities for its sustainability.

Keywords: Paddy land conversion, ecological resilience, Sustainability

Introduction

Land constitutes the most crucial component for the sustainable development of a region. Changes in the economic and demographic factors have transformed all resource bases to a great extend and obviously land has been the most transformed of all the renewable resources. For the daily human needs man interacts with land. When the users employ it for different purposes land use changes occurs leading to desirable and undesirable impacts. Sustainability, which is the combination of production with conservation, is a central concept in land resource management. The ecological services provided by paddy fields, such as flood control, water purification, and soil preservation, are exceptional. The diversion of the quality agricultural fields to non agricultural uses was a common feature everywhere in Kerala. The Kerala Conservation of Paddy Land and Wetland Act of 2008 is an Act to conserve the paddy land and wetland, restricts the conversion or reclamation and to promote growth in the agricultural sector and to sustain the ecological system, in the State of Kerala. With all these legislations in Kerala paddy lands and wetlands has been declining consistently over the last several years.

Area of the study

Kerala, the state in the south west region of India is a small narrow strip of land, was formed on 1st November 1956 as per the States Reorganization Act as part of the linguistic reorganization of the Indian states of Travancore, Cochin and Malabar. Kerala has a total geographical area of 38,863 km². It lies between north latitudes 8°.17'.30" N and 12°. 47'.40" N and east longitudes 74°.27'47" E and 77°.37'.12" E.

Significance of the Study

Kerala, famous for its green landscapes and exciting culture, faces a looming threat that strikes its ecological sustainability - the conversion of valuable paddy lands. Traditionally famous for its rice cultivation, these lands are now rapidly reducing due to various developmental activities, posing a serious risk to the fragile ecosystem of Kerala. The state's paddy cultivation has long been the backbone of its agricultural heritage, sustaining both the economy and the environment. The conversion of these lands for developmental activities has accelerated in recent years. The conversion of paddy lands disrupts fragile ecosystems and leads to the loss of biodiversity. These areas, once rich with diverse flora and fauna, are now giving way to concrete constructions, resulting in loss of habitat loss for numerous species. The disturbance of this natural balance can have far-reaching repercussions on the state's biodiversity. The paddy land conversion in Kerala jeopardizes these essential functions, leaving Kerala to environmental disasters like floods, soil erosion, and water scarcity.

Objectives of the study

This study intends to analyses the extend of the area of conversion of paddy land in Kerala and its threat on the ecological balance.

METHODOLOGY

Description of the Study area and Selection of the Sample

The study depends on secondary and primary data. Primary data was collected through a household survey by using a structured interview schedule. One district from each geographical division is selected to get the representation of the whole Kerala. Accordingly Malappuram district was selected from North Kerala, Ernakulam district was selected from Central Kerala and Alappuzha district from South Kerala. From each district block wise area was selected. Accordingly Kuttipuram block from Malappuram district, Koovappady block from Ernakulam district and Veliyanad block from Alappuzha district were chosen. Sample size was calculated as 600. 155 households were selected from Kuttipuram block, 280 households from Koovappady block and 165 from Veliyanad block.

Characteristics of Paddy Lands

The paddy field – wetland ecosystem provides an immense range of product and services either directly or indirectly. It leads to the degradation and depletion of aquatic ecosystem. It leads to decrease in the ground water recharging, water logging, land quality, weather and climate change, destruction of rice producing ecosystem and so on. Wetlands and paddy fields are two sides of the same coin. What is applicable to paddy field management is also important for conservation of biodiversity. Paddy field which occupies the characteristics of wetlands provides important services to the human societies. It includes flood control, water supply, food resources etc. It acts as the cradle of rich biodiversity providing water and productivity for the countless species of plants and animals for their survival. The management of water which is the key component of wetlands is an important issue all over the world because it affects the daily lives of the people.

Concerns for the Paddy Fields and Wetlands

Wetlands in their original form provide extensive benefits to the society. They provide main functions like biological productivity, water filtration, water storage and habitat for many species. The conversion of wetlands and its irreversibility involves many uncertainties and threat in the ecological and environmental processes. Fresh water availability is one of the important serious limitations in the state. Large scale conversion of wetlands, breaking the hillocks followed by the acute degradation of land and the consequent urbanization and industrialization results in the pollution resulted in the scarcity of safe drinking water. If proper and timely precautionary steps are not taken from the part of the authorities, this will become a very acute problem in the future.

Environmental and Ecological Functions of Paddy Fields

Paddy fields play an important role in the environmental and ecological systems. They are typical wetland ecosystem. It provides natural drainage to the flood water and also preserves ground water and is crucial for the preservation of rich variety of flora and fauna. They are known for their distinctive flora and fauna. Since the dawn of civilization man was very much associated with wetlands. Destruction and permanent conversion of this ecosystem will threaten the water security as they are the water reservoirs of the state. They provide habitat to plants and microorganisms. Enormous economic services are also done by these paddy lands.

The changes in the land use pattern of paddy fields to other uses especially the filling up of the area poses serious threat to the environment. The wetland characteristics of paddy land collect the excess water after heavy rains. Due to the conversion of paddy fields this purpose is no longer be served. The recharging of aquifers is also in danger. Many aquatic life forms lose their habitat. Paddy land which served as natural drainage system got disturbed because of rapid conversion. Due to this the ecological balance gets disturbed and it is visible in the disappearance of creatures like frogs, crabs, lobsters, small fishes, worms etc and the increasing number of mosquitoes.

Area of Paddy Cultivation in Kerala

Analyzing the area under paddy cultivation in Kerala it can be seen that there was a drastic reduction in the area of paddy.

Year	Area (Lakh Ha)
1960-61	7.90
1970-71	8.75
1980-81	8.02
1990-91	5.59
2001-02	3.22
2002-03	3.10
2003-04	2.87
2004-05	2.90
2005-06	2.75
2006-07	2.63
2007-08	2.29
2008-09	2.34
2009-10	2.34
2010-11	2.13
2019-20	1.91

Table 1. Area of Paddy Cultivation in Kerala

Source: Computed from Economic Review (Various Issues), Kerala State Planning Board, Thiruvananthapuram.

As per the records of the Government of Kerala in 1974-75 the area under paddy cultivation in Kerala was 876000 hectares. It is reported that in 39 years Kerala lost 7 lakhs hectares of paddy fields. (Mathrubhumi Newspaper daily dated February 14, 2015).

Percentage of Paddy Land Conversion to Other Purposes

In the study area only 19.7 percent of the households did not convert their paddy lands. Out of the total sample households 8 percent converted less than or equal to 25 percent of their paddy lands. 35 percent converted 26-50 percent of their paddy lands. 8.5 percent converted 50- 75 percent and 28.8 percent converted more than 75 percent of their paddy lands.

Chi- square test was conducted to test whether there was any significant difference in the percentage of paddy land conversion in Kuttippuram, Koovappady and Veliyanad blocks. The result is presented in Table 2.

Paddy land converted (%)	dKuttipp	uram	Koovap	pady	Veliyan	ad	Total	Total	
	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent	
Not converted	18	11.6	59	21.1	41	24.8	118	19.7	
≤ 25	19	12.3	9	3.2	20	12.1	48	8.0	
26-50	49	31.6	78	27.9	83	50.3	210	35.0	
50-75	11	7.1	27	9.6	13	7.9	51	8.5	
More than 75	58	37.4	107	38.2	8	4.8	173	28.8	
Total	155	100.0	280	100.0	165	100.0	600	100.0	
Chi square = 84	.601**; p	-value < 0.00	01	•					

Table 2. Percentage of Paddy Land Conversion to Other Purposes

Source: Primary Data.

** Significant at 0.01 level

Since p-value is less than 0.001, Chi square value was found to be significant at 0.01 level. This indicates that there is significant difference among the three blocks in the conversion of paddy land to other purposes. 37.4 percent of the respondents in the Kuttipuram block converted more than 75 percent of the paddy fields while in Koovappady block it was 38.2 percent and in Veliyanad it was 4.8 percent.

The Conversion of Paddy Land under Reversible and Irreversible Form

The changes in the paddy land area were mainly by converting these to reversible form or irreversible form. (Irreversible is used in the sense where paddy land cannot be reverted back to the original condition by ordinary means). The area under irreversible form poses a serious threat to both the society and the environment. The area of paddy field in the three study areas of Kuttippuram, Koovappady and Veliyanad are 226.2, 289.3 and 175.0 hectares respectively. Out of the total paddy field in the study area of Kuttippuram (226.2 ha) 170.4 ha were converted. Of this, 34.5 percent were reversible and 65.5 percent were irreversible. In Koovappady among the total paddy fields of 289.3 hectares, 254 hectares were converted and out of this only 31.5 percent were reversible and 68.5 percent were irreversible land. In

Veliyanad out of the 175 hectares of the paddy fields 69.25 percent were converted, 14.1 percent were reversible and 85.9 percent were irreversible. Thus among the total paddy land area of 690.4 hectares of paddy fields in the three regions a total of 493.65 hectares were converted and among this only 30.1 percent were reversible and 69.9 percent were irreversible. This brings out the seriousness of the paddy land conversion and if this trend is not brought under control the paddy fields in Kerala will be endangered. Table 3 gives the data regarding the area under reversible and irreversible paddy land area which changes its original use pattern.

	Reversible form	n	Irreversible	e form	Total
Block	Area	Percentage	Area	Percentage	land area converted
Kuttippuram	58.75	34.5	111.65	65.5	170.4
Koovappady	80	31.5	174	68.5	254
Veliyanad	9.75	14.1	59.5	85.9	69.25
Overall	148.5	30.1	345.15	69.9	493.65
		Sources Duins on	ry Data		

 Table 3.Area of Converted Paddy Fields under Reversible and Irreversible
 Form

Source: Primary Data.

Modes of Conversion of Paddy Fields

The researcher enquired about the modes used for the conversion of the paddy fields. The major modes mentioned by the respondents are putting sand from hillocks, putting sand as part of construction of infrastructural activities in the nearby areas, digging canals by manual work, digging canals by using machines, putting large stones and certain others factors.

Considering all the regions, putting sands from hillocks (64.2 percent) and putting large stones (41.8 percent) are the major modes used for converting paddy fields. 25.3 percent households convert paddy fields by digging canals by using machines, 20.3 percent convert paddy field by putting sand as part of construction of infrastructural activities in the nearby areas, 14.8 percent digs canals using manual work for the conversion of paddy fields and 1 percent of the households responded that the conversion of their paddy fields is because of the natural calamities. It is mainly through the breaking of bunds due to floods.

Irrespective of the area, putting sand from hillocks was the major mode used by the households for the conversion of the paddy fields. They are 80.6 percent, 50.7 percent and 71.5 percent respectively in Kuttippuram, Koovappady and Veliyanad.

Modes	Kuttippu (n=155)	ram	Koovappady (n=280)		Veliyanao (n=165)	d	Total (n=600)	
would	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent
Putting sand from hillocks	125	80.6	142	50.7	118	71.5	385	64.2
Putting sand as part of construction of infrastructural activities in the nearby areas	48	31.0	74	26.4	0	0	122	20.3
Digging canals by manual work	42	27.1	36	12.9	11	6.7	89	14.8
Digging canals by using machines	60	38.7	92	32.9	0	0	152	25.3
Putting large stones	94	60.6	83	29.6	74	44.8	251	41.8
Others specify	2	1.3	4	1.4	0	0	6	1.0

Table 4. Percentage of Respondents Utilized Different Modes of Conversion of Paddy Fields

Source: Primary Data.

Putting sands from hillocks as a mode of conversion of paddy fields affects the environment mainly in two ways. Hills have the capacity of storing water and by razing down the hillocks the water flows to the low lying areas. Paddy fields serve as water-conserving tanks and it replenishes the ground water. By filling it the specific characteristics of paddy fields are lost.

Environmental Issues Because of Changes in the Use Pattern of Paddy Land

Paddy fields feed millions of the people and it also plays a critical role in the sustenance of several species. The peculiar characteristics of the paddy fields help to grow many micro organisms and it also helps to grow many rich plants in the bunds of the paddy fields. As the paddy fields are flooded parcel of land it helps to maintain the ground water level and much helpful for the recharging capacity of the nearby wells. The enchanted beauty of the paddy fields creates nostalgic feeling for many people in Kerala. Destruction of the paddy fields creates severe environmental issues. The respondents reported several issues in common and they are requested to rank their severity in their regions. Table 5 reveals the severity index for the various environmental issues. Taking into account all regions the respondents reported that *reduction in the ground water level* is the major environmental issue as a result of the changes in the use pattern of paddy fields. The other environmental issues in their order of significance are *decreasing availability of fresh water, loss of biodiversity, contamination of water resources, decrease in the water storage capacity of the soil, improper discharge of waste and plastics, increase in flood during rainy season, disappearance of scenic beauty of enchanting paddy fields, reduction in fish and other small creatures, increase in pests, increasing incidence of diseases and other factors.*

F	Kuttippu	ram	Koovap	pady	Veliyan	ad	Total	
Reason N	/lean core	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
Reduction in the ground water level	1.94	1	2.03	1	10.33	10	4.29	1
Increase in flood during rainy season	6.48	8	4.05	4	7.27	9	5.56	7
Decreasing availability of fresh water	4.06	2	3.86	3	5.82	7	4.45	2
Contamination of water resources	5.24	5	5.80	5	4.01	3	5.16	4
Reduction in fish and other small creatures	8.37	9	8.55	8	6.80	8	8.02	9
Decrease in the water storage capacity of the soil	4.32	3	3.17	2	10.33	10	5.44	5
Improper discharge of waste, plastics	5.21	4	6.20	7	4.41	4	5.45	6
Increase in pests	9.25	10	10.01	10	5.24	6	8.50	10
Increasing incidence of diseases	9.51	11	9.54	9	5.02	5	8.29	11
Disappearance of scenic beauty of enchanting paddy fields	^f 5.85	7	7.21	8	3.84	2	5.93	8
Loss of biodiversity	5.88	6	5.83	6	3.11	1	5.10	3
Others factors	12.00	12	11.85	11	11.95	11	11.92	12

Source: Primary Data.

Disappearance of Some Medicinal Plants and Some Creatures from the Paddy Fields during the Last Several Years

The respondents reported that the medicinal plants in the bunds of the paddy fields and small creatures are disappearing because of the conversion of the paddy fields. Almost all of the respondents (99.3 percent) are agree to this opinion.

Table	6.	Resi	ponses	regar	ding	the D	isapı	pearan	e of	Medicina	al Plan	ts and	Crea	tures i	n the	Last	Severa	l Years
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Response	Kuttippuram		Koovappady		Veliyana	ıd	Total	
	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent
Yes	151	97.4	280	100.0	165	100.0	596	99.3
No	4	2.6	0	0.0	0	0.0	4	0.7
Total	155	100.0	280	100.0	165	100.0	600	100.0

Source: Primary Data.

Reduction in the Ground Water Level

Kerala's abundant availability of rainfall, availability of water even in the summer season and food security is protected by the existence of vast paddy fields and their cultivation. The Western Ghats helps to ensure sufficient rainfall and wetland and paddy fields which act as the natural water reservoirs allows filtration of water into the ground. This percolation of water into the ground helps to raise the ground water level and recharges the wells. At present the Western Ghats and wetlands and paddy fields are in jeopardy as a result of man's activities. The changes that have occurred in the paddy fields and wetlands are extremely serious and acute. Studies show that climatic changes and water shortage in Kerala was mainly due to the disappearance of vast area of paddy fields. Paddy fields which have minute soils and 1 Hectare of paddy field has the capacity of storing 5 lakh litres of water. Kerala has a history where during the acute summer seasons rivers were flowing mainly because of the water stored in the paddy fields which trickles to the rivers. Even the soils in the thick forest have the water storage capacity of 50000 litres of water. Other dry land has only the capacity of storing 30000 litres of water. 1 ha of paddy field conversion will result in the loss of 470000 litres of water for the summer season. (*Mathrubhumi Newspaper daily dated February 14, 2015*)

Water Shortage during Summer Season in the Study Area

During the summer season major parts of Kerala are facing acute water shortage. Table 7 reveals the responses made by the sample households. 92.8 percent households responded that they have water shortage during summer season.

Response	Kuttippuram		Koovappady		Veliyana	d	Total	
	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent
Have	138	89.0	265	94.6	154	93.3	557	92.8
Not have	17	11.0	15	5.4	11	6.7	43	7.2
Total	155	100.0	280	100.0	165	100.0	600	100.0

Source: Primary Data.

The discussion with the households reveals that the water shortage was not so acute in the past 20-30 years. They are of the opinion that changes in the use pattern of paddy fields play a key role in the water shortage because paddy fields act as the water reservoirs.

Responses made by the Households that Water Shortage was because of the Changes in the Paddy Land

Out of the respondents 87.0 percent are of the opinion that water shortage was due to the changes in the use pattern of the paddy fields.

Response	Kuttipp	Kuttippuram		Koovappady		ad	Total	Total	
	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent	
Yes	129	83.2	250	89.3	143	86.7	522	87.0	
No	26	16.8	30	10.7	22	13.3	78	13.0	
Total	155	100.0	280	100.0	165	100.0	600	100.0	

Table 8. Feels acute Water Shortage because of the Changes in the Paddy Land

Source: Primary Data.

Perception about whether Water Shortage was Due to the Changes in the Use Pattern of Paddy Land

The researcher then asked to order their opinion. Table 8presents this.91.2 percent of the total respondents agreed to this opinion. 7.7 strongly agreed to this opinion. 1.2 percent had no opinion regarding this.

Table 9. Perception about whether Water Shortage is Due to the Changes in the Use Pattern of Paddy Land

Dognongo	Kuttippuram		Koovappady		Veliyana	d	Total	
Kesponse	Count	Per cent	Count	Per cent	Count	Per cent	Count	Per cent
No opinion	7	4.5	0	0.0	0	0.0	7	1.2
Agree	117	75.5	265	94.6	165	100.0	547	91.2
Strongly agree	31	20.0	15	5.4	0	0.0	46	7.7
Total	155	100.0	280	100.0	165	100.0	600	100.0

Source: Primary Data.

Wetlands are areas that are particularly under threat because of the activities of the human beings. This raises wide range of issues with multiple scientific and social dimensions. Decline in the net sown area will have implications not only for the sustainability of the ongoing diversification but also for the food security of the state. Biodiversity which was the biological wealth of a nation is one of the cornerstones of sustainable development. Today the world is facing biodiversity crisis. Smalls insects and animals are the worst affected among them. Changes in the paddy land have caused severe ecosystem consequences. For example, it has long been recognized that changes in the agricultural land use and practices can cause changes in the ground water level and the effect is influenced to frame new governmental policies. These important ecosystem services will be reduced or destroyed when paddy lands are converted to other

crops or urban development. Conversions of wetlands to other crops and non agricultural uses have brought many species to the verge of extinction.

Conclusion

Changes in the paddy land use in Kerala create several threats to the environment as well as the food security of the people. The conversion of the wetlands and paddy lands which are the ecological hotspots affects the water storing capacity of the soil. Apart from local initiatives, regional and global efforts are called for to conserve the remaining hot spots of biological diversity, through initiatives based on environmental holism. The remaining paddy fields of Kerala are to be preserved for the better future of the coming generations.

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