CAUSE-CONSEQUENCE ANALYSIS OF CONVERSION OF PADDY FIELDS IN KUTTANAD

By

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THESIS

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DECLARATION

I hereby declare that this thesis entitled **"Cause-consequence analysis of conversion of paddy fields in Kuttanad"** is a bonafide record of research work done by me during the course of research and that this thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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Introduction

CHAPTER - I

INTRODUCTION

Agriculture, the most basic of all enterprises has important impact on human welfare and the environment. For centuries, agriculture was practised to meet the basic necessities and was adapted to the geographical and ecological conditions.

In India, just after green revolution, gross area under cultivation remained at 1578 lakh hectares for the country as a whole, the proportion of area under non food grain showed a tendency to increase particularly from early 1980's. The rising tendency was more marked in the relatively too dry and water scare western and southern regions of the country. In the western region, the proportion of cropped area under non-food grains, which upto early 1980's hovered around 25 per cent, shot up in the early 1990's to nearly 32 per cent, the corresponding change in the south region was from around 32 to 42 per cent. In the food grain dominating high rainfall region of eastern India, also, the proportion of area under non food grains increased, though mildly and that too from the early 1980's. But in the relatively better irrigated and controlled productive environment of Northern region, the proportion of area under non food grain remained remarkably stable upto early 1980 at around 20 per cent, and then recorded a noticeable decline in the 1990's and onwards. These changes provide a broad emerging pattern for the country.

India, like most other developing countries, is finding it awfully hard to bargain with and fight out the monopoly powers of developed country capitalism. For a large and democratic country like India, there seems to be no alternative other than fighting out monopoly capitalism of the developed economics, merely on the basis of its own inherent and acquired competitive strengths and has put forward 'food security' at the forefront of its proposals in WTO renegotiation before the international community.

Agricultural diversification is receiving greater emphasis in view of the new economic policies and trade opportunities being created through increasing trends in globalization and liberalization. Crop diversification referring to a larger crop mix

creates a land use conflict among the various crops and crop groups like food grains and non-food grains, especially on the small farms. The optimism on income generation and the scepticism on food supply have generated considerable controversy especially on crop diversification and it is believed that an increased pace of export - led diversification might lead to some trade off with the domestic food grains supply.

Diversification is an integral part of the process of structural transformation of an economy. In the last few years the need for rapid diversification was strongly articulated in the context of the rice economy of India. A number of countries where rice was a predominant crop, were faced with a decline in rice prices in 1980's. There were two options open to such countries, either to support the domestic rice prices by giving huge subsidies or to allow rice growers to 'adjust' to the declining prices of this staple crop. In this context, a forced pace of withdrawl of farm resources, including manpower, from agriculture and significant changes in cropping pattern were advanced as a more desirable alternative (World Bank, 1989).

From the initiation of planning as a rice producing state, Kerala puts major efforts to food grain production. But one of the most important developments that deserves very special consideration is the high stress given by the farmer to profit oriented agriculture farming. This has resulted in the intensive use of land on one side and choosy investment pattern in the agricultural sector on the other. Areas under commercial crops began to rise enormously which is explained by the increase in prices of those crops. The most important development was the neglect of rice.

Rice which is the staple food of Kerala, has experienced continuous decline in area over two decades. Rice production touched its peak of around 14 lakh tonnes in the mid seventies. Even at its peak level, internal production was hardly sufficient to meet 50 per cent of the state's requirement. Consequent to the enormous pressure which high value crops have excerted, area under paddy declined from 8.81 lakh ha in mid seventies to 3.47 lakh ha in 2000-01 (Directorate of Economics and Statistics, Kerala). The gravity of the problem is more severe when the state is 50 per cent short of food grains.

The conversion of paddy field in Kerala can be broadly classified under land filling soil digging and fallowing. After land filling the area will be cultivated with either perennial or seasonal/annual crops or in some cases will be put to non-agricultural uses like building purpose, real estate brick industry etc. The fields which are kept fallow will be converted in due course for other agricultural as well as non agricultural purpose. It goes without saying that each type of conversion has its own impact. Any type of conversion or filling will definitely interfere with the hydrological, especially flood control functions of the wet land. The rice fields have several other ecological functions also. It acts as a very viable ecosystem for innumerable number of organisms. In addition to this they act as a good drainage basin to collect the rain water and run off and slowly penetrating it into the ground water aquifer, thus helping for ground water recharging. Several primary observations in different locations of the state where extensive wetland conversion has taken place indicated significant reduction in water table over a period of five years apart from the changes in the flora and fauna could be observed.

The food requirement of Kerala is measured by a single parameter i.e. availability of rice. The paddy field conversion has miserably happened inspite of the Kerala Land Utilisation Act (1967) which empowers the Government to direct any holder of land not to leave any land fallow, not to cultivate any other food crops other than the one grown during the three years immediately before the commencement of the orders to attempt to convert such land for any other purpose.

All sectors of the community have been affected by the land use pattern change. Decline in the number of persons engaged in farm-related activities, shift of economic opportunity away from women to men, increasing specialization in livelihoods, migration of rural labour in search of work, withering away of traditional, local institutions are all features of this transformation. Agriculture has increasingly substituted external inputs and resources for internal ones, reduced the range of skills needed for farming.

Kuttanad, the rice bowl of Kerala, is a typical geographic location undergoing these type of changes in cropping patterns and land use systems. Since the

wetland conversion has been taking place at an alarming rate in this region, it is felt that the study on the analysis of cause and consequences of conversion of paddy fields has to be focused on Kuttanad.

The objectives of the study are

1. To analyse the nature and extent of conversion of paddy fields
2. To analyse the push-pull factors influencing the conversion of paddy fields
3. To study the socio-economic consequences of conversion
4. To analyse the agro-ecosystem impact as perceived by the respondents
5. To suggest a suitable strategy to rationalise the land use pattern to check the conversion process.

Scope of the study

Conversion of paddy fields for other purposes assumes greater importance in Kerala since it depends on other states for the supply of rice for meeting the staple food requirement. The present study, 'Cause consequence analysis of conversion of paddy fields in Kuttand' is aimed to analyse the nature and extent of conversion process. The study examines for what are all purposes and at what extent the paddy field have been converted by the farmer.

With respect to the factors affecting conversion process, the study gives emphasis on the economic, technical, personal and socio-psychological and structural factors which possess both promoting and retarding effects.

The analysis of the impact of the conversion is focussed on two major aspects, socio-economic scenario and agro-ecosystem, highlighting the preparation of different respondent categories.

Based on the present study a strategy has been proposed along with certain suggestions for a profitable paddy production.

Limitations of the study

The present study was conducted as a part of doctoral research programme. The study was confined to Kuttanad area where considerable heterogeneity exists within the region with respect to agroecological conditions. Since the study was conducted as a part of the academic programme, the application of Geographic Information System was not accessible at the researcher level. However effort has been taken to collect the data from all the other possible sources to make the study fruitful. Since the study was more concentrated in the selected panchayats, it may have certain limitations in making generalisations. Eventhen, it is expected that the findings of the study would definitely influence in formulating suitable measures for sustainable agriculture.

Theoretical Orientation

CHAPTER - II

THEORETICAL ORIENTATION

A review of previous studies may assist in throwing light on the various dimensions of the research problem, historical background, philosophies and ideas based on which the problem area originated, which in turn may help in developing a sound theoretical frame work for the study.

Based on the objectives of the study, the literature collected has been reviewed under the following broad heads.

2.1 Land tenure system in Kerala

2.2 Land use pattern in Kerala

2.3 History of rice cultivation in Kerala

2.4 History of Kuttanad

2.5 Rice in Kuttanad

2.6 Nature of conversion of paddy fields

2.7 Extent of conversion of paddy fields

2.8 Factors affecting conversion process

2.9 Socio-economic consequences of conversion

2.10 Impact of paddy field conversion on agro-ecosystem

2.1 LAND TENURE SYSTEM IN KERALA

The reorganized Kerala state of 1956 is composed of three parts viz., Travancore, Cochin and Malabar with different history and land tenure system, before the enactment of land legislation in Kerala in the decade from 1960. In Travancore area some of the main tenures were '*Pandaaravaka*', '*Jenmom*', '*Sree Pandaaravaka*', '*Kandukrishi*' and '*Sreepaadam*'.

In Cochin area the important tenures were '*Pandaaravaka*' and '*Puravaka*', while in Malabar area they were *Jenmom*, *Kaanam*, *Kuzhikaanam*, *Verumpattom* and *Kudiyirippu*. Under the *Pandaaravaka* tenure prevalent both in

Travancore and Cochin areas, the State was the owner of the land. In the case of *Jenmom* and *Puravaka* tenure, the ownership rested with the land-lords known as *Jenmies*. *Sree Pandaaravaka* lands belonged to the Sree Padmanabha Swamy Temple, Trivandrum, the family temple of the Maharaja of Travancore. *Kandukrishi* lands were the properties of the Maharaja of Travancore and *Sreepaadom* lands belonged to the women members of the royal family (Aiya, 1906). In the *Jenmom* tenure prevalent in Malabar area, the land-holders had absolute ownership, while under *Kaanam* and other tenures, ryots had fixity of tenure which was heritable and alienable. Government lands given on lease were under a system known as *Kuthakapattom* in Travancore and Cochin areas and as *Pattom* in Malabar area.

The Malabar Tenancy Act (1930) and the Kerala Agrarian Relations Act (1960) were two important enactments conferring substantial rights on the tenants. A comprehensive legislation on land reforms was enacted in Kerala in 1963 and was brought into force from first April 1964. The main objective of this legislation was to abolish intermediary rights on land between the State and the tenant-cultivator and to enforce ceilings on land holdings. With the objective of speedy implementation of the land reforms policy of the Government and to plug the loopholes in the Act of 1963, the State Government enacted an Amendment Act in 1969, known as the Kerala Land Reforms (Amendment) Act, 1969. By virtue of the provisions of this Act which were brought into force from first January 1970, the rights of all land-lords and intermediaries in respect of their tenanted lands vested in the Government. With the enforcement of the provisions of the Amendment Act, proprietary rights have been conferred on the cultivating tenants bringing them into direct relationship with the Government.

The ceiling on land prescribed in the Kerala Land Reforms (Amendment) Act (1969) was five standard acres for an adult unmarried person or a family consisting of a sole surviving member and 10 standard acres for a family consisting of two or more adult members, but not more than five with one additional standard acre for each additional member in excess of five. In the case of companies and associations, the

ceiling is 10 standard acres. It has also been prescribed that five standard acres shall not exceed 7½ ordinary acres, 10 standard acres shall not exceed 15 ordinary acres and that even the extra standard acres provided for members in excess of five shall not exceed a total of five ordinary acres. Family is defined as husband, wife and unmarried minor children. Exemption from the ceiling is given only to lands cultivated with crops like tea, coffee, rubber, cocoa and cardamom and lands of co-operative societies and religious, charitable or educational institutions of a public nature.

With the implementation of the land reforms policy of the Government, the cultivating tenants in Kuttanad now hold full proprietory rights over the lands cultivated by them, subject to the ceiling on holdings. The tenancy system has been abolished and the tenants have been absolved from the liabilities of payment of rent to '*Jenmies*' and other intermediaries.

2.2 LAND USE PATTERN IN KERALA

The nature of land utilization in Kerala for agricultural purposes has not been systematic and fluctuations in the prices of crops have had their effect from time to time on the pattern of land use. At present the gross cropped area in the State is 2.99 million hectares. Of this nearly 88 per cent is used for cultivation of non-food crops and the remaining area is utilized for production of food crops (Directorate of Economics and Statistics). On account of the higher income from cash crops, there has been large scale diversion of land from food crops to cash crops even in the rice cultivation areas, and this in turn has had its impact on the food production in the State. The scope for further expansion of land for food crops is limited. This has resulted in a huge deficit in food production mainly of rice, and the State has to depend on outside sources to a great extent to feed its population. The present land use pattern of Kerala is given in Table 2.1.

Rice is the staple food of Kerala. As the present production of rice is not adequate to meet the minimum requirements, the aim of the State has been to increase rice production, in order to achieve self-sufficiency. To attain this objective, the immediate requirements are optimum utilization of land for intensive

Table 2.1. Land use pattern of Kerala (2001-02)

Sl. No.	District	Total Geographical area	Forest	Land upto non agricultural use	Barren & unculti vable land	Permanent pastures and other gazing land	Land under misc. tree crops	Cultivable waste	Fallow other than current fallow	Current fallow	Net area sown	Area sown more than once	Total cropped area
1	Thiruvananthapuram	218600	49861	23470	486	7	85	395	390	1098	142808	50870	193678
2	Kollam	251838	81438	23421	230	2	73	380	473	3983	141838	62556	204394
3	Pathanamthitta	268750	155214	15273	438		66	520	776	4398	92065	24430	116495
4	Alappuzha	136058	-	24090	95		212	4755	3360	9677	93869	36258	130127
5	Kottayam	219550	8141	26557	2031	1	119	2690	2259	4937	172815	48134	220949
6	Idukki	514962	260907	15324	3893	153	2771	3158	980	1368	226408	49772	276180
7	Ernakulam	235319	8123	42717	1291	15	236	6840	2867	6823	166407	52300	218707
8	Thrissur	299390	103619	35060	512	13	857	3009	4451	9384	142485	49098	191583
9	Palakkad	438980	136257	52828	3436	2	1578	18170	8817	14744	203148	117566	320714
10	Malappuram	363230	103417	37433	2318	1	580	5230	4282	11653	198316	67931	266247
11	Kozhikode	233330	41386	26870	1571	1	163	760	886	1865	159828	71073	230901
12	Wayanad	212560	78787	12331	280	30	864	1680	782	2053	115753	85641	201394
13	Kannur	296797	48734	31082	3350	3	1681	3720	1937	4342	201948	66518	268466
14	Kasaragod	196133	5625	25896	9797	5	4328	12464	2071	2945	133002	19415	152417
15	State	3885497	1081509	392352	29728	233	13613	63771	34331	79270	2190690	801562	2992252

Source: Directorate of Economics and Statistics, Govt. of Kerala

farming coupled with imparting sound technical advice to cultivators in regard to crop rotation, selection of high yielding varieties, scientific application of fertilizers and control of pests and diseases.

2.3 HISTORY OF RICE CULTIVATION IN KERALA

The origin of paddy fields along the low-land ecosystems and the corresponding socio-economic and cultural processes in Kerala seem to have covered a fairly long period, probably starting from the 6th to the 8th centuries A.D. The archaeological evidence for a relatively developed material culture slowly start forthcoming in the form of monolithic shrines and isolated sculptures.

The sites excavated at Kuppakkolli in the Wayanad District, that have yielded ploughshare are worth mentioning here both for the wet-rice to eco-type and clannish inhabitants. So the earliest paddy fields of Kerala were probably in the high ranges and the elevated alluvial beds in the plains rather than along the low lying wetlands. Such areas have been identified at several points along the Western Ghats.

It is assumed that the period anterior to the close of the 8th century as the period of material and socio-cultural preparations for the development of the paddy economy. The paddy economy was able to articulate the socio-political and cultural education of its domination only by that period. Therefore, it is reasonable to believe that the stabilization of the new social formation was complete in Kerala by the end of the 8th century. The archaeology of most of the human-made water channels might go to this period and so also the antiquity of the institutional devices for the effective mobilization of the work-force (Oommen, 1971).

We only know that this major human induced landscape - change of Kerala that eventually structured her economic and cultural geography was a long process of the integration of work force into occupation groups of hereditary specialization with agrarian settlements. This process involved virtually the construction of *Kammalar* (the artisans and craftsman) and *atiyalar* (the subjected tillers) out of the class. The transformation of kin-labour into non-kin labour was then the first major transformation.

It appears that the Brahman settlements were growing in Kerala through the seventh to eighth centuries along with the process of the integration of the work force and reclamation of wetlands. The temple inscription that start appearing from the nineth century onwards show that the temple - centred Brahman settlements had become well established by the turn of the nineth century with extensive control over the fertile tracts of Kerala. They were very well consolidated by the time and were developing further into subsidiary settlements.

This would mean that by the 9th century, the simultaneous processes of the integration of workforce, the reclamation of paddy fields and the structuring of each agrarian settlement into a determinate pattern had been complete under the temple - centred Brahman villages. The later inscriptions show that every village was born as a recurring pattern structured by households of land holders, intermediaries, artisan, craftsmen and tiller on permanently sculptured in the landscape. In this same each village was the basic unit of habitation consisting of the various functionaries who were essential for the settlement. The pattern survived to the colonial times as evidenced by the recurring place names in the settlement registers, indicating the plots allotted to the various artisans and craftsman.

The formation of such pattern of settlement that evolved out of the working of paddy economy and that sculpted the landscape cannot be detached from the history of the expansion of paddy fields. It was a very significant historical process that combining the making of a new economy a new landscape and a new culture that lasted long. These three were the cornerstones of Kerala - the paddy economy providing its material foundation, the agrarian landscape its characteristic feature and the village culture its identity.

2.4 HISTORY OF KUTTANAD

From the very early days, Kuttanad has been acknowledged as the rice-bowl of Kerala. In ancient days, the term 'Kuttanad' referred to a much larger area than what it cannotes at present. Then, the region extending from *Kanneti*

(Karunagappally) to Alwaye was known as 'Kuttanad'. In early Tamil literature like '*Venpai*' and '*Tholkappiyam*', Kuttanad is mentioned as one of the 12 *Nadus* (principalities) where people spoke '*Kodumthamil*'. There are references to 'Kuttanad' in the great Tamil work '*Thiruvaymozhi*' written in the eighth century A.D. by the renowned *Vaishnavite Saint Nammalvar* and in *Periyapuranam* of the 11th century A.D.

Apart from these historical records, there are also certain legends connected with Kuttanad. It is said that the *Khandava Vana* mentioned in the epic '*Mahabharata*' was situated in Kuttanad and that the remnants of that burnt forest still lie deep under the fields. Rogs of burnt and charred wood are still seen in the *Kariniloms* of Thakazhi, Thuravoor, Vaikom etc. The legend goes that after the forest was completely burnt down, mud set occurred gradually and gave rise to the fields existing at present. As such, it is said that, this place was originally known as '*Chutta nadu'* which means parched land which later became Kuttanad.

2.4.1 Geographical setting

Kuttanad is a deltaic, trough-like formation shaped by the confluence of four major river systems of the state - the Meenachil, Manimala, Pamba and Achankoil rivers draining into the Vembanad lake and it is below MSL.

The Meenachil river is formed by several streams which originate in the Western Ghats. The length of the river is 78 km, the total drainage area being 1272 sq.km. The average rainfall in this area is 3150 mm. The Manimala river, 90 km in length, drains an area of 847 sq km having an average rainfall of 3580 mm. Pamba, the third longest river in Kerala, is 176 km long. It drains an expanse of 2235 sq km which has an average rainfall of 3240 mm. The 128 km long Achankoil river drains 1484 sq km with an average rainfall of 3050 mm. The total annual drainage from these four basins comes to about 18,500 million M^3, which is about 15 per cent of Kerala's total rainfall. Further north, though not a part of Kuttanad proper, is the Muvattupuzha river which too drains into the Vembanad lake. The Manimala, Pamba and Achankoil get

intertwined and lose their individual identity to form an intricate network of waterways.

There are mainly three types of lands in Kuttanad:

Kayal lands	: Land reclaimed totally from the Vembanad lake, 81 sq km
Kari lands	: Swampy land, 61 sq km
Karappadam	: Shallow land, 425 sq km

The water courses which crisscross the entire area on one hand provide accessibility (by boat), but on the other hand slow down the movement of men and material. On account of the omnipresence of water, spatially as well as temporally, and the occurrence of a high water table, the land resource use is developed entirely around the cultivation of paddy and coconut, and the economy of the region is solely dependent on the vicissitudes in the fortunes - productivity and price - of these two commodities. Being prone to the twin natural hazards of floods and salinity, paddy cultivation is equated with high risks, and the period available for cultivation operations is relatively short; this in turn necessitates the deployment of a large contingent of labour force for limited periods. This, together with the relatively heavy capital investment, has made agriculture in this area more capitalistic than feudal, as compared with the rest of Kerala. Kuttanad is called the *Rice Bowl* of Kerala, though not with much justification as it produces only about 15 per cent of Kerala's total rice output. Palghat district, where the productivity is higher and the problems less, produces nearly twice as much. However, the preoccupation with rice in Kuttanad has been at the root of many a human intervention in that area. But agriculture is not the sole occupation of the entire community. Fishing, lime-shell collection and toddy tapping are also major occupations. They are all interrelated and the interventions in Kuttanad have affected all of them.

2.5 RICE IN KUTTANAD

The rice cultivation in Kuttanad is known as '*punja*' cultivation. The special features of *punja* cultivation are construction of outer ring bunds and pumping

out of water before the fields are prepared for cultivation. The *punja* season is generally the period between the usual *mid-mundakan* and mid-summer seasons i.e. after the cessation of the North-East monsoon and before the ingress of saline water during the summer months. Generally one crop of paddy is grown in the *punja* lands, but of late, an additional crop of paddy is also grown during the regular *virippu* crop season.

The *punja* lands are divided into identifiable homogenous physical entities called '*Padasekharams*'. It extends over 53,000 ha. The *punja* lands of Kuttanad are classified under three categories viz., '*Karappadam*', '*Kayal land*' and '*Kari land*' with reference to elevation, geographical formation and soil characteristics. The *Karappadams* are generally situated along the water ways and constitute the lower reaches of the eastern and southern periphery of Kuttanad with an area of about 33,800 ha. The fertility of *Karappadam* lying along the water ways is periodically replenished by the silt deposited by the flood waters of the rivers. The *Kayal* lands having an extent of 10,000 ha are recently reclaimed lands from the Vembanad lake, the elevation ranges from 1.5 to 2.5 m below MSL. The *Kari* lands having an extent of 9400 ha situated in the Ambalapuzha and Vaikom taluks is peaty and marshy in nature and is overgrown in many areas with wild weeds and grass. Most of the lands lie at or below MSL with a shallow water table of less than a metre and subjected to salinity.

The present paddy fields of Kuttanad were formerly vast stretches of water. These were slowly reclaimed for rice cultivation. The process of reclamation was initiated during the second half of 18^{th} century. The earlier reclamations were confined to waterlogged areas of comparatively shallow depth in the upper reaches of Kuttanad. The increasing pressure of population on land during the last century and the exhaustion of shallow back waters for reclamation purpose, compelled the people to venture into deeper waters of Vembanad lake and a sizable area has been reclaimed for paddy cultivation.

2.5.1 *Punja* crop

During the early part of the century, rice (the *punja* crop) was cultivated in Kuttanad only once in two to three years. In order to test the feasibility of annual

cropping in Kuttanad, an experimental station was started in 1916 by the erstwhile Travancore State Department of Agriculture and it was demonstrated that annual rice cultivation is feasible in Kuttanad and the station was closed in 1921. The practice of allowing *Kayal* lands to lie fallow continued even after annual cropping became popular in other areas of Kuttanad. When the lands are left fallow, they are referred to as '*Pazhanilam*'.

In the olden days, dewatering the fields was done with the age old water wheel (*Chakram*) consuming considerable time and labour. The dewatering could be commenced only when the flood waters receded to manageable level from October-November onwards. The introduction of pumping engine (*Petty* and *Para*) in 1912 changed the entire face of Kuttanad cultivation. The '*Petty* and *Para*' is a unique locally developed axial flow pump made of wood and iron with local expertise. It is an efficient pump with low suction and head with high discharge capacity made by local blacksmiths and carpenters. This facilitated reclamation of larger blocks and the cultivation extended to a larger area. The change from oil engine to electric motors gave considerable momentum to these developments. Consequently, with the setting up of electric motors and *petti* and *para*, followed by the construction of the Spillway at Thottappally, which helped to bring down the flood water level, *punja* cultivation became comparatively safer. The sowing now starts from September-October and the peak period of harvest is January and the crop escapes the damage of salt water ingress occurring by February.

2.5.2 Traditional cultivation system

Cultivation operations begin soon after the harvest of the previous crop. Initially two rounds of ploughing are done. Then water is let in. The land gets flooded with the outbreak of the South West monsoon. The level of water may raise to five metres or even more submerging the bunds. The whole area then looks like a sheet of water. In July, when the water level falls to about one metre, one or two ploughings are given. This helps to stir up the soil and to allow fresh water to percolate into the soil. In September, when the water level goes down to a manageable level, the outer

bunds are constructed with clay, stakes, reeds and bushes. The field bunds are also repaired and renovated after which pumping is continued till the fields are completely drained. The soil is then raked by passing a harrow locally called '*palli*'. The undecomposed organic matter and weeds are then removed and the soil is brought to a soft puddle. Fresh water is let in to a depth varying from a few centimeters to 0.5 m according to the lie of the land. Sprouted seeds are generally sown broadcast in standing water. Transplanting of seedlings is rarely done. After three or four days, water is drained by pumping and the fields are allowed to dry for about 10 days or more till soil develops crow's foot wrinkles on the surface. Lime is applied at this stage on the soil surface after which water is let in and maintained to a depth of five to eight centimeters Fertilizer applications are done at the tillering and panicle initiation stages of growth of rice after draining water from the fields. The fields are reflooded one or two days after the application of fertilizers. The letting in and draining water and weeding are done as and when required. The fields are completely drained 10 days before crop maturity to facilitate harvesting operations.

A Rice Breeding Station was established in 1940 at Moncompu for developing suitable varieties especially for Kuttanad region.

2.5.3 *Kulappala* cultivation

In the upper reaches of Kuttanad where the fields are shallow, there existed a deep water crop of paddy cultivation called the '*Kulappala* cultivation'. The area under this system of cultivation varied annually depending on the seasonal conditions.

The cultivation operation starts soon after the harvest of the *punja* crop in January-February. The fields are ploughed with the residual moisture in the field or with the receipt of a few summer showers if the soil is too dry. The seeds are sown broadcast or dibbled in plough furrows and covered by subsequent ploughing. Early sowing is always practised so as to give a period of atleast one and a half months for the plants to grow to a height of 30 to 40 cms to withstand the early floods which occur by the end of May or early June. No manuring is usually done except burning the stubbles and weed growth. Some cultivators apply bonemeal also. The plants

grow up with the rising level of water and reach a height of two to three metres in a straggling manner. Both roots and tillers arise from the upper nodes and the plants with the earheads float on the surface of the water. The crop comes to maturity in September. The harvesting is done by wading through water and cutting earheads alone, which are bundled and transported in small canoes. The prominent rice varieties used were Kulappala, Chennellu, Vayalthuva and Habigunj 1.

One of the major impediments in the *Kulappala* cultivation is the removal of the long straggling straw which is not fit for fodder purpose, from the fields for the subsequent main *punja* crop. Due to the prohibitive cost of its straw removal, the *Kulappala* cultivation became slowly extinct.

2.5.4 Additional crop

In order to avoid the natural risks to the *punja* crop and for taking two crops in Kuttanad, various developmental activities were taken up in Kuttanad in the past. Some of them include the Thottappally Spillway to directly load the flood waters into the sea to reduce the flood havocs; salt water barrier of Thanneermukkom to prevent intrusion of saline water into Kuttanad region through the Vembanad lake and the Kerala Land Development Corporations's (KLDC) scheme for improvement to *padasekharam* bunds (semisubmersible permanent bunds).

The Thottappilly spillway, Thanneermukkom barrier and the permanent bunds for the *padasekharam* have reduced the twin risks of Kuttanad paddy cultivation viz., flood damage and saline water intrusion which has helped in taking up an additional crop in Kuttanad during the *virippu* season.

2.6 NATURE OF CONVERSION OF PADDY FIELDS

The studies regarding the shift in land use pattern are reviewed here.

The total wet land (*nilom*) in Kerala, according to revenue records, is 5.74 lakh hectares. A study conducted by Kerala Statistical Institute in 1992-93 showed

that, only 3.33 lakh hectares remain as wet lands and is used for paddy cultivation. The details are given in Table 2.2.

Table 2.2. Conversion of wetlands in Kerala (1992-93)

Sl.No.	Pattern of land use	Area (in lakh hectares)	Percentage of wet land
1	Area classified as wet land (Nilom) (as per basic tax register)	5.74	100.00
2	Area under perennial crops	1.37	23.80
3	Area under non-agricultural uses	0.35	6.10
4	Area under annual and seasonal crops	0.49	8.50
5	Fallow land	0.20	3.50
6	Area under rice cultivation	3.33	58.10

(Source: Report of Kerala Statistical Institute, Trivandrum, 1994)

The shift in land use in Kerala over the past decade indicated that as early as 1980-81, the state achieved a high degree of land use at 56 per cent, resulting in a steady decline in categories like barren and uncultivable land, cultivable wastes and land under miscellaneous tree crops. By the end of 1989-90, the proportion of land use touched a peak of 57.44 per cent. Also a substantial increase in net cropped area as well as area sown more than once also took place. Taken together with 27.83 per cent forest cover, the state had reached saturation point as far as land use was concerned by the end of the decade (Anon, 1993).

According to Andrew (1996), the technological intervention strategy brought about a significant shift in the nature of cultivation practices as the new strategy necessitated an input mix different from that of traditional crops. The success of this strategy appears to depend as much an adaptation and assimilation as on the rate of diffusion at farm level.

Siripong (1996) has described the land use changes at Surat Thani, Southern Thailand during 1961 to 1991. According to him, the area of tropical forest had been diminished from 63.56 per cent of the total land area to 25.47 per cent. Agricultural areas such as rubber and oil palm plantations were expanded from 32.38

per cent in 1973 to 33.32 per cent in 1984, but diminished to 30.53 per cent in 1993. The urban areas have been expanded from 0.54 per cent in 1973 to 0.64 per cent in 1984 to 1.77 per cent in 1993.

According to the report of *Nelvayal Samrakshana Prasthanam* (1998), the major types of conversion of paddy fields are land filling, digging and fallowing. The details are given in the following Table 2.3.

Table 2.3. Conversion of paddy fields due to land filling, soil digging and fallowing

Types of	1985		1995		1997	
conversion	Area (ha)	%	Area (ha)	%	Area (ha)	%
1.Land filling Perennial crops						
I.Coconut	61,000	7.00	87,000	10.00	96,000	11.00
II.Arecanut	26,000	3.00	17,000	2.00	26,000	4.00
III.Rubber	17,000	2.00	39,000	4.50	35,000	0.50
IV.Others	9,000	1.00	13,000	1.50	4,000	
2. Annual crops						
I. Banana	20,000	2.30	40,000	4.60	37,000	4.20
II.Tapioca	14,000	1.60	21,000	2.40	18,000	2.00
III.Vegetables	3,000	0.30	9,000	1.00	11,000	1.30
	37,000	4.20	70,000	8.00	66,000	7.50
3. Non agricultural prupose						
I. Building purpose real estate	22,000	2.50	70,000	8.00	76,000	8.70
II. Road, canals etc.	11,000	1.30	18,000	2.00	18,000	2.10
III. Industry and other project	2,000	0.20	6,000	0.70	6,000	0.60
	35,000	4.00	94,000	10.70	1,00,000	11.40
II. soil digging						
1. Brick business	8,000	0.900	19,000	2.20	26,000	3.00
2. Soil/lime selling/fish farming	1,000	0.10	1,000	0.10	2,000	0.20
	9,000	0.80	35,000	4.00	47,000	5.40
III. Fallowing	7,000	0.80	35,000	4.00	47,000	5.4
Total (I+II+III)	2,01,000	23.00	3,83,000	43.00	4,02,000	46.00

(Source: Report of *Nelvayal Samrakshana Prasthanam*,1998)

The shift in cropping pattern during the past three decades is depicted in Table 2.4.

Table 2.4. Area under major crops of Kerala (in '000 hectares)

Name of crop	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01
Rice	885	802	678	560	471	347
Tapioca	327	245	203	147	114	115
Coconut	693	651	705	870	914	926
Arecanut	77	61	59	65	71	87
Pepper	108	108	122	169	191	202
Sugarcane	8	8	8	8	6	3
Ginger	12	13	16	14	13	12
Cashewnut	109	141	138	116	103	92
Banana	52	49	43	66	74	99
Rubber	207	238	330	412	449	474
Coffee	42	58	66	75	82	85
Tea	38	36	35	35	35	37

Source: Directorate of Economics and Statistics, Govt. of Kerala

2.7 EXTENT OF CONVERSION OF PADDY FIELDS

Extent of conversion indicates the conversion from one land use to another expressed as percentage or acreage or hectares. Studies related to land use conversion are reviewed.

Rice, which is the staple food of Kerala, has experienced continuous decline in area over two decades. Rice production touched its peak of around 14 lakh tonnes in the mid seventies. Even at its peak level, internal production was hardly sufficient to meet 50 per cent of the state's requirement consequent to the enormous pressure which high value crops like coconut, banana, pineapple and plantain have exerted, area under paddy has declined from its peak coverage of 8.81 lakh ha in mid seventies to 3.47 lakh ha in 2000-01. Decline in area under paddy cultivation is presented in Table 2.5.

Table 2.5. Decline of area under paddy cultivation

Year	Area under rice (000 ha)
1962-63	803
1963-64	805
1964-65	801
1965-66	802
1966-67	799
1967-68	810
1968-69	874
1969-70	875
1970-71	875
1971-72	875
1972-73	874
1973-74	875
1974-75	882
1975-76	885
1976-77	854
1977-78	840
1978-79	799
1979-80	793
1980-81	802
1981-82	807
1982-83	779
1983-84	740
1984-85	730
1985-86	678
1986-87	664
1987-88	604
1988-89	578
1989-90	583
1990-91	560
1991-92	541
1992-93	538
1993-94	508
1994-95	503
1995-96	471
1996-97	431
1997-98	381
1998-99	353
1999-00	350
2000-01	347

(Source: Govt. of Kerala, *Statistics for Planning*, Economic Review, various issues)

Among the crop specific studies, Panicker (1980), who examined the trend in area, production and yield of paddy in Kerala from 1960-61 to 1978-79 observed that the area under paddy and production in Kerala had declined steadily. The yield showed an increasing trend though it was marginal. This was in confirmity with the studies of Unni (1983), Sivanandan (1985), George and Mukherjee (1986), Kannan and Pushpangadan (1988), Jose (1991) and George 1993).

Sivakumar (1994) reported that in Karnataka state, there is a state wide shift from food based agriculture to horticulture sericulture, dryland crops, energy, forestry and the like. The area under food crops declined from 75.76 lakh hectares in 1989-90 to 72.91 lakh hectares in 1991-92. While the area under oilseeds increased from 22.65 lakh hectares in 1989-90 to 29.09 lakh hectares in 1991-92, it fell marginally to 27.81 lakh hectares in 1992-93.

Change in the season wise area in paddy cultivation is presented in Table 2.6. Region wise change in wet land and total changes in area under paddy cultivation is given Table 2.7.

Table 2.6. Change in area under paddy cultivation (Area in lakh hectare)

Name of crop	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01
Autumn	3.97	3.49	2.80	2.36	1.87	1.30
Winter	3.84	3.54	3.13	2.59	2.25	1.62
Summer	1.04	0.98	0.85	0.65	0.60	0.55
Total	8.85	8.02	6.78	5.60	4.71	3.47

Source: Directorate of Economics and Statistics, Govt. of Kerala

Table 2.7. Change in wet land area

Region	1940's		1970's		1990's	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Travancore						
1. Single crop	64663	11.27	58018	11.93	38350	11.51
2. Double crop	103074	17.97	86832	17.86	58245	17.49
3. Triple crop	551	0.10	3171	0.65	244	0.07
Total	168288	29.34	148021	30.44	96839	29.07
Cochin						
1. Single crop	44441	7.74	27517	5.66	25863	7.76
2. Double crop	89168	15.55	63655	13.09	42745	12.84
3. Triple crop	4075	0.71	20855	4.29	12397	3.72
Total	137684	24.00	112027	23.04	81005	24.32
Malabar						
1. Single crop	88039	15.35	71026	14.61	43297	13.00
2. Double crop	177044	30.87	140881	28.96	111262	33.39
3. Triple crop	2521	0.44	14333	2.95	723	0.22
Total	267604	46.66	226240	46.52	155282	46.61
Kerala						
1. Single crop	197143	34.37	156561	32.20	107510	32.27
2. Double crop	369286	64.38	291368	59.92	212252	63.72
3. Triple crop	7147	1.25	38359	7.88	13364	4.01
Total	573576	100.00	486288	100.00	333126	100.00

Source: Report of the Expert Committee on Paddy Cultivation 1999.

Comparison of area, production and yield of paddy in Kerala is presented in Table 2.8.

Table 2.8. Total changes in area, production and yield of paddy in Kerala

Year	Area (000 ha)	Production (000 tons)	Yield (kg/ha)	Index (55-56 = 100)		
				Area	Production	Yield
1955-56	759	884	1164	100	100	100
1960-61	779	1068	1371	103	121	118
1965-66	802	1000	1246	106	113	107
1973-74	875	1257	1437	115	142	123
1977-78	840	1295	1541	111	146	132
1984-85	730	1256	1720	96	142	148
1989-90	583	1141	1956	77	129	168
1995-96	431	871	2023	57	99	174
2000-01	347	751	2162	46	85	185

Source: Directorate of Economics and Statistics, Economic Reviews (various issues)

Land use change in Kuttanad is depicted in Table 2.9.

Table 2.9. Area under different land use in percentage of total area

Type of cultivation	1968	1991
Paddy cultivation	77.58	50.16
Homestead agriculture	16.90	40.75
Current fallow	1.64	3.64
Fallow other than current fallow	3.88	5.45

(Source: Regional analysis of Greater Kuttanad by Chattopadhyay and Sidharthan (1975) and Satellite Imagery data of 1991)

According to Goldman (2000), in California farmland transferred to the 'other' category during 1989-98 totaled about 167,000 net acres. During 1996-98 period alone conversion from agricultural to 'other' purpose sharply increased by 74,000 acres from 40,500 in 1994-96.

A decadal trend analysis of area of rice crop in Kerala over the past half century by Gangadharan (2002) revealed that during 1952-53, the total area under cultivation of rice was about 7.5 lakh ha and it reached maximum of 8.7 lakh ha during 1972-73. Since then there was a gradual fall in the area during 1980's and even halved during 90's. In 1999-2000, the area was reduced to 3.5 lakh ha.

2.8 FACTORS AFFECTING CONVERSION PROCESS

The reasons for conversion of paddy fields are so complex and inter-related that it is difficult to classify and isolate individual factors. However, an attempt has been made to classify them under four headings viz., economic factors, technical factors, personal and socio-psychological factors and situational factors. Past studies relating to paddy field conversion as well as land use pattern changes are reviewed here.

2.8.1 Economic factors

According to George and Mukherjee (1986), the reduction in the paddy area was the result of conscious decisions made at the farm level in favour of substituting other crops for paddy. This may be due to the disadvantageous relative price situation among different crops, encouraging perennial crops prevailed over a long period.

According to Gopinath and Sundaresan (1990), the decline in area under paddy was attributed to the marginal increase in yield and the poor profitability of rice.

Thomas *et al.* (1991), studied the decline in paddy land and factors leading to it in Thrissur district of Kerala state and found that during a short span of three years (1987-1990) the decline in the area under paddy was to the extent of 31 per cent. The lower benefit-cost ratio of paddy cultivation would have influenced the process significantly.

According to Narayanan (1994), increasing cost of cultivation due to large increase in prices of inputs like fertilizer, pesticides and labour accompanied by the disproportionate increase in output price, is the major factor that contributed to the persistent pressure for replacement of rice by other more remunerative crops.

Padmanabhan *et al.* (2000) analysed the changes in cost and returns of rice cultivation in Kuttanad for 1988 and 1998. It was found that the increase in labour cost

is more than proportionate increase in wage rates by around 390 per cent for males and 257 per cent for females. The increase in cost of fertilizers and plant protection chemicals is not proportionate with increase in unit costs during the same period. The unit prices of pesticides have increased within the range of 100 to 270 per cent. The hike in the cost of total inputs was not proportionate to the increase in the value of output. While the input costs increased by around 254 per cent, the rise in the value of output was only 95 per cent. Such a mismatch in increase between input costs and value of output make the farmers to think about cultivation of other crops.

A study on paddy field conversion by Kerala Statistical Institute (1994) revealed that the most important reason for conversion of paddy field was the uneconomic nature of paddy cultivation.

Based on a study on land use change in Kuttanad, Mathew (1998) reported that the major reason for paddy field conversion is the non-remunerative nature of paddy cultivation.

According to the report of the Expert Committee on Paddy Cultivation in Kerala (1999), the major reason for conversion of paddy fields during the period 1969-1992 was the uneconomic nature of paddy cultivation.

According to Musthafa *et al.* (2002), the reason for conversion is the lack of interest among the rice farmers of Kerala to continue it due to low productivity coupled with high cost of cultivation.

Prakash (2002), reported that the rice farmers in Kerala are switching over to other cash crops like rubber, coconut etc. mainly due to the high returns and easy manageability of these cash crops.

Based on the pilot study, and review of literature, it is hypothesized that the economic factors viz., high cost of fertilizer (E1), high cost of plant protection chemicals (E2), high cost of electricity (E3), inadequate support price (E4), inadequate prices given by rice mill owners (E5) and low profit compared to other cash crops (E6) have positive and significant relationship with conversion of paddy fields.

2.8.2 Technical factors

According to Gopinath and Sundaresan (1990), decline in paddy area was contributed by a number of constraints like diverse agro-climatic conditions, acidic soil, uneven distribution of rainfall, multiple cropping, high incidence of pest and diseases and low level of fertilizer use.

According to Mathew (1998), lack of knowledge of people about the serious consequences of conversion was also found to be a major reason for paddy field conversion.

In the present study it was postulated that the technical variables viz., low mechanization (T1), high level of pest and disease infestation (T2), inefficient implementation of crop insurance scheme (T3) and possession of only paddy field (T4)have positive and significant relationship and the variable, competency in paddy crop cultivation (T5) has negative significant relationship with the conversion of paddy fields.

2.8.3 Personal and socio-psychological factors

Latha (1997) analysed the factors affecting conversion of marginal homesteads for planting rubber in Kottayam district and found that area under homestead and availability of family labour were found to have negative and significant relationship with extent of conversion.

It was hypothesised that there would be a positive and significant relationship between paddy field conversion and variables viz; education (P2), preference of white collar job among the educated youngsters(P9) and nuclear family system (P10) and negative association with age(P1), farming experience(P3), family size(P4), occupation(P5), traditionalism (P6), area under paddy(P7), local resource utilization(P8),preference of food from own field(P11), possession of livestock(P12), expectation of a good crop every season(P14).

2.8.4 Situational factors

According to Narayanan (1994), apart from diminishing returns from rice cultivation, acute shortage of labour also discouraged the farmers from continuing the traditional occupation, as successful rice cultivation demands farm operations at the right season and time. This has tempted some of the farmers to switch over to other enterprises.

According to Kerala Statistical Institute (1994), one of the important reasons for conversion of paddy field was lack of irrigation facility.

A study at Surat Thani, Southern Thailand by Sripong (1996) revealed that the major reasons for land use changes were deforestation and socio-economical problems.

According to Mahesh (1998), agricultural farms got subdivided to very small sized farms, due to increase in population. Since small sized farms are not viable, the owners of these farms turned to other occupations for their livelihood. For such cultivators, farming is only a subsidiary activity and prefer to cultivate crops that require less personal attention. Moreover, changes in the farming practices and crop pattern in the neighbouring areas induce other farmers to adapt to the changes.

According to Mathew (1998), the major situational factors found to affect conversion process were huge demand for land for habitational purposes due to increasing population followed by impact of developmental activities making the land unsuitable for farming, tourism/industry and related activities, proximity of transportation facilities and lack of serious support from the Government and society at large to the paddy farmers.

Vijayan (2001) reported that one of the major reasons for conversion of paddy field to other purpose is the unavailability or shortage of agricultural workers during peak seasons.

It was hypothesized that the variables namely location of the field (S1), salability (S2), urbanisation (S3), non-availability of labour (S4), inefficiency of agricultural labourers due to age related problems (S5), scarcity of labour during peak season (S6), high wage rate of agricultural labourers (S7), difficulties in getting labourers for application of plant protection chemicals (S8), occupational migration of labour (S9), inadequate assistance for natural calamities from government (S10), lack of proper processing facilities (S11), lack of efficient marketing infrastructure (S12), improper functioning of *padashekara samithies* (S13) and conversion to roads (S14) have positive and significant relationship with the conversion of paddy fields.

2.9 SOCIO-ECONOMIC CONSEQUENCES OF CONVERSION

Stavenhagen (1978) opined that the shift to commercial agriculture had several consequences for small farmers such as Commercial cropping usually involves a much greater risk, which increases the possibility of indebtedness and increasing the dependency on outside agencies or institutions.

According to Derr (1979), the processes of agricultural modernization and population growth had interacted in the village of Karimpur in U.P. to significantly alter traditional socio-economic relationships within the village. Though the food grain production has increased dramatically over the past 50 years, more villagers are suffering from hunger. New inputs and infrastructural support have allowed farmers to reorient their production system from subsistence to profit maximisation between the rich and the poor.

Fan (1996) found that plantation system in Malaysia has given rise to sexual division of labour and led to an increasing displacement, relocation and reorganisation of male and female labour.

Nadkarni (1981) reported that commercialization of agriculture could increase instability in output. The requirement of more inputs from the markets and hired labour increased the dependence of farmers on credit and supplies from outside.

Based on a study on the coastal land use change and the resulting impact in Bangladesh, Choudhary *et al.* (1990) has explained the socio-economic consequences as follows.

1. The monetary benefits of shrimp farming are highly skewed in favour of the large land owners who control land, capital, access to bureaucracy and employment possibilities.
2. Higher profitability has increased land values further concentrating of land ownership and changing the social relation of production.
3. There has been a significant drop in school attendance from December-March when children of the local poor are engaged in catching shrimp. These absentee children seldom return to school for the rest of the term.
4. The introduction of shrimp farming in the area has given rise to conflict with agricultural practices.
5. The main cause of destructive deforestation of Chockoria Sundarbans was the high price of shrimp in the international market. This huge amount of money could never have been earned each year by selling forest product.
6. Socio-economic status of the poor people of the shrimp farming area did not change at all. Some people had become jobless. The local fisherman have been converted into daily labourers. The biotic pressure that was once exerted on this area has been transferred to the mainland tropical forest. The environment has completely changed. This area is now completely open and will be very much susceptible to the cyclones and storm surges. The cyclone and storm surges of 29 April 1991, which caused great damage to life and property, was believed to be due to the destructive deforestation of coastal mangrove forest.

According to Gopinath and Sundaresan (1990) the shift in cropping pattern has its impact on the employment structure. The large scale diversification of cropping pattern contributed to a large extent to seasonal and disguised unemployment in Kerala. The structure of distribution of labour force also has undergone phenomenal changes. In spite of these shifts in cropping pattern, agriculture remains the major

source of livelihood for the labourers in the unorganised sector. The onfarm sector employment opportunities decreased to a large extent due to the conversion from labour intensive to labour saving crops.

According to Mahesh (1998), sharp decline in the area under paddy reduced the availability of straw which, inturn led to reduction in the number of draught animals and working bullocks in the farm sector and to replacement of local variety of milch animals by high-yielding cross bread varieties. This development led to decline in the availability of farmyard manure and breakdown of the traditional farming sector.

He also reported that the changes in cropping pattern in favour of perennial crops have an immediate and direct impact on the employment pattern in the rural area. The shrinkage of paddy cultivation has displaced agricultural labour especially women from the farm sector.

According to a study on migration in Kerala, Zachariah *et al.* (2000) reported that stagnation in the agricultural sector gave a boost to education in the state. With the traditional agriculture offering very little scope for upward mobility and rice land losing out as an investment option, parents turned to education as the best option for the children's future well being, soon a major gap developed between the number of educated persons and the number of opportunities in the state for their useful employment. It became necessary and attractive for the educated Kerala youth to try their luck in the fast developing metropolitan economics in the other states.

2.10 IMPACT OF PADDY FIELD CONVERSION ON AGRO-ECOSYSTEM

"An entity like the environment cannot have problems of itself, but we can project ours on to it" (Simmons, 1992).

According to Singh (1995), land use is a synthesis of physical, chemical and biological systems and processes on the one hand and human/societal processes and behaviour on the other.

Ecosystem has been defined as a "unit that includes all the organisms (biological factor) in a given area interacting with the environment (physical factor) so that a flow of energy leads to a clearly defined trophic (nutrient requiring) structure biotic diversity and material cycles (i.e., exchange of materials between living and non-living sectors) (Encyclopedia, 1980).

The previous studies on the land use change and the function of wet land ecosystems are reviewed here.

The significant role of wet land ecosystem in biological productivity, flood control, recharge of aquifers, regulation of water quality and erosion control has been realised.

Based on a study on the coastal land use change and the resulting impact on environment, Choudhary *et al.* (1990) identified the following impact of the land use change on the local ecosystem.

(1) Due to frequent water exchange required for shrimp farming, the internal canals have been silted up, created water logging that hampers rice production.
(2) Conversion of grazing land to shrimp farm has reduced the availability of feed for livestock, thereby, reducing milk and protein intake of local inhabitants.
(3) Because of saline water intrusion, the internal canals that served as fresh water source became unusable both for human and animals.
(4) Because of inundation of land for ten months, vegetation has been adversely affected and at places, completely disappeared.
(5) Between 1975 and 1988, almost 95 per cent decrease in forest cover has been observed following shrimp pond development. It appears from the study that the conversion has transformed a complex ecosystem supporting multiple uses into greatly simplified system that would become the private property of individual entrepreneurs.

Jose (1992) found that the introduction of rubber into home gardens had resulted in the loss of bio-diversity which could lead to the erosion of genetic resource

base and had increased the market dependence of the households affecting their food security and survival capacity.

Mwalyosi (1992) analysed the recent land use changes and its consequences in parts of the Masai Steppe in the Arusha regions of Tanzania. It was found that the land use changes have produced severe degradation of the environment and natural resource base, especially depletion of woody cover, reduction of range lands, loss of soil productivity and accelerated soil erosion.

According to Balakrishnan (1993) the probable ecological impact of anthropogenic disturbances are

(1) Indiscriminate conversion of wetland for human habitation and industrial purposes would destroy their characters, which would be detrimental to the general ecosystem.

(2) Conversion of wetlands through draining and filling into dry lands would undoubtedly increase their market value. But this apparent short term benefit would ultimately lead to a series of undesirable reactions affecting natural processes, such as inhibiting the absorption of flood water, sealing the very sources of ground water recharge, loss of natural assimilative capacity and increasing the pollution levels of adjacent water. These would lead to increased costs of flood-protection measures, increased costs for pollution abatement measures loss of fisheries and other aquatic resources and loss of natural habitat of a variety of plants and animals.

Soetrisno (1996) reported that land use conversion has an impact on groundwater recharge, both its quantity and quality. In another side the urban and industrial development effected to the total of ground water usage, since ground water is still a major resource for water supply. Abstraction of deep ground water which is recorded to be 10.5 Mm^3 in the 1970 has rapidly increased to 66.9 Mm^3 in 1995.

Modern science has confirmed the superior functions of paddy fields. To maintain high yields and to secure continuous harvests every year on arable land, we

have to add large quantities of chemical fertilizers. When such large amounts of fertilisers are applied to arable land, salt damage occurs in both soils and plants. However, in rice fields, there are no such problems because paddy soils are flooded during the hot summer season. According to Dennis (1996), the soil in paddy field shows the following superior characteristics.

1. Nitrogen fixation by algae
2. Effective use of nitrogen through the application of lime
3. Phosphorus-solubilization under reduction conditions
4. Increase of soil pH under reduction condition
5. Potassium and silica solubilization by hydrolysis
6. Activity of microorganisms
7. Nutrient enrichment from irrigation water
8. Buffer action against micro-climatic changes
9. Ability to withstand continuous cropping
10. Ability to control weeds and pests

When the paddy field gets converted for other purposes, it will naturally affect the above functions which ultimately lead to undesirable consequences to the agro-ecosystem.

Under the rapid economical development in the past 30 years in Japan one million ha of agricultural lands have been converted to non-agricultural use. Iwami (1998) has studied the beneficial ecological function of the paddy fields in addition to the mechanism of sustainability of rice production and explained as follows:

Physical functions

(1) Flood prevention function

Due to the presence of surrounding ridges and plow soles with a low permeability, paddy fields can temporarily receive and store a considerable amount of rain water and then release it gradually into rivers. Especially in case of heavy rain, the

remarkable increase in river flow peak can be eased and the flood damage in surrounding areas and downstream can be prevented or mitigated.

Temporary water storage capacity =
(Average height of ridges - Ordinary ponded water) x (Total area of paddy fields)

Besides, many other ecological functions such as water seepage to the groundwater reservoirs, stabilization of river flow, mitigation of high air temperature, scenery and wild life habitat are related to water ponding in paddy fields.

Chemical functions

Irrigated paddy fields are chemically characterized by nutrient transportation with irrigation water in horizontal and vertical direction and also by the peculiar metabolic systems developed on the soil surface and in the soil layers. The ecological functions and the sustainability of paddy fields are based on the presence of these chemical systems and water movement. The main chemical functions of paddy field are summarized as:

1. Nutrient supply with irrigation water supply
2. Suppression of decomposition of soil organic matter
3. High efficiency of Ammoniacal nitrogen fertilisers
4. Nitrogen fixation in ponded water
5. High availability of soil Phosphorus under soil reductive conditions
6. Vertical leaching of excessive nutrients and harmful metabolites
7. Nitrification on interface of soil and flooded water
8. Denitrification of nitrate in reduced soil layers
9. Maintenance of soil organic matter level
10. Natural supply of nitrogen in paddy fields
11. Water purification function of paddy soil

According to Yoshida and Nishizawa (1998), the environmental services of agriculture are

1. Conservation of natural land
   a) Stabilization of water flow, prevention of flood and drought
   b) Purification of water
   c) Prevention of soil erosion
   d) Prevention of landslides
   e) Cleaning the air by absorbing carbon dioxide and supplying oxygen and trapping dust
   f) Moderation of weather

2. Amenity creation
   a) Preservation of wildlife and ecosystems
   b) Formation of rural landscape
   c) Provision of opportunities of recreational activities
   d) Provision of residential amenities
   e) Preservation of traditional culture

The environmental services are recognized as externalities or public goods. Externalities are "positive or negative spillovers which occur in the production and consumption of goods and services. They affect people's welfare but are not themselves the object of market transactions as there is no monetary compensation for gains or losses in welfare. As externalities are produced incidentally or externally to the market they do not appear in the revenue and cost account of the producer or industry, although for the individuals affected or for society as a whole they represent real costs and benefits" (OECD, 1994).

According to Nishio (1998) "multi-functional" public benefits of agricultural land, especially paddy field are (1) the land/environmental conservation function and (2) the socio-cultural function. Japanese agricultural land provides the positive public functions worth 6,879 billion year by the alternative method, or 4,100 billion year by the contingent valuation method, even though only a limited range of public good was estimated. Moreover the paddy can temporarily store large quantity of water following heavy rainfall and slowly release this water to rivers, contributing

to flood prevention. Ridges of paddy field also contribute to the prevention of soil erosion. But a large amount of soil loss occurs following the conversion of paddy to orchards or other forms of land utilisation. In Japan some local governments are adopting a policy where farmers are paid to maintain paddy field for water storage.

The report of the Expert Committee on Paddy Cultivation in Kerala (1998) also explains the following environmental functions of paddy fields.

(1) Drainage paths: Almost always paddy fields provide a natural drainage path for flood waters as well as storm waters.

(2) Acting as flood plains for the rivers in spate: This is a natural function for the paddy lands of the coastal region and probably their original role in the scheme of things. The more the fields are filled up or blocked, the less space will be available for the flood waters to spread, and greater will be the devastation in the remaining area.

(3) Recharging the ground water: It is the most common function attributed to paddy fields.

According to Goldman (2000), agricultural areas are a major form of open space, leading to one of the most powerful arguments on behalf of farmland protection. Based on a study conducted at California, he explains the aspect of the farm land conversion issue that most engages urban and suburban residents is the strong belief that nearby agriculture improves a community's quality of life through its visual and other aesthetic properties, habitat uses and contrast with urban congestion. Further, access to locally grown products at farmer's markets and other outlets is appealing to many. To the extent that farmland provides aesthetic or other non-market values to urban and suburban residents it becomes a socially valuable public good, having value separate from the economic benefit of producing marketable commodities.

Mathew (1998) explains the consequences of land use change with respect to paddy field conversion in Kerala. According to him the loss of drainage facilities and water logging has led to the increased run off, soil erosion, and frequent floods and droughts. This also increased concentration of pollutants in the water like the

pesticide residues, which resulted in the fish diseases in Kuttanad, and the frequently occurring water borne diseases in the area. The land use changes have its own impact in contributing to the weed menace and narrowing of natural canals leading to serious consequences on water transport, water flow and giving extra pace to the ongoing entrophication of water bodies.

A study by Gopikuttan (2000) on ecological economics of wet land paddy conversion in the midland watershed region in Kerala revealed that the most important environmental and ecological crisis that the Kerala state faces is so acute that about two-third of the total population do not have access to safe drinking water and the hydrological functions of paddy fields have been affected due to large scale conversion. Once the land is converted, since the damage done to the system is irreversible, economic functions and services of the ecosystem will cease to exist.

2.11 MAJOR ENQUIRIES ON PADDY CULTIVATION

Major studies and reports enumerating the problems of paddy cultivation are

1. P.H. Vaidyanathan Committee (1950)
2. Central & State Engineers (1952)
3. Mangalabhanu Committee (1965)
4. Kuttanad Enquiry Commission or C. Thomas Commission (1971)
5. K.N.S. Nair Committee (1972)
6. T.V. Swaminathan Committee (1975)
7. Study conducted by Kerala Sasthra Sahitya Parishith (1978)
8. A.K.K. Nambiar Committee (1980)
9. Janardhanan Nair Committee (1982)
10. R. Gopalakrishnan Committee (1983)
11. Study by Kerala Sasthra Sahitya Parishith (1984)
12. Technical Committee of the Planning Board (1986)
13. S. Gopalan Committee (1986)
14. Kuttanad Water Balance Study Project (1988)
15. *Nelvayal Samrakshana Prasthanam* (1998)

(Study by Teachers Organisation of Kerala Agricultural University (Thrissur), Centre for Environment and Development (CED, TVM) & Centre of Science and Technology for Rural Development, Thrissur)

16. Expert Committee on Paddy cultivation in Kerala (1999)

All these studies have suggested various measures and recommendations for solving the problems of paddy cultivation.

2.12 HISTORICAL TRANSECT OF IMPORTANT EVENTS OF KUTTANAD WITH REFERENCE TO THE PADDY CULTIVATION

1886-87	Government of Travancore started participating in the process of reclamations of land from the back waters of Kuttanad
1888	The Government set apart a sum of Rs.50,000 to be advanced as loans to the cultivating tenants for "reclaiming and bringing under cultivation of portions of the Vembanad backwater along the shore within the taluks Ambalappuzha, Changanassery, Kottayam, Ettumanoor, Vaikom, Sherthallai
1903-1912	Temporary setback due to the suspension of the reclamation on apprehension about their possible effects on Cochin Port
1912	Introduction of pumping engine
1913	Reclamation continued
1916	Government started undertaking different projects in Kuttanad for the control and proper utilisation of its water resources
	Experimental station was started by Travancore State Department of Agriculture to test the feasibility of annual cropping of rice in Kuttanad
1940	Paddy Breeding Station was established at Moncompu
1941	Establishment of Punja special office at Alappuzha
1951	Construction work of Alleppey - Changanacherry road commenced
1955	Thottappally spillway was commissioned
1961	Industrial Relations Committee came into existance
1962-63	Intensive Agricultural District Programme (IADP) was implemented in Alappuzha Dt.
1966	Introduction of new varieties of paddy started
1969	Adoption of modern agricultural practices yield of paddy boosts up
1979	Requirement of inputs for paddy production goes up
	Thannermukkam salt water barrier was commissioned in 1974
	Conversion of paddy fields begin
1980	Paddy cultivation turns out to be a heavy financial venture
	Non-farm work
	Occupational diversification becomes a common phenomenon
	Outmigration of labour increases
1990	Conversion of paddy fields increases
	Land prices go up

Conceptual frame work of the study

Agriculture remains the key sector for the economic development of most developing countries. It is critically important for ensuring food security, alleviating poverty and conserving the vital natural resources that the world's present and future generations will be entirely dependent upon for their survival and well being.

The concept of sustainability in agriculture lies in maintaining harmony between buoyancy-dynamism in agricultural growth for meeting basic human needs along with emphasis on protection and conservation of natural resources. According to the Consultative Group on International Agricultural Research (CGIAR) sustainable agriculture is the successful management of resources to satisfy the changing human needs, while maintaining or enhancing the quality of environment and conserving natural resources.

Change and development are natural to the mankind. The process of evolution of the present day environment has been a complex interaction of conflicting and complementary forces and entities of the nature. Man has been harnessing the natural resources for developmental activities. Issues involving the environment are central to sustainable agriculture. Recorded history has many examples of civilizations and nations that suffered or even disappeared because their agriculture was not sustainable.

Land use is obviously constrained by environmental factors such as soil characteristics, climate, topography and vegetation. For any change in the land use, the central dilemma concerns the choice between representing "what is" and "what should be". The combination of good science and a land use policy dedicated to environmental improvement and economical crop production offers widespread benefits.

The analysis of land use change revolves around two central and interrelated questions. "What drives/causes land use change" and "What are the

environmental and socio-economic impacts of land use change". It is almost unanimously accepted that there are two main categories of drives viz., bio-physical and socio-economic drives. The biophysical drives include characteristics and processes of the natural environment such as weather and climatic variations, land form, topography, soil types, drainage pattern, availability of natural resources. The socio-economic drives comprise demographic, social, economic, political and institutional factors and processes such as population change, industrial change and technological changes.

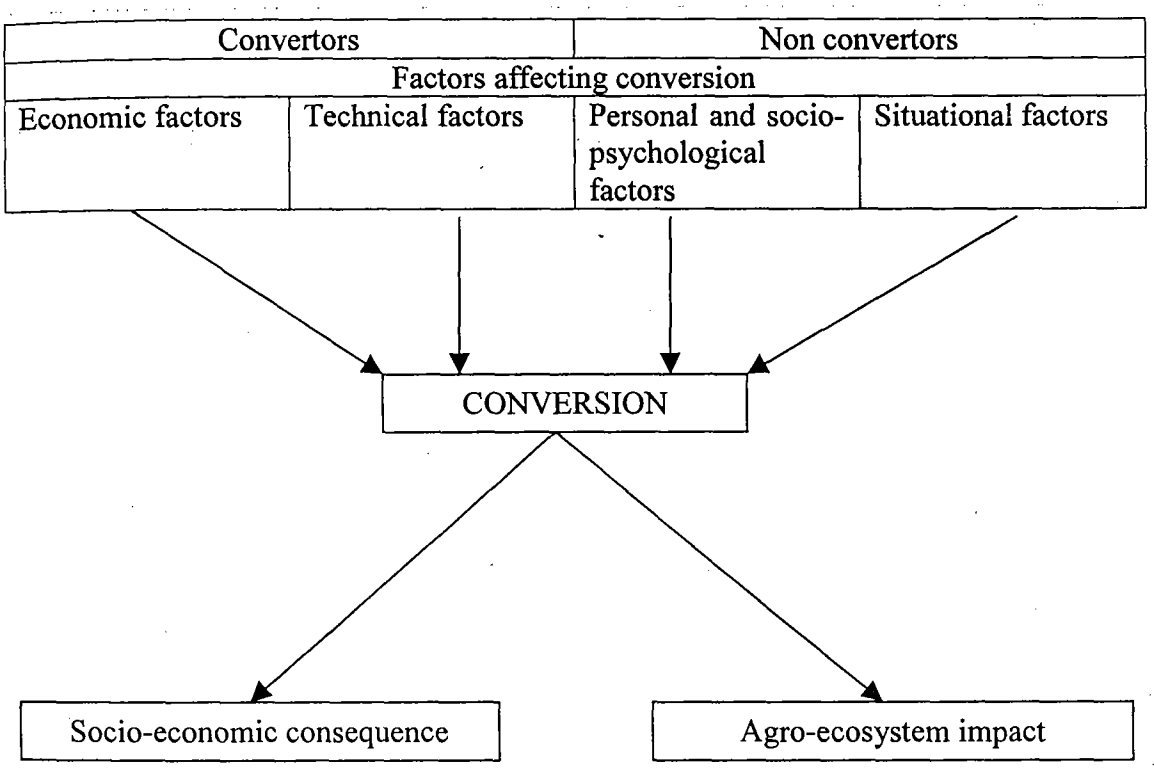
The second question is the environmental and socio-economic impacts of land use change. In fact, it was the negative impacts that stimulated the scientific and policy interest and land use change. It is often described as "the lands of the earth bear the most visible if not necessarily the most profound imprints of human actions".

It should be noted that the environmental and socio-economic impacts are closely interrelated, the former causing the latter which then feedback to the former again, potentially causing successive rounds of land use change. In addition to the environmental, the socio-economic impacts of land use change are equally significant and give rise to serious concerns at all spatial levels. The larger question, however that relates to the impacts of land use change is that of the sustainability of development at all spatial levels.

In Kerala, the decline in the area of paddy fields is a major cause for concern in relation to the conservation of the land and the environment. The present study is an attempt to analyse the various factors affecting the conversion process and the socio-economic and agro-ecosystem impact of the process.

Conceptualising the paddy field conversion as the influence of various economic, technical, personal and socio-psychological and situational factors, the consequences were also analysed. The conceptual frame work developed for the study is depicted in Fig.1.

Fig. 1. Conceptual model of the study



Methodology

CHAPTER-III
METHODOLOGY

In this chapter the methods employed in the study are presented along with a brief description of the study area.

The chapter is divided into the following sections.

3.1. Description of study area
3.2. Location of study area and sampling procedure
3.3. Techniques employed in data collection
3.4. Operationalisation and measurement of nature and extent of conversion of paddy fields
3.5. Selection, operationalisation and measurement of the factors influencing conversion of paddy fields
3.6. Measurement of socio-economic consequences of conversion
3.7. Measurement of agro-ecosystem impact
3.8. Statistical tools used in the study

3.1 DESCRIPTION OF STUDY AREA

Kuttanad is a deltaic trough like formation shaped by the confluence of the four major rivers of the state, the Meenachil, the Manimala, the Pamba and the Achankoil rivers draining into the Vembanadu lake. Geologically Kuttanadu is of a recent sedimentary formation. In the geological past the entire area was part of Arabian sea. Though the boundary of Kuttanadu is rather loosely defined and the extent of its area has been variously computed at different times today it encompasses 79 revenue villages covering 10 taluks spread over 3 districts - Cherthala, Ambalapuzha, Chengannur, Kuttanadu, Karthikappally, Mavelikkara taluks in Alappuzha district, Thiruvalla taluk in Pathanamthitta district and Changanassery, Vaikom, Kottayam taluks in Kottayam district. The area of Kuttanad is estimated to be 870 square kilometers.

3.1.1 Topography

The three identifiable topographical features on the Kuttanadu land mass are named the dry land, the wet land and the water spread.

a	Total wet land area	55000 ha
b	Total dry land area	31000 ha
c	Total water spread	1000 ha
	Grand total	87000 ha

All the land remain below mean sea level of 0.5 m to 2 mts.

3.1.2 Agronomic zones

The area has been divided into six agronomic zones with more or less similar physical conditions.

Sl.No.	Agronomic zones	Area (in ha)
1	Upper Kuttanadu	10576
2	Kayal	9464
3	Vaikom	7748
4	Lower Kuttanad	16280
5	North Kuttanad	6556
6	Purakkad	4311
	Grand total	54935

3.1.3 Climate

Kuttanad region experiences fairly uniform temperature throughout the year ranging between 21°C to the maximum of 36°C. The average annual rainfall various between 2800 mm in the north and south west to 3200 mm in the middle of eastern periphery. The relative humidity ranges from 80 to 95 per cent which is very high when compared to other regions. This higher humidity is attributed to the sudden outbreak of many pests and diseases.

3.1.4 Soils

The soil characteristics in the wet land exhibits the effects of accumulation of toxic products from anaerobic decomposition of organic matter and sulphates, mobilization of Iron and Manganese and variations in soil reaction and conductivity. The soils can be classified under three broad categories as follows.

a) Karappadam soils

These are typical clayey, highly acidic, high in salt content and moderate amounts of decaying organic matter. They are generally poor in available nutrients, particularly phosphorus and highly deficient in Calcium. These solids occur along the inland water ways, rivers and are distributed over a large part of upper Kuttanadu. They cover an area of 33000 ha. The fertility of Karapadam land lying along the water ways is periodically replenished by the silt deposited by the flood waters of rivers.

b) Kayal soils

These soils are the recently reclaimed beds from the Vembanadu lake. They are of typical fine loamy and are found in the reclaimed lake beds. They are deep, poorly drained, slightly acidic, have moderate amounts of organic matter and are poor in available nutrients, but are fairly rich in Calcium. The sub soils show the presence of lime shells. They cover nearly 13000 ha in Kainakary, Pulincunnu, Neelamperoor, Kavalam, Thiruvarppu, Kumarakam and Nattakam panchayats. The elevation ranges from 1.5 to 2.5 meters to 2.5 meters below MSL.

c) Kari soils

Kari soils are typical clayey, poorly drained. Decomposed organic matter is often observed in the lower layers. These soils are highly acidic with pH values of 3 in certain months. They cover 9000 ha.

The soils in Kuttanadu have been grouped into 15 soil series by the soil survey department namely Karuvatta, Pallippadu, Mannar, Vechoor, Changanassery,

Champakulam, Ramankari, Edathua, Purakkadu, Manjoor, Thottappally, Ambalappuzha, Thakazhy, Muttar and Kurichy series.

3.1.5 Seasons

In earlier stages rice cultivation with traditional varieties were done once in 2 or 3 years and gradually came to annual *punja* crops during the period from December to April. The pumping was done using water wheels which gave way to oil engines and ultimately to electric motor with '*petty* and *para*'. The early varieties were short duration, local cultivars like '*mula*', 'kochuvithu' etc. This again changed to medium duration local varieties and finally by the introduction of high yielding dwarf varieties. The entire area was converted to the high yielding dwarf varieties by 1960's. It was at this juncture that with an objective of maximization of food production, 'additional crop' was started, during the period May to August. It has been proved that the speedy drainage of the floods during summer months into the Vembanadu lake is a precondition for intensifying paddy cultivation in the region. Hence the following projects were formulated and executed.

a) The Thottapally Spillway, which was eventually commissioned in 1955 to drain of flood water in Kuttanad
b) The Thanneermukkam regulator which was meant to check the intrusion of saline water and stabilize paddy cultivation in 50000 ha
c) The construction of a 42 km long link road between Alappuzha and Changanassery for easy communication and transport

This ultimately led to the prevalence of two distinct paddy seasons in Kuttanad as below:

Sl.No.	Season	Period	Area in ha
1	*Punja* (Main crop - summer)	October to April	40000
2	Additional crop	May to August	10000

Kuttanad Area at a Glance

Parts of 3 districts

1. Alappuzha	- 6 taluks	30 panchayats	31000 ha
2. Kottayam	- 3 taluks	20 panchayats	18067 ha
3. Pathanamthitta	- 1 taluk	5 panchayats	5868 ha
Total	- 54935 ha		
Average additional crop area	- 10000 ha		

3.2 LOCATION OF STUDY AREA AND SAMPLING PROCEDURE

Kuttanad in Kerala is a unique area, both in its natural setting and in human intervention (Fig.2).

The physiography of the area determines its socio-economic life which is characterized by intense human intervention in the natural ecosystem.

There are mainly three types of lands in Kuttanad

1. *Kayal* lands
2. *Kari* lands
3. *Karappadam*

Regarding the paddy field conversion, the extent of conversion more in *karappadam* and Kari lands while it is very low in case of *kayal* lands since conversion become a highly costly affair and uneconomic also. For the present study, three panchayaths with different soil and agronomic features, physical peculiarities socio-economic and cultural background were selected for the study. From *karappadam* soils, two panchayath viz., Thalavady panchayath (Champakkulam block and Kuttanad Taluk, Alleppey District) (Fig.3) and Vazhappally panchayath (Fig.4) (Madapally block and Changanassery Taluk, Kottayam District) representing area with different socio-economic and cultural background but possessing a comparatively high rate of paddy field conversion. Thalavady panchayat belongs to the upper Kuttanad area while the Vazhappally panchayat which is near to Changanassery

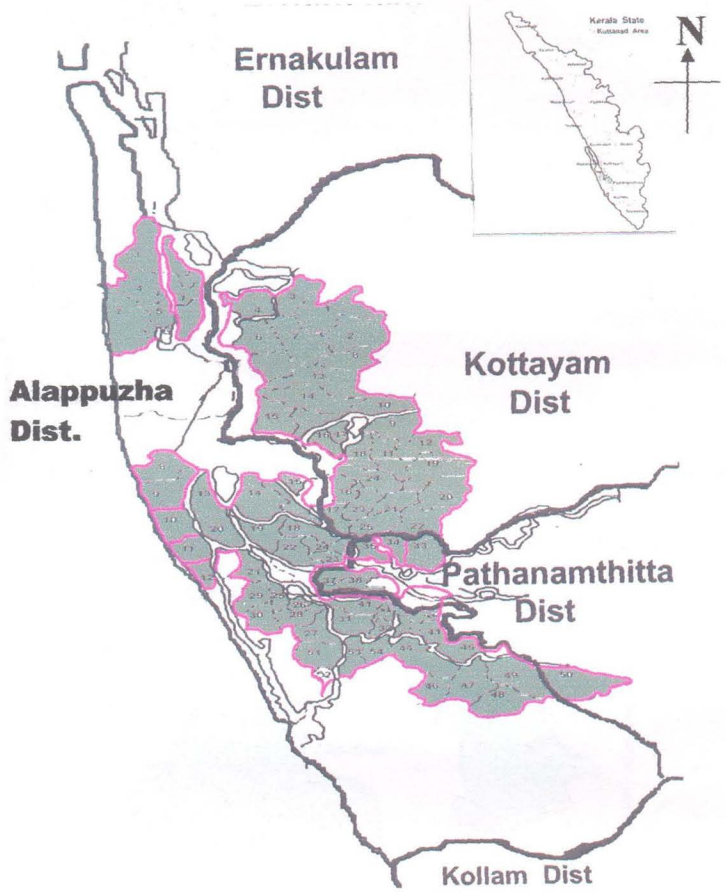


Fig. 2. Map showing Kuttanad area

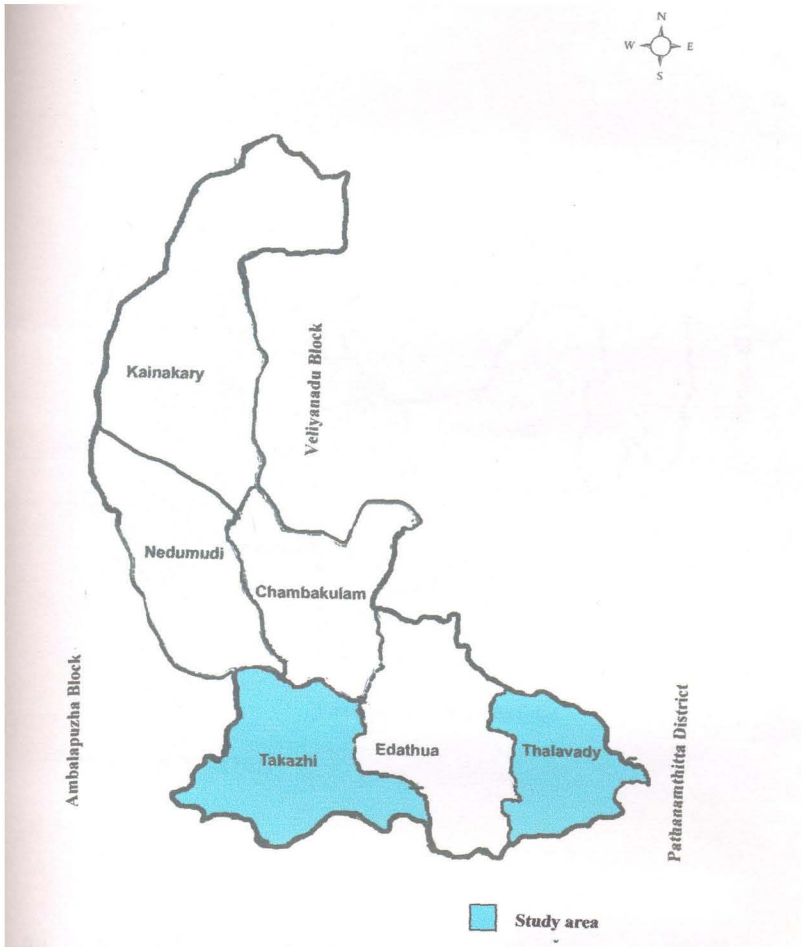


Fig. 3. Map of Champakkulam block panchayat showing the study area

Fig. 4. Map of Madappally block panchayat showing the study area

municipality area. Thakazhi panchayat (Fig.3) (Champakkulam block, Kuttanad taluk) was selected representatives the *kari* soil area. Plot study was undertaken in Pulincunnu panchayat of Veliyanadu block of Kuttanadu taluk.

Random sampling procedure was adopted in the study. Twenty convertors and non-convertors each from the above three panchayats were selected as the farmer respondents. Twenty agricultural labourers each from the three panchayats were also selected. Thus a total of 60 convertors, 60 non-convertors and 60 agricultural labourers were selected from the three panchayats. Respondent categories also included 30 scientists, 30 extension personnel and 30 social activists and peoples representation who possessed a good knowledge about Kuttanad area.

3.3 TECHNIQUES EMPLOYED IN DATA COLLECTION

The data were collected from the respondents using different techniques. Apart from the personal interview using a well structured interview schedule, data were collected by group discussion, focus group interviews, key informant interviews, oral history narrations personal field level observations and local inquiry methods. The final survey lasted for five months viz. December 2001 to April 2002.

3.4 OPERATIONALISATION AND MEASUREMENT OF CONVERSION OF PADDY FIELDS

3.4.1 Nature of conversion

In the present study, the term conversion has been used to denote the area under paddy cultivation which was replaced partially or completely for cultivating other crops or for changing to various other purposes such as construction of buildings, roads, raising the field or soil digging etc. which ultimately makes the field not suitable for paddy cultivation.

Thus a convertor is a farmer who has converted his paddy field for any of the above purposes.

The nature of conversion is analysed in terms of purpose of conversion. The number of convertors coming under different categories of conversion including both agricultural and non-agricultural purposes were found out and expressed in percentage.

3.4.2 Measurement of extent of conversion of paddy fields

Extent of conversion is related to the total area of paddy field owned by the farmers. Here the total area of paddy field should include both the present area under paddy land and area which was previously utilized for paddy cultivation.

The extent of conversion was found out by applying the formula

$$EC = \frac{\text{Area converted for other purpose}}{\text{Total paddy area including the converted area}} \times 100$$

3.5 SELECTION, OPERATIONALISATION AND MEASUREMENT OF THE FACTORS INFLUENCING CONVERSION/NON-CONVERSION OF PADDY FIELDS

A list of all possible factors that were believed to influence the conversion/non-conversion of paddy field were selected based on discussion with experts in the Kerala Agricultural University, Officials of Department of Agriculture, Scientists of Centre for Earth Science Studies, Centre for Environment and Development Studies, Kerala Statistical Institute, Kerala State Committee on Science, Technology and Environment. A comprehensive list of factors was prepared and given to 60 judges and were asked to indicate their judgement in the degree of relevancy of each factor contributing towards conversion/non-conversion of paddy fields in a three point continuum. Responses were obtained from 45 judges. The selected list of variables based on their high relevancy rating were then subjected to pilot study. Finally 39 variables were selected, out of which 13 variables possess retarding effect on conversion. The final list of variables selected is presented below.

Economic variables

E_1 High cost of fertilser
E_2 High cost of plant protection chemicals
E_3 High cost of electricity
E_4 Inadequate support price
E_5 Inadequate prices given by rice mill owners
E_6 Low profit compared to other cash crops

Technical variables

T_1 Low mechanization
T_2 High level of pest and disease infestation
T_3 Inefficient implementation of crop insurance scheme
T_4 Possession of only paddy field
T_5 Competency in paddy crop cultivation

Personal and socio-psychological variables

P_1 Age
P_2 Education
P_3 Farming experience
P_4 Family size
P_5 Occupation
P_6 Traditionalism
P_7 Area under paddy
P_8 Local resource utilisation
P_9 Preference of white collar job among the educated youngsters
P_{10} Nuclear family system
P_{11} Preference of food from own field
P_{12} Possession of livestocks
P_{13} Expectation of a good crop every season
P_{14} Management of field with own family labour

Situational variables

S_1 Location of the field
S_2 Salability
S_3 Urbanisation
S_4 Non-availability of labour
S_5 Inefficiency of agricultural labourers due to age related problems
S_6 Scarcity of labour during peak season
S_7 High wage rate of agricultural labourers
S_8 Difficulties in getting labourers for application of plant protection chemicals
S_9 Occupational migration of labour
S_{10} Inadequate assistance for natural calamities from Government

S_{11} Lack of proper processing facilities
S_{12} Lack of efficient marketing infrastructure
S_{13} Improper functioning of padashekhara samithies
S_{14} Conversion to roads

3.5.1 Operationalization and measurement of selected independent variables influencing conversion/non-conversion of paddy fields

The variables were classified into four categories, viz., economic factors, technical factors, personal and socio-psychological factors and situational factors.

3.5.1.1 Economic factors

E_1 - High cost of fertilizer

Each respondent was asked to indicate whether their perception about the cost of fertilizer was a deciding factor in their paddy cultivation. The respondents were asked to record their response in a three point continuum.

Scoring pattern

Very Important	Important	Not important
4	2	0

E_2 - High cost of plant protection chemicals

The respondents were asked to indicate whether the high cost of plant protection chemicals was influencing the conversion of paddy fields or for continuing the paddy crop production. The response was recorded as in case of E_1.

E_3 - High cost of electricity

The respondents were asked to indicate whether the high cost of electricity was influencing in the conversion of paddy fields or for continuing the paddy crop production. The response was recorded as in case of E_1.

E_4 - Inadequate support price

The respondents were asked to indicate whether the prevailing support price is influencing in the conversion of paddy fields or for continuing the paddy crop production. The response was recorded as in case of E_1.

E_5 - Inadequate price given by the mill owners

The respondents were asked to indicate the influence of the price given by the mill owners in deciding the conversion/non conversion of the paddy fields. The response was recorded as in case of E_1.

E_6 - Low profit compared to other cash crops

The respondents were asked to indicate whether their perception about the profit from paddy crop compared to other cash crops is influencing in continuing the paddy cultivation. The response was recorded as in case of E_1.

3.5.1.2 Technical factors

T_1 - Low mechanization

T_2 - High pest and disease infestation

T_3 - Inefficient implementation of crop insurance scheme

T_4 - Possession of only paddy field

T_5 - Competency in paddy crop cultivation

Regarding the above factors the respondents were asked to indicate the influence of these factors on the conversion or non conversion of paddy fields. The respondents were asked to express their response in a three point continuum.

Scoring pattern

Very important	Important	Not Important
4	2	0

3.5.1.3 Personal and Socio-psychological factors

P_1 - Age

Operationalised as the number of chronological years completed by the respondent at the time of interview. Each respondent, both convertor and non-convertor was asked to indicate the number of years he/she had completed at the time of study.

P_2 - Education

It refers to the extent of formal learning received by the farmer respondent. Education was measured by assigning scores for different levels of education in the scoring system followed in the socio-economic status scale. The categorization of respondents and corresponding scored assigned were

Category	Score
Illiterate	0
Can read only	1
Can read and write	2
Primary school	3
Middle school	4
High school	5
Collegiate	6

P_3 - Farming experience

It can be operationalised as the number of years the respondent had actually engaged in farming. It was expressed in years.

P_4 - Family size

It is defined as the number of members in the family of the respondent at the time of study. For every member a score of one was given so that the number of the score would be equal to the size of the family.

P_5 - Occupation

Susamma (1994) has operationally defined occupation as an activity in which the respondent is continually engaged for his/her livelihood or for an additional income. The same definition holds good in this study also. The occupation of both converter and non-converter was measured using an arbitrary scale developed for the purpose.

In the present study maximum scoring is given to the paddy cultivation. Occupation in terms of deviation from paddy cultivation is measured in an arbitrary scale. A four point continuum of classification of occupation followed is given below.

Sl.No.	Occupation (in terms of deviation from paddy cultivation)	Score
1	Paddy cultivation alone	4
2	Paddy and other crops	3
3	Paddy and business	2
4	Paddy and Goot/pot job	1

P_6 - Traditionalism

It can be operationalised as the mental disposition of the respondents in giving importance of traditional values, customs, culture etc.

The respondents were asked to indicate whether their traditional beliefs influence them in continuing paddy cultivation. The respondents were asked to indicate the degree of its influence in a four point continuum.

High influence	Moderate influence	Less influence	Least influence
4	3	2	1

P_7 - Area under paddy crop

Operationalised as the area owned/leased in by the farmer in hectares, put to paddy cultivation.

P_8 - Local resource utilization

It is operationalised as the degree to which effective utilization of local resources like water, labour, manures, land etc. can be carried out without external dependence.

Scoring pattern

High in effective utilization	Moderate in effective utilization	Low in effective utilization	Least effective utilisation
4	3	2	1

P_9 - Preference of white collar job among the educated youngsters

It may be explained as the degree of preference of the educated youngsters about the different Government/Private jobs which they perceive as highly sophisticated and socially appealing.

The respondents were asked whether this tendency has got influence in continuing paddy crop cultivation. The response were indicated in three point continuum.

Very important	Important	Not important
4	2	0

P_{10} - Nuclear family system

It can be operationalised as the family containing the father, mother and their children only.

The respondent was asked to indicate the influence of this system on conversion of paddy fields. The scoring pattern followed is as in case of P_9.

P_{11} - Preference of food from own field

The respondents were asked to indicate whether the preference of food from their own field is influencing to continue the paddy cultivation. The scoring pattern followed is as in case of P_9.

P_{12} - Possession of livestock

The respondents were asked to indicate whether their possession of livestock is an important factor for continuing paddy cultivation. The scoring pattern followed is as in case of P_9.

P_{13} - Expectation of a good crop every season

The respondents were asked to indicate whether their expectation of a good crop has got any influence in continuing paddy cultivation. The scoring pattern followed is as in case of P_9.

P_{14} - Management of field with own family labour

The farmers were asked to indicate whether the availability and management of field with own family labour has got any influence in continuing paddy cultivation. The scoring pattern followed is as in case of P_9.

3.5.4 Operationalisation and measurement of situational variables.

S_1 - Location of the field

It is explained as the actual place of position of the field with respect to the major centres and roads of the Panchayat in terms of proximity.

S_2 - Salability

It is explained as the demand of field in real estate business mostly for housing plots due to improved transportation and other infrastructural facilities of the particular locality.

S_3 - Urbanisation

It is explained as the change in the social setup through various developmental activities by the influence of urban centres.

S_4 - Non availability of labour

It is explained as the difficulties in getting labour for carrying out different farm operations in the appropriate time which may arise due to the lack of interest among labour community for agricultural works.

S_5 - Inefficiency of agricultural labourers due to age related problem

It can be explained as the phenomenon which becomes an impact of higher age group prevailing in the labour class.

S_6 - Scarcity of labourers during peak season

It is the extreme difficulty in getting labour since the labour requirement becomes very high particularly during transplanting harvesting etc., which are being carried out simultaneously in most of the localities.

S_7 - High wage rate of agricultural labourers

It can be described as the prevailing wage rate of agricultural labourers which becomes a major share of the cost of cultivation and is perceived to be very high when compared to the net profit from cultivation.

S_8 - Difficulties in getting labourers for application of plant protection chemicals

It can be explained as the phenomenon due to the lack of interest among the labour community as a result of the improved awareness about the health hazards of plant protection chemicals.

S_9 - Occupational migration of labour

It can be defined as the out ward movement of labour in search of occupation other than agricultural work outside or within the locality.

S_{10} - Inadequate assistance for natural calamities from government

It can be defined as the perception of the farmers about the insufficient financial assistance for natural calamities from government, which may be sanctioned on the basis of many conditions. It is normally difficult to follow these conditions and the insurance becomes lapsable in case of most of the small farmers.

S_{11} - Lack of proper processing facilities

It can be explained as the state of ineffective and inadequate number of paddy processing units.

S_{12} - Lack of efficient marketing infrastructures

It can be described as the situation when the necessary measures for the transaction of the produce are lacking due to the inefficient marketing system.

S_{13} - Improper functioning of *Padashekhara Samithies*

It can be explained as the malfunctioning of *padasekhara samithies* without following the required necessary activities for achieving the real out come.

S_{14} - Conversion to roads

It can be explained as the construction of roads by field conversion for improvement of transportation facilities.

The respondents were asked to indicate the degree of importance of these factors on conversion of paddy fields. The scoring pattern followed is given below.

Very important	Important	Not important
4	2	0

3.6 SELECTION, OPERATIONALISATION AND MEASUREMENT OF SOCIO-ECONOMIC CONSEQUENCES DUE TO PADDY FIELD CONVERSION

A list of all possible consequences was prepared in consultation with the experts in the field of agriculture, rural development, ecology etc. The comprehensive list of all possible consequences was sent to sixty judges and were asked to indicate their judgement on the degree of relevancy of each consequence on a three point

continuum. The selected list of consequences with high rating were subjected to pilot study. The final list of consequences selected is presented below.

1. Improved transportation facility
2. Land use pattern change
3. Outmigration of family labour
4. Outmigration of hired labour
5. Occupational diversification
6. Changes in income due to switching over to other crops
7. Less labour requirement in case of other crops
8. Scarcity of feed for livestock
9. Drastic reduction in the employment opportunities for women
10. Loss of traditional skills

The operationalisation and measurement of socio-economic consequences are presented below.

1. Improved transportation facility

It can be explained as the improvement in transportation due to construction of roads by the conversion of paddy fields.

The respondent was asked whether there had been any change in transportation facility as a consequent to conversion. The change is indicated in a three point continuum as follows.

Items	Scoring pattern
Substantially increased	4
Increased	2
No change	0

2. Land use pattern change

It can be defined as the change in the use of land for various purposes including agricultural and non-agricultural activities.

3. Outmigration of family labour

Latha (1997) operationalised the outmigration of family labour as the outward movement of family member (male/female) who was involved in homestead farming on occupational/geographical basis, consequent to conversion of his/her homesteads. This may include movement in search of occupation other than agricultural labour outside/within the locality or movement in search of agricultural labour itself outside/within the locality.

Each convertor was asked whether any member from his/her family who was assisting paddy cultivation had shifted his/her occupation to other occupations outside/same locality or moved out in search of agricultural labour itself outside/same locality consequent to conversion of paddy fields.

An arbitrary scale was developed to measure the outmigration of family labour in this study for every family member who had shifted.

		Score
1.(a)	Every occupation other than agricultural labour	6
(b)	Agricultural labour	3
2.(a)	Migration outside locality	4
(b)	Migration within locality	2

The final score obtained for a member who had shifted his/her occupation was

a)	Every occupation other than agricultural labour and outside locality	10 (6+4)
b)	Every occupation other than agricultural labour and same locality	8 (6+2)
c)	Agricultural labour + outside locality	7 (3+4)
d)	Agricultural labour + same locality	5 (3+2)

4. Outmigration of hired labour

Operationalised as the outward movement of hired labour (male/female) engaged, on occupational/ geographical basis which was influenced by the conversion of paddy field. This may include movement in search of occupations other than agricultural labour outside/within the locality or movement in search of agricultural labour itself, outside/within the locality by the hired labour engaged by the farmers.

Each respondent was inquired whether any hired labour engaged by him/her who was assisting in farm operations had shifted from his present occupation as agricultural labour to other occupations outside/within the same locality moved out in search of agricultural labour itself outside/same locality.

As in case of measurement of outmigration of family labour, an arbitrary scale was developed for measuring this factor also. The scoring pattern followed was

		Score
1.(a)	Every occupation other than agricultural labour	4
(b)	Agricultural labour	2
2.(a)	Migration outside locality	2
(b)	Migration within locality	1

The final score obtained for a hired labourer who had shifted his/her occupation was

a)	Every occupation other than agricultural labour + outside locality	6 (4+2)
b)	Every occupation other than agricultural labour + same locality	5 (4+1)
c)	Agricultural labour + outside locality	4 (2+2)
d)	Agricultural labour + same locality	3 (2+1)

5. Occupational diversification

Sandanji and Singh (1992) have defined occupational diversification as adopting non-crop occupation(s) which is (are) new to him for self employment along

with or deviating from the parental occupation(s) like crop cultivation, traditional occupation and caste occupation or doing the same caste or non-crop parental occupation in a new way in terms of products, services etc. to accomplish high economic needs.

In this context, occupational diversification was operationalised as the spreading of investments from paddy crop among a variety of other crops or off-farm occupation/investments which were new to him/her consequent to conversion of paddy fields for other purposes.

Based on discussion and field observations, five possible off-farm occupations/investments were selected. Each convertor was asked to indicate which all off-farm ventures started by him/her consequent to conversion of his/her paddy field. For every off-farm investment/ occupation, a score of one was given. Based on the response, the maximum score obtainable for a convertor was 5 and minimum 0. The score obtained by a convertor was then expressed in percentage to obtain an index of occupational diversification.

$$\text{Occupational diversification of a convertor} = \frac{\text{Score obtained} \times 100}{\text{Maximum score obtainable (5)}}$$

6. Leisure time availability

Susamma (1994) operationally conceptualized leisure time availability as the total time (hours) available for the members of the family which can be utilized to any subsidiary activity including the time now used for sericulture activities.

In this study leisure time availability was operationally defined as the total time in hours available to the paddy farmer which can be utilised for any other activity. The time which was devoted for paddy cultivation prior to the conversion of paddy fields is also considered. The farmer was asked to indicate the perception about the change in the available leisure time due to paddy field conversion in a three point continuum.

Scoring pattern

Substantially increased	Increased	No change
4	2	0

7. Change in income due to switching over to other crops

It can be operationalised as the difference in income due to the conversion of paddy field for cultivating other crops.

This is meant by the difference in income obtained for different crops compared to paddy crop from a definite area.

8. Change in land value

It can be operationalised as the perception of the farmer about change in land value due to the conversion.

It is measured in a three point continuum.

Substantially increased	Increased	No change
4	2	0

9. Less labour requirement in case of other crops

It can be operationalised as the reduction in labour requirement for cash crops compared to paddy crop. It is measured as the perception on the degree of importance about the relative difference in labour days for different crops.

Scoring pattern

Very important	Important	Not important
4	2	0

It is measured by the difference in labour days for a specific period.

10. Scarcity of feed for livestock

It can be defined as the shortage of cattle feed especially paddy straw due to the conversion of paddy fields.

It is scored in a three point continuum.

Substantially increased	Increased	No change
4	2	0

11. Drastic reduction in the employment opportunities for women

It can be operationalised as the declining trend of availability of agricultural employment for women as a consequence of paddy field conversion. It is measured in terms of perception about the degree of its importance.

Scoring pattern

Very important	Important	Not important
4	2	0

3.7 SELECTION, OPERATIONALISATION AND MEASUREMENT OF THE AGRO-ECOSYSTEM IMPACT DUE TO PADDY FIELD CONVERSION

Conversion of paddy field to various other purposes is expected to bring about some changes in the agro-ecosystem. In this study these are analysed closely.

A list of all possible consequences was prepared in consultation with experts in the field of land use studies, agriculture, ecology etc. The comprehensive list of all the possible agro-ecosystem impact was given to sixty judges and were asked to indicate their judgement in a three point continuum. Replies were obtained from 45 judges. The selected list of consequences with high rating were then subjected to pilot study. The final list of agro-ecosystem impact selected is presented below.

a) List of items selected for agricultural scientists and extension personnel

1. Obstruction in the free flow of water will be checked
2. Increased possibility of flood
3. High pollution during rainy season
4. Effect on water percolation
5. Increased run-off from surface
6. Increased scarcity of water
7. Physico-chemical changes of soil
8. Hardening of soil
9. Difficulties caused to neighbouring field
10. Irrecoverable loss of land properties
11. Deterioration of natural assets (Vegetation, Waterways etc.) in the neighbourhood

b) List of items selected for social activities and peoples representatives

1. Obstruction in the free flow of water will be checked
2. Increased possibility of flood
3. High pollution during rainy season
4. Effect on water percolation
5. Increased run-off from surface
6. Increased scarcity of water
7. Hardening of soil
8. Difficulties caused to neighbouring field
9. Irrecoverable loss of land properties
10. Deterioration of natural assets (Vegetation, Waterways etc.) in the neighbourhood

c) List of items selected for agricultural labourers

1. Obstruction in the free flow of water will be checked
2. Increased possibility of flood
3. High pollution during rainy season

4. Increased run-off from surface
5. Increased scarcity of water
6. Hardening of soil
7. Difficulties caused to neighbouring field

d) List of items selected for farmer respondents

1. Obstruction in the free flow of water will be checked
2. Increased possibility of flood
3. High pollution during rainy season
4. Increased run-off from surface
5. Increased scarcity of drinking water
6. Hardening of soil
7. Difficulties caused to neighbouring field

3.7.1 Operationalisation and measurement of agro-ecosystem impact

1. Obstruction in the free flow of water

When paddy fields are filled up or broken up by unimaginative or unscientific conversion, the natural drainage will be checked leading to the obstruction in the free flow or water.

2. Increased possibility of flood

Acting as flood plains for the rivers in spate is a natural function for the paddy lands. When fields are filled up or blocked, the less space will be available for the flood waters to spread which in turn may lead to increased possibility of flood.

3. High pollution during rainy season

The loss of drainage facilities and water logging cause accumulation of toxic materials, both biological and chemical through out the water surface which leads to high pollution during rainy season.

4. Effect on water percolation

Paddy field acts as a good drainage basin, to collect the rain water, and run off and slowly percolates into the ground water aquifer. When the fields get converted, naturally, the above process get affected.

5. Increased run-off from surface

Normally during rainy season, a reasonable amount of rain water gets collected in the paddy fields. When it is filled up, the excess water leads to increased run-off from surface.

6. Increased scarcity of drinking water

The entire region of Kuttanad is facing the paucity of safe drinking water. Paddy field conversion also leads to high pollution which inturn lead to the contamination of water sources ultimately affecting the availability of drinking water.

7. Physico-chemical changes of soil

When the paddy field is converted, the soil is affected since the normal land preparation practices are avoided. Soil which is used for filling purpose will be mostly from upland with different structure and texture.

8. Hardening of soil

This is the result of filling up of field with upland soil which inturn lead to hard pan formation in the lower layer soil.

9. Difficulties caused to neighbouring field

Water management becomes the main problem to the neighbouring field.

10. Irrecoverable change of land properties

Once the field is converted for cultivating perennial crops or for non-agricultural purpose, then it cannot be brought back to its previous condition.

11. Deterioration of natural assets

Paddy fields provide habitats for many plants and animals that are otherwise not adapted to the non-aquatic conditions in the dry lands. The paddy fields and the attached canals act as habitat for certain edible fisher and frogs.

The items were measured in a three point continuum based on the degree of importance perceived by the respondents. Scoring pattern is as follows.

Very important	Important	Not important
4	2	0

3.8 STATISTICAL TOOLS EMPLOYED FOR THE STUDY

3.8.1 Biserial correlation analysis

Biserial correlation analysis was carried out to find out the magnitude and direction of relationship between two variables of which one is dichotomous. The selected economic, technical, situational and personal and socio-psychological variables influencing conversion of paddy fields were analysed.

3.8.2 Simple correlation analysis

Simple correlation analysis was carried out to find out the linear relationship between the selected personal and socio-psychological factors influencing conversion of paddy fields and extent of conversion.

3.8.3 Multiple linear regression analysis

Multiple linear regression analysis was carried out to find out the relative contribution of the selected personal and socio-psychological factors to the extent of conversion of paddy fields.

3.8.4 Step-down regression analysis

Step-down regression analysis involved step-by-step elimination process of independent variables influencing the dependent variable. Based on the elimination process, the best sub set of personal and socio-psychological factors which would predict or explain the maximum variability in the dependent variable were selected.

3.8.5 Path analysis

Through step-wise regression it will be possible to know only the best sub-set of predictor variables which exert maximum influence on the dependent variable. When the selected personal and socio-psychological factors enter into path analysis, the magnitude and direction of the direct influence (effect) as well as the indirect effect of each variables on the dependent variable can be discerned.

3.8.6 χ^2-test

It is a test which decides whether in any sample the observed frequencies are in agreement with the theoretical or expected frequencies based on some specified law of distribution. If a set of *N* individuals is distributed over *k* cells such that the observed frequency in the i^{th} cell is *Oi* and the expected frequency in that cell is *Ei*, the value of χ^2 is given by

$$\chi^2 = \sum_{i=1}^{k} \frac{(Oi - Ei)^2}{Ei} \text{ or } \sum \frac{(O-E)^2}{E}$$

$$D.F = k - 1$$

If this value of χ^2 is greater than the table value of χ^2 at specified level of significance for (k^{-1}) degrees of freedom, it will be significant and then we shall be justified in suspecting significant divergence between the fact and theory and rejecting the null hypothesis of equality of two sets of observed and expected frequencies.

If the value of χ^2 is non-significant, it justified the agreement between the observed fact and the theory or hypothesis. If the value of χ^2 is equal to zero the agreement is *perfect*. In practice, it is very rate to get $\chi^2=0$ and, therefore, we start suspecting our sampling technique by declaring that this *perfect agreement* between the fact and theory is *too good to be true*.

3.8.7 Percentage analysis

For categorising the variables on the basis of obtained scores, all the variables except eight personal and socio-psychological variables were subjected to percentage analysis. For this total score obtained for each variable by all the respondents was found out. The formula used for each item was

$$\frac{\text{Total score obtained for a particular item}}{\text{Maximum potential score}} \times 100$$

For analysing the socio-economic consequence and agro-ecosystem impacts the same formula was applied for ranking purpose.

Results

CHAPTER-IV

RESULTS

The findings of the study are presented under the broad subheadings.

4.1. Distribution of convertors based on the nature of conversion

4.2. Distribution of convertors based on the extent of conversion

4.3. Relationship between the conversion of paddy fields and factors affecting conversion

4.4. Socio-economic consequences of conversion of paddy fields

4.5. Agro-ecosystem impact of conversion of paddy fields

4.1 DISTRIBUTION OF CONVERTORS BASED ON THE NATURE OF CONVERSION

It is evident from Table 4.1 that nearly 40 per cent (38.33) of the respondents had resorted to conversion of paddy field for taking up coconut cultivation while 26.67 per cent had converted the paddy field for building purpose. The other types of conversion noted are for real estate (20.00%) for banana cultivation (11.67%) and for soil digging (3.33%).

4.2 DISTRIBUTION OF CONVERTORS BASED ON THE EXTENT OF CONVERSION OF PADDY FIELDS

The categorisation of conversion is given in Table 4.2. It can be observed that the majority of the converters were under the low category (76.67%). It is followed by medium category (15.00%) and high category (8.33%).

4.3 RELATIONSHIP BETWEEN CONVERSION OF PADDY FIELDS AND FACTORS INFLUENCING CONVERSION

Relationship between conversion of paddy fields and factors influencing conversion are analysed using different statistical tools.

For the economic, technical, situational and certain personal and socio-psychological factors, statistical analyses such as percentage analysis, biserial

Table 4.1. Distribution of convertors based on the nature of conversion of paddy fields (n = 60)

Sl. No.	Purpose of conversion	Frequency	Percentage
1	Coconut	23	38.33
2	Building	16	26.67
3	Real estate	12	20.00
4	Banana	7	11.67
5	Soil digging	2	3.33

Table 4.2. Distribution of convertors based on the extent of conversion of paddy fields (n = 60)

Category	Class Interval	Frequency	Percentage
Low	0 - 30%	46	76.67
Medium	31 - 60%	9	15.0
High	above 60%	5	8.33

Plate 1. Initial stage of paddy field conversion - mounting and raising of coconut crop

Plate 2. Converted paddy field with coconut crop at different growth stages

correlation analysis and χ^2 analysis were employed. With respect to the personal and socio-psychological factors coming under normal distribution, (ratio scale measurement). Simple correlation, multiple linear regression, step down regression and path analysis were employed.

4.3.1 Biserial correlation analysis

This analysis was carried out to find out the magnitude and direction of relationship between two variables of which one is dichotomous.

It could be observed from the Table 4.3 that out of 31 factors, 22 factors showed significant positive relationship and five factors significant negative relationship with conversion of paddy fields.

Regarding the economic factors, high correlation was observed for the factor E_6 which indicates low profit of paddy compared to other crops. This was followed by inadequate prices given by rice mill owners (E_5) and high cost of fertilisers (E_4).

With respect to the technical factors, high level of pest and disease infestation exhibited a significant positive relationship with extent of conversion while possession of paddy field alone (T_4) and competency in paddy crop cultivation (T_5) had negative significant relationship with conversion.

In the case of personal and socio-psychological factors, nuclear family system (P_{10}) showed high significant and positive correlation. With respect to the situational factors, all the factors possessed positive and significant relationship.

4.3.2 Percentage analysis

It could be seen from Table 4.4 that the economic factors viz., inadequate support price (E_4) and inadequate price given by rice mill owners (E_5) are included in the higher group category.

Table 4.3. Results of biserial correlation showing the relationship between extent of conversion and selected independent variables

(n = 60)

Variable No.	Name of variables	Coefficient of correlation
E_1	High cost of fertilser	0.509**
E_2	High cost of plant protection chemicals	0.179NS
E_3	High cost of electricity	0.417**
E_4	Inadequate support price	0.292NS
E_5	Inadequate prices given by rice mill owners	0.692**
E_6	Low profit compared to other cash crops	0.704**
T_1	Low mechanization	0.349*
T_2	High level of pest and disease infestation	0.628**
T_3	Inefficient implementation of crop insurance scheme	0.422**
T_4	Possession of only paddy field	-0.445**
T_5	Competency in paddy crop cultivation	-0.364*
P_9	Preference of white collar job among the educated youngsters	0.718**
P_{10}	Nuclear family system	0.959**
P_{11}	Preference of food from own field	-0.538**
P_{12}	Possession of livestocks	-0.579**
P_{13}	Expectation of a good crop every season	-0.705**
P_{14}	Management of the field with own family labour	-0.538**
S_1	Location of the field	0.739**
S_2	Salability	0.697**
S_3	Urbanisation	0.478**
S_4	Non-availability of labour	0.427**
S_5	Inefficiency of agricultural labourers due to age related problems	0.427**
S_6	Scarcity of labour during peak season	0.879**
S_7	High wage rate of agricultural labourers	0.712**
S_8	Difficulties in getting labourers for application of plant protection chemicals	0.524**
S_9	Occupational migration of labour	0.545**
S_{10}	Inadequate assistance for natural calamities from Government	0.686**
S_{11}	Lack of proper processing facilities	0.685**
S_{12}	Lack of efficient marketing infrastructure	0.685**
S_{13}	Improper function of padashekhara samithies	0.545**
S_{14}	Conversion to roads	0.545**

** Significant at 1% level

* Significant 5% level

Table 4.4. Result of percentage analysis showing the distribution of independent variables

(n = 60)

Category	Interval	Variable No.
High group	Above ($\bar{X}$ + SD) (> 52.873)	E_4, E_5, S_6, S_{11}, S_{12}
Medium group	Between ($\bar{X}$ - SD) and ($\bar{X}$ + SD) between (21.33 - 52.873)	E_1, E_2, E_3, T_1, T_2, T_3, T_5 (P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8) P_9, P_{10}, P_{11}, P_{12}, P_{13}, S_1, S_2, S_3, S_4, S_5, S_7, S_8, S_9, S_{10}, S_{13}, S_{14}
Low group	Below $\bar{X}$-SD (< 21.33)	T_4, P_{14}

In the case of situational factors, 'scarcity of labour during peak season' (S_6), 'lack of proper processing facilities' (S_4) and 'lack of efficient marketing infrastructure' (S_{12}) belong to higher group category.

Regarding the medium category all the remaining factors, excluding the technical factor 'possession of only paddy field' (T_4) and the personal factor management of field with own family labour (P_{14}) were included.

4.3.3 χ^2 analysis

The results of χ^2 analysis is presented in Table 4.5. From the table, it is evident that the economic factors viz. low profit of paddy compared to other cash crops (E_6) and high cost of electricity (E_3) and plant protection chemicals (E_2) exhibited a high influence on extent of paddy field conversion.

Regarding the technical factors, extent of conversion is found to be highly influenced by the factors viz. inefficient implementation of insurance scheme (T_3) and competency in paddy crop cultivation (T_5).

With respect to personal and socio-psychological factors, extent of conversion is much influenced by the factors viz. nuclear family system (P_{10}) and expectation of a good crop every season (P_{13}). Of these nuclear family system showed the maximum degree of association with extent of conversion (r = 96%).

Regarding the situational factors, the extent of paddy field conversion is found to have high association with the push factors viz. scarcity of labour during peak season (S_6), salability (S_2), high wage rate of agricultural labourers (S_7), urbanisation (S_3), conversion to roads (S_{14}) and occupational migration of labourers (S_9).

4.3.4 Relationship between selected personal and socio-psychological variables with extent of conversion

It is evident from Table 4.6 that all the variables except the variable education possessed negative and significant relationship with the extent of conversion. The variables

Plate 3. Converted paddy field with coconut and arecanut plantations

Plate 4. Converted field with banana cultivation

Table 4.5. Results of χ^2 analysis showing the influence of independent variables in extent of conversion

(n=60)

Variable No.	Name of variable	χ^2	$\sqrt{\frac{\chi^2}{N}}$
E_1	High cost of fertilser	27.70**	0.67
E_2	High cost of plant protection chemicals	31.60**	0.72
E_3	High cost of electricity	32.40**	0.73
E_4	Inadequate support price	6.40*	0.33
E_5	Inadequate prices given by rice mill owners	26.80**	0.67
E_6	Low profit compared to other cash crops	48.30**	0.90
T_1	Low mechanization	12.10**	0.45
T_2	High level of pest and disease infestation	0.90NS	0.12
T_3	Inefficient implementation of crop insurance scheme	30.40**	0.71
T_4	Possession of only paddy field	27.20**	0.67
T_5	Competency in paddy crop cultivation	29.20**	0.70
P_9	Preference of white collar job among the educated youngsters	11.20**	0.43
P_{10}	Nuclear family system	55.60**	0.96
P_{11}	Preference of food from own field	11.10**	0.43
P_{12}	Possession of livestocks	9.10*	0.39
P_{13}	Expectation of a good crop every season	24.40**	0.64
P_{14}	Management of the field with own family labour	8.30*	0.37
S_1	Location of the field	6.70*	0.33
S_2	Transportation facilities	45.30**	0.87
S_3	Urbanisation	32.50**	0.74
S_4	Non-availability of labour	6.10*	0.32
S_5	Inefficiency of agricultural labourers due to age related problems	1.30NS	0.14
S_6	Scarcity of labour during peak season	51.40**	0.93
S_7	High wage rate of agricultural labourers	40.10**	0.82
S_8	Difficulties in getting labourers for application of plant protection chemicals	20.70**	0.59
S_9	Occupational migration of labour	30.90**	0.71
S_{10}	Inadequate assistance for natural calamities from Government	29.10**	0.64
S_{11}	Lack of proper processing facilities	21.90**	0.60
S_{12}	Lack of efficient marketing infrastructure	19.60**	0.57
S_{13}	Improper funçtion of padashekhara samithies	27.10**	0.67
S_{14}	Conversion to roads	30.40**	0.71

** Significant at 1% level

* Significant at 5% level

NS - Non significant

viz. local resource utilisation (P_8) possessed high correlation which was followed by occupation (P_5) and farming experience (P_3).

4.3.5 Multiple linear regression analysis

It was carried out to find out the relative contribution of the selected eight factors towards the extent of conversion of paddy fields (Table 4.7). Among the different variables included in the linear model local resource utilisation and occupation alone showed statistically significant relationships with paddy field conversions.

4.3.6 Step-down regression analysis

It was carried out to find out the best sub set of factors which contributed to maximum variability in the dependent variable, viz., extent of conversion (Table 4.8).

All the selected eight factors were subjected to step down regression analysis. The method involved continuous step by step elimination of variable which did not make significant contribution towards variability of the dependent variable. The variables which contributed maximum effect were farming experience (P_3), occupation (P_5) and local resource utilisation (P_8). These three variables contributed as much as 86.65 per cent variability in the extent of paddy field conversion.

4.3.7 Path analysis

It was employed to find out the relative direct and indirect effect of the selected variables/factors on the dependent variable (Table 4.9). When the eight factors were together entered into path analysis, local resource utilisation (P_8) was found to exert maximum direct effect on paddy field conversion followed by farming experience and occupation. Largest indirect effect was observed by the factor local resource utilisation (P_8) through the variable occupation (P_5) followed by farming experience (P_3) through age (P_1). Thus among the selected variables, local resource utilisation exerted maximum negative influence on paddy field conversion followed by farming experience and occupation.

Table 4.6. Relationship between selected personal and socio-psychological variables with extent of conversion

(n=60)

Variable No.	Name of variable	Coefficient of correlation
P_1	Age	-0.7817**
P_2	Education	0.3474**
P_3	Farming experience	-0.7839**
P_4	Family size	-0.7659**
P_5	Occupation	-0.8427**
P_6	Traditionalism	-0.4169**
P_7	Area under paddy	-0.4509**
P_8	Local resource utilization	-0.9007**

** Significant at 1% level

Table 4.7. Results of multiple linear regression showing the relationship between extent of conversion and selected personal and socio-psychological variables

(n=60)

Variable No.	Name of variable	Beta	Partial regression coefficient 'b'	Standard error of 'b'	't' value
P_1	Age	0.123	0.170	0.401	0.425
P_2	Education	0.052	0.882	0.936	0.942
P_3	Farming experience	-0.404	-0.507	0.366	1.385
P_4	Family size	0.022	0.242	1.027	0.235
P_5	Occupation	-0.254	-4.298	1.525	2.818*
P_6	Traditionalism	-0.006	-0.064	0.695	0.092
P_7	Area under paddy	0.069	0.013	0.012	1.092
P_8	Local resource utilization	-0.524	-7.423	1.415	5.246**

Intercept constant = 66.11
S.E. of intercept = 12.48
K2 = 0.8598

* Significant at 5% level
** Significant at 1% level

Table 4.8. Result of step down regression analysis showing the reltionship between extent of conversion and selected personal and socio-psychological variables

(n=60)

Variable No.	Name of variable	Beta coefficient	Partial regression coefficient (b)	S.E. of (b)	't' value
P_3	Farming experience	-0.249	-0.312	0.087	3.603*
P_5	Occupation	-0.256	-4.339	1.441	3.012*
P_8	Local resource utilisation	-0.514	-7.272	1.281	5.678**

Intercept constant = 76.13
S.E. of intercept = 2.55
$R^2 = 0.8665$

* Significant at 5% level
** Significant at 1% level

Table 4.9. Results of path analysis of selected personal and socio-psychological variables with the extent of conversion

(n=60)

Variable No.	Name of variable	Direct effect	Largest indirect effect	Through variable
P_1	Age	0.1232	0.1211	P_3
P_2	Education	0.0517	-0.0182	P_5
P_3	Farming experience	-0.4041	-0.3971	P_1
P_4	Family size	0.0221	0.0172	P_8
P_5	Occupation (Deviation from rice production)	-0.2535	-0.2081	P_8
P_6	Traditionalisation	-0.0058	-0.0033	P_1
P_7	Area under paddy	0.0689	0.0352	P_3
P_8	Local resource utilisation	-0.5243	-0.4305	P_5

Residual value = 0.1212

4.4 SOCIO-ECONOMIC CONSEQUENCES OF CONVERSION OF PADDY FIELDS

Socio-economic consequences of conversion by the convertors are given in Table 4.10. According to the convertors change in land value was perceived as the most important consequence followed by change in income due to switching over to other crops and less labour requirement in case of other crops. Improved transportation facility and more leisure time availability were also perceived by the convertor. Occupational diversification, outmigration of family labour and hired labour were other consequences. Scarcity of feed for livestock, drastic reduction in the employment opportunities for women and loss of traditional skill were the other consequences.

According to the agricultural scientists (Table 4.11) land use pattern change was perceived as most important consequence, which was followed by occupational diversification and less labour requirement in case of other crops. Drastic reduction in the employment opportunities for women, outmigration of hired labour and family labour, change in land value, change in income due to switching over to other crops and improved transportation facility were the other important consequences. Scarcity of feed for livestock and loss of traditional skill were also the important consequences.

Regarding the extension personnel (Table 4.12) land use pattern change was perceived the most important consequence. Change in land value and change in income due to switching over to other crops, less labour requirement in case of other crops and occupational diversification were the other important consequences. Outmigration of family and hired labour, drastic reduction in the employment opportunities for women, and improved transportation facility were the other consequences. Leisure time availability, scarcity of feed for livestock and loss of traditional skill were the other consequences.

With respect to social activists and peoples representatives (Table 4.13) change in land value was perceived as the important consequence. Land use pattern change, change in income due to switching over to other crops less labour requirement in case of other crops, drastic reduction in the employment opportunities for women occupational diversification, outmigration of family labour and hired labour were the important consequences.

Table 4.10. Socio-economic consequences of paddy field conversion as perceived by convertors

(n = 60)

Sl.No.	Items	Rank
1	Improved transportation facility	4
2	Land use pattern change	9
3	Outmigration of family labour	7
4	Outmigration of hired labour	8
5	Occupational diversification	6
6	Leisure time availability	5
7	Change in income due to switching over to other crops	2
8	Change in land value	1
9	Less labour requirement in the case of other crops	3
10	Scarcity of feed for livestock	10
11	Drastic reduction in the employment opportunities for women	11
12	Loss of traditional skill	12

Table 4.11. Socio-economic consequences of paddy field conversion as perceived by agricultural scientists

(n = 30)

Sl.No.	Items	Rank
1	Improved transportation facility	9
2	Land use pattern change	1
3	Outmigration of family labour	6
4	Outmigration of hired labour	5
5	Occupational diversification	2
6	Leisure time availability	12
7	Change in income due to switching over to other crops	8
8	Change in land value	7
9	Less labour requirement in the case of other crops	3
10	Scarcity of feed for livestock	10
11	Drastic reduction in the employment opportunities for women	4
12	Loss of traditional skill	11

Table 4.12. Socio-economic consequences of paddy field conversion as perceived by extension personnel

(n = 30)

Sl. No.	Items	Rank
1	Improved transportation facility	9
2	Land use pattern change	1
3	Outmigration of family labour	6
4	Outmigration of hired labour	7
5	Occupational diversification	5
6	Leisure time availability	10
7	Change in income due to switching over to other crops	3
8	Change in land value	2
9	Less labour requirement in the case of other crops	4
10	Scarcity of feed for livestock	11
11	Drastic reduction in the employment opportunities for women	8
12	Loss of traditional skill	12

Table 4.13. Socio-economic consequences of paddy field conversion as perceived by social activists and peoples representatives

(n = 30)

Sl. No.	Items	Rank
1	Improved transportation facility	9
2	Land use pattern change	2
3	Outmigration of family labour	7
4	Outmigration of hired labour	8
5	Occupational diversification	6
6	Leisure time availability	10
7	Change in income due to switching over to other crops	3
8	Change in land value	1
9	Less labour requirement in the case of other crops	4
10	Scarcity of feed for livestock	11
11	Drastic reduction in the employment opportunities for women	5
12	Loss of traditional skill	12

Table 4.14. Socio-economic consequences of paddy field conversion as perceived by agricultural labourers

(n = 60)

Sl. No.	Items	Rank
1	Improved transportation facility	8
2	Land use pattern change	12
3	Outmigration of family labour	4
4	Outmigration of hired labour	3
5	Occupational diversification	2
6	Leisure time availability	9
7	Change in income due to switching over to other crops	6
8	Change in land value	7
9	Less labour requirement in the case of other crops	5
10	Scarcity of feed for livestock	11
11	Drastic reduction in the employment opportunities for women	1
12	Loss of traditional skill	10

4.5 AGRO-ECOSYSTEM IMPACT AS PERCEIVED BY DIFFERENT RESPONDENT CATEGORIES

According to the scientists, the most important impact perceived were increased possibility of flood and increased scarcity of drinking water. The other important impacts were effect on water percolation, obstruction in the free flow of water, increased run-off from surface and high pollution during rainy season (Table 4.15).

According to the extension personnel also the most important impact perceived were increased possibility of flood and increased scarcity of drinking water which were followed by obstruction in the free flow of water, effect on water percolation and high pollution during rainy season (Table 4.16).

Irrecoverable change of land properties and obstruction in the free flow of water were the important impacts perceived by the social activists and peoples representatives (Table 4.17). With respect to the agricultural labourers difficulties caused to neighbouring field and hardening of soil were perceived to be the important impacts (Table 4.18).

According to the non-convertors, difficulties caused to neighbouring field, hardening of soil and increased possibility of flood were the important impacts (Table 4.19).

Table 4.15. Agro-ecosystem impact due to conversion of paddy fields as perceived by the scientists

(n = 30)

Sl.No.	Item	Rank
1	Increased possibility of flood	1
2	Increased scarcity of drinking water during summer	2
3	Effect on water percolation	3
4	Obstruction in the free flow of water	4
5	Increased run-off from surface	5
6	High pollution during rainy season	6
7	Physico-chemical changes of soil	7
8	Hardening of soil	8
9	Difficulties caused to neighbouring field	9
10	Irrecoverable change of land	10
11	Deterioration of natural assets (vegetation, water ways etc. in the neighbourhood)	11

Table 4.16. Agro-ecosystem impact due to conversion of paddy fields as perceived by the extension personnel

(n = 30)

Sl.No.	Item	Rank
1	Increased possibility of flood	1
2	Increased scarcity of drinking water	2
3	Obstruction of free flow of water	3
4	Effect on water percolation	4
5	High pollution during rainy season	5
6	Increased run-off from surface	6
7	Physico-chemical changes of soil	7
8	Hardening of soil	8
9	Difficulties caused to neighbouring field	9
10	Irrecoverable change of land properties	10
11	Deterioration of natural assets (vegetation, water ways etc. in the neighbourhood)	11

Table 4.17. Agro-ecosystem impact due to conversion of paddy fields as perceived by the social activists and peoples' representatives

(n = 30)

Sl.No.	Item	Rank
1	Irrecoverable change of land properties	1
2	Obstruction of free flow of water	2
3	Increased possibility of flood	3
4	High pollution during rainy season	4
5	Water percolation is affected	5
6	Increased run-off from surface	6
7	Increased scarcity of drinking water	7
8	Hardening of soil	8
9	Difficulties caused to neighbouring field	9
10	Deterioration of natural assets (vegetation, water ways etc. in the neighbourhood)	10

Table 4.18. Agro-ecosystem impact due to conversion of paddy fields as perceived by agricultural labourers

(n = 60)

Sl.No.	Item	Rank
1	Difficulties caused to neighbouring field	1
2	Hardening of soil	2
3	Increased scarcity of drinking water	3
4	Increased run-off from surface	4
5	High pollution during rainy season	5
6	Increased possibility of flood	6
7	Obstruction of free flow of water	7

Table 4.19. Agro-ecosystem impact due to paddy field conversion as perceived by non-convertors

(n = 60)

Sl.No.	Item	Rank
1	Difficulties caused to neighbouring field	1
2	Hardening of soil	2
3	Increased possibility of flood	3
4	Increased scarcity of drinking water	4
5	Increased run-off from surface	5
6	High pollution during rainy season	6
7	Obstruction of free flow of water	7

Discussion

CHAPTER-V
DISCUSSION

The results are discussed in this chapter under the following heads.

5.1. Distribution of convertors based on the nature and extent of conversion of paddy fields
5.2. Relationship between the factors affecting conversion and extent of conversion
5.3. Socio-economic consequences of conversion process
5.4. Agro-ecosystem impact of conversion of paddy fields
5.5. Constraints experienced by the paddy cultivators
5.6. Strategy for rationalising the land use pattern

5.1 DISTRIBUTION OF CONVERTORS BASED ON THE NATURE AND EXTENT OF CONVERSION

From the Table 4.1 it is evident that conversion for coconut cultivation is higher compared to other purposes.

Analysis of average farm prices of principal crops and agricultural wages reveals that the price of rice, which showed a continuous increase upto mid-seventies declined and ruled low from 1976 to 1982. Thereafter they rose slowly and showed strong tendency of recovery by the early nineties. As for coconut, although an upward trend is seen, wide seasonal and periodic fluctuations are common. Thus the push factors viz., scarcity (S6) and high wage rate of labourers also had a strong influence in the selection of crops. When compared to the increase in the prices of agricultural commodities, agricultural wages showed a higher rate of increase during the period. Labour being one of the principal inputs in crop production, it is natural that farmers shift to crops requiring a lower labour input.

Moreover coconut does not require constant attention from the part of the cultivator where as keen and constant observation is a must for paddy. After a gestation period, a steady income can be obtained from this crop also.

Plate 5. Conversion of paddy field for construction of buildings

Plate 6. Multipurpose conversion - roads, buildings and raising crops

From experience, farmers have found that in the long run coconut is a more reliable and useful crop responding favourably to manuring and irrigation. Income from coconut gardens could be augmented by raising various other crops like banana, tubers, pepper etc. as inter-crops. The farmers therefore prefer coconut cultivation with inter-cropping to all other crop. This pattern is said to be providing a reasonable level of income from land and at the same time minimises risk due to crop failures and price fluctuations.

Over and above these, the coconut field is highly attractive in the real estate market. All these factors would have significantly influenced in selecting the coconut crop.

The break up of the traditional joint family system has promoted the conversion for building purpose. Increase in population and partitioning of households have resulted in fragmentation of holdings and rise in the demand for new dwelling units. The development of the education and communication systems opened the rural society to the outside world. Consequently the average household size began to decline and the idea of nuclear family system got momentum. The number and area of operational holdings in Kerala is given in Table 5.1.

Table 5.1. Number and area of operational holdings in Kerala 1995-96

Sl. No.	Class and size of holdings	Number (Lakhs)	Area (Lakhs ha)
1	Marginal (<1 ha)	59.18 (93.96)	9.11 (53.24)
2	Small (1-2 ha)	2.62 (4.16)	3.50 (20.46)
3	Semi medium (2-4 ha)	0.95 (1.51)	2.43 (14.20)
4	Medium (4-10 ha)	0.20 (0.31)	1.04 (6.08)
5	Large (>10 ha)	0.03 (0.04)	1.03 (6.02)
	Total	62.98 (100.00)	17.11 (100.00)

Figures in brackets are percentage to total
Source: Farm Guide, 2003

About few decades ago the prominent families in the areas were paddy cultivators and their houses (*Tharavadu*) located nearby paddy fields. The new generation especially the educated is after jobs outside agriculture and do not give any

importance to agriculture especially to paddy cultivation and prefers to construct dwelling units along the sides of motorable roads and local market centres.

Soetrisno (1996) reported that urban and industrial development in Banding has changed the land usage. For nearly three decades, thousand hectares of irrigated paddy fields and dry crop land in the Banding basin have been converted to the housing complexes, business purpose and industrial areas.

In the case of real estate, it is felt by the farmer that the land fetches a very high price when it is filled and converted to salable plots. Farmers opine that if they sell these plots and keep the money in bank, they can easily meet their expenses with the interest itself. They also feel that when the land is converted and kept as such also, it is a very good asset compared to the paddy field.

According to Goldman (2000) in California farm land transferred to the "other" category in 1988-98 totaled about 167,000 net acres, about half of the direct agricultural-urban conversion. During the 1996-98 period, agricultural to "other" transfer sharply increased. Here the difference in the price per acre for land in agricultural production and agricultural land for development is typically large. In urbanising areas, bare ground sold for development regularly exceeds $ 40,000 per acre, considerably more if urban improvements are in place.

It can be also observed that certain area was converted for banana cultivation, which does not require much care and attention from the part of the farmer. More attention is needed during critical stages only. The reclaimed paddy field with its inherent qualities enhances the yield component. This also attracts the neighbouring farmers to go for banana cultivation and spread of this trend. Compared to paddy, it has got a very high benefit/cost ratio and risk factor is minimum. Usually before going for coconut cultivation farmers plant banana crop. In the case of paddy field, since the area is an open space without any shade tree, it will promote the establishment and production of the crop. These would have probably influenced the farmer for converting the land to banana cultivation.

Plate 7. Conversion of paddy field for industrial purpose

Plate 8. Large area under conversion for starting new industries

5.2 RELATIONSHIP BETWEEN CONVERSION OF PADDY FIELDS AND FACTORS INFLUENCING CONVERSION

The relationship between conversion and factors influencing conversion were analysed using different parametric and non-parametric statistical tools.

5.2.1 Push factors

Regarding the economic factors, low profit of paddy compared to other cash crops (E_6) possessed the highest significant influence (coefficient of contingency = 0.897). Change in the cost of paddy during the past decades recorded a lower increase while the plantation crops had many fold increase. Moreover, cost of cultivation of this seasonal crop paddy is very high and an increasing trend is observed for the past few years. While in case of plantation crops, a steady income can be easily obtained for a long period even though certain crop possess a gestation period. This would have influenced the paddy farmers for conversion to other crops.

Regarding the other economic factors like high cost of plant protection chemicals (E_2) and fertilizer (E_1) lead to a heavy investment from the part of the farmer for the cultivation of this crop. Cultivation cannot be undertaken without these important inputs. When we analyse the cost of these inputs and price of paddy for the past 20 years, the drastic difference in the rate of change can be realised. In case of paddy, the increase is very meagre, compared to the inputs. These inputs are manufactured by private sector and multinational companies and they fix the price to their convenience. These factors also make the farmer to go for other alternatives. Regarding the Kuttanadu rice cultivation, pesticide consumption is very high. Farmers used to apply plant protection chemicals eventhough the pest population is below the economic threshold level. In most cases, the dosage adopted is very high compared to the recommended dosage. Even if the farmers are producing paddy with a heavy financial investments, they receive only inadequate prices from the rice mill owners (E_5). Farmers opine that actually the mill owners are exploiting the situation and the profit obtained through paddy cultivation is not at a desirable level compared to cost

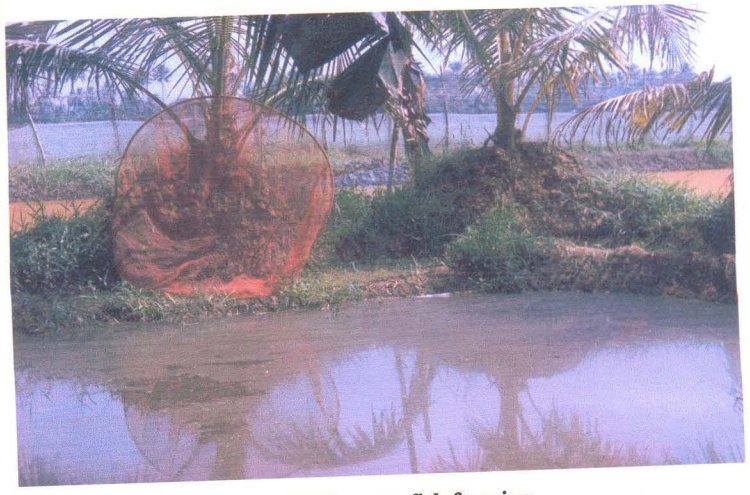


Plate 9. Rice cum fish farming

of production. Most farmers are meeting cultivation expenses by lending money from local money lenders and banks. Immediately after harvest, they want to repay it otherwise, they have to pay a high amount as interest. In this situation they are forced to sell the produce at a lower cost without waiting for a change in the price market.

Moreover the support price declared by the Government is often found to be inadequate (E_4) for cultivation. Considering the cost of production, the support price is not at a desirable level. But paddy, being the staple food, the price cannot be increased in an unlimited rate. This may be another reason for the low support price. But here the poor farmer becomes the ultimate sufferer by feeding the population. Naturally he may think that there is no need for such sacrifice and withdraw from the cultivation. Regarding the paddy farmers, they are not at all organised, while in the case of plantation sector, farmers are well organised. Therefore, paddy farmers are not in a position to argue for achieving their required benefits. Moreover, the farmers are a heterogenous group differentiated by caste, landed wealth and power. They range from small peasants to big landlords. Therefore unanimity in thinking and opinion formation is very difficult here. This is another lacuna for achieving the required benefits from the Government. These factors ultimately lead to deviate from paddy cultivation and to convert the field for other purposes.

Regarding the technical factors, inefficient implementation of crop insurance scheme (T_3) and low mechanisation were found to influence the conversion process positively. In the case of paddy cultivation in Kuttanad, it undergoes lot of difficulties like high pest and disease infestation (T_2), natural calamities etc. which are beyond the control of the farmers. Since an effective implementation of crop insurance scheme is not prevailing, once the crop is lost, the farmers have to face the whole financial loss. Regarding the other factor mechanisation (T_1), it is not at an appreciable level. In Kuttanad area mechanisation has been popular in dewatering using electric motor, land preparation using tillers and tractors, threshing and winnowing by power threshers specially designed for Kuttanad area. For social reasons, the potential of combined harvesters and transplanting machines are not been explored in the area. In

Plate 10. Severely weed infested paddy field due to fallowing, ready for conversion

Plate 11. Neglected canal with severe infestation of weeds*

* Previously the canal was extensively used for transport of farm produce. Due to improper maintenance consequent to the conversion of the paddy field at both sides, it turned out to be a habitat for weed flora.

larger padasekharams especially in kayal lands combined harvesters will be helpful. This compels the farmer to go for more manual work which inturn boost up the cost of cultivation. This factor becomes crucial when the availability of labour (S_4) is also a major problem in the present situation. These might have probably influenced the farmers for converting the paddy field to other purposes.

Regarding personal and socio-psychological factors, nuclear family system (P_{10}) was found to be the important factor promoting the conversion process. For setting up nuclear family itself, certain portion of the paddy field will be converted for house construction as the members inherit paddy field as ancestral property. Since the new family consists of only few members and in most cases, the younger generation will not show any interest towards the paddy cultivation, being a tedious procedure which requires a constant attention from the part of the cultivator. Farmer parents do not wish their children to continue their own profession since they do not want their children to undergo the struggles and difficulties in farming. Moreover, the educated youngsters feel cultivation of crops as a low dignified job and prefer highly appealing white collar job even though it is not so easy in the present day circumstances. Both these factors are complementary and ultimately affecting a shift in paddy cultivation.

In India, Government Department and agencies had not always followed consistent definition in referring to agricultural labourers. The first Agricultural Labour Inquiry (1952) conducted under the auspicious of the Govt. of India operationally defined agricultural labour family as one in which either head of the family or 50 per cent or more of its earners reported agricultural labour as their major occupation. Who are the agricultural labourers of today? When did this class begin to appear in Kuttanad? Accurate information about these questions does not exist. Agrestic servitude seems to have been of particular importance in the first half of the nineteenth century for rice cultivation and for agricultural work in general. During this period, the bulk of the agricultural labour force was in servitude and belonged to the agricultural labour castes. Almost every member of the slave caste was an agricultural labour. It would appear, therefore, that agrestic servitude must have been an important

factor in paddy cultivation in Kuttanad before the abolition of slavery (Unni, 1975). Their ancestoral history would have definitely influenced the youngsters for keeping a distance from agriculture and preferring white collar job.

With respect to the situational factors, scarcity of labour during peak season (S_6) was found to be the important factor promoting conversion process. It is a major problem farmers are facing now. Difficulties of getting labour at the time of harvest will lead to delay in the process which may ultimately cause shedding of grain and heavy loss to the farmer. Changes in the labour population in different sectors is presented in Table 5.2.

Table 5.2. Category-wise percentage distribution of workers of Kerala

	1961	1971	1981	1991	2001
Cultivators	20.9	17.8	13.1	12.2	7.2
Agricultural labourers	17.4	30.7	28.2	25.6	16.1
Household industries	8.7	4.3	3.7	2.6	3.5
Other workers	53.0	47.2	55.0	59.6	73.2

Source: Census Report, 2001

A complex division of labour based on the caste system and differential rights and duties in relation to land and labour, developed in Kuttanad quite early. What is important here is that at least during the last few hundred years, a clear relationship has existed among caste land ownership and the extent of participation in labour.

During the previous days, one of the most difficult issues in Kuttanad for some years has been that of controlling the number of workers for harvesting. The IRC (Industrial Relation Committee) decided that the number should be restricted to 125/ha. Even after this decision, however, harvesting in the larger fields continued to be accompanied by violence and police protection was required in many cases. But now, the situation has been totally changed. Scarcity of labour during the crucial period and postponement for a few days can jeoparadize the crop. These would have definitely influenced the farmers for conversion process.

Salability (S_2) factor was also found to promote the conversion process. Paddy field near to road side possess a high salability compared to other areas. Hence the farmer show a tendency for conversion because they feel that the land value will be increased when it is converted and it will fetch a very good price while transaction.

High wage rate of agricultural labourers (S_4) was also found to promote the conversion process. In the case of paddy cultivation, the labour charge accounts for the major cost of production. The report of the Kuttanad Enquiry Commission (1971) gives some data on wage rates specifically for Kuttanad. Cost of cultivation of paddy in Kuttanad is also analysed in the reports of Expert Committee of paddy cultivation (1999) and *Nelvayal Samrakshana Prasthanam* (1998). In the present study also, cost of paddy cultivation was worked out for 2001-02 *punja* crop. The total cost of cultivation was found to be Rs.7885 per acre, out of which 57 per cent accounted for labour charge alone. The changed social and cultural context in which today's agricultural labourers live and the new needs and aspirations in particular have an impact on their consumer expenditure and have made demands on their meagre incomes. The awakening and the organization of the agricultural labourers of Kuttanad were greatly facilitated by the social and political developments in Travancore in general and Alleppey in particular.

The literacy rate among the agricultural labourers could be expected to be nearly as high as the literacy rate among the general population in Kerala which the highest among all the state in India. Literacy along with high leftist ideology has spread much faster in Kerala leading to much higher levels of trade union activity in general among the agricultural labour in particular. The share of wages constitute the single most important item in the cost of cultivation of paddy in Kerala. The bargaining power of the labour force is higher in Kerala than elsewhere in India. This would imply that supply of labour is also influenced by the degree of unionisation. The real wage rate is high if the degree of unionisation is high and low if it is low (Pushpangadan, 1992). In fact the wage rates of paddy field labour, both product wage and real wage, have grown very rapidly relative to productivity. Farmers allege that collective bargaining by the labourers in on-farm work coupled with the low price of their produce is the reason behind the shift from food crops to labour saving commercial crop.

The widespread decline in the profitability of paddy cultivation has uniformly reduced the rental value of paddy land. Therefore, the land owners have an idea for allocation of such land for the next best use. This may also work as a catalyst to develop a land market in Kerala and further contribute to the conversion of paddy field. According to Vinayagam (1998) the major difficulties related to labour as perceived by the agri-business operators are the problems of high labour cost and labour management. With the changed socio-economic scene and strong trade unions prevalent in the state, the bargaining power of the labour class are higher and the term and conditions demanded by the labourers make the work environment very strained which inturn leads to high labourer cost and management problem.

As an impact of urbanisation, farmers show an inclimation towards (S_3) consumer culture and withdrawal from paddy cultivation and try to improve their standard of living. Farmers opine that they can get more income from land if it is cultivated with other cash crops or converted to salable plots. This feeling itself will act as a motivating factor for the conversion process.

Conversion to roads (S_{14}) also accelerates the conversion process since the area near to the road will fetch a very good price compared to other area. Hence the farmers prefer to have buildings or real estate. Hence the land owners have a tendency to fill the field and convert it as salable plots which in turn enhances salability (S_2).

Considering the occupational migration (S_9) of labour, it is a major problem felt by the farmers. Since the labourers are getting more job opportunities in the construction and other loading works with a high wage rate, they find it more attractive. This factor itself influence the labour scarcity (S_6). In Kuttanad traditionally there were three kinds of agricultural labourers. *Paniyal* or attached labourers, *panathal* (also known as *onappanikkaran*, or semi attached labour; and *purthal* (literally "outsider") or completely free casual labourer. The bulk of the labour force was made up of attached labourers. The labourer together with his entire family was attached to a landlord. The adult man of his household performed the heavier work such as bunding and ploughing, the women and children attended to operations such

as weeding transplanting and harvesting. Even the smaller children had their duties to perform. They would run errands or chase the crows and other birds from the fields. It seems that when the Harijan children began to attend schools in large numbers, they faced the open displeasure of the land lords (Joseph, 1981). The labourers attachment to the landlord was further strengthened by the fact that he was also a *Kudikidappukaran* permitted to put up his residence in a portion of land lord's property. He usually built his hut in a convenient location from where he could keep watch over the crops while the landlords are nostalgic about the old system the labour have no regrets that it has changed so drastically and so fast. As a result, unavailability of labour became a difficult problem and the farmers have also changed their mind for conversion of field for other purposes. Farmers opine that eventhough they go for cultivation overcoming lot of unfavourable situations, it becomes most pathetic when they face much difficulties in getting labour for harvesting the ripened crop.

5.2.2 Pull factors

History of agriculture in Kuttanad is the success story of human endeavours triumphing over the limitations imposed by nature and extracting maximum benefits in the form of yield from agricultural operation. The natural conditions of landscape and traditional habits of the cultivator were the determinant factors in the choice of crops of paddy. The kuttanad farmer has displayed an unusually high level of enterprise taking advantage of the latest technology and advanced methods available from time to time. Even though the paddy cultivation in Kuttanad has been becoming increasingly unremunerative, farmers continue the cultivation in the unfavourable situation also.

Regarding the factors which are retarding the conversion process, technical factors viz. possession of only paddy field (T_4) and competency in paddy cultivation (T_5) were found to possess negative association with conversion process. Since the farmers are highly competent in paddy cultivation and are not much exposed to other cultivation, there is a tendency for continuing the same crop itself. Farmers possessing only paddy field also continue the crop, since they do not posses any other income

generating activities. According to the farmers, they are simply taking up cultivation since they are not interested to keep the field as fallow as it will lead to heavy financial requirement for weeding and land preparation before taking next crop. Moreover certain farmers are not interested to deviate from their traditional culture.

The other factors which were found to possess influence were local resource utilisation (P_8), occupation (P_5) and farming experience (P_3). Farmer who are using their available resources may face less difficulties compared to other groups. Moreover they are having rich experience also. Farmers whose major occupation is paddy cultivation have to continue cultivation since they do not have any other alternative.

Farmers with livestock (P_{12}) also show a tendency to continue crop, since they have to feed the cattle, in return, the FYM etc. will be given back to field. So there exist a balance between these two processes.

In certain areas conversion of paddy field is a highly costly affair. When the farmers compare the expense for conversion and its benefit, the net result will not be appreciable. Due to the geological peculiarities of that area, the field is suitable for paddy cultivation only. In such circumstances, instead of keeping fallow farmers continue paddy cultivation.

In case of paddy fields which are located in the interior area, the conversion becomes a costlier affair due to the difficulties in the transportation of soil from other areas. Moreover, since the area is inaccessible, the demand is also low in the land transaction market.

5.3 SOCIO-ECONOMIC CONSEQUENCES OF CONVERSION

According to convertors, the most important socio-economic consequence was the change in land value. Normally wetland fetches a low price compared to other types of land. By converting the wetlands by filling, the demand for land also increases.

Similarly land with perennial and other annual crops are more attractive in the field of transaction also. Menon (1994) analysis rise in the price of lands. By 1930, the value of land growing coconuts had risen to well above300 per cent of that of wetlands. The value of land in Travancore also rose steadily till 1928-29, but began to decline thereafter. The price of wetland noted a steady decline after the mid seventies while that of garden land showed an increasing trend. Both these phenomena might be due to the fact that wetland cultivation has been increasingly becoming unremunerative compared to dryland cultivation.

The next important consequence perceived was the change in income due to switching over to other crops which was influenced by the less labour requirement also. In traditional system, agriculture had revolved around paddy and the cultivation was done mainly for home consumption. Paddy was also the exchange medium for meeting most of the household requirements. As the economy became monetised, the consumption pattern changed with greater dependence on the use of purchased foods. This change expanded the need for cash income in the community. The cultivators therefore chose to cultivate those crops that yielded higher cash income in the long run. Compared to paddy the risk due to fluctuation in yield is also low for cash crops. In the converted paddy lands, coconut and banana were cultivated predominantly and since their yield rates are higher, they bring higher income than paddy farming does. From the point of view of the farmers, the emerging crop pattern reduced risk and improved standards of living.

When compared to the increase in the prices of agricultural commodities, agricultural wages showed a higher rate of increase during the period. Labour being one of the principal inputs in crop production, it is natural that farmers shift to crops requiring a lower labour input. In case of coconut labour requirement is high only during the initial stages. Once the crop start yielding, labour is required only for maintenance price of agricultural products and wages had the effect of shifting to crops requiring lower labour input.

The next important consequence perceived was improved transportation facility. This is due to the conversion of field for road. The number of roads

constructed in Kuttanad shows a rising trend during the last few decades. Previously there were only very few roads in the Kuttanad region an account of its water-logged nature. The National Highway-47 is on the western side and the Main Central Road on eastern side. Ettumanoor-Vaikam road passes along the northern side and Thiruvalla-Mavelikkara road is on the southern side. Ambalappuzha-Thiruvalla road and Alleppey-Changanacherry road traverse through the heart of Kuttanad from west to east. Vaikom-Kumarakom-Kottayam road passes through the north east portion of Kuttanad. In other areas, navigation was the mode of transport. Mechanised boats and country crafts (*valloms*) carry passengers along a network of rivers, channels, canals and waterways. Eventhough the unplanned development of roads shattered the environmental and ecological balance of Kuttanad, it has enhanced the transportation facility.

The fifth important consequence perceived was leisure time availability. When the field is converted for other agricultural purpose like coconut cultivation banana cultivation etc., the keen attention from the part of the cultivator becomes very less and thus they get much leisure time. Similarly in case of conversion to non-agricultural purpose, once it is converted, it does not require any attention from the part of the owner except at the time of transaction.

The sixth consequence was occupational diversification which was immediately followed by outmigration of family labour and outmigration of hired labour. The labour requirement for different crops are presented in Table 5.3.

Table 5.3. Labour requirement for different crops

Sl.No.	Crop	Number of labour days			Percentage of women labour
		Male	Female	Total	
1	Paddy	50	116	166	70
2	Tapioca	64	16	80	20
3	Coconut	67	8	75	11
4	Arecanut	81	15	96	16
5	Pepper	42	3	45	7
6	Rubber	208	-	208	0

Source: Report of Nelvayal Samrakshana Prasthanam, 1998

The transition of the economy from agriculture to non-agriculture, growth of urban centres in the neighbourhood and growth of facilities for quick transport induced movement of labour from the village to outside areas in search of work. Availability of farm lands for timely operations declined. After the eighties, the area witnessed a spurt in non-agricultural activities like construction, transport and trade in and around the villages. The higher wages existing in the non-agricultural sectors and the preference of the workers to work in sectors other than farming resulted in the shift of a sizeable proportion of the rural labour away from agriculture. The supply of labour for agriculture, especially for paddy cultivation, fell drastically in consequence. Increased educational facilities extended the period of schooling and delayed the entry of younger generation to the work force. The new entrants who are better educated than their elders preferred white collar or non-manual jobs, reducing the availability of farm labour even further.

Earlier, the relationship between the cultivator and the labourer was based not solely on economic considerations, but was a relationship between the families of the cultivator and of the labourer. In some cases, the attachment continued for generations. Both the cultivator and the labourer were equally involved in cultivation and mutually depended for survival. The system was in some sense of a feudal type. With the decline in the importance given to paddy cultivation, the attached labour system has lost its relevance. Labourers are now non account workers who shift from employer to employer according to their preference and convenience. This practice has pushed up the self-confidence and self-esteem of the rural labourer.

Scarcity of feed for livestock is common as a consequence of the paddy field conversion process. In earlier times, rearing of milch animals was prevalent in most farming households and in some of the rural labour households. Due to the increase in maintenance cost owing to the scarcity of feed, the livestock population has come down to a larger extent.

Drastic reduction in the employment opportunities for women is also observed as the consequence of the conversion process. Mainly the male workers attend to the agricultural operating in the converted lands.

As a consequence of the paddy field conversion, loss of traditional skills is happened. Modernisation has transformed cultivation practices making them more dependent on external resources. The local traditions and skills become irrelevant in the changed scenario. The younger generations of the rural artisans, blacksmiths, carpenters etc. who were previously engaged in the making and repairing of farm implements have shifted to the construction and other industrial sectors.

According to scientists, land use pattern change was observed as the most important consequence. In case of conversion process, the converted land will be used for both agricultural and non-agricultural purposes, scientists are much concerned about the usage of land, since they are much aware of the land and soil pecularities which are required for different crops and they perceive that, any shift in the prevailing pattern has to be viewed seriously.

The other important consequences were occupational diversification, less labour requirement in the case of other crops, drastic reduction in the employment opportunities for women, outmigration of hired labour and outmigration of family labour. With the shift from seasonal crops to annual and perennial crops, a decline in the demand for local labour has taken place in the agricultural sector and a gender shift in employment opportunities from women to men. The transition of the economy from agriculture to non-agriculture, growth of urban centres in the neighbourhood, and growth of facilities for transport induced movement of labour from the villages to outside areas in search of work. The higher wage rate existing in the non-agricultural sectors and the preference of the workers to work in sectors other than farming shifted a sizable proportion of the rural labour away from agriculture. With the reduction in the area under paddy cultivation, job opportunities for women in the agricultural sector have diminished. In the paddy based system, women worked side by side with men in all farm operations, from planting to harvesting. The post harvest operations like winnowing, drying and threshing were attended to entirely by women. For agricultural operations on the dry land areas and in the converted paddy fields, men are preferred.

With regard to the extension personnel, social activists and peoples representatives more or less same trend was observed in relation to the views and perceptions.

The major consequences perceived were land use pattern change, change in land value, change in income due to switching over to other crops and less labour requirement in case of other crops. As far as these categories are considered, since they have got very good contact with their area, they are well aware of the changes which are taking place and its impact in that particular area. This would have influenced in their appraisal of the conversion process also.

Regarding the agricultural labourers, they felt that drastic reduction in the employment opportunities for women as the most important one which was followed by occupational diversification, outmigration of hired labour and outmigration of family labour. The changing trend in the population of female workers is depicted in Table 5.4.

Table 5.4. Distribution of female workers of Kerala in the Agricultural sector*

	1981	1991	2001
Cultivators	4.95	5.56	4.70
Agricultural labourers	43.55	36.09	22.00

* Percentage of the total working women population
Source: Census Report, various issues

Labour class are much concerned about their employment opportunities so that their perception and evaluation of the conversion process will be focusing on the impacts that have occurred in their basic livelihood.

5.4 AGRO-ECOSYSTEM IMPACT AS PERCEIVED BY THE SCIENTISTS

According to the scientists, the most important impact perceived was increased possibility of flood which was immediately followed by increased scarcity of drinking water and decrease in water percolation which are interrelated to one another. The flood prevention function of paddy field is well explained by Iwame (1998). Due to the presence of surrounding bunds and soil with low permeability, paddy fields can temporarily receive and store a considerable amount of rain water and then release it gradually into rivers. Especially, in case of heavy rain the remarkable

increase in river flow peak can be eased and the flood damage in surrounding areas and downstream can be prevented or mitigated. Besides many other ecological functions such as water seepage to the groundwater reservoirs, stabilization of river flow, mitigation of high air temperature are related to water ponding in paddy fields.

In Kerala, paddy is cultivated mainly in plains of the low-land and the valleys of the high land and in midland. These paddy fields are best examples for the wet land ecosystem and the natural systems of rains, drainage, flood plains and tidal basins maintain the nature's equilibrium.

In case of paddy field, around 1.5 metre depth of water can be stored apart from the normal absorption by soil and the percolation rate of water is around 1 mm/day. When the field gets converted, this water storage facility will be lost and as a result it will aggravate the flood situation due to poor drainage. When the field is converted by filling soil from other places, it will affect the percolation since the original clayey soil will form a subsurface soil and soil which is deposited becomes the surface soil, which will be in most cases sandy loam taken from uplands. During the flood situation, percolation will be affected and remaining water will be stagnated at the top. Estimate of crop loss due to the natural calamities for the past 15 years in Kuttanad region is presented in Table 5.5.

Table 5.5. Estimate of agricultural crop loss due to natural calamities in Kuttanad region

Year	Loss in crores
1985	13.00
1986	11.50
1988	16.00
1989	16.00
1991	44.30
1992	20.00
1993	66.00
1994	34.00
1995	7.00
2001	47.00

Source: Office of the Principal Agricultural Officer, Alappuzha District

Plate 12. Scene from 'R' block with coconut plantation raised during 1960's*

* The last series of reclamation in the form of government financed project popularly known as "Holland project" of the early 1960's converted 616 hectares of *Kayal* into cultivable land with a view to raise a second crop of paddy. Eventhough the reclaimed area was used for cultivation of cash crops which was opted by the private owners, later it turned to be unprofitable especially for coconut in certain areas due to ecological disasters.

When the paddy fields are converted for other purpose, it will affect the water storage capacity which inturn leads to decrease in water table. The significant role of wet land ecosystem in biological productivity, flood control, recharge of aquifers, regulation of water quality and erosion control are being studied.

The entire region of Kuttanad is facing the paucity of safe drinking water. The public water supply does not cater to the water demands of the people in Kuttanad. All the water bodies in Kuttanad are highly polluted due to agricultural and municipal wastes. The Pamba is polluted throughout its long stretch mainly due to poor sanitation. Poor water supply and sanitation promoted the occurrence of disease also.

Obstruction of free flow of water was the next important impact. In most cases of conversion, the field will be raised by soil filling for either cultivating other crops or for building or real estate purpose. This will naturally check the flow of water from one place to another. Similarly increased run off from the converted field surface occur during heavy rain. This will lead to the erosion of top fertile soil.

According to Nishio (1998), "multifunctional" public benefits of agricultural land especially paddy field are (1) the land environmental conservation function and (2) the socio-cultural function. Japanese agricultural land provides the positive public functions worth 6,879 billion yen by the alternative method, or 4,100 billion yen by the contingent valuation method, even though only a limited range of public good was estimated. Moreover, the standing crop of paddy can temporarily store large quantity of water following heavy rainfall and slowly release this water to rivers contributing to flood prevention. Ridges of paddy fields also contribute to the prevention of soil erosion. But a large amount of soil loss occurs following the conversion of paddy to orchards or other forms of land utilisation. In Japan some local governments are adopting a policy where farmers are paid to maintain paddy field for water storage.

Another important impact was high pollution during rainy season. All the water bodies in Kuttanad are highly polluted due to agricultural and municipal wastes

Plate 13. View of 'R' block showing the permanent non-submersible bund and centrifugal pump to bail out water*

* 'R' block area is protected by permanent, non submersible bunds standing at a height of 1.8 m above MSL and with top width of 3 m; it is served by 21 centrifugal pumps at suitable sites which bail out water on a permanent basis.

Plate 14. View of 'R' block with narrow waterway and reclaimed land at both sides

and the situation is aggravated during the monsoon month due to poor drainage of flood water. Regarding the contamination of drinking water it happens during both the flood and drought situation. During flood situation there will be overflow in all the water ways and mixing up of water from different sources which inturn enhances pollution. One important factor which activates the pollution is the higher level of consumption of pesticides, since pesticide consumption is highest in case of paddy crop as it is infested by different types of pests in all the growth stages. Biological pest control and IPM measures can control this situation to a larger extent.

According to Hidaka (1996), due to the water purification function of paddy soil, pollutants brought into paddy fields with irrigation water are cleaned in surface flow and also in percolating flow into soil layers. Flocculation, deposition and filtration of suspended materials, decomposition, nutrient absorption by algae and phosphate adsorption by soil act as cleaning processes and the denitrification of nitrate in reduced soil plays a major role in water purification.

In Japan, it is considered that the water purification capacity of paddy fields plays a very significant role in water quality in rivers and underground, because many of the paddy fields located in low lands receive and clean nitrate polluted water derived from the upper surfaces on which orchards and vegetable fields are cultivated with heavy application of fertilizer and manure. Under these conditions, it was found that around 300 kg/ha/yr of NO_3-N was removed in paddy fields (Hidaka, 1996).

High pollution is also due to the discharge of waste through the run off which affects the existing water quality. The historic declaration by the United Nations Commission on Human Rights at the close of its 57^{th} session in Geneva has addressed to link between environment and human rights. The commission concluded that every one has the right to live in a world free from toxic pollution and environmental degradation.

It cannot be derived that many of the fundamental rights enshrined in the Universal Declaration of Human Rights have significant environmental dimension. A

clear environment will definitely ensure a better enjoyment of the basic right to life, health, adequate food and housing and traditional livelihood. A degraded environment will mean severe curtailment of these rights. Therefore, those who pollute or destroy the natural development are committing a crime against human beings in the ultimate analysis.

Another impact is the physico-chemical changes of soil which also leads to the hardening of soil structure, texture etc. The soil is affected when the normal paddy cultivation practices along with its land preparation and treatment procedures are avoided.

When the paddy field is converted by adding soil from other uplands, no changes occur to the underlying soil and it will act as a hard pan and affect the root penetration. But paddy is the single crop which can grow in clayey soil where enrichment of soil oxygen content is normally not possible.

Apart from the above impacts, in certain cases, conversion may cause difficulties to neighbouring field. There is chance of high pollution of neighbouring field. Water management of this field also becomes very difficult and costly.

Another impact is the irrecoverable change of the land properties. When the field is converted for cultivating perennial crops and for building or real estate purpose, change becomes permanent and it cannot be recovered to its previous position.

Deterioration of natural assets was also perceived as an impact of conversion. When the prevailing crop is changed, there will be definitely variation in the ecosystem. Biological diversity will be affected by the changes in the aquatic and semi-aquatic plant flora and the organisms associated with these flora.

Based on the discussion with the scientists, impact of the developmental activities are summarised below.

1. Emergence and proliferation of new water weeds causing serious problem to rice cultivation and navigation.

2. Decline in fertility status of the soil (the fertility level used to be maintained by annual deposition of silt during monsoon flood.
3. Decrease in organic matter content owing to intensive agricultural practices without addition of organic matter.
4. Increased incidence of pest and diseases necessitating the use of large quantities of pesticides, polluting the ecosystems.
5. Fall in breeding, growth and catch of fishes, prawn and other shelf fishes due to prevention of saline water entry and decrease in exposure of natural fish growing areas.
6. Extinction of mangroves and other estuarine ecosystem that used to function as favoured necessary areas of brackish water in fish and shell fish.
7. Increased scarcity of water due to lowering of water tables during summer leading to drought effects on coconut cultivated on garden lands.
8. Aggravation of flood situation as a result of continuous decrease of water spread area causing to increased land reclamation.

One important factor which is not usually taken into consideration is the economics of water storage capacity of paddy field. The following Table 5.6 shows the ecosystem related economics of paddy cultivation.

Table 5.6. Change in area and economics of water storage capacity of paddy fields

Factor		Measurement
1.	Area of paddy field (based on the statistics of 1940s)	5740 sq.km
2	Present area of paddy fields (based on the statistics of 1995-96)	3300 sq.km
3.	Reduction in area	2440 sq.km (2440×10^{-6} m)
4.	Average depth of paddy fields (Based on the observation of 55 centres)	1.35 m
5.	Maximum water sotrage capacity of converted fields	$2440 \times 1.35 \times 10^6 = 3294 \times 10^6 m^3$
6.	Possible water storage (m^3) capacity (when only half of the depth is considered)	165 crores m^3
7.	The additional value of 1 m^3 water is considered as value of 1 unit electricity)	Rs.2/-
8.	Loss due to the conversion of fielder (source: Report of Nelvayal Samrakshana Prasthaam).	165x2 = Rs.330

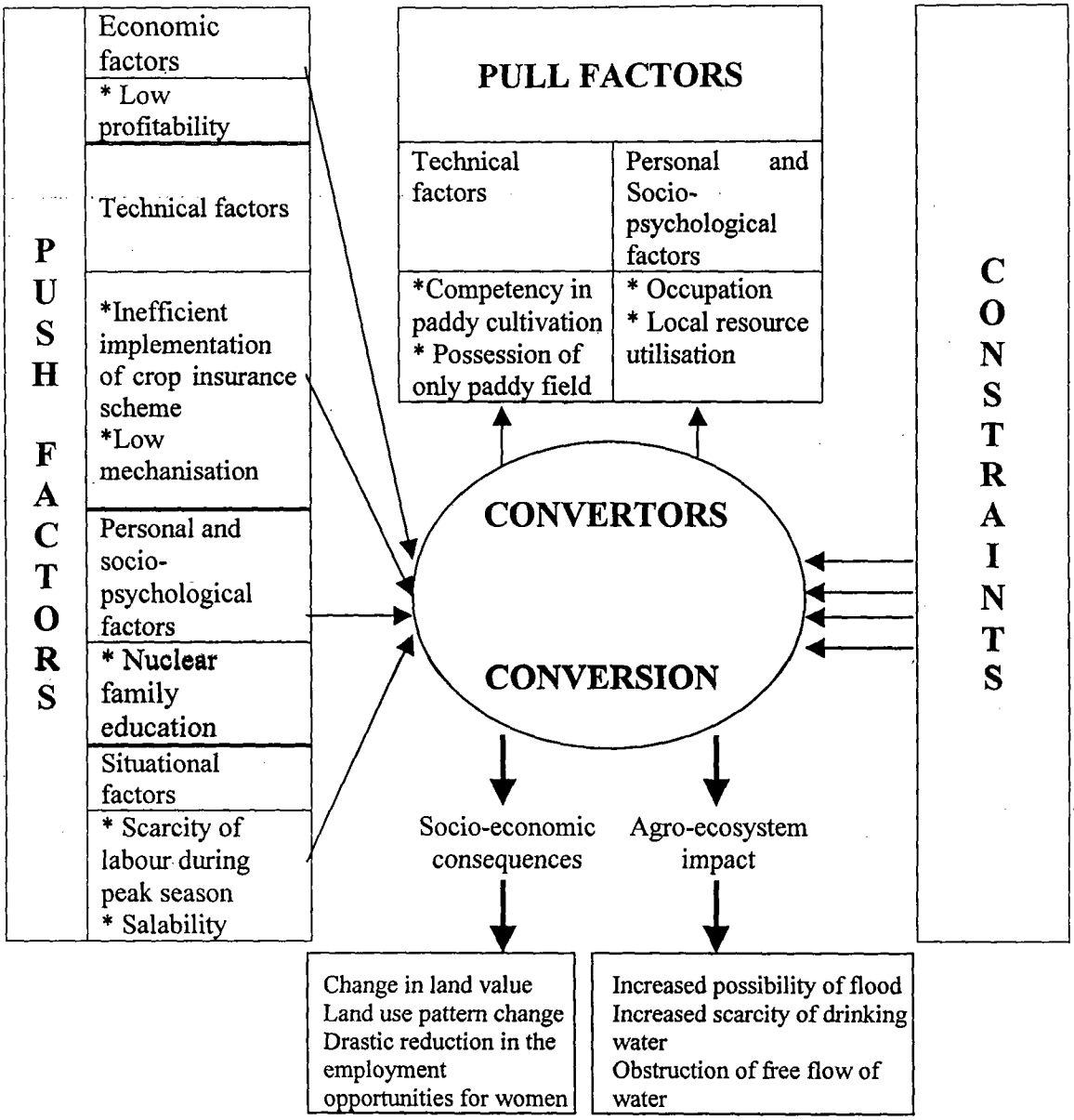


Fig. 5. Empirical model of the study

It is evident from the above table that a very huge amount is lost due to the conversion process.

Regarding the extension personnel, their perception of the agro-ecosystem impact due to conversion process was in most cases similar to that of scientists.

With respect to the social activities and people's, representatives, irrecoverable change of land properties was perceived as the most important impact. In majority of the conversion process, the paddy field once converted cannot be brought back to its previous purpose. It will lead to the permanent loss of the field. In case of fields of perennial crops, which cannot be converted for paddy cultivation. So this would have influenced in the opinion formation about the agro-ecosystem impact due to conversion.

Regarding the agricultural labourers and non-convertors more or less similar perception was observed. Difficulties caused to neighbouring field and hardening of soil were perceived to be highly important. Since agricultural labourers and non-convertors are working in the field, the immediate effect due to the conversion of their neighbouring field will be felt seriously. When the nearest field got converted, naturally the continuity of the paddy fields will be lost. This will seriously affect the farm operations especially in case of water management. The hardening of soil of neighbouring field can be easily experienced by them, which will be due to avoidance of land preparation measures which was followed in paddy cultivation and filling up of field with soil from upland areas.

5.5 CONSTRAINTS EXPERIENCED IN PADDY CULTIVATION OF KUTTANAD REGION

The study revealed the following major problems of rice cultivation in Kuttanad area.

1. Natural calamity and salt water intrusion
2. Endemic to pest especially to gall midge and brown plant hopper and diseases sheath blight and blast

3. High cost for weed control due to severe weed problems
4. Non-availability of sufficient quantity of quality seeds due to the inadequacy of seed distribution system and lack of modern storage facilities
5. Soil health problems caused by acidity, iron toxicity and low fertility status
6. Weak bunds and recurring cost of maintenance
7. High cost of infrastructure maintenance
8. Over involvement of human labour
9. Minimum product diversification
10. Decline in the market value of the produce during the peak harvest period
11. Lack of substantial income from average holding

Apart from the above constraints, farmers opine that the disadvantages of the existing dewatering system is a serious problem. At present the dewatering of paddy fields of Kuttanad is controlled by Punja special Office at Alappuzha and Kottayam District as per the provisions of Irrigation Act. Farmers feel that they are forced to pay additional cost for dewatering since the pumping contractors who were selected through public auction will have an upperhand in determining the time of dewatering and cost involved. This is because eventhough the contractor bid for a lower rate of subsidy from Government, the farmers were forced to pay additional amount known as additional '*nerma*' based on the cost anticipated by the contractor. As per the existing rules, pumping subsidy is not allowable when crop is lost due to natural calamity, since the clause after the full harvest is incorporated in the Act and also subsidy is denied if seasonal fallows occur for succeeding crops. Moreover the pumping subsidy from *punja* special office for the last two to three seasons will always be due which also influence the enhancement of additional '*nerma*' collected from farmers.

5.6 STRATEGY FOR RATIONALISING THE LAND USE PATTERN

Crop diversification referring to a larger crop mix creates a land use conflict among the various crops and crop groups like food grains and non-food grains. The agronomic conditions in a given region and the technology available for

various crops are important forces which condition diversification. Certain soils and water regimes are suitable only for given type of crops. Similarly some of the physical and geographical features as well as climatic factors are other factors which have to be taken as "given" while making production decisions. Any effort to modify these natural and physical condition in order to introduce a different cropping pattern may prove, in most of the circumstances quite difficult, and also economically non-viable.

The individual activities leading to land use changes meet locally defined needs and goals, but aggregated they have an impact on regional and global environment and land use change is directly linked to the theme of transition to a sustainable world. The transition requires an improved understanding of the trajectories of land-use change that invoke positive or negative human-environment relationship.

The agricultural sector of Kerala has undergone wide-ranging changes in terms of ownership of land, cropping pattern, cultivation practices productivity and intensity of cultivation. Nearly 54 per cent of Kerala's population depends agriculture for their livelihood. To discuss the agrarian structure in Kerala, it is necessary to place it in the context of historical developments of land and society. Ecological and political factors combined to keep Kerala isolated from the rest of the country and to develop an agrarian system that, in the view of some writers, resembled European feudalism in some important respects. Mencher (1966) has drawn attention to the ways in which ecological conditions have influenced the formation of loosely organised and dispersed settlement patterns in Kerala which stand out in sharp contrast to the nuclear village settlements in other parts of India.

According to Oommen (1985) the process of land reforms brought about a change in the agrarian class structure. The erst while non-cultivating rentier land owners were replaced by owner cultivators who directly hired labour and supervised agricultural operations. The former tied labourers were converted into an agrarian labour force with contractual relations with the employer, and these former landless labourers with slave status have undergone a vigorous process of politicisation which rendered them capable of articulating their demands.

When it is claimed that rural unemployment is rising in Kerala, there is a shortage of rural labour especially in the agricultural sector in the sense that cultivators are willing and are actually seeking to hire additional workers at the going wage rate but find no more available at that rate there are statistical evidences to show that the average number of days worked by an agricultural labour has declined over the years in Kerala.

The decline in rice cultivation is closely related to the political economy of development in Kerala in which farmers have opted for shifting land out of rice into more remunerative and less labour absorbing crops. On the other hand, the farmers face a high cost regime in cultivation mainly due to high wages without a corresponding increase in labour productivity. Similarly increase in cost of cultivation and decrease in profitability also accelerated the conversion process.

Historically, Kuttanad was a thickly populated area because of the scope for various economic activities like rice cultivation, fishing, coir making etc. The traditional agrarian structure was hierarchial and caste based, land being owned or possessed only by upper caste Hindu or non Hindus. Tenants under took the actual cultivation, the agricultural labourers who tilled the land and harvested the crop. According to Jose (1977), the penetration of capital into Kuttanad region and the technological advancement led to decline in labour use. Rice cultivation which is labour intensive relatively, became uneconomical owing to the break up of the traditional labour relations.

With the spread of education a tendency of moving away from agriculture was observed among all sections of the society. The possibility of greater occupational mobility that unfolded after the 1970's also led to this tendency. The tenancy reforms of the 1960's and the subsequent fragmentation of land holdings made the average holding size uneconomic. The employment issue is related not only to the number of man-hours of employment to be provided but also linked with the nature of employment where the unemployed are no longer the older generation of unskilled, illiterate, poor people, but the younger generation of educated and at least semi-skilled. They want jobs instead of manual work. With these educated youth emerging

as a sizable section of the workforce in the rural households, there is a need to identify and encourage enterprises which may retain the educated youths on the farms and their gainful employment.

Compared to the rest of India, agriculture in Kerala is characterised by high value yielding cropping pattern, good physical yields, a high intensity of cropping and superior cultivation techniques. High density population with limited cultivable land, and with considerable growth of population have posed several problems. Therefore sustainable development has to enter in our planning process as one of the basic and permanent objectives. We also need a time-bound micro-level land-use survey starting with the village. Such a survey should also indicate our long term requirements for competing land uses and land capability. The total scenario of land use will need to be built up meticulously which has to be backed by appropriate legislations. A strategy must be developed to cure the past damage as also insulate the state from future damage to land. This would lead to a dynamic land-use policy.

A development strategy in general is eseentially an effort to bring together and adopt a combination of all the resources in such a manner that the objectives are realised over time. It is composed of three broad sets of elements. (1) a set of institutions (2) a set of production conditions and (3) a set of state policies.

It should become the commitment of the government to provide food security and to protect the natural resources by improving the profitability of paddy cultivation in the state.

A Paddy Promotion Council should be established in the state with a view to organize all the developmental activities relating to paddy cultivation. Based on the present study, following suggestions are made.

I. Technological interyentions

1. There is a need for varietal improvement to adjust with the agronomic and climatic conditions and the development of management practices for the expression of its full genetic potential.

2. Application of biotechnology for the development of varieties which are resistant to biotic and abiotic stresses.
3. Efforts should be taken for promoting the adoption of integrated pest and disease management practices.
4. Technological packages for economising the use of purchased inputs particularly fertilisers should be implemented.
5. Necessary steps should be taken for encouraging the use of organic manures. Suitable programmes should be launched for the production of green manures. Rice-based fish farming system can be practised in suitable areas. Integrated farming for optimum biomass production can be given priority.
6. Adoption of rice hybrids to realise higher yields and scented rice for value addition in suitable areas.
7. Production of high quality seeds and distribution should be enhanced.
8. The irrigation system need to be made more efficient as well as flexible.
9. Realising the need for selective mechanisation in specific areas like land preparation, transplanting, harvesting, threshing, winnowing and cleaning, it should involve the integrated approach of scientists, agro-industries, farmer societies for the technological development, commercialisation, popularization and adoption.
10. Steps should be taken for minimising the technological gap in the adoption of scientific practices at the farmers field.

II. Labour issues

The people who have the willingness to work on paddy lands and activities related to rice production may be registered in the panchayats and a list of workers can be prepared at each ward or *padashekharam* level. Steps may be taken for imparting training for these groups in operating and maintaining farm machinaries. Farm implements can be purchased at the panchayat level and should be made available to the farmer as and when necessary.

III. Socio-economic issues

1. The agenda for the future should include substantial changes in the institutional capabilities particularly on enhancing the capabilities of the delivery system for inputs and credit.
2. Export oriented cultivation practices should be encouraged wherever possible.
3. Group farming should be encouraged for revitalising the rice production scenario with new vigour and enthusiasm and mass participation. Tillage operations using tractors, procurement and transport of seeds, fertilizer and the like, community nursery for rice, plant protection operations, water management and such other activities amenable for group action may be organised on a community basis.
4. The major inputs such as quality seeds, fertilisers, plant protection chemicals and soil amendment materials may be supplied at 90 per cent subsidy level so as to make rice cultivation more profitable. Since the input cost is a major share of cost of cultivation higher subsidy will be appreciable to the farming community.
5. Adequate infrastructural facilities should be ensured for proper storage, procurement and marketing of the produce. The proposed council may take up action for the same. At each panchayat, the area under paddy crop at different season may be estimated and the list of farmers who have taken up paddy cultivation may be prepared. For the harvested produce storage facilities should be provided at ward level. Immediately after harvest, procurement may be done along with the disbursement of cost of the produce to the farmers.
6. Crop-insurance scheme should be modified so as to impart maximum compensation to the paddy farmers. For any crop loss, whatever may be the extent of crop loss and area affected, the insured farmer should get the compensation.
7. Adequate support price for paddy should be declared for each season which must be sufficiently higher. Paddy production bonus should be fixed based on the cost of cultivation. For encouraging the farmers, those who produce more than the state average, for each additional quintal of paddy a substantial amount may be given as a special bonus.
8. For improving the processing facilities, small scale units may be established at panchayat levels and the interested farmers can derive its benefits. For this purpose, electricity may be supplied at free of cost.

Summary

CHAPTER - VI

SUMMARY

During the past three decades, the agriculture sector of Kerala has undergone wide ranging changes in terms of ownership of land, cropping pattern, cultivation practices, productivity and intensity of cultivation. Official figures show that agricultural income in Kerala which showed a steady growth upto the mid-seventies, began to decline thereafter and showed a vacillating trend in the eighties. This change is mainly attributed to the shift in area from seasonal/annual crops to high value yielding perennial cash crops having a long gestation period.

The share of area under paddy has nearly halved during the past two decades. The area under tapioca, which is a cereal substitute, has also considerably declined, to about one third. The area under vegetables has gone down to nearly two-thirds. Among the crops that have expanded in area cultivated, the most significant is rubber which has more than doubled its area followed by coconut and pepper which have increased their area by nearly one-third and three-fourths respectively. Thus it will be seen that in the process of intercrop adjustments, food crops in general are the losers and perennial cash crops, the gainers. The trend that has been persistent in the past two decades is continuing. Against this background, the present study was undertaken with the following objectives.

1. To analyse the nature of conversion of paddy fields
2. To analyse the push-pull factors influencing the conversion of paddy fields
3. To study the socio-economic consequences of conversion
4. To analyse the agro-ecosystem impact as perceived by the respondents
5. To suggest a suitable strategy to rationalise the land use pattern to check the conversion process.

From the study area of Kuttanad, three panchayats viz., Thakazhi and Thalavady panchayats from Alappuzha district and Vazhappally panchayat from Kottayam district were selected. The study was conducted during the period 2001-02. Random sampling was adopted for selecting the 60 convertors and 60 non-convertors in the study.

The different factors viz., economic factors, technical factors, personal and socio-psychological factors and situational factors which were assumed to influence conversion as well as non-conversion were selected.

The data were collected using a structured interview schedule through personal interview, group discussion, focus group interviews, key informant interviews, oral history narrations, personal observation and local inquiry methods. Analysis of the data were carried out using different parametric and non parametric statistical techniques.

The salient findings of the study are summarised and presented below.

1. Distribution of the convertors revealed that majority of the convertors belonged to low category with respect to extent of conversion.
2. Regarding the nature of conversions, the conversion to coconut plantation was found to be maximum compared to other purposes.
3. Biserial correlation analysis revealed that the economic factors viz. low profit of paddy compared to other crops (E_6) followed by inadequate prices given by rice mill owners (E_5) and high cost of fertilisers (E_4) possessed a positive and highly significant relationship. With respect to the technical factors, high level of pest and disease infestation possessed a positive significant relationship while possession of only paddy field and competency in paddy crop cultivation had negative and significant relationship with conversion.
4. In the case of personal and socio-psychological factors, nuclear family system (P_{10}) possessed high correlation coefficient. With respect to the situational factors, all the factors except one possessed positive and significant relationship.
5. Through percentage analysis all the four factors were categorised under high, medium and low categories. The economic factor viz. inadequate price given by rice mill owners and situational factors viz. scarcity of labour during peak season (S_6), lack of proper processing facilities and lack of efficient marketing infrastructure were classified under high category.

   Regarding the medium category, all the remaining factors, excluding the technical factors viz., possession of only paddy field and the personal factor, management of field with own family labour were included.

6. The results of χ^2 analysis revealed that the economic factors viz. low profit of paddy compared to other cash crops and high cost of electricity and plant protection chemicals possessed a high influence on paddy field conversion.

   Regarding the technical factors, extent of conversion was found to be highly influenced by the push factor viz. inefficient implementation of crop insurance scheme and pull factor competency in paddy crop cultivation.

   With respect to personal and socio-psychological factors, extent of conversion was much influenced by the factors viz., nuclear family system and expectation of a good crop every season.

   Regarding the situational factors, the extent of paddy field conversion was found to have high association with the push factors viz. scarcity of labour during peak season (S_6), salability (S_2), high wage rate of agricultural labourers, urbanisation, conversion to roads and occupational migration of labourers.

   Parametric tests were employed to analyse the relationship between extent of conversion and personal and socio-psychological variables which followed the normal distribution.

7. The results of correlation analysis revealed that the local resource utilisation possessed high correlation followed by occupation (deviation from rice cultivation) and farming experience. According to multiple linear regression analysis the variables possessed high contribution to extent of conversion were local resource utilisation and occupation. Regarding the step down regression analysis, the variables which contributed maximum effect were farming experience (P_3), occupation (P_5) and local resource utilisation (P_8).

8. Socio-economic consequencies due to the paddy field conversion were also analysed. According to the convertors, the most important consequences were change in land value, change in income due to switching over to other crops, and less labour requirement in case of other crops. Scientists opined that the most

important consequences were land use pattern change, occupational diversification and less labour requirement in case of other crops. According to extension personnel land use pattern change change in land value and change in income due to switching over to other crops were the important consequences social activists and people's representatives opine that the change in land value, land use pattern change and change in income due to switching over to other crops were the important consequences. According to agricultural labourers, the important consequences were drastic reduction in the employment opportunities for women, occupational diversification and outmigration of hired labour were the important consequences.

9. The agro-ecosystem impact due to conversion of paddy fields as perceived by the different respondent categories were as follows.

   According to scientists the most important impact perceived was increased possibility of flood which was followed by increased scarcity of drinking water. The other important impacts were influence on water percolation obstruction in free flow of water. Regarding the extension personnel also increased possibility of flood and increased scarcity of drinking water were the important impacts. According to social activists and peoples representatives the most important impact perceived was irrecoverable change of land properties followed by obstruction in the free flow of water and increased possibility of flood. Regarding the agricultural labourers and nonconvertors most important impact perceived were difficulties caused to neighbouring field, hardening of soil and increased scarcity of drinking water.

Suggestions for future research

The present study was confined to Kuttanad area, rice bowl of Kerala. An interdisciplinary approach is essential for the in depth analysis of economic and environmental issues consequent to the paddy field conversion. Studies may be taken up to analyse the gender shift in the employment opportunities and the endangered traditional skills in the paddy production system.

Action research is to be undertaken to popularise integrated organic farming for a sustainable crop production.

The other rice growing tracts of the state are also to be studied focussing on the changes in the land use pattern.

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* Originals not seen

Appendices

APPENDIX-I

Results of relevancy rating of factors influencing paddy field conversion

Sl. No.	Factor	Rating
A	**Economic factors**	
*1	High cost of fertiliser	0.788
*2	High cost of plant protection chemicals	0.767
*3	High cost of electricity	0.732
4	High cost of high yielding varieties of seeds	0.488
*5	Inadequate support price	0.755
*6	Inadequate proces given by rice mill owners	0.733
7	Poor subsidy rate from the Government	0.234
*8	Low profit compared to other cash crops	0.855
9	High interest rate of loans	0.488
10	Over dependency on the money lenders	0.400
11	Increase in the cost of agricultural implements	0.222
12	High cost of fuels	0.122
13	Low marketability of straw and other byproducts	0.111

Sl. No.	Factor	Rating
B	**Technical factors**	
1	Lack of knowledge about high yielding varieties	0.424
2	Non-availability of high quality seeds	0.314
3	Inadequacy of seed distribution systems	0.234
4	Nonavailability of organic matter	0.111
*5	Low level of mechanization	0.755
6	Weed management difficulties before sowing	0.234
7	Additional expenditure for soil reclamation	0.258
	measures before sowing	0.346
8	Soil characteristics	0.238
9	Water management problems	0.326
10	Problems of saline water intrusion	0.424
11	Unfavourable climatic conditions	0.286
*12	High infestation of pest and diseases	0.744
13	Non-availability of sprayers	0.348
14	Non-availability of drying and winnowing machines	0.264
15	Silting up of the kayal area	0.432
16	Inefficient implementationof crop insurance scheme	0.776
17	Low use of information sources	0.286
18	Low adoption of scientific cultivation practices	0.294
19	Low use of information sources	0.184

Sl. No.	Factor	Rating
C	**Personal and socio-psychological factors**	
1	Indebtedness	0.213
*2	Leisure time availability	0.082
3	Cultural compatibility	0.124
4	Lack of interest of youngest generation towards agriculture	0.424
*5	Preference of while collar job among the educated youngsters	0.753
*6	Nuclear family system	0.812

Sl. No.	Factor	Rating
D	**Situational factors**	
*1	Location of the field	0.784
*2	Salability	0.793
*3	Urbanisation	0.728
4	Infrastructural facilities	0.328
5	Development in the communication system	0.246
6	Labour problems	0.823
*a	Non-availability of labour	0.834
*b	Low eficiency of agricultural labourers due to age related problems	0.804
*c	High wage rate of agriculturallabourers	0.862
d	Poor commitment of agricultural labourers	
*e	Scarcity of labour during peak season	0.962
*f	Difficulty in getting labour for application of plant protection chemicals	0.724
*g	Occupational outmigrationof labour	0.786
*7	Inadequate assistance for natural calamities from Government.	0.737
8	Lack of proper storage facilities	0.224
*9	Lack of proper processing facilities	0.794
*10	Lack of efficient marketing infrastructure	0.838
*11	Improper functioning of padasekhara samithies	0.738
12	Inadequacy of procurement measures from Government	0.224
*13	Conversion to roads	0.824
14	Lack of processinbg units owned by farmers	0.246
15	Climatic problems including floods and drought	0.282
16	Fragmentation of the field	0.432
17	Absence of land lordism	0.128
18	Variations in the market price	0.410
19	Impact of tourism development	0.262

Sl. No.	Factor	Rating
	Pull factors	
*1	Age	0.728
*2	Farming experience	0.784
*3	Family size	0.716
*4	Occuption	0.724
*5	Traditionalism	0.708
6	Risk orientation	0.088
7	Status need	0.104
8	Local resource utilisation	0.826
*9	Preference of food from own field	0.732
*10	Competency only in paddy crop production	0.746
*11	Management of field with non family labour	0.784
*12	Expectation of a good crop every season	0.718
*13	Paddy field conversion is a highly costlier attempt	0.177
*14	Farmers are in the habit of keeping their own seeds	0.255
*15	Innate interest in agriculture	0.111
*16	Possession of livestocks	0.702

Socio-economic consequences

Sl. No.	Item	Rating
*1	Improved transportation facility	0.812
2	Improved communication system	0.424
3	Improved community facilities and services	0.356
*4	Land use pattern change	0.784
*5	Outmigration of family labour	0.768
*6	Outmigration of hired labour	0.748
*7	Occupational diversification	0.796
*8	Leisure time availability	0.738
9	Perceived change of social status	0.422
10	Changes in dependability for subsistence	0.324
*11	Change in income due to switching over to other crops.	0.824
*12	Less labour requirement in case of other crops	0.816
13	Construction of roads leads to blockage of drainage channels	0.326
14	Additional amount for maintaining soil health	0.246
*15	Scarcity of feed for livestock	0.806
*16	Drastic reduction in the employment opportunities for women	0.786
*17	Change in land value	0.884
*18	Loss of traditional skills	0.768

Sl. No.	Factor	Rating
	Agro-ecosystem impact	
*1	Obstruction in the free flow water	0.904
*2	Increased possihbility of flood	0.922
3	Change in humidity	0.324
*4	Physico-chemical changes of soil	0.755
5	Leaching problem	0.384
6	Ammoification/nitrification decreases in flooded situation	0.456
7	River/stream discharge quantity may vary	0.384
8	Fish population will be affected	0.282
9	Mangrooves population will be affected	0.134
*10	High pollution during rainy season	0.822
11	High weed problem in rainy season	0.484
*12	Water percolation is affected	0.844
13	Detrimental effect in the quality of air and water	0.434
14	Rish of contamination of aquifers	0.424
*15	Hardening of soil	0.788
*16	Increased scarcity of drinking water	0.766
*17	Increased run off from surface	0.844
18	Fall in fertility status of soil	0.234
*19	Difficulties caused to neighbouring field	0.842
*20	Irrecoverable change of land properties	0.777
21	Additional expenditure for maintenance of bunds	0.224
22	Enhances mechanisation	0.324
*23	Deterioration of natural assets (vegetation, water ways etc.) in the immediate neighbourhood	0.755
24	Atmospheric warming and climtic or micro weather change	0.204

* Items selected for the study

APPENDIX-II

CAUSE-CONSEQUENCE ANALYSIS OF CONVERSION OF PADDY FIELDS IN KUTTANAD

Interview Schedule

A. Name and address of the farmer

1. Age
2. Education
3. Farming experience
4. Family size
5. Size of land holding

    Area under paddy crop :

    Area kept as fallow :

    Area converted for other purpose :

    a) Type of conversion :

    i) Annual crops :

    ii) Perennial crops :

    iii) Building purpose :

    iv) Real estate :

    v) Soil digging / Excavator :

    vi) Conversion to roads :

    vii) Others :

    b) Area under fish culture :

6. Occupation

    What are the sources which contribute your major income

    a) Paddy cultivation alone

    b) Paddy and other crops

    c) Paddy and agribusiness

    d) Paddy and Govt./ Pvt. job

7. Traditionalism

    How do you feel the influence of traditionalism on paddy cultivation?

High influence	Moderate influence	Less influence	Least influence

8. Local resource utilization

   How do you utilize your local resources like water, labour implements, manures, land etc. for cultivation

High in effective utilization	Moderate in effective utilization	Low in effective utilization	Least in effective utilization

9. What is your perception about the following factors on conversion/ non conversion of paddy fields for other purpose. Please indicate the degree of importance of each item

Push factors

	Very important	Important	Not important
A) Economic factors			
1. High cost of fertilizer			
2. High cost of plant protection chemicals			
3. High cost of electricity			
4. Inadequate support price			
5. Inadequate prices given by rice mill owners			
6. Low profit compared to other cash crops			
B) Technical factors			
1. Low level of mechanization			
2. High infestation of pest and diseases			
3. Inefficient implementation of crop insurance scheme			
C) Personal and socio-psychological factors			
1. Preference of white collar job among the educated youngsters			
2. Nuclear family system			
D) Situational factors			
1. Location of the field with respect to the major centres of the panchayath			
2. Salability of the field			
3. Urbanisation			
4. Non-availability of labour			
5. Inefficiency of agricultural labourers due to age related problems			

6. Scarcity of labour during peak season			
7. High wage rate of agricultural labourers			
8. Difficulties in getting labourers for application			
9. Occupational migration of labour			
10. Inadequate assistance for natural calamities from government			
11. Lack of proper processing facilities			
12. Lack of efficient marketing infrastructure			
13. Improper function of padashekhara samithies			
14. Conversion to roads			

Pull factors

How do you feel the influence of following factors for non conversion of paddy fields

	Very important	Important	Not important
A) Personal and Socio-psychological factors			
1. Preference of food from own field			
2. Possession of livestocks			
3. Expectation of a good crop every season			
4. Farmers can manage the field with their own family labour			
B) Technical factors			
1. Possession of only paddy field			
2. Competency in paddy cultivation			

Socio-economic consequences

How do you feel the consequence of conversion of paddy fields?

1. Land use pattern change

   Do you feel that the conversion of paddy fields to other purpose has influenced the land use pattern significantly

High influence	Moderate influence	Less influence	No influence

2. Transportation

   How do you feel the difference in the transportation facility due to paddy field conversion?

Substantially increased	Increased	No change

3. Occupation

a) Outmigration of family labour

Have your family labour moved to other places for occupation? Yes / No

If yes, please indicate

1. Occupation to which shifted :

   Place : Same locality / outside locality

b) Outmigration of hired labour

Have your hired labourers moved to other places for occupation? Yes / No

If yes, please indicate

1. Occupation to which shifted :

   Place : Same locality / outside locality

c) Occupational diversification

Did you change your occupation as a result of conversion of paddy fields?

Yes / No

If yes, please indicate

Shares in business :

Real estate business :

Construction of buildings :

New enterprises :

Others :

4. Economic consequence

   1. Do you feel any change in income due to switching over to other crops

      Substantially increased / Increased / No change

   2. Do you feel any change in land value due to conversion of paddy fields

      Substantially increased :

      Increased :

      No change :

5. Employment related consequence

   How do you perceive the following statements?

	Very important	Important	Not important
1. Less labour requirement incase of other crops			
2. Drastic reduction in the employment opportunities for women			

6. Others

   How do you perceive the following statement

   1. Leisure time availability
   2. Scarcity of feed for livestock

Substantially increased	Increased	No change

Agro-ecosystem impact due to conversion of paddy fields

How do you perceive the following impact due to paddy field conversion?

	Very important	Important	Not important
1. Increased possibility of flood			
2. Increased scarcity of drinking water			
3. Effect on water percolation			
4. Obstruction in free flow of water			
5. Increased run-off from surface			
6. High pollution during rainy season			
7. High pollution during rainy season			
8. Hardening of soil			
9. Difficulties caused to neighbouring field			
10. Irrecoverable change of land			
11. Deterioration of natural assets			

APPENDIX-III

Perception of socio-economic consequences of paddy field conversion of the respondent categories - Agricultural scientists, Extension personnel, People's representatives and social activists and agricultural labourers

Interview schedule

A. Name and address of the respondent

B. Socio-economic consequences of conversion of paddy fields

How do you perceive the following changes due to the paddy field conversion in Kuttanad area? Please indicate the degree of importance of each items

Sl.No.	Item	Very important	Important	Not important
1	Improved transportation facility			
2	Land use pattern change			
3	Outmigration of family labour			
4	Outmigration of hired labour			
5	Occupational diversification			
6	Leisure time availability			
7	Change in income due to switching over to other crops			
8	Change in land value			
9	Less labour requirement in the case of other crops			
10	Scarcity of feed for livestock			
11	Drastic reduction in the employment opportunities for women			
12	Loss of traditional skill			

APPENDIX-IV

Perception of Agro-ecosystem impact due to paddy field conversion of Agricultural scientists and Extension personnel

1. Name and address of the respondent

2. Impact of conversion of paddy fields on Agro-ecosystem

How do you perceive the following impact of conversion of paddy fields on the Agro-ecosystem

Sl.No.	Item	Very important	Important	Not important
1	Obstruction in the free flow of water			
2	Increased possibility of flood			
3	High pollution during rainy season			
4	Effect on water percolation			
5	Increased run-off from surface			
6	Increased scarcity of drinking water			
7	Physico-chemical changes of soil			
8	Hardening of soil			
9	Difficulties caused to neighbouring field			
10	Irrecoverable change of land			
11	Deterioration of natural assets (vegetation, water ways etc. in the neighbourhood)			

APPENDIX-V

Perception of Agro-ecosystem impact due to paddy field conversion of Social activists and People's representatives

1. Name and address of the respondent

2. Impact of conversion of paddy fields on Agro-ecosystem

How do you perceive the following impact of conversion of paddy fields on the Agro-ecosystem

Sl.No.	Item	Very important	Important	Not important
1	Obstruction in the free flow of water			
2	Increased possibility of flood			
3	High pollution during rainy season			
4	Increased run-off from surface			
5	Increased scarcity of drinking water			
6	Physico-chemical changes of soil			
7	Hardening of soil			
8	Difficulties caused to neighbouring field			
9	Irrecoverable change of land			
10	Deterioration of natural assets (vegetation, water ways etc. in the neighbourhood)			

APPENDIX-VI

Perception of Agro-ecosystem impact due to paddy field conversion of Agricultural labourers and Farmer respondents

1. Name and address of the respondent

2. Impact of conversion of paddy fields on Agro-ecosystem

How do you perceive the following impact of conversion of paddy fields on the Agro-ecosystem

Sl.No.	Item	Very important	Important	Not important
1	Obstruction in the free flow of water			
2	Increased possibility of flood			
3	High pollution during rainy season			
4	Increased run-off from surface			
5	Increased scarcity of drinking water			
6	Difficulties caused to neighbouring field			
7	Irrecoverable change of land			

APPENDIX-VII

Cost of cultivation of paddy in Kuttanad region (per acre)

Sl. No.	Item	Labour	Machinery	Input cost	Total
1	Land preparation				
2	Infrastructure (Maintenance, Dewatering)				
3	Seeds and sowing				
4	Fertilizers, lime				
5	Weeding and inter cultural operations				
6	Plant protection				
7	Harvest and post harvest (including cost of kind wages) Additional labour (if any)				
8	General management and unforseen expenditure				

Yield of paddy

CAUSE-CONSEQUENCE ANALYSIS OF CONVERSION OF PADDY FIELDS IN KUTTANAD

By

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ABSTRACT OF THE THESIS

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ABSTRACT

The keynote of Kerala's agriculture is the diversity in crop production, which is the consequence of a wide range of natural conditions. The food habits and the consumption pattern have made rice the staple food of the people of Kerala. A major land use change that has occurred in Kerala is the conversion and reclamation of paddy cultivated areas, both in the low lands and uplands to agricultural and non-agricultural purposes jeopardizing the food security of the state , when it is designated as a "Statutory Ration State" with over sixty percent need of food grains met by imports.

Several primary observations in different locations of the state where extensive wetland conversion has taken place indicated significant consequences. It is estimated that more than forty percent of the population in the Kuttanad region is engaged in rice cultivation. In this background the study was designed to find out the nature and extent of conversion of paddy fields in Kuttanad. It was also aimed to analyse the push-pull factors influencing the conversion and socio-economic consequences of conversion of paddy fields. The agro ecosystem impact as perceived by the respondents was also analysed. The study was also aimed to develop a suitable strategy to rationalise the land use pattern to check the conversion process.

The study was conducted in three panchayats viz. Thakazhi and Thalavady from Alappuzha District and Vazhappally from Kottayam District. The different types of respondents included convertor and non-convertor farmers, agricultural labourers, agricultural scientists, extension workers, people's representatives and social activists. Data were collected through personal interview using well structured interview schedule, group discussion, focus group interviews, key informant interviews, oral history innovations, personal field level observations and local inquiry methods. Different parametric and non-parametric statistical tools were used for analyzing the data.

Results of the studies are summarized as follows. The study revealed that 38.33 per cent farmers among convertors had converted the paddy field for coconut cultivation. It was followed by construction of buildings. Conversion for real estate, banana cultivation and soil digging were also observed. Among the convertors 76.67 per cent farmers possessed below 30 per cent conversion.

Regarding the different factors affecting the conversion process, majority of the economic and situational factors acted as promoters of conversion while certain technical and socio-psychological factors were found to retard the conversion process.

Low profit compared to other cash crops, nuclear family system and scarcity of labour during peak season were found to have high influence on accelerating the conversion process, while local resource utilization possessed the highest retarding effect.

With respect to the socio-economic consequences, change in land value, land use pattern and change in income due to switching over to other crops, occupational diversification and outmigration of labour force were the important consequences. A strategy to rationalise the land use pattern is also proposed.

Regarding the impact of conversion on agro-ecosystem, increased possibility of flood and increased scarcity of drinking water were perceived as most important by scientists and extension personnel.

Irrecoverable change of land properties and checking of free flow of water were also considered as important impacts of conversion process.