SUSTAINABLE LANDUSE FOR AGRICULTURE

A LOCAL LEVEL APPROACH WITH REFERENCE TO PADDY CULTIVATION IN KERALA

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF PHILOSOPHY IN APPLIED ECONOMICS OF THE JAWAHARLAL NEHRU UNIVERSITY, NEW DELHI

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TRIVANDRUM

JULY 1994

July 21, 1994.

I hereby affirm that the research for this dissertation titled, "Sustainable Landuse for Agriculture: A Local Level Approach with reference to Paddy Cultivation in Kerala" being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy, was carried out entirely by me at the Centre for Development Studies, Trivandrum.

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Certified that this dissertation is the bonafide work of Sri N. C. Narayanan. This has not been considered for the award of any other degree by any other university.

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ACKNOWLEDGEMENT

The inspiration for a study integrating the physical and socio-economic realities came to me from the involvement in an innovative experiment, the Panchayat Resource Mapping Programme. It was realised that the 'environmental appraisals' I had been engaged in was but one aspect of the problem and the real dynamics of environmental degradation lies in the social mosaic.

When I begin to write the acknowledgement with gratitude so many faces pass through the mind.

My supervisors Professors K.P. Kannan and John Kurien were always open to ideas and allowed me to think my own way. John spent much time listening to my ideas and positively reflected upon the varied aspects of the problem. Kannan translated these to an 'economic language'. His sharp comments have helped me lot in crystallising the arguments.

I complete this work in the shadow of the sudden demise of my teacher-friend Dr. C. Radhakrishnan Nair. Prof. Mohankumar , University College, Trivandrum and Dr. Roy Chacko, Dept. of Geology, University of Kerala taught me the stories of land scape evolution and generated my interest in nature. Sri. Subrata Sinha, introduced me to the geologist's role in land use planning. Dr. C. J. Thampy, Land Use Commissioner, allowed me to use the facilities in the Land Use Board. Sri Mohankumar offered me further encouragement. Samad, Chandramohan, Sanal, Edison and Paul gave me cheerful company in the office. Prakash helped in the planimetric and cartographic work. Samad gave me insights about land use and agriculture during the various field trips. Director, CESS, and Senior scientists Dr. K.K. Ramachandran and Sri. N.J.K. Nair, gave me the details I needed to do Chapter III. A special thanks to Sri.Sankar and Sri. A.S.K. Nair for the kindness shown in this regard and encouragement in all stages of work.

I was inspired by Dr.Thomas Issac's talks during the PRM days regarding larger problems of "development". Dr. M.P. Parameswaran, Sri.T. Gangadharan, Dr. Babu Ambat, Sri.Manmohan and other activists of KSSP showed me the 'parishad spirit' of voluntary work. The involvement in PRM gave the possibility to visit many villages in Kerala. Though the idea was to teach the people mapping, they taught me so many things about the nuances of the land and water system and cultivation practices. The opportunity to spend a few weeks in one such area, Madakkathara, made it possible to observe the land,people and life here. Without the help of particularly Ramanunni, Gopihassan and Sathyaseelan, I would not have able to bring out the microlevel specificites of the problems. The hospitality of Sri Raghunandanan and family in Madakkathara made the field study less tedious.

Sri. D. Narayana was kind enough to go through an earlier draft of the dissertation. Interaction with Professors P.R. Gopinathan Nair, K.N. Nair and K.K. Subrahmanian and Michael Tharakan was particulary useful. Dr. Srikumar Chattopadhyay helped me to clarify many issues. Discussions with Professors P. S. Ramakrishnan (JNU), Sudipto Mundle (NIPFP) and Anil Agarwal (CSE) were also helpul. K.T.Rammohan and K.N. Harilal enthused me on new possibilities to look for.

Shobha in the library counter with the considerate smile was always there to help me with Molly, Anitha, Nasru and Anil. Thanks to Girija for her excellent word processing and to Philroy for the final touch.

Thanks to Suresh, Sanjith, Hari, Bhaskar, Pyare, Denny and Vinod whose company made me feel "young" again. Jom and Dolly, Thomas Mathew, Babu, James, Joshy, Anandraj, Arvinder, Reddy, Neetha, Deepa, Ranjan, Sreejith, Ramu, Shylajan, Mihir, Rajib, Pinaki, Jayakumar and Venki and others made the two years in CDS enjoyable.

I am thankful to the Centre for giving me a friend like Saikat whose timely help in the final stage made it possible to give a decent shape to the thesis.

My mother gave me strength throughout. Without her persuasion I would not have been able to take the difficult decision of spending the course work time with Centre's subsistence allowance . I am thankful to my "other" parents Sudha and Ramachandran Nair for giving me a nice 'home', particularly during the difficult process of writing. The credit of completion of work in time goes to Sindhu whose undemanding nature gave me the liberty to be "irresponsible" and this helped me a lot in the creative process.

When I look back I find that without the help of all these people around me, the study would not have been possible.

I dedicate this work to the fond memory of my father who left me early to make me what I am today.

Narayanan
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Chapter I

INTRODUCTION

Human beings are part of a larger eco-system consisting of different organisms and the physical environment. This creates their dependence on nature for the very existence and satisfaction of their basic needs. With the knowledge developed through observation and experience over a long period, they began to place themselves, to an extent, outside the system and manipulate it. Such interventions on land can be termed 'landuse'. Landuse can generally be defined as the application of human controls in a relatively systematic manner, to the key elements within an eco-system to derive benefit from it (Vink, 1975). Agriculture is one of such earliest activities the human beings took on after their nomadic phase. In this, the 'useful' components of the eco-system are fostered and others are removed and in the process the eco-system gets simplified. The nature of agricultural use depends on the climate, physiography, the socio-economic conditions and the needs of the existing society. When the 'needs' of the society or individuals shift to the realm of 'greeds', intensive agricultural/ nonagricultural activities, not conformable with the physical peculiarities of the land and water system, may be practised. This leads to the degradation of the system, diminishing or destroying the future returns from the resource base. Hence, the need for a sustainable land use strategy.

In the present study we are focussing on a specific landuse - viz., paddy cultivation in the State of Kerala. In Kerala, the area under paddy and production has been fast declining in the last two decades. Many studies, confining to the economics of paddy cultivation, have put forward the declining profitability resulting

from the increasing cost of cultivation, low relative price of paddy, increasing wages, etc., as the reasons for this. However, the socio-economic realities cannot be the result of such economic reasons alone. In the present study the physical, social, economic and institutional factors that affect land use decisions, are sought to be integrated for a more holistic approach to the problem. Land use, thus, is seen as a process worked out by the historical evolution of these factors. The macrolevel policies affect microlevel decisions and macrotrends may be an aggregate of microtrends. But the specificities of these may vary. The earlier studies on paddy cultivation looked at the macrotrends with the State or district as the basic unit. These seldom captured the considerations of farm level decisions at the microlevel. So an appraisal of both the levels is attempted in the present study. It also reviews the impact of the earlier interventions on the system from an ecological perspective and probes into a strategy to maintain or enhance paddy cultivation and sustainable use of valleys.

1.1 *Kerala's 'Development': A Brief Overview*

Kerala has a peculiar pattern of development which has come to be known the *'Kerala Model of Development'*, characterised by spectacular improvements in the physical quality of life (PQLT) while growth in income and employment have been lagging behind. Kerala leads all the Indian States in PQLT, like high literacy, high life expectancy, and low infant mortality.

The State has reached the third stage of demographic transition characterised by low mortality rates and low fertility

rates though it has not reached the high levels of per capita income, industrialisation and urbanisation associated with this phase of demographic transition. There is a deceleration in economic growth from 1975-76. Dis-aggregation of sectoral growth shows that crop production, fisheries, forestry, etc., had shown a negative growth. In the secondary sector, unregistered manufacturing units showed an absolute decline in income generated. Tertiary sector of the economy including public administration, banking and insurance showed impressive growth trends. Stagnation in the economy is reflected in the low levels of employment. Higher educational levels in the State have introduced a qualitative dimension to the problem. The State incurs large amounts for social security schemes and welfare programmes targeted mostly at the aged, disabled and unemployed. Kerala has achieved spectacular results in social development mainly due to the public intervention in social sector. Ninety-seven percent of the households are covered by the Public Distribution System. Such a wide PDS has become necessary as Kerala is predominantly an importer of food grains. This in turn was the result of the State concentrating on the production of cash crops (George, 1993).

1.2 *Uniqueness of Kerala Terrain and Problems Relating to Landuse*

Kerala is situated in the south western corner of India and has a unique location and physiography. It is an elongated land mass having the Western Ghats along its eastern margin with a maximum elevation of 2670 m (Anamudi) and the coastal plains along the west bound in by the Arabian sea. The physiographic diversity, along with the climate and soil have endowed the state with a very

rich flora and fauna. The State can broadly be divided longitudinally into three physiographic sub divisions, the highland, midland and the low-land.[1] The highland is generally thickly forested in its upper reaches, while in the lower ranges the forests are interspread with plantations. On the western fringe of the State are the lowland and the coastal zone containing a string of estuaries, and back-waters. The rolling hills of the midland lie between these. Due to its location on the windward side of Western Ghats, Kerala State receives an average rainfall of 2800 mm. The diversity in the original rocks, variations of micro-climatic situations and differences in the intensity and type of weathering under variable terrain conditions have led to the generation of different types of soil in Kerala (Government of Kerala, 1982).

The soil and the equitable climate provide ideal conditions for plant growth. Seventy percent of Kerala terrain is suited to grow garden crops, plantations and forests. This is a peculiar climate when compared to most of the other parts of the sub-continent. The humid tropical climate with high rainfall is conducive for growing a host of plantation crops and the water faciled valley portions are devoted for paddy cultivation. Because of the undulating terrain conditions in midland and in parts of the lowland, and of the highly dissected nature of the highland (which also is due to the high surface slopes and rainfall), the soils of

[1] The classification of area is according to elevation above mean sea level (MSL). Low lands are those below 7.5 m from MSL, midlands between 7.5 to 75 m and highlands above 75 m from MSL. Low land covers 10%, midland covers 41.76% and high land 48.14% of the total geographic area (Government of Kerala, 1989).

Kerala are susceptible to erosion under conditions of improper landuse and inadequate soil conservation measures.[2]

The long coastline along the west with the natural harbouring facilities have facilitated trade relations with other countries from very early times. So historically the agricultural landuse in the State was in favour of production of cash crops oriented at the market, especially the external market. Since land revenue and the tax on agricultural produce constituted in those days the most important income of the State, the government policy greatly emphasised the need for encouraging commercial cultivation. The various land revenue and allotment rules framed between 1860 and 1925 were essentially to attract more people into the process of expansion of commercial agriculture.

The forest wealth of Kerala is confined to the Western ghats. Widespread deforestation started in the last century, essentially for extending commercial agriculture and the State had always been lenient to encroachers of forest land (Sivanandan, et. al., 1986). Migration to uplands is an important factor which facilitated deforestation and an important element in the State's agriculture. Migration into uplands by people from lowland and midland who were technologically and culturally advanced from native tribals considerably influenced the State's commercialisation of

[2] It has been estimated that out of a total area of 38.85 lakh hectares, 19 lakh hectare area is affected by soil erosion problems.

agriculture[3].Presently, as per official estimates, almost 28 per cent of the State's total area is covered with forests.[4] But estimates based on satellite imageries and ground observations have revealed that the area of forests decreased from 44 per cent of the total geographic area in 1905 to between 7 and 10 per cent in 1983 (Chattopadhyay, 1984).

According to Menon (1981), deforestation in the State had acquired a different dimension in the sixties and seventies which had largely been cleared for "developmental activities". But that itself had acted as an incentive for more and more forests to be cleared for agricultural purposes. Kannan and Pushpangadan (1988) have summarised the reasons for deforestation as:

(1) encroachment of forests by powerful rural interests, making use of a large army of land-poor and land hungry peasants.

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[3] Kunhaman cited in Joseph, 1992.

[4] Table 1.1: Land Use Pattern in Kerala

Classification of Land	1990-91 Actual [Area in Ha as in 1990]	Percentage of total
1. Total Geographical Area	3885497	100.00
2. Forest	1081509	27.83
3. Land put to non-agricultural uses	297381	7.65
4. Barren and uncultivated land	58308	1.50
5. Permanent pastures and grazing land	1912	0.04
6. Land under miscellaneous tree crops not included in net area sown	34375	0.8
7. Cultivate waste	94608	2.43
8. Fallow other than current fallow	25466	0.68
9. Current fallow	44164	1.13
10. Net area sown	2246774	57.82
11. Area sown more than once	796270	20.49
12. Total Cropped Area	3043044	78.31
13. Cropping intensities		135.44

Source: Kerala State Land Use Board, Trivandrum.

(2) clear felling by government for raising plantations and construction of irrigation and hydro electric projects.

(3) illegal felling of trees and plundering of forest resources by private interests, mainly timber contractors.

1.3 *Environmental Consequences of Deforestation and other Interventions*

The Western Ghats form the catchment area of all the 41 rivers in the State. Invariably all the rivers are dependant on the forests for a sustained flow. A vegetation cover presents an entirely different surface to solar radiation as compared to the barren soil. Further, the role of vegetation in reducing surface run-off is of particular importance in a region like Kerala, where the topography is rugged and the rainfall is heavy and concentrated during a few months. Existence of forests helps in reducing the peak flow and prolongs the duration of the flow[5]. Most of the flash floods arise from the rapid run-off from catchments where the vegetation has been removed. By regulating the peak flow, the forests check flash floods in the valleys during rains and prevents extreme drought conditions in summer. Further, by regulating the flow it helps to prevent the saline water intrusion in the lower reaches in summer, by maintaining a minimum water level (Government of Kerala, 1982).

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[5] World conservation strategy (1980) points that "Only 10% of the world's population live in mountainous area, but another 40% live in the adjacent plains; the lives and livelihoods of half the world are directly dependent on the way in which watershed ecosystems are managed. (World Conservation Strategy 1980, cited in Tobla, 1987).

Deforestation and raising of tubers like cassava and monoculture plantations accelerate the process of soil erosion and increase the possibility of land slides in the highland. Moreover the soils of the Western Ghats are laterite which if left barren would react with the atmospheric oxygen and get hardened - the process technically referred to as lateritisation, reducing the productive capacity of land (Grainger, 1980). A study by Ramachandran, et. al, (1984) revealed that yield rates of cassava (tapioca) have come down from 23,226 kg/ha in 1972-73 to 17650 kg/ha in 1978-79. In a span of six years, the yield rate has declined around 5500 kg/ha. A high decrease in the rate of production starts within two or three years of initial cultivation. The soil erosion triggered by the cultivation leads to an increase in the amount of silt carried by the rivers bringing down the storage capacities of the reservoirs (for irrigation and power generation), thus wasting public investment (Chattopadhyay, 1984). This reduces the sediment load in the rivers downstream, but in the midland and lowland portions, heavy sand mining is done which again reduces the sediment capacity. The depth-width ratio of the stream is also distorted during the process. Rivers retain their natural shape by carving off the banks along with the buildings and cultivated land. A study in Neyyar river, showed that the extent of sand removal was dis-proportionately higher than the feeble countering mechanism of sediment deposition by the stream. The deepening of the channel further resulted in the depletion of ground water from either side of the river (Thrivikramaji, 1986). The reduction in flow enhances the saline water intrusion in the lowland due to variation in biotic and sediment content.

And in the lowland, the wetland are drained, cleared and filled for agriculture, human settlement and industrial purposes. Such acts are likely to disturb the ecological balance of the coastal zone. The unprecedented scarcity of water in the coastal zone, drying up of wells which used to be perennial are indications of this. Intrusion of salinity in the wells can be attributed to the unscientific reclamation of extensive areas of wetland and the indiscriminate deforestation along the Western Ghats.

The increasing man-land ratio ,consequent pressure on land and short-sighted landuse practices mentioned above resulted in varying degrees of environmental degradation and highlights the need for a holistic approach for managing the heterogenous land and water system in the State. This is important since these units are parts of a single fragile system where tampering with one part will automatically have its repercussions on the others. The environmental degradation mentioned above are a result of the interventions in the system which degrades it. This will create a situation whereby the returns from the natural resource base will decline or diminish with the passage of time which is not sustainable in the long-run.

1.4 *The Concept*

Sustainable Development is a concept which draws two frequently opposed intellectual traditions: one concerned with the limits which nature presents to human beings; and the other with the potential for human material development which is locked up in nature (Redclift,1987). This broad concept of "sustainable

development" was first widely publicized by the World Conservation Strategy (IUCN, 1980). It has since become central to the thinking on environment and development. A notable recent example is that of the report of the World Commission on Environment and Development (WCED 1987), also known as the "Brundtland Report".

The Brundtland report defined sustainable development as "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED,1987). By needs, it has meant the essential needs of the world's poor to which overriding priority should be given. After this a host of literature with multitudes of definitions for sustainable development has been coming.[6] It is a strategy meant for the satisfaction of basic needs, welfare and survival (Bratt and Steetskamp, 1991). If development is defined as an increasing per capita well-being or welfare, then sustainable development is simply non-declining welfare over time (Pearce and Maler, 1991).

Developing countries have to give more weightage to conserving the ecological quality of the land and water system when drawing up their development strategy because they are more directly dependent on natural resource systems and the environment for food, shelter and employment and so also for the reasons that their development is tied to the productivity of these systems. Sustainability of development here implies providing means for accommodating a growing population and economy while maintaining environmental

[6] At the end of the book the "Blueprint for a Green Economy" by Pearce et.al. (1989) a separate appendix titled, 'Annex: Sustainable Development - A Gallery of Definitions' is given in which 28 definitions for 'Sustainable Development' is provided!

quality and productivity of the natural systems. It is not merely a question of economic growth versus environment nor simply a question of trade offs - whether inter-regional, inter- sectoral or inter generational. It encompasses an alternative pattern of development (Patnaik, 1992).

The present study is an attempt to look at the possibility for a sustainable landuse strategy with respect to agriculture. Borrowing the WCED (1987) definition of sustainable development we may define sustainable landuse as a landuse that meets the needs of the present without compromising for the ability of future generations to meet their own needs from land. For this the stock of the resource base of the land and water systems must continue to give rise to flows, in a manner that does not decline with the passage of time. Different types of land have different resilience limits - capacity to withstand tampering. Landuse has to be planned to conform to these bio-physical variations. Hence, sustainable landuse development requires a proactive planning approach in which ecological integrity is the governing factor and the permissible level of economic activity is the dependent variable (Rees, 1988).

The only way to successfully achieve this goal and make the concept of sustainable landuse development operational, is the deep scientific and factual understanding of the bio-physical system, more importantly land and water - the basic determinahts of productivity in the primary sector of the economy. Consequently, sustainable development must address the question of productivity and management (Carpenter and Harper, 1989). Intervention must

adhere to the natural principle of spatially differentiated production potential of the bio-physical system.

The concept of carrying capacity or resilience is relevant in this context. To understand the process by which ecosystems respond to environmental change, ecologists have developed the concept of resilience or carrying capacity - the ability of the system to maintain its structure and pattern of behaviour in the face of external disturbance, i.e., ability to adopt to change. Carrying capacity is not static. It can be increased by investment and technology and decreased by consumption of capital (Foy & Daly, 1989.) However, it would be misleading to consider that carrying capacity can be expanded indefinitely and this varies with biophysical variations. The degradation of one or more parts of an ecosystem beyond some threshold level may lead to a breakdown in the integrity of the whole system. Dramatically the total costs of the system breakdown may very much exceed the value of the activity, causing the initial degradation (Pearce, 1989).[7]

The bio physical realities are only a part of the system. What is equally important is the socio-economic and political dynamics that is acting on the system which decides the nature and intensity of use. Thus the current literature on development emphasises the need for formulating a strategy that gives sufficient weightage to the constraints of the resource base as well as the socio-economic situations. Hence it is argued that, to

[7] For example, the profits from the cultivation in the steep slope is negligible when compared to the huge loss and irreversible degradation caused by a landslide triggered by this activity.

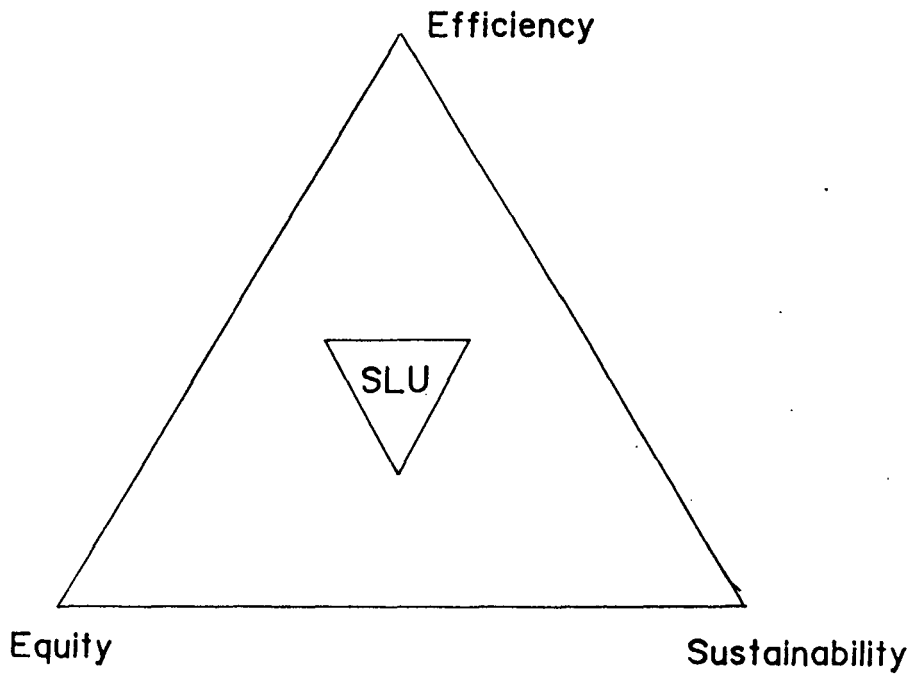
overcome such long term adversities as well as to sustain the development process, resource base utilisation should be managed not only from the resource base point of view but also should give equal emphasis on the socio-economic environment into which it is fitted in (Norton, 1991).

As a resource base, the users are interested in the 'efficient use' of it, ie., to accrue maximum returns from this. This is the individual concern of a resource use. But there are larger societal concerns of resource use like an equitable sharing of the returns by different users. There should be a `spread effect' for the use so that maximum number of people benefit out of it. Thus, the concept of sustainable landuse with efficiency, equity and sustainability can be expressed as in Fig. I.1.

The three corners of the tri-linear diagram represent the three aspects of any landuse. A landuse is efficient when it maximises returns per unit area. It satisfies the equity criterion when the use has the maximum 'spread effect' and it is sustainable when it gives returns in a non-declining fashion for the longest possible time span. So sustainable landuse must compromise between these components. The aim is to achieve the maximum returns benefitting the maximum number of people for the longest possible time from the stock of natural resources. Any landuse strategy must compromise between these three components.

Fig. 1.1

Components of Sustainable Land Use



SLU :- Field of Sustainable Land Use

1.5 *Present Study*

The present study focusses on the dynamics of a single landuse activity - paddy cultivation in Kerala. Paddy is cultivated in a variety of agro-climatic regions in the high, mid and lowland terrains of the State.[8] Paddy is cultivated in coastal tracts including the *kayal* cultivation (areas reclaimed from the back waters in Kuttanad, and Kole lands) which are lands below the MSL, the plains of Palakkad district and in the valley portions of high altitude areas as in parts of Wynad district. The most prominent cultivation is in the valley portions of the midland and moderate highland terrain (upto 600m above MSL).

The present study is confined to the dynamics of paddy cultivation only in these areas. In these terrains, paddy is traditionally being cultivated in the wetland ecosystem of valley landforms which are the lower most geomorphic units in such an undulating topography. In recent times, due to a host of reasons - economic and institutional - these valleys are being filled up and the ground raised for a variety of other uses both agricultural and non-agricultural. These conversions make the valleys into drylands. The larger concern of environmental sustainability of the system demands the conservation of the essential nature of these valleys as wetland eco-systems and the small and fragmented nature of the farms in Kerala forces the farmer to make the best

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[8] "In very few parts of the World is rice cultivated under such diverse and difficult conditions as in Kerala, which differs from the rest of the States in S.India in regard to rainfall, physical features, nature of terrain and types of soil. The midland region presenting an undulating terrain with its low hills and valleys is the most important rice area of the State in regard to both the methods of cultivation and the number varieties grown" (Sahadevan, 1966, p.26).

economic use from his limited holding. Consequently there is a conflict between what is individually beneficial from the profitability perspective and what is socially desirable from the stand point of ecological sustainability.

A sustainable landuse strategy should balance these conflicting claims. In a democratic regime the farmer has the full right to practice any landuse, and hence he may choose the one that maximises his returns. So the only way to ensure a sustainable landuse strategy is to make the ecologically best use economically viable. This can make the erstwhile conflicting elements of individual profitability and the larger social good complimentary in the long-run.

1.6 *Objectives of the Study*

1. To examine the problems and prospects of paddy cultivation in the State of Kerala.
2. To search for the reasons for the shift away from paddy cultivation in a representative area by an appraisal and integration of the physical and socio-economic realities.
3. From the insights from 1 and 2, and an evaluation of earlier programmes to search for the prospects of paddy cultivation and hence sustainable use of valleys in the State.

1.7 *The Approach*

The approach is interdisciplinary and the focus is on the local level. As mentioned earlier, the two aspects of landuse are the physical and socio-economic realities. So an inter-

disciplinary approach of assessing both is a must to formulate any intervention strategy.

The present landuse is the product of a host of earlier socio-economic-political and institutional decisions taken at both the macro and micro levels. So a look into the history of these was found to be inevitable. The physical realities are specific to micro regions. So a representative region in Central Kerala is identified to study this. Information collected from certain earlier studies like GALASA[9] and PRM[10] programmes (described in chapter V) conducted in the area also acted as a criterion in the selection of the area.

1.8 *The Scheme*

To get an idea of evolution and problems pertaining to paddy cultivation, the various aspects of the same at the macrolevel are reviewed with the help of available literature in Chapter II. At the micro level, the physical peculiarities of the study area and changes through a period of time (1910-1990) is studied with the help of Survey of India topographic sheets surveyed in 1910,1967 and 1980 and aerial photographs (1990). The environmental consequences of the changes in the different paddy growing areas classified on the basis of location and physiography are examined in a disaggregate fashion with these maps and a series of thematic maps generated by the PRM is done in Chapter III. This is supplemented with field studies.

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[9] Group Approach to Locally Adaptable and Sustainable Agriculture.

[10] Panchayat Resource Mapping programme.

The socio-economic and institutional factors responsible for the changes at the local level were enquired into with the help of a field survey in Chapter IV. Farmer respondents were selected using a purposive sampling methodology from the particular physiographic units identified earlier. Hints from the methodology of Participatory Rural Appraisal (PRA) were used to bring out the farmer respondents' perception of the changes. The macro picture of problems identified from the literature and the specificities of the problems of paddy cultivation in the study area were compared and discussed in an illustrative fashion (methodology detailed in the respective chapters). In Chapter V, the earlier programmes to boost paddy production are reviewed to evaluate their performance and look for a new strategy of intervention.

Chapter II

DECLINING PADDY AREA IN KERALA
An Enquiry into the Socio-economic Causes

2.1 *Introduction*

The present landuse is an outcome of the past. A look into the history of landuse dynamics -- especially, paddy cultivation is necessary to get a more comprehensive understanding of the present. In this chapter an attempt is made to observe some relevant facts pertaining to the landuse, especially paddy cultivation in Kerala. The historical analysis upto 1947 is done mostly for the erstwhile princely states of Travancore and Cochin and for the State of Kerala thereafter. Most of the historical discussion is done with the help of two major studies -- Umadevi (1984) and Panikar et. al. (1978) with supporting evidence from relevant Census reports and Cochin (Menon,1911)and Travancore State Manual(Pillai,1940). The post independence scenario is analysed with the help of relevant information obtained from various sources.

2.2 *Landuse Pattern: The Stylized Facts*

a. 1900 - 1947

In the early part of the twentieth century, in Cochin, only land under paddy cultivation was considered for revenue collection.[1] All arable lands at that time could be broadly divided into two categories - *nilams* (paddy lands) and *parambas*. The former were lands adapted for the cultivation of paddy and used

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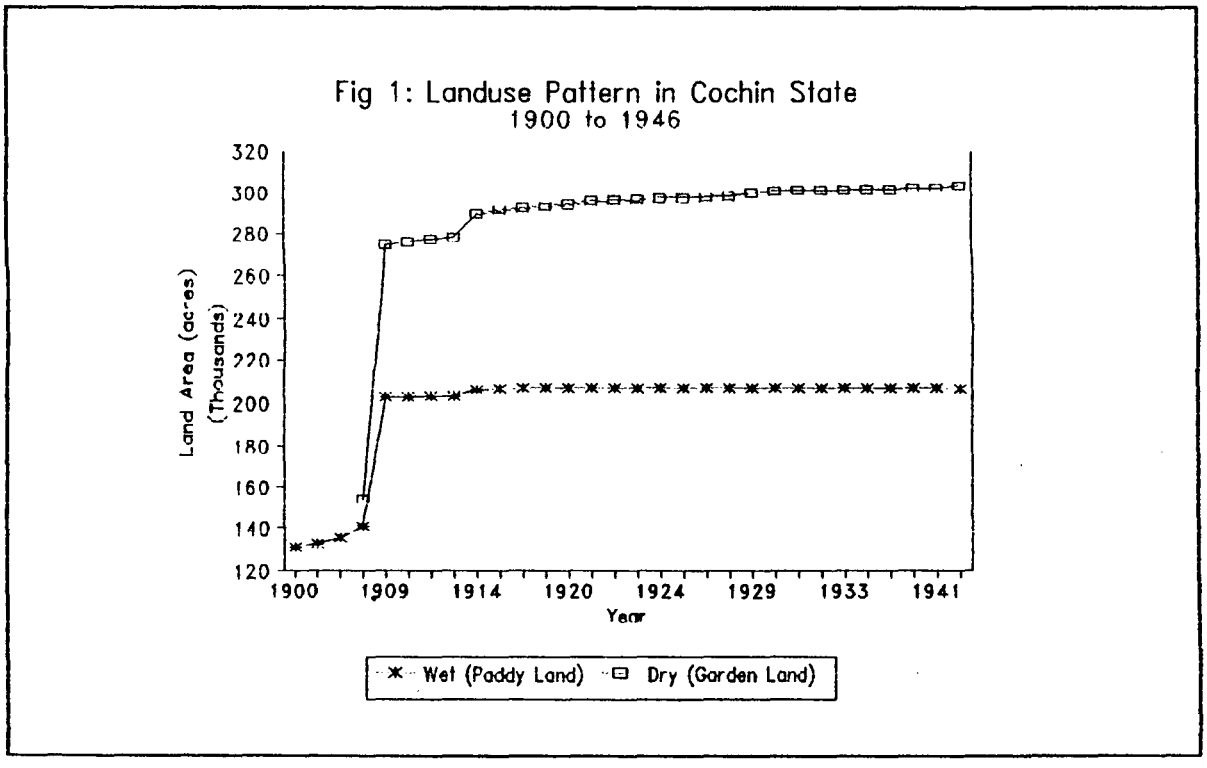
[1] To quote: "*Cultivation* : The area under wetland cultivation during the year (1901) was 1,32,386 acres against 1,30,724acres in the previous year. As stated in reports of previous years, no information is available regarding the area of *parambas* (garden or drylands)". (Administration Report, Cochin State, 1901)

almost entirely for the purpose, while all other lands were called parambas (Menon, 1911, p. 233).

The trend in the pattern of landuse in Cochin State gives an interesting picture (see Fig. 1). The area under wet landuse increased from 1.31 lakh acres in 1900 to 2.07 lakh acres in 1920.



However since 1921, the area under wet land remained constant at 2.07 lakh acres till 1935. Thereafter it declined. The increase in dryland area indicated in the table is attributed to the assignment of wastelands, *Purambokes* (government owned lands), forest exclusions and new accretions on sea coast and backwater reclamations. It is worth noting here that only from the 1906 Cochin Administration Report onwards, dry land area was also included for assessment of land revenue. From Table 2.1 it can be

seen that out of total landuse, the majority was under dry (garden) land cultivation and the area under such landuse increased from 52.27 per cent of total area in 1906 to 59.46 per cent in 1946.

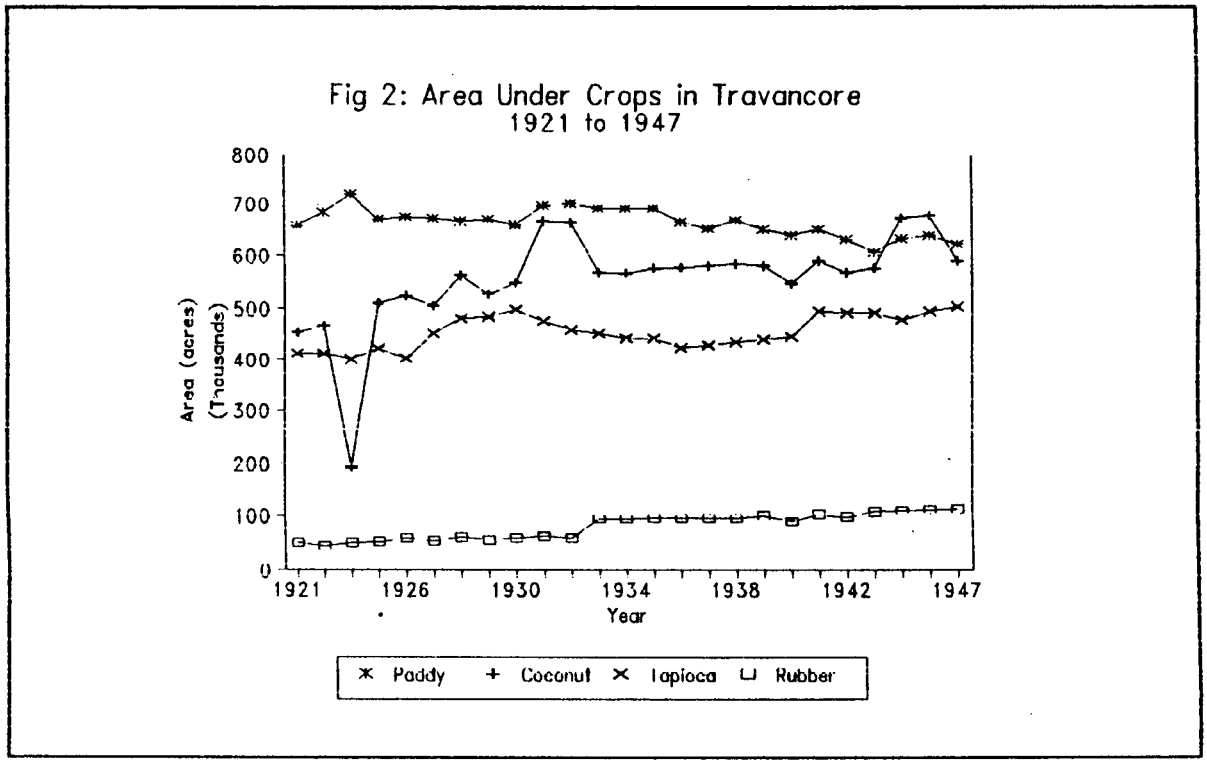
Table 2.1: Patterns of Landuse in Cochin State (1900 to 1946)

Year	Total Landuse (lakh acres)	Different Uses (in per cent) Wet Land	Dry Land
1900	1.31	-	-
1901	1.32	-	-
1904	1.35	-	-
1906	2.95	47.73	52.27
1912	4.82	42.20	57.80
1917	5.01	41.40	58.60
1921	5.03	41.20	58.80
1926	5.05	41.05	58.95
1931	5.08	40.79	59.21
1935	5.09	40.74	59.26
1941	5.09	40.68	59.32
1946	5.10	40.53	59.46

Source: Administration Reports - Cochin State (various years)

In Travancore, in 1920, 1.04 lakh acres of wet land and 3.38 lakh acres of dryland were additionally brought under cultivation (Pillai, 1940, V.III, pp.20-21). It can also be observed that the area increase under dryland was three times that of wetland since the former was seen to be more attractive than the latter.

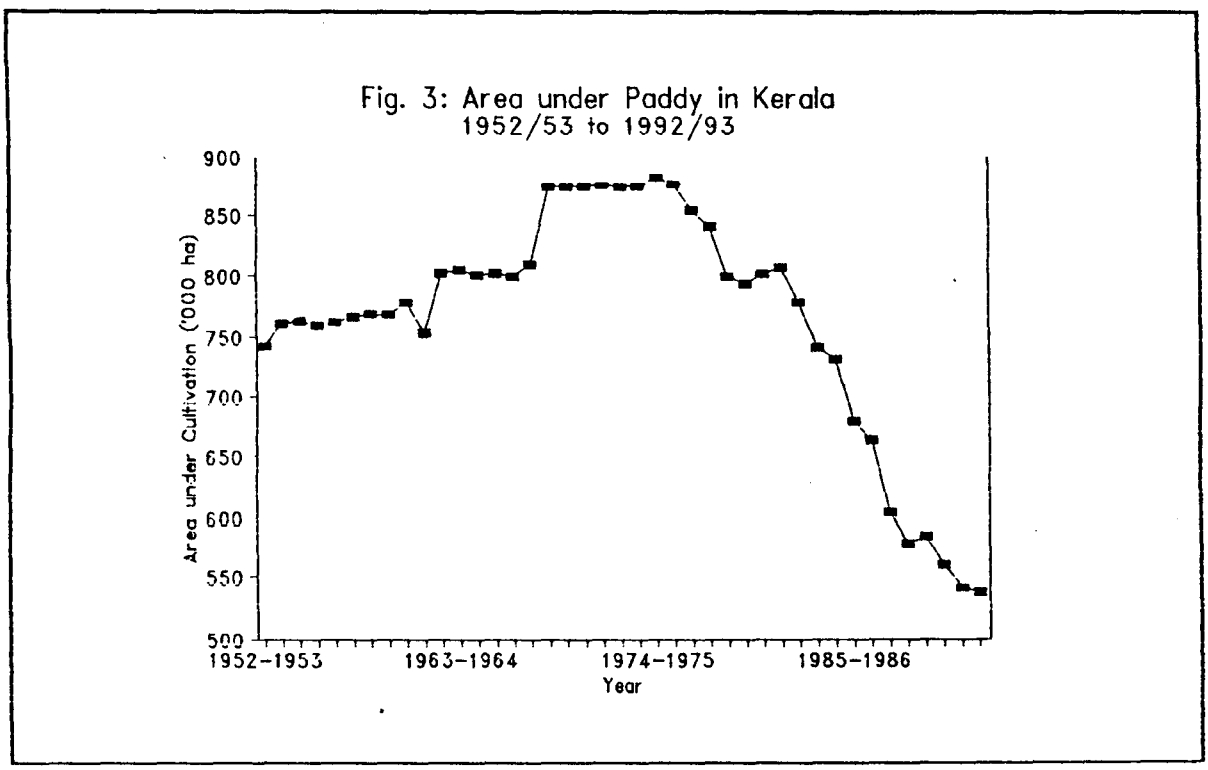
It can be seen from Fig. 2 that the area under paddy in Travancore declined from 6.57 lakh acres in 1921 to 6.22 lakh acres in 1947 at the annual average rate of 0.18 per cent. There is not much decline during the depression years of late 1920's. Simultaneously, the area under coconut increased from 4.55 to 5.89 lakh acres at the annual rate of 5.40 per cent between 1921 and 1947. During the same period, the area under rubber more than doubled and that under tapioca rose marginally at the annual average .94 per cent respectively.



b. 1947 onwards

In the post-independence period, area under paddy expanded from 742,000 ha to 882,000 ha between 1952/53 and 1974/75 (Fig. 3). Areas under tapioca, banana and other plantains increased by over 50 per cent between 1952/53 and 1974/75, and the area under foodcrops by about 92 per cent. Compared to these, the increase in

area under paddy was small.[2] Nearly three quarters of the additional area were brought under commercial crops. Of this group, two crops, viz., coconut and rubber, claim one half of the total addition to cultivated area. Thus significant shifts in the cropping pattern have taken place in favour of commercial crops. These shifts are largely explained by the increase in prices of



commercial crops; the large rise in rice prices did not affect the acreage changes, partly because of the nature of the land and its suitability for rice cultivation brought additionally under cultivation (Panikar et. al., 1978, p. 33).

[2] Panikar et al (1978, p. 31) found that the compound growth rate in area under rice in Kerala during 1951/52 to 1974/75 was 0.9 per cent as against -0.14 per cent in Travancore over the period 1920/21 to 1948/49.

The cultivation of garden lands has built-in advantages in that a variety of perennial crops such as coconut, arecanut, mango, jackfruit and others can be grown along with various seasonal crops such as tapioca, yams, colocasia or other root crops. The crop-mix would vary with the soil type and other agroclimatic conditions among the different parts of the state. The system of inter cropping has been developed to such a high degree of intensity that maximum use appears to be made of the limited land available.[3]

After the initial increase till the mid-seventies, area under paddy noted a steady decline thereafter (see Fig. 3) at the average rate of 2.68 per cent annually.[4] This is in sharp contrast to the area under coconut (except in the last three years) and rubber (see Table 2.2).

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[3] According to a study conducted by the National Council of Applied Economic Research, the gross value of agricultural output per acre in Kerala came to about Rs. 522 during 1960-61 as against an average of Rs.187 for all states; the net value of agriculutral output in Kerala works out at Rs. 445 compared to about Rs. 161 per acre for all States taken together. Though Kerala has a sizeable proportion of the cropped area under commercial crops grown in plantation estates, a large variety of crops such as coconut, pepper, turmeric, ginger, cashewnuts, coffee are raised in garden lands on a non-plantation scale (Panikar et al 1978, pp. 33-34).

[4] This phenomenon is also observed in other studies such as, Panikar (1980), Sivanandan (1985), George and Mukherjee (1986), Kannan and Pushpangadan (1988).

Table 2.2 : Area under Some Tmportant Crops in Kerala 1959-60 to 1992-93 (area in '000 ha)

	Paddy	Coconut	Rubber
1959-60	769.10	493.09	117.45
1963-64	805.08	544.89	144.20
1969-70	874.10	707.80	196.70
1975-76	876.02	673.00	206.70
1980-81	801.70	651.37	237.80
1985-86	678.28	704.68	336.32
1986-87	663.80	706.10	347.81
1987-88	604.08	778.37	358.95
1988-89	577.56	816.88	366.50
1989-90	583.39	878.89	376.00
1990-91	559.45	870.02	407.82
1991-92	541.32	863.06	419.17
1992-93	537.60	860.50	428.86

Source: Government of Kerala, Economic Review (various issues).

c. The Consequences of Changing Landuse Pattern

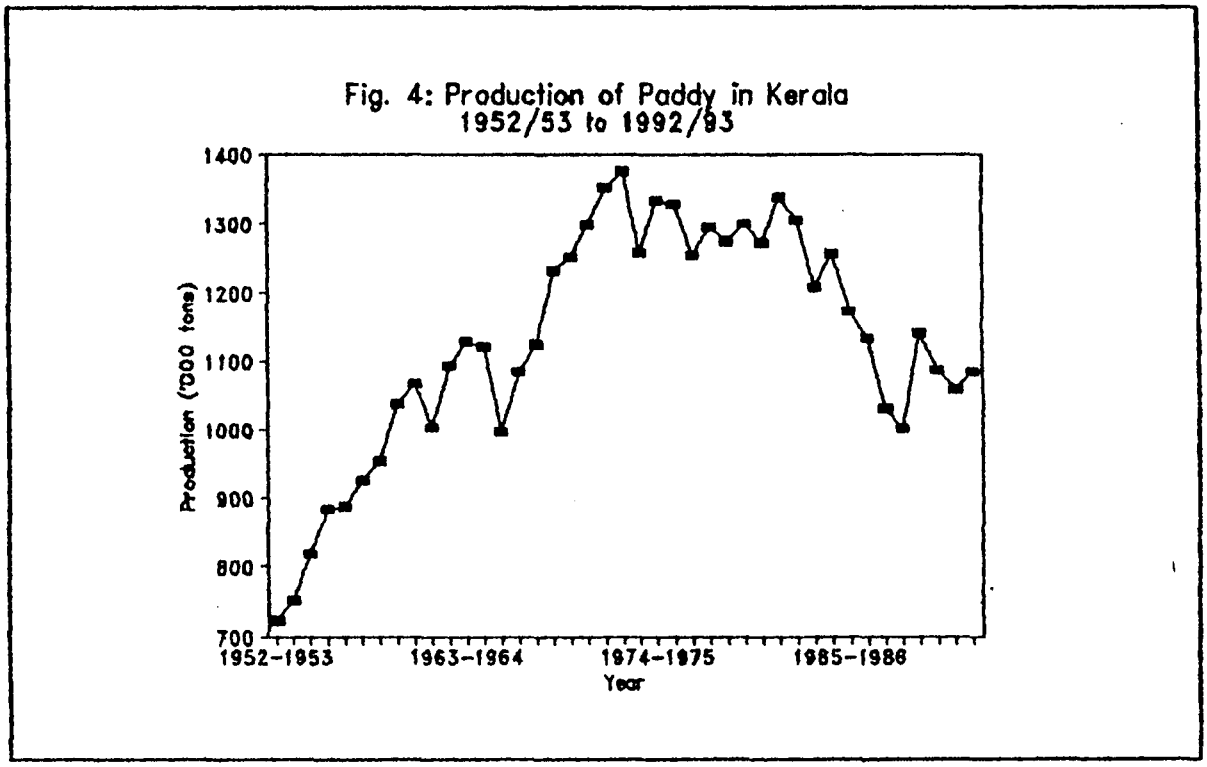
This changing profile of landuse has considerable impact on the production and yield of foodgrains and other crops in the regional econonmy. There was increase in production of paddy till 1931 and a sharp fall in production in the following decade (see Table 2.3). Here it is worth mentioning that the share of total cultivated land under wet land cultivation also noted a fall during this period.

However, paddy production observed a mixed trend in the post-independence period. There was rising production (though with fluctuation) of paddy till the mid-seventies (see Fig. 4) and a sharp decline thereafter. This pattern exactly followed the trend of area under paddy. Tt is worth noting that the yield of paddy production steadily increased from 0.97 tons/hectare in 1952/53 to 2.01 tons/hectare in 1992/93.

Table 2.3: Total Availability and Total Requirement of Rice in Travancore, 1911-1941 (in Lakhs)

Year	Population	Domestic production (cwt.)	Imports (cwt.)	Total supply (cwt)	Total requirement (cwt)
1881	24.02		6.41		
1901	29.52		15.64		
1911	34.29	103.08	13.97	117.05	89.40
1921	39.63	117.33	22.62	139.95	103.31
1931	50.19	124.37	49.12	173.49	130.86
1941	60.70	116.05	45.02	161.06	158.25

Source: Table II.6, Umadevi (1984), p. 62.



Bengal paddy was imported to Travancore for the first time in 1852 to relieve the famine conditions. Such imports continued and Travancore, a net exporter of paddy, turned into a net importer from 1869 onwards (Pillai, 1940, Vol. II, p.2). The gap between internal production and requirement of rice widened, and was filled by increasing imports.[5]

From the Table 2.3, it can be seen that the total supply was well above the total requirement due to large scale imports. Such a large scale free import of paddy thus did discourage paddy cultivation. However the situation dramatically changed with the outbreak of World War II and disruption of supplies from Burma due to the Japanese occupation. Imports from Burma to India dropped from 180 lakh tonnes in 1939-40 to 98 lakh tonnes in 1941-42 and to 0.8 lakh tonnes in 1942-43 (Chopra, 1988). The situation in Cochin state worsened despite fixation of price by the Price Control Committee. The government even went to the extent of purchasing the stocks with merchants and selling them to the retailers. The Central Government took the responsibility of supplying food stuff to deficit areas from March 1943. This compelled the State to take urgent steps to augment internal supplies of food. As a result, the State of Cochin introduced rationing from February, 1943

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[5] Umadevi (1984, pp.57-58) notes that, "while the population of Travancore increased from 2,401,158 to 2,952,157 during 1881-1901 or by less than 50%, paddy imports increased by more than 200 per cent (from 6,40,720 cwts in 1881 to 15,63,850 cwt. in 1901. No data are available for the acerage under paddy for the years prior to 1911). Imported paddy formed 13.5 per cent of the domestic production in 1911, 20% in 1921, 39.5 per cent in 1931 and 38.8per cent in 1941". The agricultural sector, other than paddy, generated surplus to sustain the growing volume of paddy imports (Panikar et al, 1978, p.17). The study shows (p.11) that Travancore's trade surplus rose from Rs. 23.1 lakhs in 1870-80 to Rs.14.7 lakhs in 1930-40.

(Sivaswamy, 1946).

The crisis situation of the 1940's initiated the process to augment food production by extending cultivation mostly to the upland areas. By the end of the 1940's, an intensive crop cultivation system with yams, colocassia, banana and jackfruit in addition to tapioca began mainly for augmenting food supplies.[6]

The increase in the domestic production of paddy during the fifties and the sixties did not significantly reduce Kerala's dependence on supplies from outside the state. Since mid-seventies, the gap between internal consumption and production tended to widen, it has been filled by imports through Central allotment and private trade.[7] The import of rice into the State increased by three fold between 1974-75 and 1978-79. Rice distributed through the public distribution system for the three years 1975, 1976 and 1977 were 5.31 lakh, 9.04 lakh and 13.62 lakh tonnes respectively. In the subsequent years, the supply of rice and other foodgrains in the open market improved so much that there was a perceptible fall in the absorption of foodgrains through the public distribution system. The quantity of rice distributed

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[6] Panikar (1983). The study also observes that "In addition to topographical factors, economic factors promoted the evolution of this cropping pattern. With a fairly continuous rise in the price of rice since the Second World War, this commodity has increasingly proved beyond the reach of the masses. The growth of the production of tapioca made it possible to maintain subsistence to cheaper cereal substitute."

[7] Due to the substantial increase in rice output elsewhere in the country, the large buffer stock with the Central Government and removal of restrictions on inter-state movement of foodgrains, the inflow of rice into Kerala steadily rose and provided a cushion against declining per capita output in the State. (Panikar, 1983)

through the ration shops dropped to 8.95 lakh tonnes in 1978 and 5.48 lakh tonnes in 1979. Since then the improvement in the off-take from the public distribution system has steadily increased through the eighties to reach 17 lakh tonnes in 1991. (See Table 2.4) This overall improvement in the supply position, reflected in the steep fall in price of rice, as well as rise in the cost of cultivation have brought about the unprecedented decline in area under rice since 1974/75.

Table 2.4 : Rice Distributed through PDS, 1965-1991

Year	Rice (in Tons)	Per capita availability of Rice
1965	906400	48.84
1966	848506	44.67
1967	613094	31.53
1968	647885	32.55
1969	838493	41.16
1970	822329	39.43
1971	843315	39.50
1972	886471	40.80
1973	762236	34.47
1974	785570	34.91
1975	538061	23.49
1976	904177	38.79
1977	1362724	57.44
1978	895727	37.10
1979	548603	22.32
1980	769510	30.77
1981	1063287	41.77
1982	1158696	44.93
1983	1288114	49.30
1984	1325308	50.06
1985	1384327	51.61
1986	1554983	57.22
1987	1597962	58.03
1988	1546264	55.43
1989	1269985	44.93
1990	1649273	57.59
1991	1671398	57.61

Source: Economic Review, various issues, State Planning Board, Trivandrum.

The changing landuse pattern and its consequences on paddy production and total rice supply in the state suggests the need to look into the factors directing the changes. These factors can be broadly classified into economic and institutional. The economic factors include relative prices, wage rates etc.. The non-economic/institutional factors as the ownership pattern, caste-class structure, tradition, education, population pressure, fragmentation of holdings and state policies are also found to have a bearing on the evolution of landuse pattern.

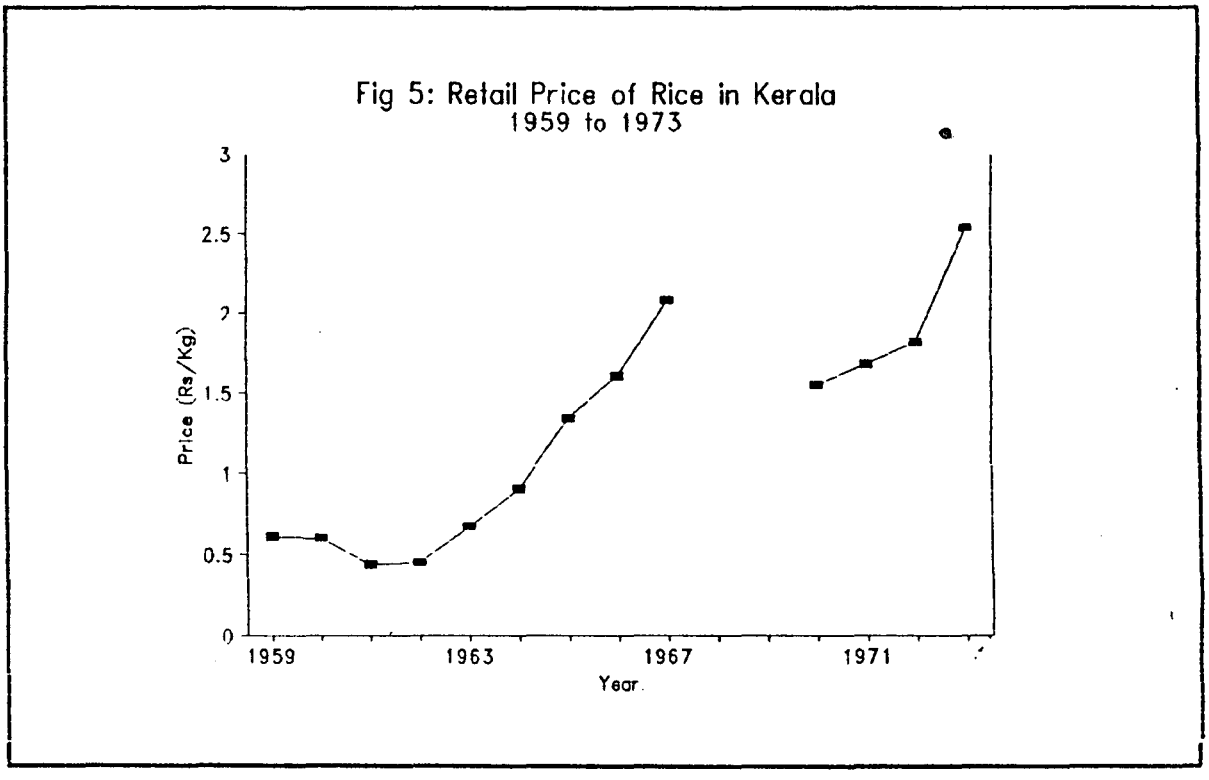
2.3 *Influence of Economic Factors on the Landuse*

i) Prices

The movement of the prices of agricultural commodities often exert an influence on landuse. This is well demonstrated by the developments in the period 1900-1947. During this period the price of paddy showed a declining trend with occassional revival such as in 1919-1924, while plantation crops such as pepper and rubber indicated a rising trend in prices over the entire period of time. During the Great Depression of the late 1920's, however, prices of most crops including paddy declined. The decline in paddy price was mainly attributed to large scale dumping by Siam and Indo-China in the Indian market. In the period after the First World War and prior to the depression, prices of coconut oil, copra and coir increased by more than two times and thereafter a declining trend set in from 1929 (Umadevi, 1984, p. 66; Panikar, et. al. pp. 8-9)

Menon (1994) gives the rise in price of coconut due to the enhanced demand of coconut in 1920s in the world market as the

reason for the increase in the area under coconut in Malabar. Lands were converted from paddy cultivation to the growing of coconut, and many leases on wet land were beginning to include the stipulation that they should be converted to coconut gardens. By 1930, the value of land growing coconuts had risen to well above 300% of that of wetlands (Menon, 1994, p. 24). The value of land in Travancore also rose steadily till 1928-29, but began to decline thereafter. The price of wetland fell by about 50 per cent and that of gardenland about 16 per cent (Pillai, 1940, V.III, p. 9). Both these phenomena might be due to the fact that wetland cultivation has been increasingly becoming un-remunerative compared to dryland cultivation. This affected the area under paddy also.



In the post-independence period, as domestic production was not sufficient to meet the requirement, price of rice remained high throughout the period. Since mid sixties, the retail price of rice in Kerala registered a notable increase, as can be observed in Fig. 5. Between 1959 and 1973, the increase in the retail price of rice was over four-fold, the index number rising to about 415 by the terminal year. *This is one of the major reasons for the increase in the expansion of area under rice* (Panikar et. al., 1978, p. 29).

Though absolute retail price for paddy rose, it is worth looking into the movement in relative prices from mid-seventies, when paddy field conversion took place at a significant rate. The study by Sivanandan (1985) suggested that the movement of relative price of paddy and shifting of area from paddy to coconut was

Table 2.5: Average Farm Prices of Paddy, Coconut and Rubber, 1970/71 to 1992/93

Year	Paddy Rs/100kg	Coconut Rs/100nuts	Rubber Rs/100kg
1970/71	90.25	56.68	464
1975/76	182.98	66.86	744
1977/78	130.69	98.71	632
1978/79	125.76	102.09	953
1979/80	133.24	114.27	1016
1980/81	156.84	139.54	1212
1981/82	182.85	115.37	1431
1982/83	208.16	144.32	1409
1983/84	251.62	242.73	1708
1984/85	200.76	261.60	1587
1985/86	240.99	146.91	1661
1986/87	243.92	241.40	1592
1987/88	275.50	282.90	1726
1988/89	295.07	262.59	1745
1989/90	290.47	203.81	2057
1990/91	299.61	301.23	2023
1991/92	374.17	393.31	1975
1992/93	420.80	420.14	2420

Source: Statistics for Planning, GOK, various issues; Economic Review, GOK, various issues; Indian Rubber Statistics, GOI, various issues.

somewhat correlated. Till 1968-69, when relative price of paddy with reference to coconut went up, there was no shift away from paddy. The relative price became unfavourable from 1968-69, and that appears to be the main reason for the substitution of paddy by coconut. But since coconut is a long gestation crop, there was a lagged response in area to price changes (Sivanandan, 1985).

Support price given to some crops affect the area under them in determining the kind of a crop mix. The example of rubber is worth mentioning in this context. A guaranteed minimum price for rubber growers is assured by the various price supporting mechanisms operated in India from the 1940's. During the period 1940 to 1946 it was in the form of monopoly procurement of rubber by the government at a statutory price. From 1947 to 1981 it was in the form of a statutory minimum notified price based on Tariff Commission's reports. During the 1970's, when there was glut in the domestic market, price support operations were carried out by the State Trading Corporation by procuring natural rubber and exporting it. In the mid-eighties, when the domestic price of rubber registered a sharp decline, the Government of India introduced a buffer stocking scheme, which is still prevalent[8].

ii) Labour cost and Labour Mobility

However, prices alone do not determine the profitability and hence landuse decisions. For this, the input costs of cultivation

[8] Information collected from the Statistical Division, Rubber Board.

for paddy are to be taken into account.[9] The rate of productivity growth has not been commensurate with that of real wages especially in paddy cultivation (Kannan, 1988). Jose (1991) found that while the price of paddy has risen around three times during the period 1970-71 to 1988-89, labour cost which contributes a substantial portion of the total cost of cultivation of paddy registered six-fold increase.

Paddy cultivation demands timely labour for different operations like ploughing, transplation, water control, weeding, manuring, harvesting and threshing. All these operations need specific number of labour at particular time which make paddy cultivation highly labour dependent. Jose (1977) argues that managing the labour in the case of paddy operations became difficult and the critical role played by labour made it even more difficult. In certain parts of the state, due to trade union and Government intervention, the farmers have lost not only control over wages, but also the decision making power regarding the size of workforce to be employed and mechanization of operations (Kannan, 1988).

The flow of paddy field workers to the booming construction sector in Kerala was observed by Jose (1991) in a periurban area of Trivandrum. This phenomenon was confirmed by Francis (1991) for Kuttanad, a primarily rice growing area of the state. The reason,

[9] The increasing cost of cultivaton and hence declining profitability has been put forward as one of the major factors for the shift away from paddy. (George, 1980; Unni,1983; Panikar,1983; Kannan and Pushpangadan, 1988).

as in Krishnan (1991), behind such a fact is the migration of traditional artisans to West Asian countries and urban centres for better rewards and the unskilled labour requirement for the booming construction sector in Kerala in mid seventies was met by the labourers from agricutlural sector. In the construction sector, after the migration of traditional skilled artisans, the time taken to acquire skill for unskilled ones is rather brief (Prakash,1985).

When the average daily wages between paddy field labour (male) and construction worker are compared, it is found (in Table 2.6) that till 1983-84 high differential prevailed between the wage rates of construction worker (both skilled and unskilled in rural and urban areas) and that of the paddy field workers. The rate differential between paddy field worker and unskilled construction labour (both rural and urban) reduced thereafter. However, the

Table 2.6: Average Daily Wage Rates: Paddy Field Labour and Construction Labour (Rs / day)

	Paddy field labour(Male)	Construction sector (1960/61 to 1992/93)			
		Skilled (Rural)	Skilled (Urban)	Unskilled (Rural)	Unskilled (Urban)
1960-61	1.85	-	-	-	-
1965-66	-	-	5.41	-	3.31
1970-71	5.09	8.19	8.73	5.40	5.71
1978-79	8.99	15.23	15.68	9.86	10.42
1979-80	9.58	16.66	17.42	10.72	11.43
1980-81	11.13	18.75	19.36	12.30	13.07
1981-82	12.74	22.66	23.01	15.22	15.94
1982-83	13.29	28.13	30.80	17.85	19.09
1983-84	15.86	33.29	35.12	20.29	21.18
1984-85	23.60	36.65	38.03	21.90	22.80
1985-86	26.08	41.10	42.01	25.31	25.70
1986-87	28.36	44.24	45.91	27.66	28.42
1987-88	30.36	49.32	50.04	31.31	32.23
1988-89	31.95	51.17	52.00	32.92	33.55
1989-90	33.31	53.23	53.87	34.15	34.95
1990-91	35.77	56.00	56.00	37.00	37.00
1991-92	41.38	59.00	61.00	39.71	41.63
1992-93	48.40	68.07	70.23	46.34	48.66

Source: Government of Kerala, Economic Review, various issues

wage rate gap between skilled construction and other workers persists even after 1983-84. Once a worker gets into the construction sector, the change from unskilled to skilled takes only a short span of time. The difference between rural and urbanis also reduced due to the well developed transportation facilities in the state. Due to these reasons, the construction sector work has become a very attractive proposition to the paddy field worker especially of the younger generation whose social stigma of caste is related to the traditional paddy field work.

2.4 *Impact of Institutional and Other Non-economic Factors*

i) Caste structure

In Kerala, the caste system spreaded its root across the population from the ancient times. Agriculture and allied activities have been one of the main sources of livelihood to most castes in addition to other traditional occupations.[10] The upper castes having access to abundant land and other natural resources, inevitably tried to establish their economic and social life based on land (Census Report, Cochin State, 1931, p. 145). However, there existed great disparity in the distribution of population across different physiographic terrains in the state.[11] This means

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[10] Census Report, Cochin State, (1901) as cited in Census Report (1931), p. 145.

[11] To quote Census Report (1931):
"But for the small area occupied by the lagoons, the former (sea board lowland) taluks comprise extensive coconut gardens, thickly dotted with houses, the cultivation of coconut trees not interferring with the rearing of homesteads in their midst. The various industries in connection with the cultivation of coconut palms, rich fisheries of the sea and the lagoons, the fertile rich fields on the margin of the latter and the multifacious occupations of a commercial and maritime tract can afford to maintain a fair degree of comfort a population so densely packed, that it must

that paddy cultivation was the main economic phenomenon around which the whole socio-economic and political process was revolving in the mid and moderate highland regions at the beginning of the century (in the highlands, plantation economy was gaining grounds). As agriculture was the main economic activity, there was very little occupational mobility leading to a virtual stagnation in the economy.[12] However, Kannan (1988, p. 48) characterises the predominantly agrarian economy as consisting mostly "of landless labourers attached to their masters".[13]

ii) Education

The advent of education due to conscious State policies (Tharakan, 1984; Nair, 1979), resulted in the emergence of a middle class in the society. This new class opted for occupations other than those related to land. Moreover, they rented out their land to tenants who do not have requisite 'skill and knowledge' for agricultural growth. (Cochin State Manual, 1911, p. 203) This added to the already existing stagnation in agriculture in the

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inevitably starve in less favoured regions. In the forest taluks, the inhabitable area is only less than two fifths of the total area. These taluks depend mainly on rice cultivation for the support of their population and they contain extensive rice fields in which no houses can be reared. The cultivation of rice in a given area, as it does more capital and labour than the cultivation of coconut palm, cannot find occupation for, or supply means of livelihood to, as many people as may be maintained in an equal area on the sea board with its coconut plantations, fisheries and other facilities." (pp.11-12)

[12] See Balakrishnan (1983) for more details of the stagnant or stationary nature of the economy.

[13] Balakrishnan (1983) also points out to this fact.

economy. In Travancore also, the situation was no different.[14]

Though the spread of education changed the rigid social customs and practices of the predominatly agrarian society, it changed the attitudes of the people both in Travancore and Cochin.[15] The educated found it difficult to practise their hereditary profession and any menial jobs and this created a pool of 'educated unemployed'. This tendency has aggravated over time in post-independence Kerala.[16]

This kind of attitude of the people progressively kept them away from agriculture, particularly from traditional agriculture like paddy cultivation. This means that owners and substantial tenants had little attachment to the land. Since cultivation was done by undertenants having insecurity of tenure, they had no

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[14] To quote Pillai (1940, V. TTT, pp.2-3) : "The middle class people are reluctant to work the spade or hold the plough. Instead of the owners of lands cultivating them, as was the custom, we now find absentee landlordism and a general disposition to lease out lands for such rents as they may fetch. People are tempted to sell away their lands, especially when they are in small parcels, rather than try their hand at 'tantalising agriculture' which, after all, fails to enable them earn a livelihood. The usual training in schools gives them the incentive to do so. The educational institutions are within easy access through out this State and even the poorest take the trouble and submit to the sacrifices involved in sending their children to school, envisaging the prospect of securing employment, under government in some capacity or other."

[15] Census Report, Cochin State, 1931, p. 203 and Pillai (1940), V. II, p. 3.

[16] Tsaac and Mukherjee (1994) confirms this trend by pointing to the fact that the educated unemployment in Kerala is due to their look out for the 'preferred job' (which is still a job in Government service) in Kerala. Jose (1991) relates the phenomenon of non-availability of labour for paddy cultivation to the evolution of the social structure of the state which evolved due to emancipation of education.

motivation to develop land qualitatively.

iii. State Policies

Additionally, the conscious State policies on land and labour created an atmosphere for the promotion of commercial cropping (Umadevi, 1984). The creation of title to land by the government did away with the existing forms of ownership of land (e.g. jenmi, sirkar etc.) and encouraged private property as an instrument of production. This facilitated the commercialistion of land and thereby brought about a fundamental change in the customary modes of land tenure. This was because the organisation of land, labour and capital in the case of paddy cultivation was not done on a commercial basis, but was interconnected with the social, economic and cultural factors. This is definitely a movement away from paddy cultivation and the one in favour of commercial crop production (Umadevi, 1984, p. 29).

Added to pattom proclamation, government's differential tax structure on wet, garden and waste lands also encouraged a shift away from paddy. For the purpose of taxation, lands in Travancore were classified as wet, garden and waste lands. The Government's taxation policy encouraged the cultivation of tree crops rather than paddy. It can be shown that the tax on paddy lands worked out to about 20 per cent of the gross income, on coconut lands to about 1.5 per cent and for lands under rubber to about 2 per cent.[17] Eventhough the lands taken up for the cultivation of plantation crops (other than coconut) were not suitable for the cultivation of

[17] For the rate of taxation on wet, garden and rubber lands, refer Travancore Land Revenue Manual (1940), Vol. IV.

paddy yet the policy of taxing lightly the growers of plantation crops and taxing heavily the growers of paddy amounted to subsidizing the former at the cost of the latter (Umadevi, 1984, p.33).

This policy of differential taxation was meant for promoting market-oriented cultivation, especially the external market. Panikar et. al. (1978) noted that the commercial crop sector of Travancore responded positively to the stimulus provided by a growing export market and comparatively high prices (except during the depression).[18] The exports from Travancore increased, yielding an ever increasing trade surplus over the decades. Given the relative prices of the state's principal imports and exports and the then prevailing foreign trade arrangements; allocation of agricultural resources in favour of non-food crops,seems to have been advantageous to Travancore. Also, the land on the extensive margin brought under cultivation was not suited for paddy growth. So the growing deficit in food requirement was met by imports.

iv. Fragmentation of holdings

The fragmentation of holdings added newer dimensions to the problem. This was primarily due to the breaking of joint family system in Cochin and Travancore. Moreover, the state historically had a high man-land ratio.[19] The State policies like the 'Nayar Regulation of 1921' and others accelerated the process of disintegration of properties (mostly land) belonging to these

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[18] Studies have observed significant correlation between the export prices and the area under cultivation.

[19] Refer Table 4.6 of this essay.

communities in Travancore (Pillai, 1940, V.TIT, p.6). In Cochin, disintegration in the family structure resulted in the 16.47 per cent increase in the number of houses and garden lands since the 1920's (Census Report, Cochin State, 1931). Moreover, this process of fragmentation of the social structure must have also contributed significantly to the emergence of small peasants.[20] Added to such small holdings for cultivation, habitat planning of Keralites with a house and courtyard increased the demand for land (Census Report, Cochin State, 1931).

In the post-independence period, the institutional change in the form of land reforms augmented the land fragmentation process. The Land Reforms (Amendment) Act, which came into effect in 1970 abolished tenancy. The land ceiling, taking over and distribution of surplus land during land reforms created a good number of new owners of land, most of them small and marginal. Such changes resulted in the creation of many uneconomic holdings which were unable to sustain farming families. Since plantations, private forests and land belonging to religious and charitable institutions were exempted from the ceiling limit, it was mainly the paddy and coconut lands which got subdivided (Nair, 1989). But consolidation of area under plantation crops started much before 1970.[21]

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[20] To quote Pillai (1940, Vol. TTT, p.7): "Travancore is a country of small hodlings. Of the total number of holdings about 6 per cent are less than 20 cents in extents, about 26 per cent less than 60 cents, 38 per cent less than 5 acres and 95.5 per cent less than 10 acres. Only 4.5 per cent are 10 acres and more. If 10 acres is considered to be the minimum size of an economic holding, only less than 5 per cent of the holdings are economic. Similar findings are also obtained in Krishnaji (1979), p. 117.

[21] This is because the institutional changes for a more equitable land distribution were anticipated since the Communist Ministry in 1957. For a quantitative estimation of cropping pattern from 1955-56 to 1968-69, see Oommen (1971), Appendix B.

The process of land reforms brought about a change in the agrarian class structure. The erstwhile non-cultivating rentier landowners 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 (Oommen, 1985). According to Raj (1992), the small plots transferred to landless households were also an important element in the qualitative changes brought about in the distribution of economic and social power in the Kerala country side. They could improve their bargaining power in the labour market.

v. Irrigation

Irrigation is one of the crucial inputs in paddy production and the type of irrigation projects undertaken indicate the technological lapses of declining production (Raj, 1983). Moreover, the scarce investible resources available for irrigation had been spread too thinly among a number of large projects which are still in an incomplete stage. In the case of large irrigation projects, very little was given to distribution and control of water to the fields. The sole preoccupation was on providing water and not its management[22]. There was also a disparity between the quantum of water discharged from the dams and its reach in the fields with hardly 46 per cent of the water let out from the dams available for

[22] It is indicated that the marginal output of paddy due to irrigation from large projects was only 200 to 250 kg per hectare and the cost of irrigation worked to Rs.15000 to Rs. 20000 per hectare.(Government of Kerala, 1981)

irrigation in the fields (Government of Kerala, 1981). It is also noted that within irrigation priority assigned is the opposite of what the State requires. Most of the resources are committed to building large irrigation dams accounting only for 12-13 per cent of the total irrigation expenditure. According to Kannan and Pushpangadan (1988), "major irrigation has given only minor benefits and major benefits have come from minor irrigation". They calculated the cost of major irrigation systems so far implemented as almost six times higher than the minor irrigation system.

vi. Demand for Land for Non-agricultural Uses

From the latter half of the seventies an interesting phenomenon emerged . As a result of increasing remittances from the Middle-east from that period onwards, a disequilibrium occured in the land market via the phenomenal increase in land prices (Kannan, 1988). The additional demand for land was for the construction boom in Kerala during the period. Land was also put to speculative use due to higher levels of return than traditional paddy cultivation. Paddy lands being cheaper were converted to building houses.[23] The individualistic attitudes developed due to nucleation of families demanded more land for housing. This process was accentuated by the presence of a strong middle-class in the society as a result of the growing tertiary sector. Paddy lands being relatively cheaper, have been increasingly used to meet this growing demand especially in the peri-urban areas.

[23] This phenomenon occured despite the Landutilisation Order Government of Kerala, 1967.

2.5 *Summary*

The analysis in this chapter was an attempt to bring out the salient features of the historical evolution of landuse dynamics, with an emphasis on paddy cultivation. It is observed that the area under paddy either remained stagnant (in the colonial period) or declined sharply (as in the post mid-seventies) barring some years from early fifties till mid-seventies. Over the period increasing area was brought under commercial crop cultivation. The observations suggest that institutional factors are as responsible as the economic factors like prices and labour costs in shaping the landuse pattern at the macro level.

Being basically an agrarian economy, the state encouraged cultivation of commercial crops which was produced for the external market. Due to this, the area under commercial crops in the state increased steadily during the whole period of analysis. Import of foodgrains kept the price of rice increasing throughout except during World War II and the latter part of sixties. The increasing cost of cultivation without the commensurate increase in prices resulted in the decline in profitability of paddy cultivation. Supply of rice through PDS during this period ensured availabilty of the grain at fair prices which prompted the farmers to earmark more and more areas under commercial crops. More remunerative prices of competing crops also played a vital role.

Institutionally, paddy was done in an exploitative social structure, where respective roles of all communities were fixed. The cultivation was done on a non-commercial basis. The change in social ramification in Kerala brought about particularly with the

spread of education induced a tendancy for all sections of the society to move away from traditional agriculture. The possibilities of occupational mobility after 1970's also added to this. The fragmentation of land made holding size uneconomic. The enhanced remittances which came into the economy increased the land value due to speculation in real estates. All these factors cumulated to a situation where traditional agriculture, became an unprofitable option. With these macro insights of the process of change, the following chapters are devoted to delineate the specificities of a representative micro area.

Chapter III

APPRAISAL OF THE PHYSICAL REALITIES

3.1 Introduction

The land we see today is the result of a combination of natural processes and human influences. There are two aspects of the phenomenon: the natural characteristics or the physical peculiarities of the land and water system and the human or biotic interventions into the system. In the present chapter, we will look into the first aspect.

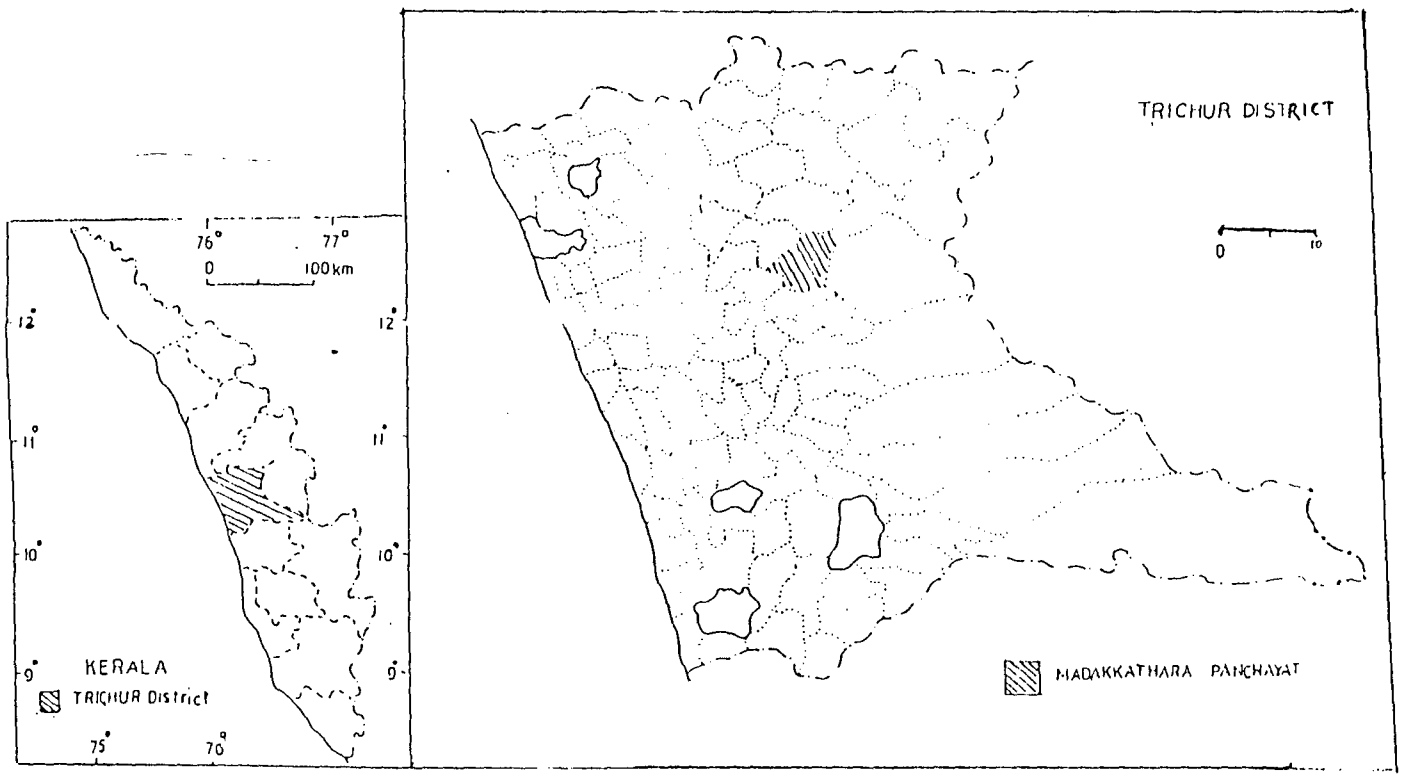
Land and water are not uniformly distributed even at the microlevel. The type of land and its quality vary from one place to other. Each parcel of land has an optimum production potential and a particular land unit cannot be used for all types of activities. There is a definite correlation between climate, geology, landscape, soil fertility and availability of usable water. In Kerala, due to the uneven nature of the highland and midland terrains (which cover 90 per cent of the total area), even places having the same climate and rainfall exhibit an array of agro-climatic regimes from summits to valleys. Hence, for any meaningful intervention towards formulating a sustainable landuse strategy, the appraisal of physical realities at the microlevel is needed as the first step.

3.2 *Study Area*

The topic of study is concerned with the use of land and its environmental sustainability with reference to paddy cultivation, particularly in the midland and moderate highland terrains. The area selected for the present study includes 14 micro watersheds coming under the Chalakudy watershed in the Madakkathara panchayat of Trichur district (See Map III.1).

Map III. 1.

Location Map



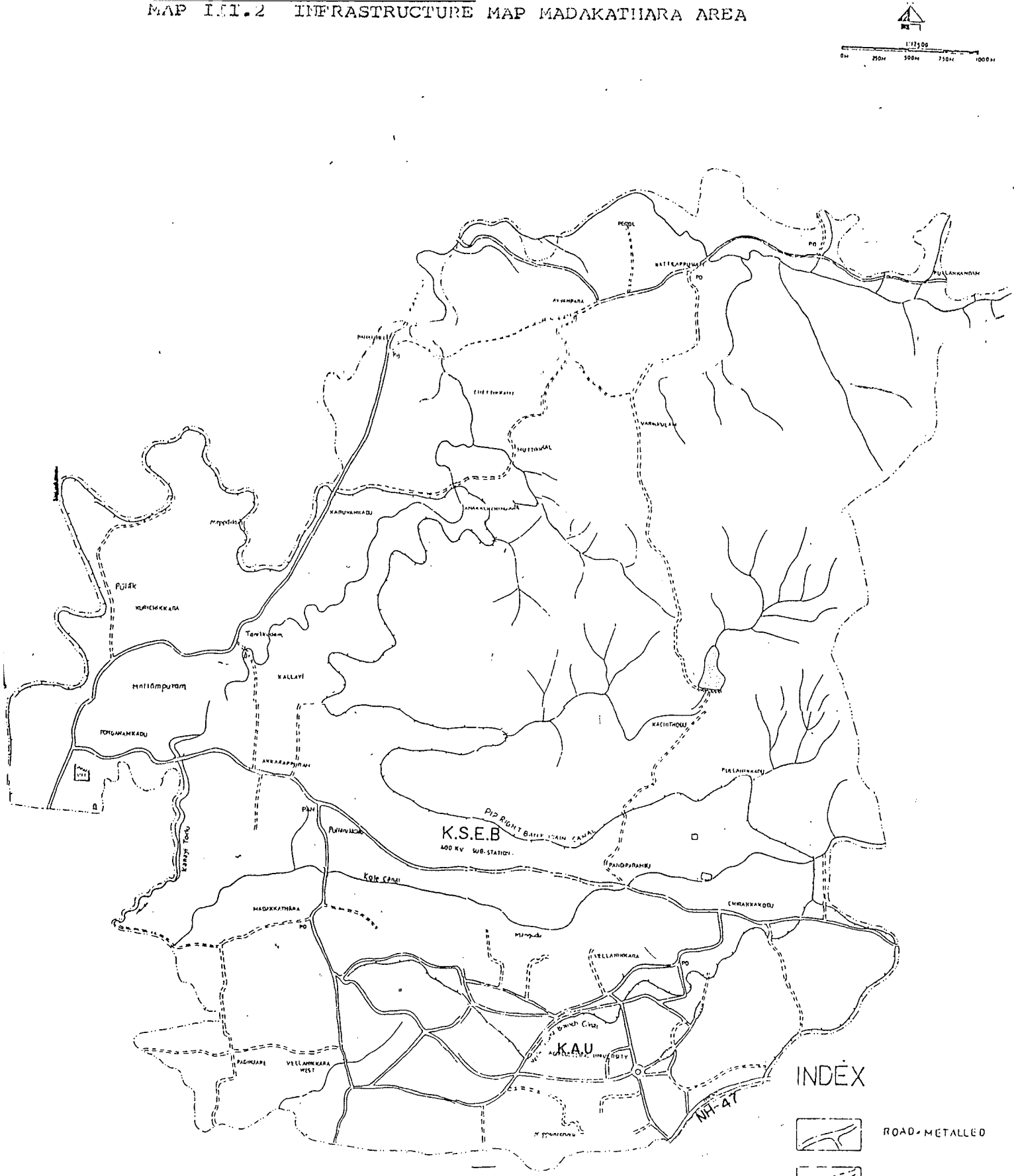
SOURCE :- CESS

Madakkathara panchayat is 9 k.m. north east of Trichur town lying between 76°14'44" E and 76°18'54" E longitude, 10°32'20" N and 10°36'8" N latitudes covering an area of about 32 sq. k.m., falling in Survey of India Toposheet No.58 B/2,58 B/6. The Madakkathara panchayat, is bounded by Killanur in the east, Ollukkara in the south and Vilvattom panchayat in the west. As per the 1981 Census, the total population is 17,940 covering 9 wards. Though the area is in the suburbs of Trichur town, it still retains its rural characteristics except in the southern most portion, where the Kerala Agricultural University (KAU) is situated. The National Highway (NH) 47 also passes through the periphery of the panchayat near the KAU. Because of these, there is a wide network of roads and hence an enhancement of land value in the southern portion of the study area. A KSEB 400 KV substation is also situated here.

The Peechi Irrigation Project located in the neighbouring Panancheri panchayat is catering irrigation water exclusively for paddy. The main sources of irrigation in the study area are the PIP Right Bank canal, Kole canal and Kallayi *thodu* (see Map III.2). The stream marked 'Kole canal' in the map was originally a natural stream and subsequently taken up by the Irrigation Department to cater to the needs of the Kole lands situated 10 k.m. to the west of the study area.

The area exhibits heterogeneity in physical characteristics. The eastern part is bounded by hills of elevation upto 400m with steep slopes and V-shaped valleys and the western part is a broad valley of elevation below 10m with islands of gentle uplands showing the characteristics of a lowland terrain. The middle part is covered by rolling lateritic hills and U-shaped valleys showing

MAP I.T.2 INFRASTRUCTURE MAP MADAKATHARA AREA



SOURCE :- CESS

midland characteristics. Therefore, the area can be taken as a typical case to do a microlevel study as it can qualitatively represent the three main physiographic units in the state.

In the present chapter, the physiographic characteristics of the study area, including the landform, soil and water availability, will be discussed along with the present landuse and its environmental consequences. This is followed by the detailed analysis of one landform unit -- the valley fills and the physical changes of paddy growing areas (PGA) over a period of time.

3.3 *Methodology*

A generalised landform map of the study area is prepared by using remote sensing techniques (aerial photographs taken in 1990) and also information and maps generated by the Centre for Earth Science Studies (CESS) and Kerala State Landuse Board (KSLUB) as part of the Panchayat Resource Mapping programme. The information collected about the related parameters of soil, water availability and land use are superposed over this to derive an idea about the environmental consequences of the use. From this the conservational requirements and the desirable landuse for each landform unit and thereby the deviations of the landuse practised from the ideal or desirable ones is brought out in a tabular form. The physical changes of paddy growing areas over a period of time is done using the Survey of India toposheets for the periods 1910, 1967 and 1980[1]. The paddy growing areas (PGA) is plotted into the

[1] The 1980 map has largest scale of 1:25,000, meaning one unit in the map is 25,000 units on the ground or 1cm in the map is 250m on the ground. Likewise the 1967 toposheet has a scale of 1:50,000 and 1910 has the smallest scale of 1:63,360. So the scale and size of the map has an inverse relationship.

same map and divided into seven sectors according to their location[2] and fourteen sub-sectors depending on their physiography, (mainly the contours[3]). The area under each subsector is calculated using a digital planimeter. The information from the maps are digitised and made into the raster format using ILWIS[4] programme and the colour printout obtained is presented in the form of a photograph. The area of reduction in each subsector for the two time periods (1910 to 1967 and 1968 to 1980) is presented in the form of a table. The rate of reduction in both these periods is calculated using the compound growth rate formula.

The major limitation of the methodology is the time gap between the first two sources which comes to 57 years. However, this is partly rectified by the discussion in the preceding chapter. Also slight errors during the cartographic exercise results in possible distortion of area because of scale limitations.

3.4 *Landform Ecological Peculiarities and Landuse of the Study Area*

a. General Physiography

Before going into the details of landforms, we will look into

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[2] For this, the 1910 map is used since it has the maximum area under paddy.

[3] Contours or contour lines are lines in the map connecting the places having equal elevation from the mean sea level. The study area has a maximum contour value of 400m and the minimum is below 10 m. (according to the 1980 toposheet). As the scale, the contour interval also vary among the maps. The 1980 map has a contour interval of 10m, the 1967 has 20m interval and 1910 has one of 50 feet. The interval from the 1980 map is used to delineate the sub sectors since this has the smallest interval and hence the maximum details.

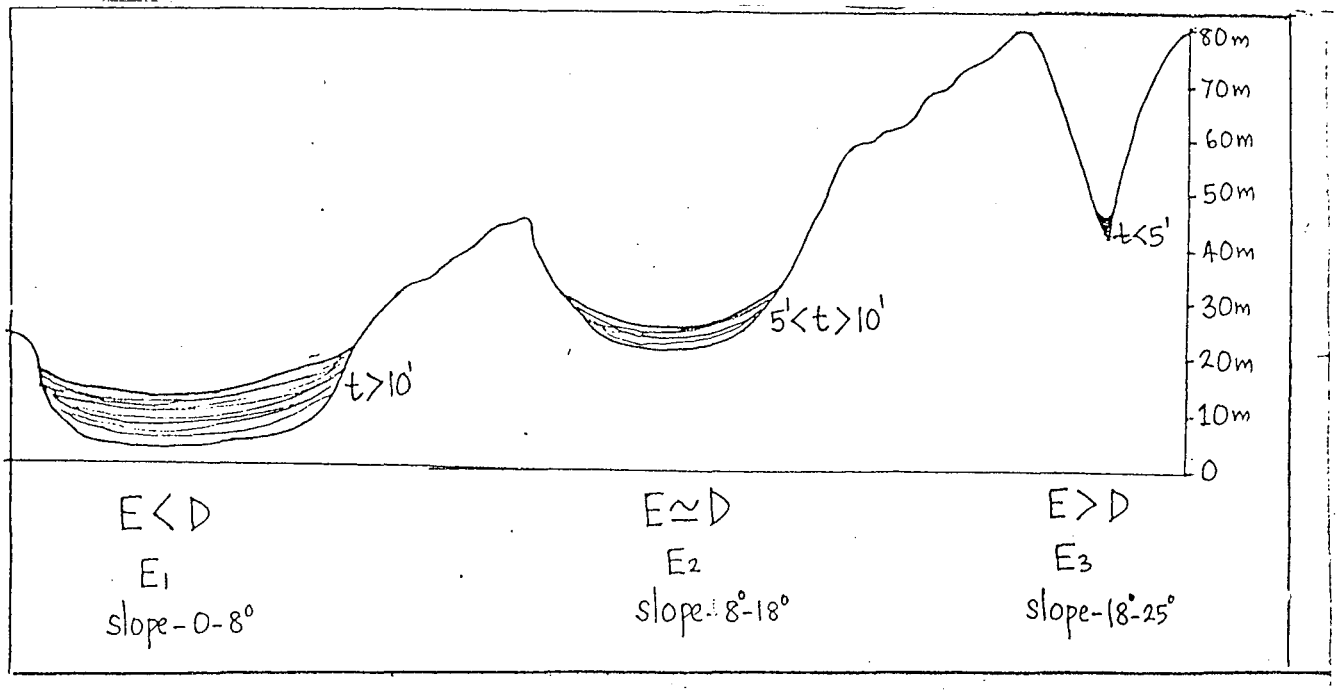
[4] This is an image processing cum map generation Geographic Information System (GIS) software developed by the ITC, Netherlands.

the general physiography of the study area, which shows the broad characteristics of the highland, midland and lowland terrains that extend from northeast to southwest.

The highlands have V-shaped slopes which are steep to very steep (above 18°) and shows a high degree of erosion (E3). The gradient (slope of the valley bottom) is also steep and hence the streams in these valleys flow very fast. The weathered material from side slopes reach the valleys fast. More coarser materials come to the valleys because of the steep slopes and fast fluvial activity. Since in the highland terrain, the process of erosion is faster than the process of deposition (E>D), the depth to bedrock (t) is thin.

FIG. 111.1

Cross section diagram of the high, mid and Lowland Valleys in the study area



The midlands have rolling lateritic hills and broad U-shaped valleys with moderately steep midland slopes. The intensity of erosion is only medium(E2) with the erosion almost equals deposition (E≈D). The depth to bedrock (t) in valleys is greater than the previous case. (see Fig. III.1)

In the case of lowlands, the valley-upland demarcation is not very conspicuous since the lower the slopes and gentle summits occur as islands in broad expanses of valleys, hence erosion from the upper portions is minimal and deposition is more (E<D). So the depth to bedrock in the lowland valleys is greatest among the three. From this it can be inferred that the slope and erosion parameters decreases from highland to lowland terrain, so do the depth-width and elongation (l/b) ratios of the valleys. The gradient of valley floor also has same trend and hence the thickness of fill material (see Fig III.1).

Geomorphology is the branch of earth science that deals with the processes of landscape development. Here different landform units are identified. Variations with respect to the matrix of slope-water availability-surface material-erodibility is minimum within a landform unit. Depending on these, each landform unit has a capacity for certain uses which are conformable to the landscape ecological peculiarities. Hence such desirable landuses (dependent on the above mentioned matrix of parameters) can be generalised for each landform unit.

b. Landforms

Any landform unit is composed of an assemblage of slopes of various types and gradients and evolved by the interaction between climate, relief, lithology and drainage (Thrivikramaji,1986). In

short, these are landscape ecological units formed by natural process of erosion and deposition. Since the variations of other parameters of landuse is minimum within the landform units, identification, measurement and description of these units are necessary for any scientific land management-landuse studies. Accordingly, the following units (see Map III.3) were identified in the landform map of the study area :

i. Summits (S) are the highest portion of the high and midland hills which are flat or gently sloping;

ii. Upper Slopes (US) are found only in the eastern highland terrain with steep to very steep slopes ($>18^0$);

iii. Mid Slopes (MS) have moderate to steep slopes (8^0-18^0). They occur in the midland hills below the upper slopes and summits;

iv. Foot slopes (FS) are gentle to moderate sloping landforms sandwiched between upper or mid slopes and valleys coming in the high and midland terrain ($<8^0$);

v. Lower Slopes (LS) are usually lowermost areas above valleys, sometimes occupying extensive areas in lowland and midland terrain ($<5^0$);

vi. Ridge Lines are usually the waterdivides seperating the area into different watersheds as given in the map along with the directions of slope;

vii. Valley fills (VF) are the lower most geomorphic units which are sediment reserves formed by a combination of slope processes and stream deposition. The valley fills of the study area could be divided into three categories according to the nature of the terrain (as described in Fig. III.1).

c. Soil

The different soils in the study area can be generalised for the different landform units. The summits and upper slopes of the

MAP III.3

LAND FORM MAP OF STUDY AREA

SOURCE :-

COMPILED FROM

LANDFORM MAP (CESS)

AERIAL PHOTOGRAPH (KSLUB)

eastern highland terrain is covered with forest loam soil which has a sandy loam texture (gravelly). These are well drained soils. The depth of the soil varies from 50cm to 100cm .

The mid slopes and summits in the midland terrain is covered by sandy loam (gravelly) soils of lesser depth (less than 50cm). The valley fills are fluvial in origin and hence this is covered with alluvium of silty clay or clayey silt texture which are usually more than 100cm in depth (except in highland valleys). These are ill drained soils. The rest of the area (footslopes and part of lower slopes) is covered with lateritic soil which are deep and moderately drained.

d. Water Availability

A qualitative idea of water availability of different areas can be derived by taking mainly the landforms, slopes and surface material parameters. Some open well sections and their water table levels were also examined. Based on these, the area can be divided into poor, low, moderate and good water potential areas. If this is generalised with respect to landforms, slopes and surface material:

- Summits are generally the upper most units, but there is little scope for moisture retention than the upper and middle slopes due to their gentle gradient and hence a low water potential.

- The upper and mid slopes have no scope for moisture retention and have only a poor potential since water is lost either as surface run off or as ground water seepage because of the steepness of gradient and gravelley loam soil. This water comes to the foot or the lower slopes and then to the valleys.

- The lower and footslopes have thicker surface material and gentler slopes. So the water availability here is moderate and in certain areas it is good.

- The valleys are the lowermost geomorphic units and the slopes are very gentle or flat. The alluvium surface material with clayey silt or silty clay imbibes the water and there is minimum drainage loss. So the valleys act as a cushioning material for the water draining from all the higher landform units. Because of all these, valleys have a good water potential. However, highland valleys retain only lesser water because of the steep gradient and lesser thickness of fill and hence have only a moderate potential.

e. Landuse -- Practiced and Desirable

From the above discussions, we get an idea of the landform-wise physical peculiarities of the terrain resulting from natural processes. Also, each landform has a capacity for specific uses. From the landform ecological characteristics of each landform unit and the existing landuse in each, an attempt is made to derive the ecological consequences, desirable landuse and conservation measures in each of the unit (see Table 3.1).

The summits in the eastern highland terrain have scrubs, teak and cashew. The upper slopes immediately below this have forest land, teak, cashew and rubber plantations, settlements and tapioca. These two landforms were originally under forest cover and scrubs, which have now paved way for the above mentioned cultivation. Here, soil cover is limited and hence the upper slopes have a natural tendency for erosion due to the steep gradient. In high rainfall areas like Kerala, without vegetal cover, the area becomes degraded due to the loss of rich topsoil in a shortspan of time. The ideal land use in these landforms will be perennial deep-rooted

trees. The teak and rubber plantations can be continued provided, contour bunding and such soil conservation practices are done. Tapioca cultivation and further deforestation should be completely avoided from the upper slopes. Further settlements and cultivation of seasonal crops also should be avoided from these landform units. The open scrub areas should be brought under afforestation.

The midslopes have mixed crops, coconut, arecanut, teak, rubber, openscrubs and settlements. These landuses are desirable. But to protect the slopes, soil conservation measures as mentioned above should be done. Tapioca cultivation has to be avoided from these landform units also.

The footslopes have mixed crops (mostly coconut), and settlements. These can continue. Some deep rooted trees can also be recommended for this unit. The lower slopes cover an extensive area. These have an array of mixed crops, rubber plantations, coconut, arecanut and teak. The second oldest rubber plantations in Cochin State (1905)[5] comes in this landform unit, a part of which has been taken for establishing the Kerala Agricultural University campus. These cultivations can continue with adequate soil conservation practices in the upper parts. The cultivation of tapioca should be restricted to the lower most part of this landform unit. A detailed break-up of the landuse (major) in the area as in 1991 is given in Appendix III.1.

There is a tendency in all the landform units to shift to monoculture plantations of rubber. This is more prevalent in the case of larger holdings.

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[5] Menon (1911).

With this overview of the landform and landuse peculiarities of the study area, specific problem of the landform ecological characteristics of valley fills (hereafter valleys) are to be taken into consideration to derive at the desirable landuse practices.

Table 3.1
Existing Agricultural Land Use, Environmental Consequence & Desirable Landuse in the Study Area

Land Form	Existing Land Use	Environmental Consequence	Desirable use and Conservation measures needed
Summits	Open scrubs, teak, cashew	Open scrub areas are prone to erosion	In scrub areas more perennial tree crops should be grown. Teak and cashew can continue
Upper slopes	Forest land, teak cashew, rubber, plantation, settlements, tapioca	Due to steep slopes and high rainfall there is tendency for the limited soil cover to erode	Perennial deep rooted trees - Teak & rubber plantation can continue with contour bunding and other soil conservation measures. Settlements & cultivation of tapioca and other tubers which disturb the soil cover should be avoided.
Mid slopes	Mixed crops, coconut, arecanut teak, rubber, tapioca, scrubs & settlements	Soil erosion in upper parts due to tapioca & open scrubs	Open scrubs shall be replaced with perennial trees contou bunding & soil conservation measures are to be done particularly in upper portions.
Lower & Foot slopes	Mixed crops - coconut, arecanut rubber,plantation teak, tapioca	Soil erosion in the upper most parts due to tapioca cultivation	All uses can continue. Intensity of inter cropping is to be reduced with scientific recommendation so that productvity of land can be sustained. Tapioca should be restricted to lowest portions.
Valley fills	Paddy,banana coconut, rubber nursery settlen- clay mining	Wetlands are being converted to dry lands which affects conservation of water in the system. Disrupts the local ecosystem. Flooding due to reclamation.	Paddy should be retained and rotation with pulses is desirable

Source: Aerial photographs (1990), Thematic Maps (PRM-CESS) and Field studies.

3.5 *Landform Ecological peculiarities of Valleys*

The valleys are fluvial in origin and the streams passing through the middle of the valleys can be identified as the third or fourth order member of a stream network usually starting from the highlands reaching rivers which ultimately join the sea. Kerala is a high rainfall area with two monsoons -- the Southwest and the Northeast. According to Sampath (1991), all the precipitation (rainfall) in a year happens during a span of 170 hours. Because of the steep slopes and gravelly loam texture of the uplands, most of the water reaches the intervening valleys as surface runoff or as subsurface flow. The fine grained silty-clayey material in the valleys imbibe the water and act as a cushioning material. During rains, after saturation in the valleys, the water is flushed out through the streams which later reaches rivers and then to the lowlands, backwaters and ultimately to the ocean. This is the water control activity played by the valleys.

a. Desirable landuse

The valleys are water facilied and the impermeable clay formation allows only minimum percolation loss. Due to the high rainfall and steepness of slopes of intervening upland, the valleys in Kerala exhibit the characters of a wetland eco-system. The most conducive soil for paddy is silty clay or clayey silt, and this is the only landuse which can survive the marshy condition of valleys in the monsoon months of Kerala. According to Bray (1986), rice is the best landuse in such a terrain.[6] Due to these reasons, in

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[6] To quote: "Rice by nature is a swamp plant,and by far the greatest number of varieties are grown in standing water, but there are also dry rices which are grown on steeply sloping hillside fields. (p.11) If the field is continuously planted with wet rice, its fertility, unlike that of dry fields, will not diminish over time even if few or no fertilizers are used, for the nutrient

Kerala, the highland, midland and lowland valleys are traditionally being used for paddy cultivation.

But in recent times, due to both economic and institutional reasons (discussed in Chapter IV), the valleys are being used for a variety of other uses -- agricultural and non- agricultural, which needs conversion of the valleys. For this, valleys are usually filled up and the ground is raised with coarser material like laterite and channels are made to drain off the standing water. All other uses like cultivation of coconut, banana or vegetables do not need standing water. Non-agricultural uses like building of houses, industries or clay mining do not need standing water at all. So the raising of ground by coarser surface material and channelling will lead to excessive runoff to lowlands leading to water-logging and flooding of these during rains. This deprives the surface and ground water reservoirs in midland areas their due share of rain water which leads to drought conditions during summer. In the sloping physiography of Kerala (high relief from eastern mountains to the western coastal tract), a very large quantity of water is lost as surface run-off and what is needed is the conservation of water to the maximum possible extent. So if the amount of precipitation in a watershed is taken, and if the earlier argument of water reaching the valleys is considered, it can be noted that when the surface area of paddy fields are reduced by conversion, only lesser and lesser area will be available to imbibe the incoming water and this poses a grave problem to water conservation.

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content of irrigation water, together with the nitrogenising power of naturally occurring algae, are sufficient to maintain regular returns."(Bray, 1986, p.16)

b. Physical Changes over a Period of Time

> " The landscape we see today is a collection of the legacies from the past... It has become what it is and it is usually in the process of becoming different ...Let us then not study a static picture but a process that is continuing and seemingly never ending". (Darby, 1967)

Since the present is a cumulative outcome of the past, for a comprehensive understanding of the existing patterns of landuse, a look into the past is imperative. It provides a more comprehensive and multidimensional view of the present. To get a spatial dimension of the extent and nature of landuse, the earliest evidence available was the 1910 toposheet in which the paddy line could be traced. This is the demarcation between the paddy land and the garden land.

The data on the extent of the paddy line for three time periods is taken from the Survey of India toposheets i.e., for 1910, 1967 and 1980. An analysis of these showed that the paddy growing area (PGA) has declined considerably during this period (see Map III.4). When the pattern of decline was observed, it was seen that the decline is occurring in the periphery portions since the garden land is encroaching into the paddy land or we can observe a process of receding paddy line.

The paddy growing areas (PGA) in Madakkathara panchayat could be divided into seven sectors[7] depending on the location of the PGA (see Map III.5). It was found that the altitude of the sectors ranged from 80 m. above MSL to below 10 m.. Hence the area could be divided into three types of PGA as:

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[7] Sector mentioned in this study means a contiguous unit of paddy growing area which usually comes within a watershed unit. It is a valley in the middle with intervening side slopes and in the study area, it is seen that in all the sectors paddy is shrinking into the valleys.

Low paddy growing areas (LPGA) below 20 m.;
Mid paddy growing areas (MPGA) 20-40 m.;
High paddy growing areas (HPGA) above 40 m.;

Sector I has all the three sub sectors (IH,IM,IL) while sector IV is exclusively a MPGA. All other sectors have any two of the sub sectors. The area of decline from 1910-1980(ha) is given sub sector wise in Table 3.2. Percentage column denotes the decline from the original area in 1910.

Table 3.2: Decline in High, Mid and Low PGA from 1910-1980 (ha)

Sectors	High				Mid				Low				Total			
	1910	1967	1980	%	1910	1967	1980	%	1910	1967	1980	%	1910	1967	1980	%
I	26	3	3	89	233	108	60	75	37	36	31	17	296	147	94	68
II	-	-	-	-	186	48	20	89	50	37	12	76	236	85	32	87
III	-	-	-	-	122	70	42	66	167	151	133	21	259	221	173	40
IV	-	-	-	-	61	54	33	45	-	-	-	-	61	54	33	45
V	9	4	0.2	97.5	23	20	13	44	-	-	-	-	32	24	13.2	66
VI	36	3	2	95	56	39	21	62	-	-	-	-	92	42	42	54
VII	90	43	43	52	11	8	8	29	-	-	-	-	101	51	51	49
Total	161	53	48.2	70	692	347	197	72	254	224	176	31	1107	624	438	60

Note : The % column denotes the % decline of area 1910 to 1980.
Source : Survey of India Toposheets (1910,1967 and 1980).

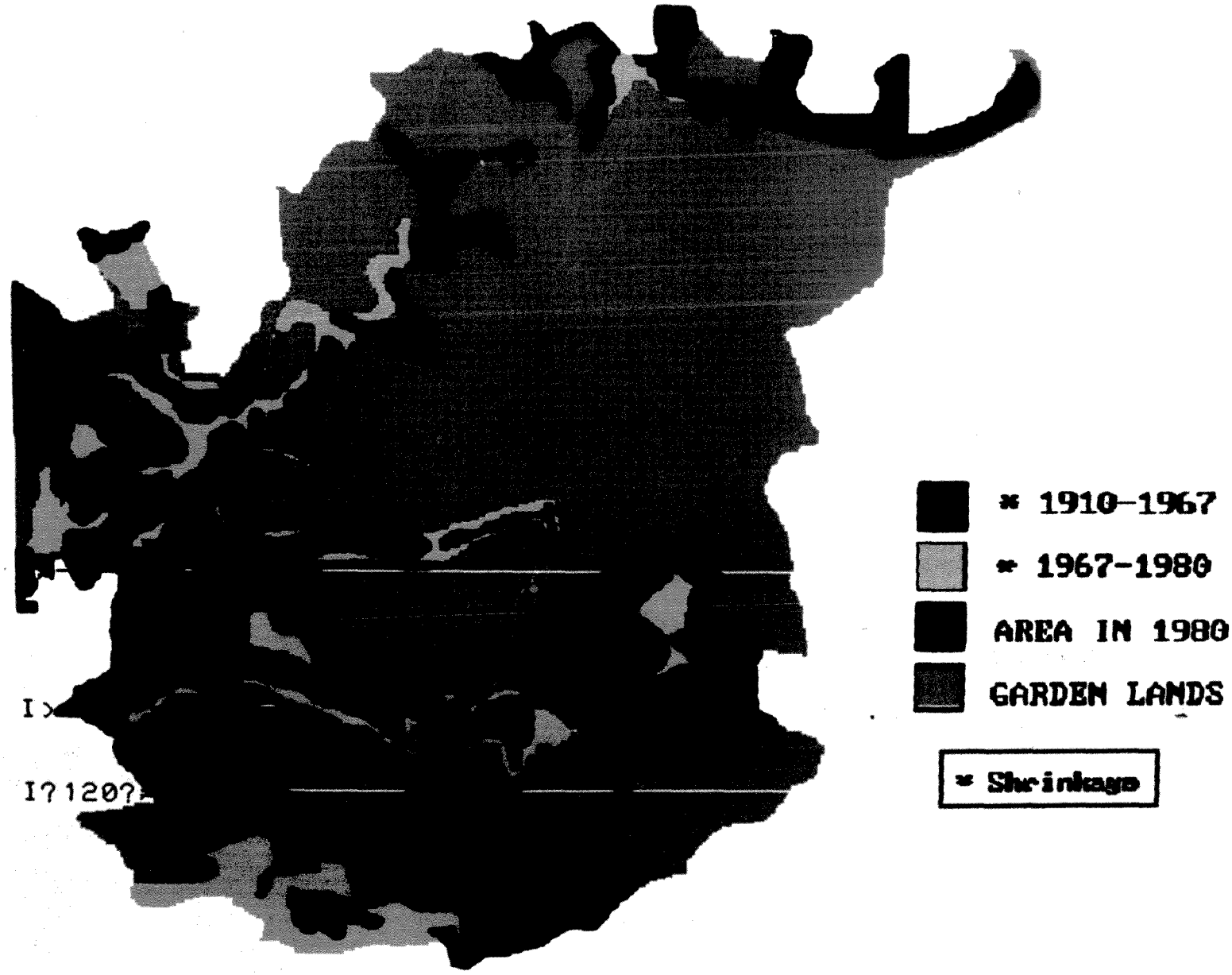
Table 3.3 gives the rate of reduction in the two periods:

Table 3.3: Reduction Rates in Different PGA

Sectors	Highland		Midland		Lowland		Total	
	R1	R2	R1	R2	R1	R2	R1	R2
I	3.47	0.00	1.34	4.37	0.04	1.15	1.20	3.40
II			2.33	6.74	0.55	8.27	1.78	7.36
III			0.98	3.88	0.17	1.01	0.46	1.81
IV			0.21	3.74			0.21	3.74
V	1.37	20.58	0.28	2.94			0.53	4.21
VI	4.21	0.00	0.66	4.42			1.03	3.65
VII	1.28	0.00	0.64	0.00			1.19	0.00

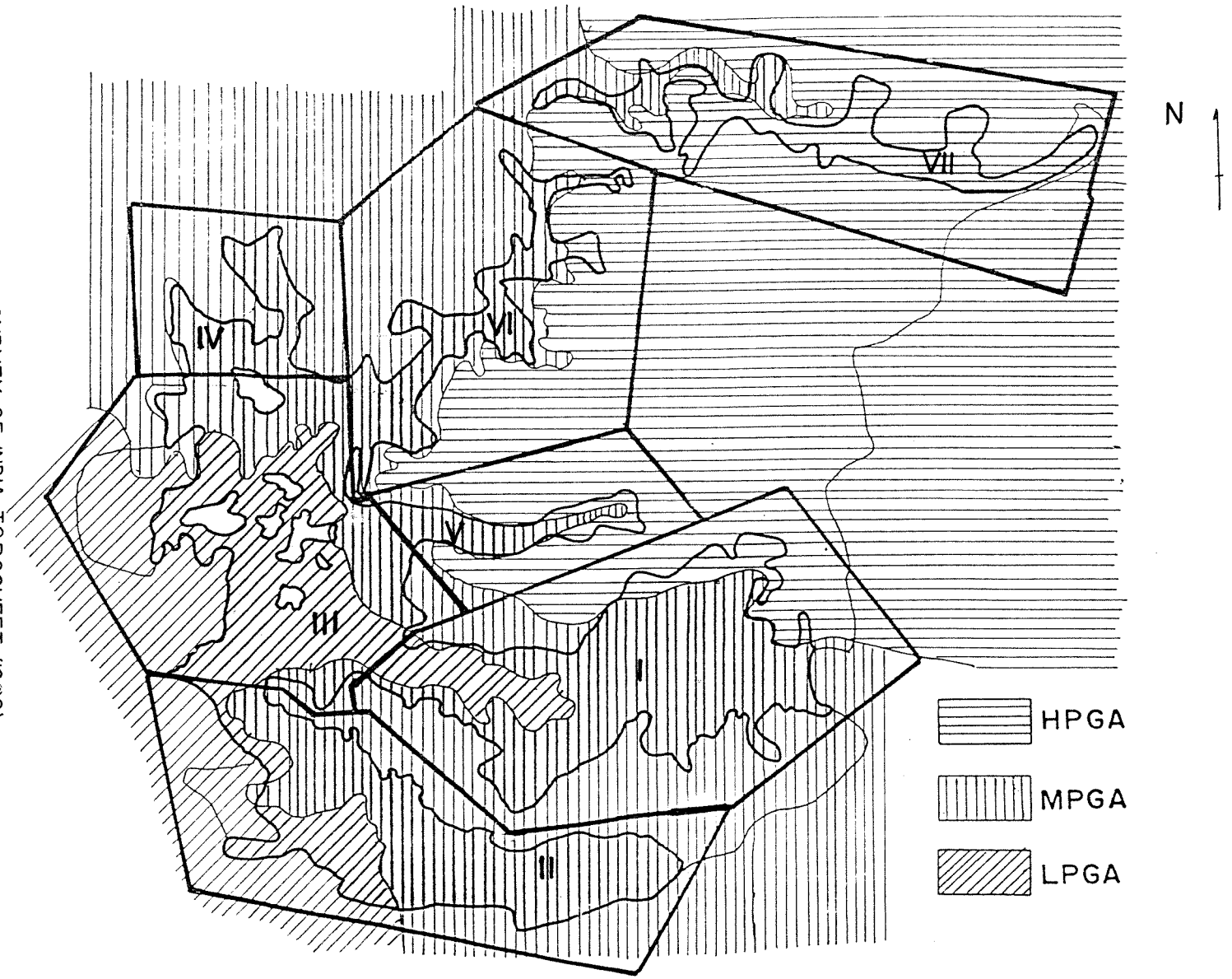
Note: The Reduction Rates have been calculated using compound growth rate formula
R1 refers to the period between 1910 and 1967
R2 refers to the period between 1967 and 1980

Source: Table 3.2.



DECLINE IN PADDY AREA FROM 1910 TO 1980
MADAKKATHARA AREA, TRICHUR DISTRICT, KERALA.

MAP III . 5 MAP SHOWING DIFFERENT SECTORS



SOURCE :- SURVEY OF INDIA TOPOSHEET (1970)

Table 3.3 gives the rate of decline (reduction rates) during the two periods R_1 from 1910 to 1967 and R_2 from 1968 to 1980. It was noted that there was a phenomenal 60 per cent reduction in the total area under paddy from 1107 ha in 1910 to 438 ha in 1980. The aerial photographs (1990) showed that the area was 330 ha in 1990.[8] Since the landform ecological characteristics are similar for respective PGA, the trend of reduction is analysed PGA wise.

c. Trends in Reduction

i. High Paddy Growing Areas (HPGA)

When the landform Map III.3 was consulted, it was seen that these are the lower most portions of the steep upper slopes and lower and footslopes which are only marginal areas as far as paddy cultivation is concerned. Only 30 per cent of the area of HPGA remain as a percentage of the original area in 1910. It is seen that in all the highland sectors $R_1 > R_2$.[9] Due to the steep slopes and gravelly loam surface material, there is very little water retention in these subsectors. In the socio-economic survey, it was revealed that these were rainfed single crop paddy lands which are fallowed for rest of the years. The percentage decline of PGA in sector VII is 49 per cent. It is seen that, these are in the lower most portions of the valley which forms a part of MPGA. But the aerial photographs in 1990 revealed that only five per cent of

[8] This figure is not used in Table 3.2 since the disaggregate figure is difficult to get due to the absence of contour details in this. Also the former data is from a different source.

[9] The only anomaly for this is the sector V.But if the absolute figure of areal changes is taken, it is seen that the total 9ha under HPGA got converted to 4ha in 1967and to.2ha in 1980.So the high figure of R2 here is an anomaly from the general trend.

the area remained then. The physical constraints of water availability and narrow nature of the valleys were told as reasons for this in the socio-economic survey. There is no irrigation system in the highland terrain. The steep gradient of the valley floor, and loss of forest cover in slopes affected the moisture retention even in the valleys making paddy cultivation difficult. The narrow nature of the valleys makes it even more difficult to cultivate when holdings got fragmented.

ii. Mid Paddy Growing Areas (MPGA)

The MPGA generally come in the lower and footslopes and valleys in the midland terrain which have the competing garden crops immediately above. They had the greatest share in the initial area under paddy (See Table 4.1). The percentage of decline is also highest for these. The MPGA show consistent reduction (except in Sector VII whose reason was given above). Here R1<R2. This is because in the first period only marginal areas (in slopes) got converted due to physical reasons such as water availability etc.. Paddy being a profitable proposition, the valleys were being retained for paddy cultivation. During the second period, especially after 1975, the shift away from paddy started and then the rate of conversions were much faster than in the first period. The flat U-shaped nature of the valleys make them easily convertible also. Therefore, only 28 per cent of the MPGA remained in 1980.

The 1990 aerial photograph and field work revealed that only the central portion of the valleys remain as paddy growing areas now. The central portion of valleys being the lower most

geomorphic entity, receives ground water seepage throughout the year from the intervening uplands. The irrigation canals going through the lower slopes here also enrich these valleys with water. But this keeps many of the valleys in a water logged condition for most of the year (see the section on Irrigation in the next chapter for more details). Because of these physical constraints, the only possible landuse here is paddy and that is the reason why people are forced to continue paddy cultivation here despite their aspirations to convert. The influence of competing crops like rubber and coconut in the landuse dynamics is strongest in the mid PGA.

iii. Low Paddy Growing Areas (LPGA)

The LPGA are the broad expanses of valleys with islands of gardenland. Hence here, there is not much scope for conversions since the landform is more suited for paddy cultivation. But conversion for banana cultivation is greatest in the low PGA. In the low PGAs, Sector II showed the greatest decline. Only 24 per cent of the original area remained in 1980. Here economic reasons prompted conversions rather than physical, which is very clear by the high values of R2. An analysis of the toposheet and aerial photographs showed a wide network of roads and settlements in this sector. This was predominantly due to the presence of the KAU. Another important point noted was the influence of the NH-47 bordering a portion of the sector. From this urbanisation and the subsequent escalation of land value was found to be the reason for the anomalous decline of paddy area in the low PGA of sector II. The period of conversion is after 1967.

In short, the conversions in the first period was a positive reaction to a cultivation which was detrimental to the landform ecological characteristics of the terrain. So the reasons for conversions in the first period are more physical. But in the second period the conversion of landunits best suited to grow paddy started and this can be connected with the socio-economic reasons mentioned in the preceding chapter.

3.6 *Environmental Impacts of the Landuse Dynamics*

The conversion of the PGA has grave environmental consequences since the water faciled valleys are being converted to dry land by raising the land by filling it with coarser clastic material. The role of valleys and paddy land use in water conservation was discussed earlier. The valleys are fluvial landform which act as a storm drainage which flushes out the excess water after saturating the ground and surface water reservoirs during the heavy and concentrated rainy days in monsoon times. The filling-up of a portion the valley deter the free movement of water leading to flooding and waterlogging of the unreclaimed portions affecting the fertility of soils and thereby paddy cultivation here. The stagnant water creates a reducing environment which force the farmers in the unreclaimed portions either to fallow the land or to convert the valleys by filling up. This is a unidirectional externality suffered by the cultivator in the unreclaimed portions and one of the main physical factors responsible for conversions. So if the conversion of a valley happens in one part, this is carried on as a chain reaction throughout. The storm drainage system also gets blocked due to the construction of roads and irrigation canals without proper drainage facility , making the

valleys into waterlogged fragments forcing the farmers to convert them.[10]

It is observed that landuse other than paddy in the valleys have adverse environmental consequences. The time span for these will vary depending on the nature and intensity of intervention. For example, an activity like clay mining from paddy fields for the use of brick kilns is a short term activity for four to seven years. The mining cannot be prolonged after a depth since after reaching the shallow water table of valleys, pumping out water is a necessity to continue mining. So after a stage, it becomes uneconomical as is the case with all mining activities. But by the time, the top A horizon or which is the product of fluvial activity for thousands of years along with the whole eco-milieu of the paddy land ecosystem is lost, turning the valley into a pool of stagnant water. Because of the hydraulic head developed due to pitting, the water from the neighbouring unmined portions flow to these pools reducing their moisture retention. (which is a unidirectional externality inflicted on the cultivating farmer).

Thus, the valleys can be considered as the 'stock' of the resource base and the 'flows' or returns from it are to be taken into account. Paddy cultivation, is an activity which does not alter the landform ecological characteristics of the valleys since

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[10] The building of roads is widespread in Kerala even due to the expansion of tertiary sector. Paddy fields being cheaper in land value than garden lands are usually the first choice to align a road. The relative flat nature of the landform makes the construction also easier.

the essential nature of the landform unit is maintained. The agricultural activity has been giving returns for hundreds of years and can continue to do so. The activity has a much longer time horizon than the short term mining activity. Much more labour can be absorbed in paddy operations and has greater linkages than clay going to brick kilns. But these are relevant only in the long run and the social and environmental issues are larger societal concerns. The individual concerns may be governed by the compulsions of the present which tries to maximise the returns from the resource base in the short-run.

Having discussed the physical dimensions of landuse and temporal changes of it through a period of time, we will go into the socio-economic factors responsible for this in the study area.

3.7 *Summary*

A representative area covering the midland and moderate highland terrains in Central Kerala was selected for the appraisal of physical realities. A generalised landform map of the area was prepared and the parameters of soil, water availability, and existing landuse in each landform unit was studied. The ecological consequences of the landuse, conservational measures required and the desirable ones in each landform unit was worked out. The landform ecological characteristics of valley fills showed that paddy is the most desirable use here. The essentiality of growing paddy to conserve the wetland ecosystem of valleys was also noted. A study of the physical changes over a period of time from 1910 to 1990 brought out the phenomenal decline of these. The trend, rate

and consequences of reduction were studied in a disaggregate fashion. This showed that the changes upto early seventies were more controlled by the physical factors since marginal areas growing paddy got converted. But it was realised that the changes after this period and particularly after 1980 was very detrimental to the environmental sustainability of the land and water system.

APPENDIX TTT.1

Area covered by the major landuse in the study area (1991)

Landuse	Area (ha)
Mixed crops* [Coconut,Arecanut,Plantain, Banana etc.]	675
Paddy	319
Rubber	350
Cashew	212
Teak	79
Banana	31
Arecanut	25
Coconut	90
Tapioca	43
Mixed trees	81
Kerala Agrl. University	407
KSEB (400 KV substation)	40
Wasteland	51
Reserved Forest **	552

* These come generally under the homestead gardens typical of Kerala associated with settlements in which the area under individual crops is difficult to assess because of the mixed nature of cropping.

** These areas are under the possession of the forest department of which a large portion has now turned to monoculture plantations. The area under natural forests is only limited.

Source: CESS (Panchayat Resource Mapping Programme, 1991)

Chapter IV

SOCIO-ECONOMIC REASONS BEHIND THE PHYSICAL CHANGES

4.1 *Introduction*

This chapter attempts to bring out the socio-economic and institutional factors responsible at the micro level for the landuse changes, particularly paddy cultivation, captured in the last chapter. A socio-economic survey was done to get a better understanding of local level specificities of the problems related to paddy cultivation. This is intended to obtain a holistic picture of the reasons and consequences of the landuse dynamics in Madakkathara. An attempt is also made to calculate the cost of cultivation to get insights of the relative profitability using secondary data.

4.2 *Survey Methodology and Sample Selection*

To get the information of the evolution of paddy cultivation and problems at the lowest level, i.e., the farm level, it was decided to interview some farmers who could remember these transitions[1]. Purposive sampling method was adopted to select the farmers.

In Table III.2, the paddy growing areas were divided into seven sectors and fourteen sub sectors. Sector IV is entirely a mid PGA whereas Sector I has all the three sub sectors (i.e., IH,IM and IL). All other sectors have any two of the three. Since each PGA was found to be homogeneous in terms of landform ecological characteristics, it was decided to select the sample with PGA as

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[1] Insights from the methodology developed by Robert Chambers for 'Participatory Rural Appraisal' is used for the survey (Chambers, 1990).

the basic criterion. The areal extent of changes in each sector was given weightage during sample selection.

Another criterion was the period and pace of change. In Map III.4, the decline in PGA is shown by different colours. Red denotes the decline in area from 1910-1967 (R_1) and yellow denotes the decline from 1968-80 (R_2). These were also given weightage during sample selection. For example, the reasons for conversions in high paddy growing areas (HPGA) during R_1 was obvious. These are only marginal areas as far as paddy cultivation is concerned since these are lower areas of steeply sloping highland mountains. Hence, only three samples were selected from this area for the survey. The conversions in the LPGA except Sector II is less. In sector II this happened because of the presence of KAU, NH-47 and the wide network of roads. Since these reasons are obvious from the analysis of Chapter III, only lesser weightage is given to the HPGA and LPGA. The MPGA had the greatest share of PGA and the conversions are also highest here. Parts of two midland sectors (V and VI) showing more of highland characteristics were identified as high-midland sectors. Though the area in these high-midland sectors was not large, the extent of conversions was found to be maximum here. So a higher weightage was given to high-midland paddy growing areas. For sample selection this is included with MPGA.

Thirty farmers were selected by purposive random sampling. The criteria of sample selection depended on the initial area as a percentage of the total PGA and decline in area as a percentage of the total decline of the PGA. The following table was thus

obtained:

Table 4.1: Criterion of Selection of Samples in Different PGAs

Physiographic units	HPGA	MPGA	LPGA	Total
Initial area as a percentage of the total paddy growing area (1910)	14 (161)	62 (692)	24 (224)	100 (1107)
Decline in area as percentage of total decline of paddy growing areas	17 (113)	72 (495)	11 (78)	100 (686)
Samples selected	3	19	8	30

Note: Figures in parentheses denote the area of corresponding PGA in hectares.

The heterogenous sample belonged to, fulltime cultivators whose predecessors were either tenant cultivators or agricultural labourers who still work in the paddy field, but now own a piece of land after the implementation of land reforms. The only common thread that runs through all those interviewed (except two) was that, they and their ancestors have been living in the study area for at least three generations and have consistently been associated with paddy cultivation either in a working or supervisory capacity. For this it was ensured that all the farmers interviewed were at least aged above 50 years which helped to bring out the problems of paddy cultivation from their point of view. It was found that their views were very valuable since all of those interviewed have been both witnessing and experiencing the consequences of the landuse dynamics in Madakkathara. They also have a hindsight about what was happening in the previous two generations. So the valuable insights of their 'learning by doing' and their perception of the changes have been helpful to trace out the reasons for the changes. Sometimes an attempt is made to

connect the ideas expressed by them to the macro picture of these changes in the state with supporting literature.

a. Limitations of the Survey

The age-group of those interviewed gives a tendency to glorify the past. But this was the only possible way to bring out the historical evolution of paddy cultivation and the reasons for the changes at the microlevel which is very important in such a study.

4.3 *Observations at the Microlevel*

The constraints of paddy cultivation observed in the study area are discussed under seven broad sections:

1. Problems related to water availability which is discussed as two sub sections -- natural and artificial.
2. Problems related to labour.
3. Problems related to soil fertility and applied nutrients and the effect of 'package of practices'.
4. Influence of Competing Crops.
5. Relative Higher Cost of cultivation[2] .
6. Externalities of valley conversions.
7. Effect of fragmentation and miniaturisation of holdings.

The data from an earlier socio-economic survey done by KSSP and Census data is used for analysis in section 2. Section 5 was done using the data from the 'Comprehensive Scheme on the study of the cost of cultivation of principal crops in Kerala'.

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[1] This is the only section that exclusively uses secondary data for the discussion.

1. Problems of Water Availability

Water is the most crucial input for paddy cultivation. Formerly the cultivation was entirely monsoon dependent. But from 1959 onwards the Peechi Irrigation Project began to cater irrigation water to the study area. First we will look into the problems of natural water availability.

i. Natural

Kerala is a high rain fall region. But the pattern of rainfall is concentrated and the annual rainfall is spread over a few days. So the prolonged availability of water depends on the vegetal cover, particularly the higher catchments. Hence the need to look into the history of highland landuse that affect the water availability in lower reaches. In the last chapter, cultivation of paddy in the steep slopes was noticed. But even in the earlier part of the century, the negative effects of cultivation in forested slopes were realised:

> "'*Peruvaka*' or hill rice is grown on patches of forest-clad hills in rotation. The patches are cleared of all jungle growth and burnt, and the seed is sown in April and the crop reaped in September... This form of cultivation once so common is now practically prohibited owing to its ruinous effect upon forest growth".[3]

However, by 1940's the need for augmenting the food production forced the state to legalize deforestation for extension of cultivation. With the 'Grow More Food' campaign, area of cultivation under foodcrops increased.

It will be interesting to look at the reasons behind and the kind of state policies that initiated this phenomenon. To quote:

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[3] Menon (1911), pp. 238.

> "Dewan Devan of Cochin introduced a scheme called the Hilpad scheme' to increase the rice production of the state by clearing and bringing under cultivation large tracts of forest land. This government sponsored cultivation was a big failure as it was implemented through a corrupt and inefficient bureaucracy. So the government decided to allot lands to individuals. In many places non cultivating wealthy people[4] and bureaucrats got the allotments." (George, 1992)

Such state policies opened up avenues of prosperity to those adventurous lot who migrated from the plains to start cultivation in the uplands. Though population pressure and enhanced migration accentuated the process of deforestation, state policies initiated this phenomenon.[5]

The highlands in the study area are only moderate highlands (since the maximum altitude is only 400 m). Highland cultivation began in the early years of this century in the valleys and lowest slopes (e.g. sectors I and VTT of the study area). Paddy cultivation was done either in the valleys or lowest slopes called '*azhakal*' with opposing slopes with good water facility. The seeds used were '*modan*' and '*peruvaka*'. The upper slopes were thickly forested. The cultivation was rainfed. Due to the thick forest cover, the amount of water conserved in the system was more and

[4] In the highland sector VII, a farmer who migrated from Central Travancore in 1960 began cultivation as a tenant of such a noncultivating rentier owner. The owner belonged to Kodungallur which is a coastal town 21 km away from the study area and had no roots in the area. So after a short span of time the cultivators stopped giving him his share of produce since the owner could not exercise his rights on this strangeland far away from his native place.

[5] The interesting point here is that no natives dared to cultivate in the forested highlands even after a long time since the migrated farmers initiated cultivation. When the natives saw the fruits of migration and the fertility of the virgin humus rich forest loam soils of the highland, they also began to slowly follow the path of the migrants.

this allowed more water to go downstream to the mid and lowland valleys. In the deforested highlands, cultivation started with rice. But the landform ecological constraints do not allow this mode of cultivation to prolong.[6]

This was the trend observed by the farmers in the study area also. This initiated the cultivation of tapioca since it was supposed to be an alternative food crop and it can grow easily even in degraded lands. But with the increased production of tapioca, ".... various devices were adopted by the government to control the distribution of tapioca by way of registration and licensing. Finding that the price of tapioca was soaring, a maximum sale price was fixed in January 1943. Government took power under this order to fix the selling price. Intertaluk movements of tapioca were also prohibited." (Sivaswamy, 1942) Though tapioca cultivation was becoming unprofitable due to the price and movement controls, during the short span, it had denuded much forests in the uplands.

The cultivation of tapioca in the steeply sloping uplands generated soil erosion and degradation of the land.[7] The role of

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[6] The reasons for this is given by Bray (1986): "swidden fields cut from jungle will often produce high yields of dry rice (and other crops) during the first year of cultivation, but their fertility comes from the forest humus and ashes of the felled trees, which are quickly washed away. During the second year, much of the fertility is lost and unless in exceptional circumstances, it is unusual for farmers to cultivate their swidden fields for more than three years before moving on to clear new lands".

[7] All the highland farmers interviewed agreed on two things:
(a) Tapioca has a tendency of diminishing returns year after year.
(b) It degrades the land by soil erosion. This is due to the disturbance of the soil during harvest. (Tapioca is generally cultivated in the steep slopes and the area has a high rainfall also).

the vegetal cover of forests in protecting soil and regulating streamflow in terrains as the highlands of Kerala was discussed earlier.[8] Without forest cover, this kind of conservation of water does not happen leading to excess runoff resulting in drought conditions in summer. As a result, the lower order streams at the top get dried up. Siltation of higher order streams down lead to the reduction of water holding capacity.

With the passing of Land Reforms Act (1970), land got fragmented. Added to this, the population pressure and generation of nuclear families needed settlements that demanded gardenlands to meet the domestic needs of coconut, vegetables etc. Along with this, the lower order streams in the upper slopes got privatised and their diversion for cultivation reduced the amount of water going to higher order streams down below resulting in a reduction in the total available quantity of water in the system (see case I of section 4.4).

This kind of landuse changes in the highland sectors has led to the confinement of paddy (in all the sectors down below) to the lowest slopes and valleys, where there is more scope of moisture retention. . By late 1950s, the large irrigation projects came including the Peechi Irrigation Project in the study area. In the 1967 Survey of India toposheet, the boundary of paddy area is

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[8] This opinion was expressed by all the farmers in the terrain. One farmer explained this as an old saying like:

"*Oru Divasam Mazha Paithal*
Pathu Divasam Mala Peyyum"

which can be approximately translated as

"If it rains for a day, the hills
assure water for ten days."

almost confined to the irrigation canal in the lowest slopes. The Peechi Irrigation Canal is not catering to the highland valleys of sectors I and VII. The highland cultivation was more monsoon dependent cultivation. But in Sector I, a small dam called *Kachithodu* dam (see Map III.2) was built in 1972. Since this was in the lower portions of steep intervening uplands (more than 120' above MSL) this got silted very fast. This was the fate of all '*Thalakulams*' or the ponds constructed at the head of valleys in the lower slopes which used to be perennial sources of irrigation due to changes in landuse in the upper slopes. The lack of adequate water was the main reason put forward by the farmers for the conversion of even valley portions in the highland terrain. Due to the steep gradient of the valley floor, there is a possibility for quick drainage of the available moisture also.[9] (See case study I).

The data on the production, yield and area under paddy also shows a decline in the production due to a decline in area from 1974-75 despite a positive growth rate in yield.
Kannan (1988) attributes this positive growth in yield due to the fact that the marginal lands were converted due to a host of price and non price factors. The marginal areas may be the single crop lands which came in the midland and lower slopes of highlands which got converted due to the above mentioned factors.

Heavy fragmentation of holdings and non-availability of labour

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[9] For example, in the S.O.I. toposheets, it is seen that a fall of 40 m (from 80 m to 40 m) happens in the case of sector VII, from east to west.

affected the periodic maintenance of natural streams. In the mid and low PGA in earlier times, when number of farmers were less, control and sharing of stream water was easy. With the increase in the number, de-silting and maintaining the streams became a rare possibility as nobody was interested in the common property resource. Encroachment for cultivation into the streams also obstructed their flow which led to the non-availability of water in summer months and flooding of the adjacent areas during the rains.

ii) Artificial (Irrigation)

The study area comes in the immediate vicinity of the Peechi Irrigation Project (PIP) which is supposed to be one of the most successful projects completed in the State. The construction of PIP across Manali river was originally started by the Cochin Government in 1947. The water was set out from this dam for irrigation in 1953 and the full storage of the reservoir obtained in 1957 (Census Report, 1961). This was commissioned in 1959 with a capacity of 110 MCM. But it is estimated that the capacity of the dam is now 70 MCM, i.e. 67 per cent of original due to siltation resulting from the undesirable land use practice in the catchment area (IRTC, 1991). The amount of water available for irrigation got again reduced when the project began to cater to the drinking water needs of Trichur town from 1982. In the beginning of the project, water used to come through the canals from the beginning of July to the end of December. Then it became as late as middle of August. Now water is available only from the end of August to December and that also only for 3 days in a week.

In the midlands, the canal passes through the lower slopes. So even if the sprouts of the canals to the paddy fields is not open, seepage of water happens through the unlined portions in the upper parts (eastern part where the canal enters the study area). So 'socially conscious' farmers here do not open the sprouts upto January since it causes a reduction in the reservoir capacity which deprives the tail enders their due share of water in the lean period. In the high midland and certain parts of midland valleys, the seepage causes excess moisture leading to marshy conditions. So ploughing by tractor or by animal power becomes difficult. In spite of this, no water is available for the third crop since the reservoir does not have adequate water for irrigation in the summer months. Water is diverted to the Kole lands for *puncha* (summer crop) cultivation which also contributes to the reduction of irrigable water. (Kole lands as stated earlier are low lands reclaimed from lagoons which are below the sea level and only one crop is raised in summer).

Madakkathara Padasekharam (Sector II), which is the largest one in the panchayat is a victim of the Peechi Irrigation Project. There is a perennial stream through the middle of this valley. PIP has bought the rights of the stream from the farmers in the valley and made this a canal to carry water to the Kole lands. Therefore the farmers cannot divert water from the stream which used to be their traditional water source. Command Area Development Authority (CADA) has built a feeder canal and a sluice in the stream to distribute water from the same. Irrigation Department objected to the construction since, according to them, the stream is an irrigation canal to cater water exclusively to the Kole lands.

This is an example of how "development" of one area deprives the other of the erstwhile potentials[10]. This happened because of lack of coordination between the agencies working in an area, which brings us to a need for an integration of the work of these agencies at the microlevel which now work as 'water tight compartments' with no interaction among themselves as well as with the farmers.

Canals may provide water, but block other nutrients. In the midland valleys, the irrigation canal is constructed in the lower slopes. The natural flow of rain water leaches the nutrients from slopes to the valleys during the rain. But now this gets trapped in the canals. The small collection canal above the main canal is completely silted up now. Thus the canal acts as an impediment to the natural enrichment of the valleys. There is a thorough under utilisation of canal water in the high midland valley areas. To cite an example, the PTP canal circles round the whole of Sector V. But only less than 5% of the area in the sector is under paddy cultivation. Most of the other areas are used for raising nurseries for various crops (see case II of section 4.4). This is a case of under utilisation of public investment. Public investment in irrigation is mostly for paddy. But since paddy cultivation is unprofitable, farmers have shifted to other landuses which does not require standing water and hence the water from the irrigation canals is not used. This disturbs the original

[10] Farmers in Sectors I, VI & VII were of the opinion that if water is diverted through the PTP canal instead of the above mentioned natural stream to the Kole lands, they will get enough water for a third crop. There is no need even to open the sprouts since seepage water is enough.

projections of return from the investments on irrigation. So this is a social loss and suggests the need for rethinking of investment in major irrigation.

Peechi reservoir is situated in the eastern highland terrain of the neighboring Pananchery Panchayat and hence is away from the western lowland area and make these areas farthest from the source. The canals and other water harvesting structures such as weirs and cross bars have no proper maintenance because it is treated as 'nobody's property'. Even the beneficiary farmers are not concerned about these structures in the natural waterways which now deter the free flow of water due to sediment/debris collected due to lack of maintenance. According to majority of farmers in the area, Irrigation Department responsible for this has little idea about the status of these structures since they have no interaction with the farmers.

There is thorough misuse by people living on both sides of the canal by treating the latter as waste dump thus deterring the flow, depriving the tail enders (in lowland sectors) their due share of water. In the drought months of 1983-84 due to a reduction of available water for irrigation in the reservoir, only farmers in the upstream portions of the canal were given water by damming the canals with sand bags. This was to help at least a section of the cultivators to optimise the scarce resource. But non-availability of water for two continuous years resulted in the conversion of many paddy fields in the lowland terrain of the study area.

2. Problems of Labour

Sixty percentage of the farmers in the study area, identified high wages and non-availability of labourers as the most serious problem facing paddy cultivation. In the study area the labourers have enough alternative employment opportunities. The KAU which came in 1974 absorbed much labour as regular and casual employees. The construction of 400 KV substation of KSEB started in 1986 and provided jobs to labourers until the end of 1993. The Extension Training Centre of Rural Development Department at Mannuthi in the neighboring panchayat also provides casual employment to the working class. All these raised the local wage rates.

In Table 4.2, an attempt is made to observe the changes in the occupational structure between 1971 and 1981. It can be seen that

Table 4.2: Occupational Structure in Madakkathara Panchayat
(Share in per cent)

Occup. Structure	1971	Share	1981	Share
Total Workers	4838	100	5679	100
Cultivators	1015	21	776	13
Agri. Labourers	2400	49	2310	41
Other Workers	1423	30	2583	46

Source: Census Handbook, Trichur District, 1971 & 1981.

that the percentage of cultivators in the study area has come down from 21 to 13 and that of agricultural labourers from 49 to 41 per cent. It is seen that the share of other workers (ie,other than agriculture) has increased from 30 per cent to 46 per cent of the total workforce. Interestingly the share of non-workers in the total population remains same at 51 per cent in both the years.

KSSP did a socio-economic survey in 1993 as part of the PRM programme and brought out the detailed breakup of the occupational structure in the study area (given in Table 4.3). It is seen that the share of agriculture in total workforce has reduced from 71 per cent in 1971 to 55 per cent in 1981 to 45 per cent in 1993. The breakup of agricultural workers into cultivators and agricultural labourers is not available in the KSSP survey. But the above mentioned trend clearly shows a shift of occupation away from agriculture. The occupations to which the probable shift of workers might have taken place is also shown from which it can be seen that these does not need specific skills. The shift towards other occupations can also occur after acquiring required skills.

Table 4.3: Occupational Structure in Madakkathara Panchayat, 1993

	Total workers	per cent
PRIMARY SECTOR		
Agriculture	3112	45
Other Allied Activities (Animal Husbandry, fisheries etc	190	3
SECONDARY SECTOR		
Quarrying *	338	5
Traditional Industries * (Handloom, Coir, Beedi, Cottage and other traditional industries)	424	6
Factory and Repairshops	478	7
Electricity & Others	393	6
TERTIARY SECTOR		
Headload, Bullockcart & Motorvehicles *	456	7
Construction & Road Work *	224	3
Trade & Communication	212	3
Petty Shops *	45	0.6
Finance, Insurance & Real Estate	117	1.2
Education	146	1.8
Public service	496	7
Others	265	4
TOTAL	6896	

Note: * denotes occupations to which possible shift has taken place.
Source: Socio-Economic Survey, KSSP (1993)

For example, in the highland sectors of the study area, women have alternative non-farm employment opportunities in quarrying for breaking the stone into rubble sized material. The wages are according to the quantity of rubble made. There is no time stipulation as in the case of paddy field work. Since the work is done inside thatched sheds, there is no threat of adverse weather conditions as working in paddy fields in hot sun or rains. Even-though this is less remunerative, the toil of working in kneedeep water for the whole day is avoided and they get more time to look

after the domestic needs also. In Table 4.3, it is seen that 338 persons in the study area are engaged in quarrying. In the 1971 Census Report, it is seen that only 14 persons here were engaged in quarrying. In the high land and high midland, this was an escape to the labour who got displaced from paddy cultivation due to the conversion of paddy fields.

As far as paddy cultivation in the State is concerned, mechanization is at a very low level -- mostly confined to the ploughing and threshing. Almost all other operations need timely availability of labour. The perception of cultivators about the labour affects labour use. There is a tendency to glorify the behaviour of labour 30 or 40 years back, when their older generation used to cultivate. Then labourers used to work without stipulated timings whereas now the labour unions have fixed up the timings like from 8 a.m. to 5 p.m. with breaks in between and in certain areas this is only for less than 6 hours. Labourers in the bonded labour days used to see their job as a way of living. Over time, labour became aware of their rights and fixed their duties.

The occupational shift away from agriculture seems to be increasing with the spread of education. In the Table 4.4, the educational status in the Madakkathara panchayat is given.

It was observed by majority of farmers that people who have acquired at least secondary education are shifting away from agriculture which accounts to 41 per cent of the population. This is happening in the case of both cultivators and agricultural labourers. They go as salesmen in shops and bus cleaners though

these jobs are less remunerative. This is more in the case of agricultural labourers whose earlier social stigma is related to their work in the paddy field.Another example is the girls who go for work in the 'nurseries'. The agricultural labourers children

Table 4.4: Educational Status of People in Madakathara Panchayat

Categories	Number of persons	percentage
Illiterate	2511	14.74
Literate without formal education	435	2.55
Below primary	1752	10.28
Primary	2682	15.74
Upper primary	2825	16.57
Secondary	4940	29.00
Pre-degree	988	5.80
Degree	505	2.96
P G	136	0.80
Professional	74	0.43
I T I	56	0.39
Diploma	117	0.69
Others	11	0.06
Total	17035	

Source: Socio - Economic Survey, KSSP (1993)

who discontinued education go for this.Here they get only Rs 20 per day (whereas it is Rs. 45 to 55 for paddy field work).But this is less tedious compared to the other. The income is steady since the nursery has work in all the seasons and the work is not looked down upon as paddy field work. This kind of attitude pushes them to construction work also. The study area is connected to Trichur town by bus which facilitates mobility of the labour to get absorbed in the construction sector there. This phenomenon as seen in chapter II is happening throughout the State.

The availability of alternative employment opportunities, decline in the availability of opportunities in agricultural sector, contradiction between the perception of cultivators, the awareness of labour about their rights coupled with high wage rates and non-availability of labourers have forced the cultivators to shift to landuse which are less labour demanding.

3. a. Soil Fertility and Response to Applied Nutrients

The productivity or yield per unit area is an important criterion in any landuse decision. The yield depends on the natural conditions especially the soil fertility and water availability and also on the inputs such as applied nutrients -- organic or chemical. Due to the ruggedness of the terrain and high rainfall, there is a possibility of soil nutrients leaching out fast. Historically the State has a disadvantage in this[11]. More recent studies have also proved this. Prof. Thomas Varghese's studies[12] on the soils in parts of highland and midland valleys including those of the study area has confirmed this. The valleys in the high land and midland tracts of the study area is covered with lateritic alluvium. In this soil, with increasing input of chemical fertilizers there will be no response or a negative response in yield because of the intrinsic nature of the soil. According to Varghese, the peculiarities of this soil are:

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[11] "The lands in Travancore except certain parts of Kuttanad are deficient in organic matter or humus. The soil of this region comprising several thousands of acres is a useless residue of silica and iron oxides, the valuable ingredients so essential for the successful growth of the plant having been leached out by rainfall on account of deficiency in humus". (Pillai, v.TT, 1940)

[12] Personal Communication, 1994.

(1) Lack of organic matter,
(2) High acidity,
(3) High Iron and Aluminum concentration,
(4) Low content of bases (Calcium, Magnesium, Potassium) (meaning very low base saturation)
(5) Very low CEC (cat ion exchange capacity),
(6) Very high AEC (An ion exchange capacity),

Because of these properties the soil has:
(a) High leaching,
(b) Very poor retention of applied nutrients,
(c) High fixation of phosphorous.

Due to the above mentioned reasons, soils like lateritic alluvium in the study area, have only a very low response to chemical fertilisers. The declining trend in yields due to the inherent nature and low response to fertilizers were observed by the farmers of the study area. This phenomenon is more pronounced in the lowland sectors. Here the soil is more sandy (sandy clay loam). Because of this the seepage loss is more and along with this the applied nutrients also percolates down. The result is low yields. According to Varghese what these soils require is more organic manure. In the olden times, when forest was there in the uplands, there used to be burnt out matter (either by forest fire or human induced fire). The forest loam soil was also very fertile due to the humus content. During rains these used to get leached out to the valleys which organically enriched the valleys. But farmers who use cowdung and limited organic manure along with this does not have the problem of declining yields.

Earlier the uplands used to have trees like teak and Maruthu which used to give lots of leaves and could be used as organic manure in the fields. But historically this is a problem in the state mainly due to limitation of land. Due to high man-land ratio

and State policies (as mentioned in Chapter II) common property and community assets like grazing land was very less in Kerala.[13] The advent of rubber, limited the scope. The irrigation canal in the lower slopes at the demarcation of uplands and valleys deter even the limited leached out nutrients from reaching the valleys. The inherent nature of the soil with leached out organic nutrients makes it less responsive to chemical fertilisers. There is acute shortage of organic manure also. This leads to a situation of lesser yield which makes paddy cultivation unremunerative.

b. Package of Practices

The farmers' experience show that the package of high input cultivation of High Yielding Varieties (HYV) - fertilizer - pesticides is not the answer to the profitability problems. Though there is a marginal increase in yield with the use of HYVs, there is a reduction in returns due to the non availability of straw and the farmers usually compensate the labour wages by selling the straw and this is a major loss to cultivators like the subsistence farmers of Kerala.

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[13] Pillai (1940) portrays the situation like this,"The case of green leaf manure is equally discouraging. In the olden days, the higher lands adjacent to paddy fields belonged to the owners of the fields. Sometimes they were held in common for the benefit of the villagers. Green manure was collected from the Government lands as well. But all these sources have undergone diminution. The fragmentation of land as a consequence of frequent partition leaves but little space for the planting of manure trees such as konna, puvarasu etc. Wastelands have been brought under assessment and indiscriminately registered to individuals, very often to speculators who have no local interests. The rules of the Forest Department, designed no doubt for conservation, prevent the ordinary ryot from taking advantage of the free pass system. In these circumstances the careful utilisation of waste materials like night soil is imperatively called for".

The input cost of HYV is high since this demands more application of chemical fertilizers. Since HYV is more disease prone, pesticide application also is greater. A farmer in sub sector IL in the study area, compared the pesticide needs of HYV and traditional varieties. While the traditional varieties need only two times of spraying in their entire growth period, HYV need this every two weeks or sometimes once in a week due to their vulnerability to pests and diseases. HYV cultivation needs assured irrigation and enhances labour cost for the increased operations. So when the economics of cultivation is taken, use of HYV is unprofitable compared to the low input cultivation demanded by the traditional varieties.[14] This confirms the observation made by Panikar (1983) that "the yield rates of the new varieties of rice is susceptible to a greater degree of fluctuation, the coefficient of variation of HYVs found to be nearly twice as high as that of local varieties". Due to the steadily increasing price of chemical fertilisers and unavailability of chemicals in time, farmers cannot afford to use the 'recommended dosage' (the recommendations are 'universal' in nature since these are not based on the specificities at the micro level).

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[14] A farmer from the Madakkathara padasekharam (sub sector IM) narrated one sad experience of his with the cultivation of HYV. In 1991, during the initial days of Group Farming Programme, a part of his paddy field was selected as a model plot for scientific farming. HYV was used and operations from sowing to harvesting, was done under the supervision of the Agricultural Officer (Madakkathara Krishi Bhavan) and Assistant Director of Agriculture. The yield was 30 per cent of the normal yield and the technical experts could not understand what went wrong. This is an example of how 'universal technology' cannot be applied to every piece of land. The local specificities of operations vary with respect to the land specificities which the farmers know by the process of 'learning by doing'. This should be blended with the appropriate elements of 'universal technology'.

c. Questions of Sustainability

In paddy cultivation also, the farmers observe a thorough disruption of the ecosystem by the use of pesticides, since along with the pests it destroys the friendly organisms like earthworms which enrich the soil. The organisms like frogs, snakes, fish etc. in the wet land ecosystem of valleys get destroyed by this poisoning, upsetting the whole eco-milieu. This will have long term repercussions on the sustainability of the system. The leasing of paddy lands for banana cultivation is found to be very detrimental to the sustainability of productivity of the land. Leasing is done for a year and the terms are usually that of share cropping, i.e., 50 per cent of the produce. The owners are usually absentee share croppers who are only interested in the return from the land. So the leasee usually uses very high doses of fertilisers and pesticides for high yields. His aim is only to maximise the benefits in the short run which will have detrimental effects on soil fertility.

4. Influence of Competing Crops

In a mixed cropping system, as in Kerala, competing crops have definitely affected the landuse decisions of the farmers. The best example is the phenomenal expansion of rubber in recent years in the study area. Rubber has governmental patronage right from planting stage. Now the crop is even grown by marginal holders since the minimum area for availing a planting subsidy from the Rubber Board has now been reduced to 0.25 acres which is attracting even the marginal farmers to rubber cultivation which was an erstwhile 'plantation crop'. There is technology diffusion, marketing facilities and an assured price. This assures rubber

cultivators price and yield stability. Because of all these, rubber is supposed to be a 'safe crop'and thus stability rather than profitability makes its cultivation more attractive.

Another important factor is the lower labour dependency. Tapping labour are not difficult to get and most of them are involved in this as a part-time occupation since tapping is mostly done in the early morning hours of the day. Rubber does not need the timely operations that a seasonal crop like paddy needs and hence suitable for the part-time farmers. Though rubber is rarely raised in valleys (except for rubber nurseries), the crops that rubber displaces are shifted to the valleys. It suits the attitudes and perceptions of the new generation. This kind of a "rubber effect" is strongest in the midland and moderate highland terrains. The shift from paddy to banana is also found to be the most common practice in the study area. This is also found to be the first step towards conversion to other landuses since conversion to banana does not need filling-up of the valleys. It only needs raising of the ground as mounds by the soil in the paddy field itself (See case study II).

5. Cost of Cultivation

This section is an attempt to work out the cost of cultivation of different crops to look at the micro-economics of the land use decisions taken at the farmlevel. The present analysis is done with the data collected from Panancheri village which is the adjacent one to Madakkathara since the study area is not yet

covered by the scheme[15]. But the physiographic and socio-economic profile is very much comparable due to the proximity.

The land use in Kerala is a mix of seasonal crops, annual crops and perennial tree crops. So a representative crop from each is taken to study the cost of cultivation. Paddy, Tapioca and rubber are selected for the analysis.[16]

In the surveyed holdings, the area covered by paddy is 35.21 ha. and that by tapioca is 1.09 ha. The cost of cultivation per hectare of paddy, tapioca and rubber is given in table 4.7.

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[15] The 'comprehensive scheme on the study on cost of cultivation of the principal crops of Kerala' attached to the Dept. of Economics, University of Kerala is collecting the cost of cultivation in selected villages. The farmers are divided into 5 size classes as (ha): 0-1, 1-2, 2-4, 4-6 and >6. Ten samples (two from each size class) are selected and cost accounting method is used for the survey. This is done for a period of three years from 1983-84 to 1986-87. The latest year is taken for the present analysis.

[16] The limitation of the present study is that the collection of data for all the 3 crops are done using the same method. Crops like rubber have a lag in giving returns due to the gestation period of seven to ten years after planting. But the cost is worked out as only the operational cost of the different crops. In the collected data, only one rubber holding covering 0.64 ha. is available. Another limitation is that only the data for a single year is included.

Table 4.5
Cost of Cultivation per hectare of Paddy, Tapioca & Rubber in Panancherry Village 1986 - 87

Cost of items	Paddy (Rs)	Tapioca (Rs)	Rubber (Rs)
Cost A1 Paid out costs			
1. Value of hired human labour	1837.64	2118.46	2983.87
2. Value of hired bullock labour	48.40	-	-
3. Value of owned bullock labour	169.58	63.04	-
4. Value of owned machinery labour	351.25	-	-
5. Hired Machinery Charges	176.68	293.58	
6. Value of seed (both farm produced and purchased	409.98	224.50	-
7. Value of Insecticides/ Pesticides	31.79	-	361.29
8. Value of Manure (Owned and purchased)	229.55	24.77	-
9. Value of Fertilizer	381.24	430.05	1741.94
10. Depreciation of implements and farm building	157.49	-	443.55
11. Irrigation charges	27.10	49.54	61.48
12. Land revenue, Cesses and other charges	8.65	15.19	19.68
13. Interest on working capital	239.33	201.20	350.74
14. Miscellaneous Expenses	-	9.17	-
Cost A1 Total	4068.68	3429.50	5962.55
Cost A2 = Cost A1 + rent paid for leased-in land	4068.68	3429.50	5962.55
Cost B1 = Cost A1 + interest on value of owned fixed capital assets (excluding land)	4524.59	3429.50	6911.14
Cost B2 = Cost B1+rental value of owned land (net of land revenue) and rent paid for leased in land	4524.59	3429.50	6911.14
Cost C1 = Cost B1+imputed value of family labour	7558.79	4017.40	7260.42
Cost C2 = Cost B2 + imputed value of family labour	7558.79	4017.40	7260.42
Value of Output per hectare (main and by-product)	6032.17	9935.37	8637.90
Profitability per hectare (Value of output/ha - paid out cost/ha)	1963.49	6505.87	2675.35

Source: Comprehensive scheme on the cost of cultivation of the principal crops of Kerala, University of Kerala.

Notes:1.The practice of leasing in/out-is not noticed in the village during 1986-87. Hence the rental value of owned land is not included in the cost.
2.The value of family labour is imputed on the basis of the wage paid for casual hired labour.
3.The cost of cultivation of rubber is generated as is done in the case of seasonal crops. Hence the cost incurred in the bringing-up stage is not included in the cost.
4.Interest on working capital is calculated at 12.5% for half of the period of the crop.
5.Interest on value of owned fixed capital is worked out at 10%.

From the table it can be seen that though the paid out cost of paddy cultivation is less when all the cost components are taken, it ranks highest among the three. Irrespective of the crop, a larger proportion of the cost incurred is the paid out cost. These paid out costs for rubber are higher than paddy primarily due to higher hired labour cost and fertiliser cost. It is to be noted here that though paddy cultivation is more labour-intensive than rubber, hired labour costs are more for rubber. The needed labour input for paddy is generally supplied by family labour, which is reflected in the highest imputed cost of labour for paddy. On the other hand, low imputed cost for rubber confirms the part-time involvement of the cultivator. The higher paid out cost for rubber is compensated by low imputed cost of labour and makes rubber cultivation less costly than paddy. This relative cost effectiveness leads a cultivator to opt for rubber.

It was found that the profitability from tapioca was the highest and paddy the lowest. This is because of the low cost of cultivation for tapioca. The costs B1 and C1 are absent only for tapioca. This might be the reason for the spread of tapioca to the paddy fields. But the yield instability of tapioca was

quantitatively seen in Chapter I (Ramachandran et. al, 1987) and the preceding discussions in this chapter. This might be the reason why area under tapioca is not spreading as rubber. Though profit margin is lower for rubber, the reasons mentioned in the former section makes rubber cultivation attractive.

6. Externalities of Valley Conversions

Some cultivators are forced to discontinue paddy cultivation due to the action of other farmers which are uni-directional externalities inflicted on them. In sector V, (a high midland sector)the soil is good. From the steep upper slopes, there is scope for leached out nutrients. Water is available from a stream and also through the irrigation canal which encircles the sector completely. Here the yield of paddy was very good due to the above mentioned reasons. In 1983, a nursery was established at the head of this valley. Water from the stream was diverted for this (since nursery requires intensive watering). Due to this the farmers below are not getting water from the stream. This forced the small and marginal farmers below to convert the paddylands or sell their lands to the nursery.[17]

The farmers in the upper part of the midland valley of Sector IV converted the paddy fields to cultivate banana and coconut. Water comes from the streams or the irrigation canal through this part. Since banana and coconut do not need standing water, it was

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[17] Farmers with capital and knowhow for starting nurseries, have already started this, converting paddyfield, particularly in sector V. Nurseries are so widespread here because of the "Mannuthy" name; people identifies the name with KAU and because of this they can sell the plants to even far away places.

diverted away from the valleys which deprives the cultivators of water in the lower reaches. They have only two options -- either to convert or fallow the paddy land.

Farmers in the Sector I told about a positive externality which indirectly helps paddy cultivation. Because of the 400KV substation at Madakkathara above the Sector I, a number of towers and power lines cris s cross the study area. No perennial trees can be grown at a distance of 55 feet on both sides of these. This, in fact, is a grave blow to the local agricultural economy (since in general as mentioned earlier, Kerala's Agricultural scenario is dominated by perennial tree crops). But this acts as a positive externality for the paddy fields in the area since they cannot be converted to grow perennial tree crops.

7. Effect of Fragmentation and Miniaturisation of Holdings

a. Population

From the beginning we observe the problem of a rising population with not many alternative economic opportunities other than land. We will look into the population expansion in the study area to get an idea about the graveness of the problem.

Table 4.6: Population -- Trichur District

Census Year	Population	% decade variation
1901	658,873	-
1911	742,707	+ 12.72
1921	786,564	+ 5.91
1931	961,965	+ 22.30
1941	1,119,565	+ 16.38
1951	1,362,665	+ 21.71
1961	1,639,862	+ 20.34
1971	2,128,797	+ 29.81
1981	2,439,543	+ 14.60

Source: District Census Handbook (various years).

This is done for the Trichur district since there has been reallocation of villages in the study area which makes the Panchayat figures non comparable between censuses. If we look at the density of population in the district:

Table 4.7: Density of Population of Trichur District, Kerala and India

Year	No. of persons per Sq.kilometer		
	Trichur	Kerala	India
1901	225	165	77
1911	254	184	82
1921	268	201	81
1931	328	245	90
1941	381	284	103
1951	463	349	117
1961	557	435	142
1971	702	549	177
1981	805	654	221

Source: District Census Handbook, 1981.

The density of population in the district has been consistently higher than the state rates which in turn was higher than the nation in all censuses, the increase between district and state being 150 persons in 1981.

When the limited land got fragmented due to this, naturally people had to look for the most economic use of land and a stage came when family cannot sustain with agriculture alone with the limited land. This resulted in the search for other jobs in other sectors and urban centres. Landuse practices which demanded less labour and minimum attention was the answer. Thus a new class of farmers called 'Sunday' or 'Weekend' farmers emerged in the agricultural scenario of the State who consider agriculture as a source of supplementary income. The limited land makes it uneconomical to resort to any kind of land development. But as long as the ownership is retained, they are satisfied with the limited income from these miniaturised holdings.

b. Fragmentation

There is heavy fragmentation of holdings in the study area. Here the largest valley, i.e. the Madakkathara padasekharam coming in Sector I can be taken as an example. Now 315 farmers own 133 ha with per capita holding size of 0.42 ha.[18] The heterogenous group range from earlier large owners to small peasants.

The break up of the respondent farmers, with details of their prior status, caste, age and years of experience with paddy cultivation is given in Table 4.8. The prior status of the cultivators (i.e. their status before two generations in paddy

[18] This was taken from the list of cultivators who applied for fertilizer subsidy in the Group farming society. They show their original area under paddy to get the maximum subsidy amount of which a major part might have been converted at present. So the actual average holding size may be very much smaller now. This is evident from the fact that the total area under paddy in 1991 was only 319 ha in the study area. Although Sector I is the largest sector here, it cannot occupy 42 per cent of the area under paddy!

operations) gives three types - earlier large tenants (above 25 acres), medium tenants (10-25 acres) and small tenants (below 10 acres). No owner cultivator could be identified since they were tenants of some landlord living away.[19]

Out of the thirty persons interviewed, seven are agricultural labourers - Five of them do not retain any paddy land now and these are the persons missing in the table. According to them, perennial crops which do not demand periodic inputs and other operations which paddy cultivation demands, relieve them from their own plots so that they can sell their labour in the much demanded labour market. The following is the breakup of agricultural labourers interviewed terrain-wise:

Lowland = 2 Highmidland = 2

Midland = 3

In the highland, out of three cultivators interviewed, two are now daily wage labourers since they were forced to convert their erstwhile paddy area. Their prior status two generations back was of medium tenants. Table 4.8 gives the picture of their drastic decline in areas from 15 acres to 0.08 acres and 18 acres to 0.01 acres respectively.

[19] A Nambudiri family from Cherpu (Pattathu mana) held a substantial portion of the midland valley fields in the study area.

Table 4.8: Profile of Cultivators Interviewed

Sub sector	Age	Caste	Years of experience	Prior status	Present occupation	Present involvement	Holding size in Area			
							GF	F	Far	Chil.
VII H	75	Ezhava	50	MT	cultivator	cult+labour	15	3.6	0.25	0.08
VII H	62	Christian	30	MA	cultivator	full time	18	4.5	0.20	0.01
I H	69	Ezhava	55	MT	house wife	part time	--	15	4.0	0.40
VI M	64	Nair	50	MT	Cultivator	full time	--	16	3.5	0.3
I M	56	Nair	35	LT	Rtd. from KSEB	part time	30	30	1.5	0.5
III M	80	Nair	66	MT	cultivator	full time	18	8	3	0.8
VII M	62	Christian	40	MT	cult.+agri.lab.	cult +labour	14	4.5	1.2	0.40
II M	54	Nair	35	MT	cultivator	full time	15	6	1.5	0.5
VI M	57	Nair	30	MT	govt. servant	part time	16	6	1	0.15
I M	61	Ezhava	35	MT	Pharmacist	part time	12	3	2.5	0.5
II M	59	Nair	35	MT	Pharmacist	part time	12	3	2.5	0.5
I M	70	Nair	50	MT	politician	part time	12	5	0.7	0.23
I M	62	Ezhava	40	ST	cultvator	cultivator	2	2	1	0.25
IV M	54	Ezhava	35	ST	cultivator	full time	9	4	2.5	0.8
VI M	62	Ezhava	40	ST	cultivator	full time	4	1.5	0.5	0.08
III M	57	Ezhava	42	ST	cult.+agrilabour	Cult.+labour	-	0.5	0.10	0.05
VI M	68	Nair	55	ST	cultivator	full time	7	2.5	0.8	0.2
VI M	64	Christian	30	MA	cultivator	full time	-	4	1	0.5
II L	65	Nair	50	MT	Rtd. teacher	part time	15	5	1.5	0.5
II L	57	Ezhava	35	ST	cultivator	cult.+labour	1	1	0.20	-
III L	56	Ezhava	40	ST	cultivator	full time	-	3	1	0.80
III L	62	Nair	30	MT	Rtd. professor	part time	-	6	1	0.5
III L	76	Ezhava	64	ST	cultivator	full time	-	3	1	0.3
I L	63	Christian	46	ST	cultivator	full time	6	2	0.8	0.3
III L	56	Nair	40	MT	Rtd. teacher	part time	12	3	1	0.5

Source: Socio-economic Survey, 1993

Note : GF = Grand Father
F = Father
Far = Farmer
Chil= Children
ST = Small Tenant
MT = Medium Tenant
LT = Large Tenant

The years of paddy cultivation experience, present involvement with this and caste of the farmers is also given in Table 4.8. It is seen that 11 of the interviewed are full time cultivators who are associated with paddy cultivation for a period between 30 to 64 years. Ten of them have become part time cultivators in the process since they got government jobs. The seven agricultural labourers are also not full time paddy field labourers. They go for other casual employment in other agricultural and non-agricultural works also. Out of the eleven full-time cultivators

interviewed, only two persons' sons are interested in full-time cultivation and hence giving them a helping hand. All others in the present generation have either left their native village or are working in nearby Trichur town. Those who have left have either gone to other urban centres inside the country or to middle east. To get an idea of the fragmentation of paddy area, the ownership pattern of the farmers through 4 generations is attempted. In the Table, the drastic reduction in the area inherited by the fourth generation highlights the fact that paddy cultivation has become an unviable proposition as a full time occupation to the next generation. This does not mean that the family has lost their cultivable area since nuclear families retain the fragments they received as garden lands with some perennial tree crop or annual crops.

In the next section, two representative case studies are given. To get a profle of their changes through the generations an attempt is made to construct family trees of these farmers (Appendix 4.1). Two other selected family trees are also given. Wherever data was available,the holding was divided into paddy(P) and garden land(G). The farmer interviewed is given as 'Farmer' in the family tree to know his position in the hierarchy. The details of the next generation is given to find out whether they are interested in paddy cultivation. From the survey, it is revealed that:

(1) There is heavy fragmentation of holdings;
(2) Drastic reduction in paddy area (due to conversion to other crops);
(3) The new addition to holdings are only gardenlands;
(4) Out of the thirty persons interviewed, only three persons in the next generation are continuing in agriculture. But two have already converted a major part of the paddy area to nurseries.

(5) Even the cultivating farmers do it to get paddy for own use and not on a commercial basis. They are doing it mostly because their culture and tradition does not allow them to buy grains from the market (which is not a problem for the children).

The above facts reveals that unless there is a thorough change in the institutional structure, the process is likely to continue. Better insights are expressed through two representative case studies, one from the highland subsector VTT H and the other from the midland subsector VT M, which are dealt in the succeding section.

4.4 *Selected Case Studies*

a. Case I: Sub Sector VTT.H (Eastern part)]

This case is an interesting example of the spread and decline of paddy cultivation in the highland sector. The history of highland cultivation dates back to the beginning of this century here. Chakkola family of Trichur owned the land. Five families migrated here and they started paddy cultivation on lease in the valleys and lower slopes. But this was done only in the narrow valley and lowest foot slopes. The portions above this was thickly forested, and had perennial streams and enough water was available. The settlements of the five families were in one place. The soil was very fertile and there was no need for any manuring. Sowing used to be done just after rains. Paddy was the only permissible cultivation here (due to insecurity of tenure). After harvest, the paddy used to be transported in bullock carts to Trichur, to the landlord's house.

When the population increased, migration to uplands also increased, resulting in heavy deforestation in the upper reaches.

This resulted in the drying up of perennial streams. Those remaining were under the threat of siltation. The passing of Land Reforms Act in 1970 was a blessing to the cultivators in the sense that it took away the landlord's right to the produce. The cultivators were given right to 13 acres of land each (since these were on the uplands). Partition of this into different holdings also started as the farmers gave independent rights to their children. Then more and more nuclear families needed separate houses which demanded garden lands for cultivation. The new houses were all built in the slopes through which the streams catering to the mainstreams in the valley were flowing. The private property rights given to the farmers gave them the opportunity to use these streams for their cultivation. So the limited water coming through the streams after the deforestation in uplands also did not reach the mainstream due to these landuse changes.

With the abolition of tenancy in 1970 , the cultivators were free to do whatever cultivation they liked. Earlier landlords insisted on cultivating paddy alone. The cultivators had no freedom other than this since the terms of tenancy were so insecure. Fragmentation of the land also forced them to go for more profitable activities to maximise the benefits from their limited holdings. It is interesting to note that a pond dug in the foot slopes, which used to collect enough water for paddy cultivation, with deforestation, silt coming into the pond after each rain made it a tough task to maintain its capacity of the pond. This led to the conversion of paddy lands to other uses.

Tapioca was first tried. But the yield declined after two to 3 years. The nearest market for tapioca was Trichur. The farmers were complaining that the returns were so less that they did not get even the cart rents to transport it.

About 15 years back, migration from central Travancore started and along with this, heavy deforestation also. This is why paddy almost disappeared from Sector VII after 1980. They introduced rubber cultivation here. This had a negative impact in the local labour in the sense it produced only very little labour especially during the gestation period. This has affected the economy of the area. Now the small holders are leaving the area one by one since they cannot sustain their families neither through farming nor other activities (like casual labour). No group farming is practiced here now since paddy remains only in 4-5 acres now.

The farmer's grand father had 18 acres of land (only paddy since this was the only permissible landuse). His father had 3 brothers and each one got 4.5 acres of paddy land. The farmer is one among six children and each got 0.5 acres since 1.5 acres were earlier converted for housing the nuclear families of the children. The farmer converted 0.3 acres into G and now retains only 0.2 acres. This he does since it is the middle part of the valley (see Appendix 4.1, case 1).

b. Case II: Sub sector VI.M]

Major part of Sector VI belonged to the farmer's family in which only less than 12-15 cultivators were there. So all

operations could be done in a cooperative basis in time. He remembers the festive atmosphere in the premonsoon days before sowing when every cultivator used to desilt the stream in his stretch of the paddy field. The bonded labour in those days used to do all these operations as their duty or it was their part of life. Water control also was easy between the limited number of cultivators. Number of farmers increased due to fragmentation and hence, nobody is interested in the maintenance of common property resources like natural streams and even irrigation canals.

Regarding irrigation facilities, here in high-midland sectors, there is no need even to open the sprouts of the irrigation canal upto December. Due to the hydraulic head (since canal passes through the lower slopes) valleys become water faciled. But due to lack of drainage, partly due to conversion, neighboring valleys results in water logging which affects yield. But no water is available for the third crop since water is diverted to Kole fields for the summer crop there. Water comes through the canal once a week in summer and recharges the water table here which is used mainly for drinking purpose.

Earlier uplands had trees like Kaini, Maruthu, teak and rosewood which are deciduous. So organic manure was available. The undergrowth was burnt and these used to get leached to the valleys. Even in 1950s paddy was being done using seeds like kattumodan and manjavari which needed moisture only while sowing. The settlers from Travancore came by mid fifties. Deforestation, soil erosion and consequent silting of streams and ponds began. He remembers elephants bathing in the stream (Kallayi thode)

through the middle of sector VI. Now it is only less than 2' deep due to silting. The other problem relates to lack of co-operation between farmers. Paddy cultivation needs perfect co-operation between farmers in a sector, particularly for the sharing of water.

About the fragmentation of holdings : Father had 24 acres of land. 16 acres paddy (P) and 8 acres garden and (G). He had seven brothers and sisters (5 male and 2 female). The brothers including the farmer got 3.54 acres each which had 1.40 acres of paddy land. Now he retains 60 cents of land under paddy. He has 2 children (students), who will inherit 30 cents of paddy land each (see Appendix 4. 1. case 2).

About the conversion of paddy land for alternative use : The paddy lands retained are the central portions of valleys. The peripheral portions which are less water-faciled and fertile were converted to banana, coconut and arecanut. The banana and tapioca are done in rotation in the same land. According to him, coconut is the 'safest' landuse. The first conversion of paddy land was in 1979 to build the house. Then it was done step by step. Since he is a full time farmer, only a combination of crops can give him the desired returns from his limited holding. In the total holding, rubber and is cultivated in 1 acre and is most impressed by the daily returns he get for eight to nine months a year. According to him, banana has become very popular in the last six to seven years mainly because of the credit facilities available for it. Loan is availed on the basis of number of plants and this is a real incentive for conversion of paddy lands. The initial cost of

conversion is also less since banana needs only heaping the soil into mounds and channelling in between. Banana though more remunerative are prone to the vagaries of nature such as rain, wind and floods and more recent diseases. Conversions according to him are an irreversible process since even for banana (which needs the least alteration), channelling and raising of ground is a must. After 2 or 3 years, if paddy is to be cultivated, it is impossible, since land preparation by tilling or even animal power will not be possible.

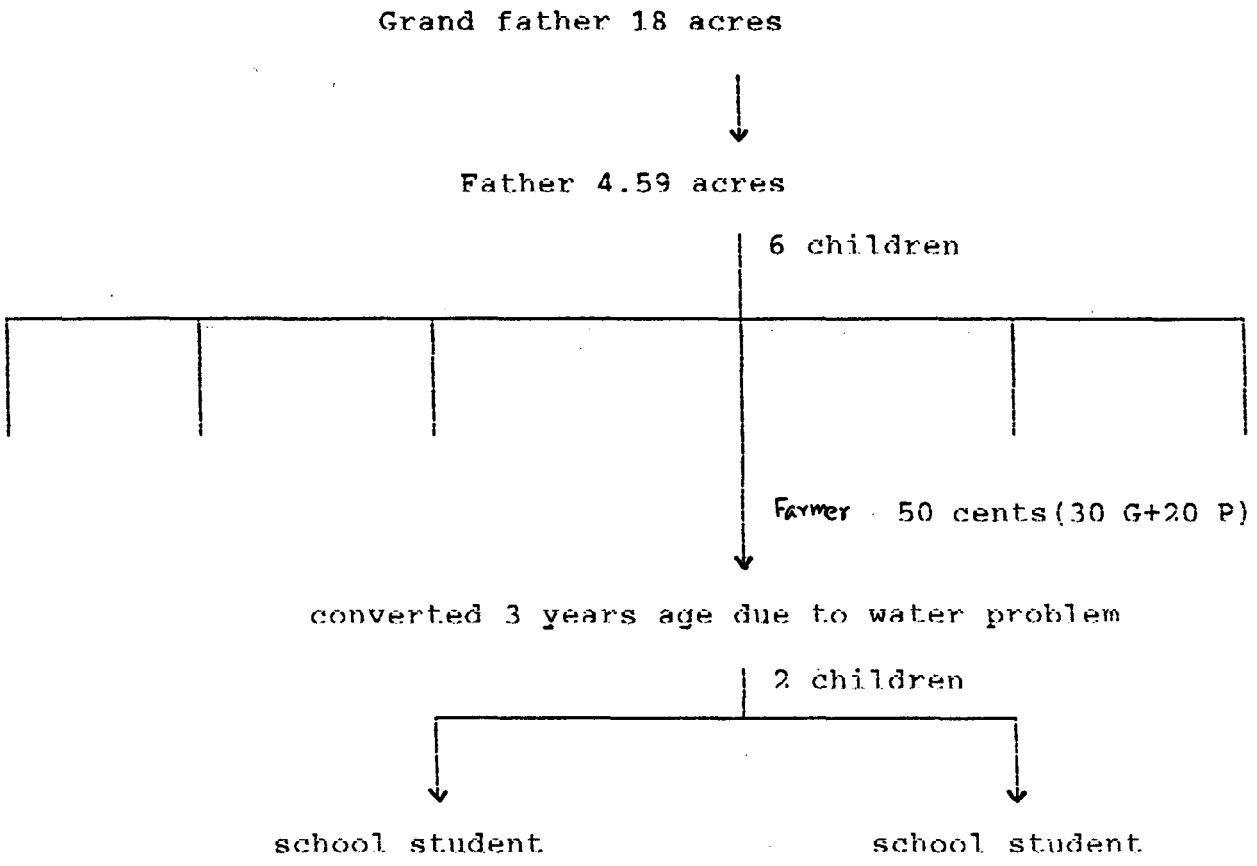
4.5 *Summary*

The socio-economic survey, conducted at Madakkathara to trace out the historical evolution and problems relating to paddy cultivation, revealed that deforestation, erosion and silting of natural streams are the impediments to natural water availability. Lack of maintenance and lack of awareness of people are found to be the important problems relating to irrigation. Availability of alternate employment opportunities, occupational mobility and changing attitudes particularly due to spread of education is keeping people away from traditional agriculture. Inherent nature of the soil makes it less responsive to chemical fertilisers coupled with lack of availability of organic manures has led to a situation of low yields and returns. A preliminary attempt to calculate the cost of cultivation and relative profitability showed trends unfavourable to paddy. The phenomenon of conversions are found to impose unidirectional externalities on the cultivating farmer which leads to more conversions. The extensive fragmentation of holdings have brought a situation where paddy

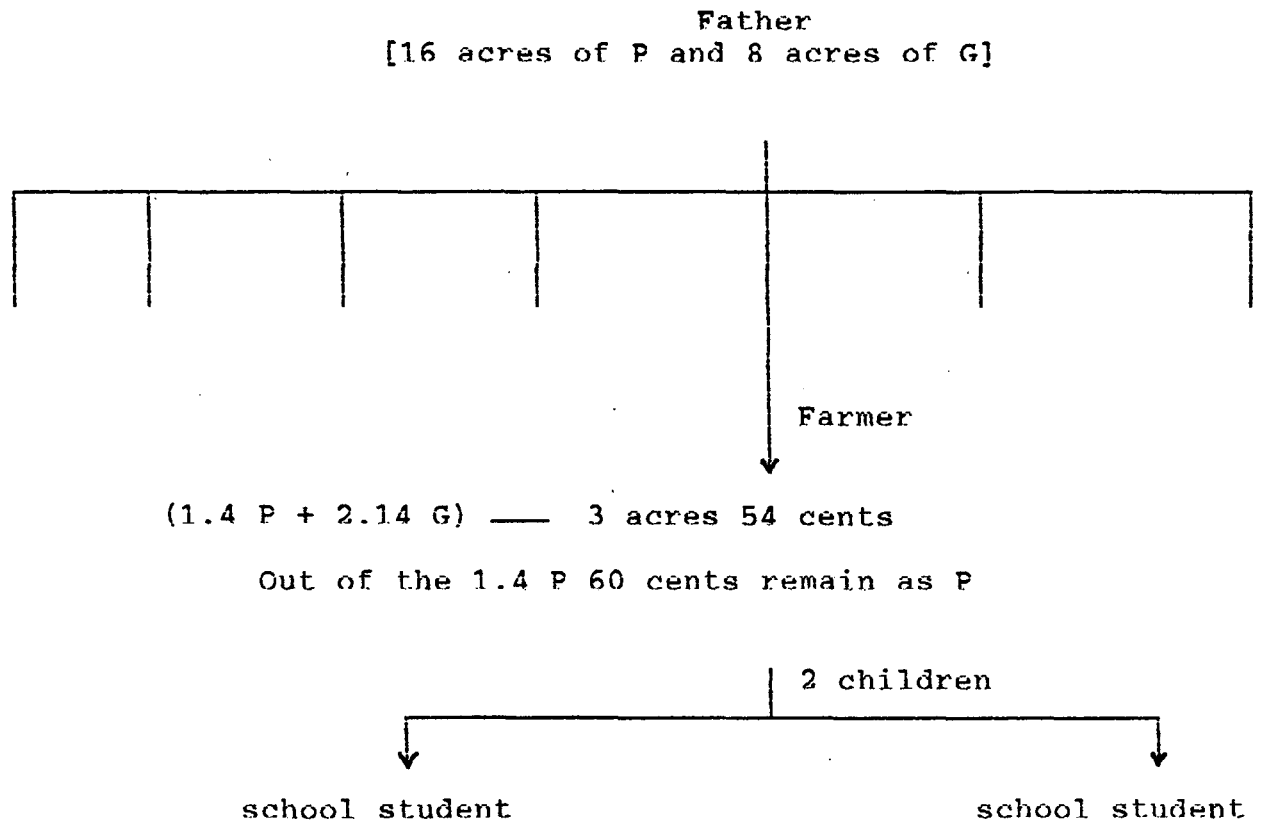
cultivation has become a subsistence one from which increasing number of people are shifting.

APPENDIX IV.1

Case 1: Sector VIII.

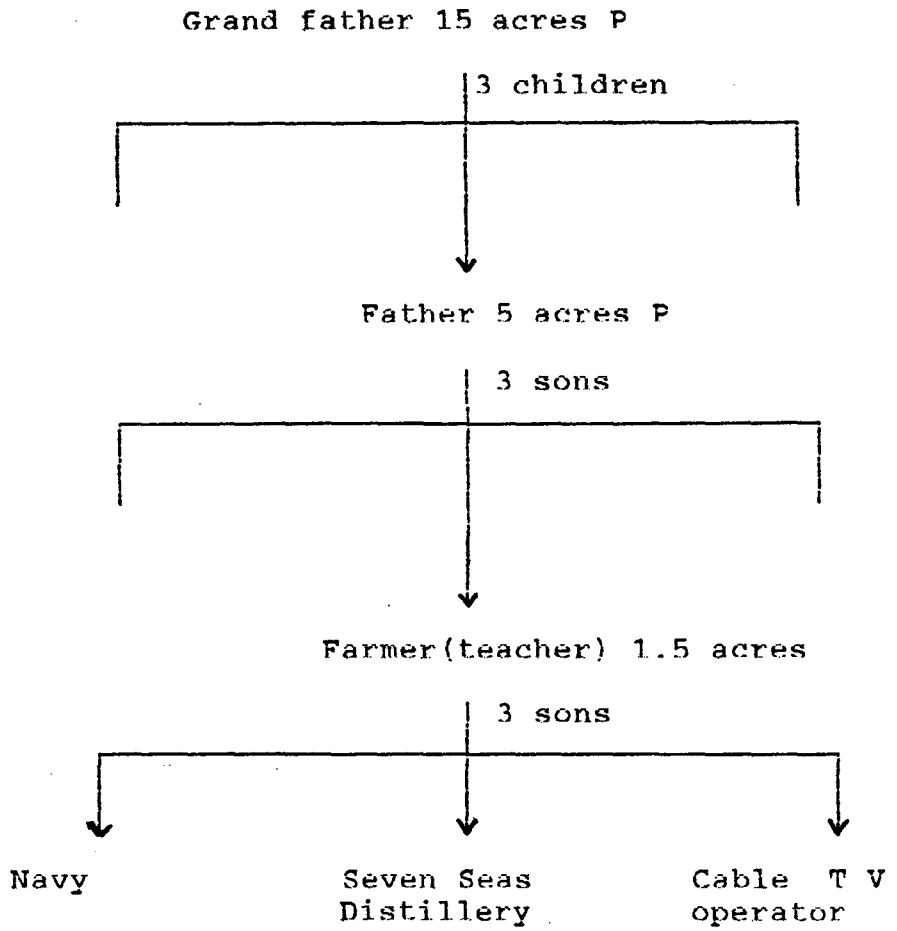


Case 2: Sector VIM



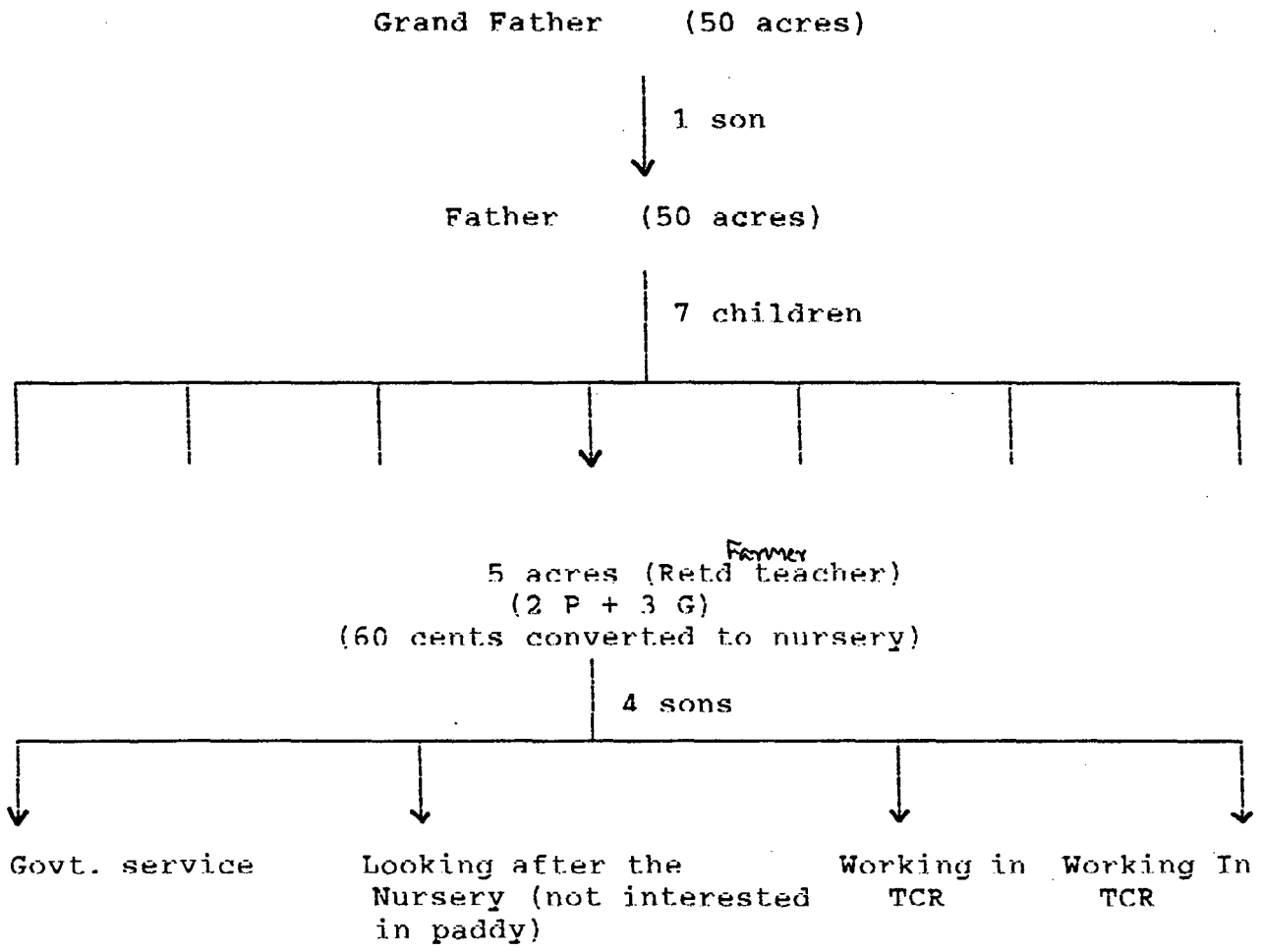
Case 3:

Sector II M



Case 4:

Sector V M



Chapter V

EVALUATION OF EARLIER PROGRAMMES AND STRATEGY FOR INTERVENTION

Foodgrains being basic to an economy, the central and state governments have launched a variety of programmes to boost paddy production. We will briefly look through these to evaluate their performance. These programmes are discussed in detail in Appendix V.1 (see Appendix V.1).

The important programmes by the central government were the IADP (Integrated Agricultural District Programme), launched in 1960 and IAAP (Integrated Agricultural Area Programme), launched in 1963-64. But these were implemented as packages of high input cultivation only in selected regions in the country. Palakkad and Alleppey were selected in Kerala to implement the programme. An evaluation on IADP done by the State Planning Board in 1971 has pointed out some limitations of the programme. The evaluation noted that the programme is found to have produced a direct impact only on a limited section of the farming community. It did not succeed in enthusing the majority of the farming community who lacked both motivation and the equipments to benefit from the promotional effects of the extension machinery. The study also noted that IADP discriminated in favour of a few especially endowed districts and operationally it tended to produce a greater impact on a small group of farmers who are in a better position to take full advantage of the programme. The performance of IAAP also did not match upto the expectations. The mid-term appraisal of the programmes showed that the agriculture production programmes had to be revitalised. It was felt that greater use of modern methods of

production was necessary to bridge the gap between demand and supply (Government of Kerala, 1978).

High Yield Variety programme was launched in the Fourth Five Year Plan which envisaged the introduction of a new strategy which stressed the use of high yielding variety of seeds and improved scientific methods of cultivation. This was also restricted to the IADP & IAAP areas which are endowed with irrigation, extension staff and other facilities. This failed mainly because of vulnerability of HYV to pests and diseases and also due to the yield fluctuations (Panikar,1983).

Intensive Paddy Development (*Ela*) Programme (IPDP), a state level programme launched in 1971 in the Fourth Five Year Plan period envisaged for organising paddy production with *Ela* (sector as noted in the last chapter) as the basic unit. Joint procurement, timely application of inputs as well as the adoption of improved farming practices were also planned.

The IAAP, IADP and HYV programmes were a part of the Green Revolution strategy of the period which was a high input, energy intensive cultivation aimed at maximising agricultural production. This was planned only with a view to enhance food grain production to attaining self sufficiency in the food sector. From the efficiency point of view, the programme was a success in the sense that it boosted paddy production in both the districts. The main failure of the programme in Kerala was the lack of spread and hence the benefits being accrued by a small section of farmers and that too in two districts. So in the context of sustainable landuse, it

can be seen that these programmes only had the efficiency component in it and lacked the equity and sustainability components.

The IPD (*Ela*) Programme at least identified the need for an *Ela* (sector) approach. But the evaluation study of IPDP by the State planning Board (Govt of Kerala,1978) has brought out the following problems, which undermined the programme :

Physio-climatic conditions for selection of *Ela* (sector) originally conceived was not done properly. Diversity in the nature of land, practical difficulties in raising common nurseries, fragmentation and lack of co-operation among farmers were the main hurdles identified for the failure in adopting uniform operations. Proper coordination by Minor Irrigation Department for the transfer of funds to IPD units were not done. The study suggested certain improvements like proper representation of farmers in the committee, planning from grassroot level and a subsidy for fertilizers and pesticides since price of rice was not attractive.

The recent addition to these programmes is the Group Farming programme launched in 1989. Group farming programme was definitely a well conceived one in the sense it identified almost all constraints of paddy cultivation in the planning stage. The very physiography of the valley landforms and the cultivation of paddy demand treating it as a single unit for effective water control,etc.. Though the ownership structure and distribution of output were skewed in earlier times, the inegalitarian structure was a 'workable' one in this sense. Now in the small and

miniaturised holdings[1], mostly subsistence cultivation is practiced. So there is no incentive for investment in land and even maintenance of the available infrastructure like irrigation. Retaining ownership rights (which enhance individual initiative) and collective management (which takes care of the economies of scale) conceived in Group Farming programme was an ideal strategy which took care of efficiency and equity considerations of the paddy landuse under the existing conditions. Group Farming perceived all the recommendations made by the IPDP study during its planning stage like an institutional structure at the sector level to the district level and fiscal incentives as subsidies.

Sunny Jose's (1991) microlevel study on the performance of Group Farming in Trivandrum district found that Group Farming has brought out significant reduction in cost of cultivation -- mainly the cost of labour. This was greatly brought about by technological innovations like mechanised tilling and chemical weed control introduced under Group Farming. In the cost of materials, though there has been a significant reduction in the cost of seed and plant protection chemicals, due to a larger increase in the cost of fertilizer, organic manure and weedicides the total material cost has increased under Group Farming. This was mainly due to the increase in the use of HYV seeds to which more manure is applied which resulted in the increase of output (it was noted that favourable climatic factors played the major role).

[1]90 percent of paddy holdings in Kerala are below 0.36 hectares (Government of Kerala,1989)

He noted that the variations between the size classes has come down under Group Farming which are indicative of the benefits that could accrue from Group Farming operations, especially for small-sized holdings. But the constraints identified were the lack of initiative of *Krishi Bhavans* (Panchayat level agricultural office), problems of leadership and organisational ability of convenors of Group Farming Committee, non-coordination between departments, problems of marketing and the lack of interest shown by part time farmers who have other employment, which undermines the functioning of Group Farming Committees.

Since this is an ongoing programme, the farmers in the study area were asked to comment on the programme. Almost all the farmers in Madakkathara are aware of the usefulness of the programme. According to them, this is a programme that can turn out to be beneficial as a cost reducing intervention, but is failing at the implementation stage. At the operational level, the programme is failing mainly due to the following reasons:

1. Political: This was introduced by Left Democratic Front (LDF) Government in 1989. The present United Democratic Front (UDF) Government is more interested in the new schemes they are introducing. So, for the past one year, practically no funds are being allotted for Group Farming programme. When the attraction of even the marginal subsidies are withdrawn, farmers who are basically individualistic and who likes to do cultivation according to their own convenience lost interest in group action.

2. Lack of Capital: Due to lack of capital, the small holders are not usually in a position to start cultivation in time. For these small holders the access to institutional credit is also

limited, being a function of the assets. This makes their agricultural operations non-synchronous, making group action difficult.

3. Leadership of Group Farming Committee: The political background of conveners prompt them to take unilateral decisions which may not be acceptable to all and thus leading to a lack of cooperation between members. Most of the conveners of Group Farming committee are LDF nominees since the programme started during their time. Now with the UDF Government in power, the UDF members, who were earlier sidelined, are taking advantage of the favourable political climate. The end result is that the Committees have almost become non functional.

4. Lack of support from bureaucracy: The 'line' departments responsible for imparting technical support and providing inputs are unaware of the local problems of farmers. Departments like Irrigation and Command Area Development Authority (CADA) have only offices in the district headquarters. Though the Agriculture Department has an office at the panchayat level, the officer complains that he hardly gets any time for 'extension' work since the accompanying bureaucratic 'paper work' for the different schemes takes up most of his time.

5. Physical Constraints: The extent of conversions in valleys, especially the highland and midland valleys (Sectors V, VI & VII), makes it difficult for any kind of group activity. Since paddy cultivation here are done in disjointed pockets with newly formed garden lands in between, any mechanization of operations like tilling or ploughing is difficult. Waterlogging and lack of drainage are also forcing the farmers to convert the land for other uses. In these sectors any form of group activity has practically

no scope at all.

6. Part time cultivators: The part-time cultivators with other occupations, especially of the new generation, are not at all interested in group action or boosting paddy production. They are only interested in subsistence production for own consumption and have neither the time nor the will to participate in any group activity. The part time farmers are the greatest impediment to implementing any group action.

In the present study's point of view of the sustainable use of valleys for paddy cultivation, it can be seen that although the Group Farming programme was conceived on the efficiency and equity components of the sustainable landuse strategy, it lacks the sustainability component. It was also following the same 'package' policies of high input cultivation, as the earlier programmes.

A Strategy for Intervention

From the discussions in this chapter, the major problems faced by paddy cultivation can be grouped into three as:

1. Lack of Co-operation

In the present individualistic system of cultivation, most cultivators raise the crop according to own convenience and suitability. If cultivation is done with the same type of seeds and follow a common crop rotation and unification of the cropping scheme, it can facilitate the use of machinery, economise water and simplify pest control resulting in higher returns to both capital and labour. The unit cost on inputs could also be reduced if they

are purchased and transported in common. The main impediment is the lack of co-operation among the heterogenous group of farmers, a large number of them being part-time or absentee which acts in the way of implementing any collective action.

2. Non-Coordination of Bureaucracy

At the macrolevel, policies are framed and funds are allotted to execute the various programmes. For example, in the study area, a well developed irrigation infrastructure is there. But the Minor Irrigation Department responsible for water control and maintenance of the same are not effective and hence the full benefits from the investment is not accrued to the farmers. The same is the case with the supply of inputs and subsidy too.

3. Sustainability of the System

Cultivation of paddy and thus conservation of the essential nature of the valley landforms is the first step towards this. In the preceding chapter, we saw that even the present system of paddy cultivation also poses questions of sustainability to the larger eco-system. But planning at the macrolevel still holds on to the package of high input cultivation. Even the otherwise well-conceived programmes like *Ela* and Group Farming failed to recognise the detrimental effects of recommending 'universal packages' without an eye on the local specificities of the land and water systems.

In the given situation, what can be the best strategy to conserve at least the remaining paddy fields in Kerala ?.

a. Instilling Cooperation

The cultivators, even in the same sector (as seen in the study area) are a heterogenous group with varying holding sizes, social and economic status. For making them into a cultivating unit of economic size, a collective action is needed. This points to the need for an effective institutional structure that ensures full participation of the farmers. The part-time and absentee farmers should be kept away from the day to day management of paddy cultivation. The paddy operations should be entrusted with a committee constituting exclusively of the cultivating farmers preferably full-time ones. The owners who cannot devote attention to cultivation can thus be relieved from the present burden of supervision of cultivation. For the formation and effective functioning of these bodies there should be co-operation and participation of the real cultivators at the lowest level (sector) and there should be integration of such bodies at an appropriate higher level, say the panchayat. But these bodies should have sufficient finance and certain amount of autonomy for their proper functioning.

b. Restructuring Bureaucracy

In the present centralised bureaucratic set up, the funds allotted and the funds expended do not ensure optimum benefits at the farm level. Due to the centralised nature, the bureaucracy does not have any answerability towards the farmers. Hence a decentralised body which plays more of a facilitator's role than the executor's role is desirable.

Tang (1992) puts forward that local, self governing

organisations have several advantages over centralised bureaucratic agencies, since they are organised in ways that are compatible with specific social and physical environments. The users with their proximity to the appropriation area have the most intimate knowledge about their physical and social environments, which enable them to utilise their knowledge effectively. About the rules adopted for the use of resources , Tang (1992) notes that,

> "The rules adopted by farmers are likely to be more relevant to local circumstances because farmers who decide to adopt the rules have to bear the consequences of their own decisions, and personal stakes motivate them to monitor one another's behaviour. This is contrasted with officials in bureaucratic agencies whose career advancement is unrelated to how well they serve farmer's interest."

Further, individuals who have lived together for a sustained period may be able to develop various social networks and reciprocal relationships with one another. It is often difficult for outsiders to ascertain the complex web of these relationships and networks. The participants themselves know better effective utilisation of their social capital to undertake collective action.

c. Operationalising Sustainability

This can only be ensured by restricting the interventions into the system by a clear understanding on the limitations and scope of the local land and water system. The studies in this context are usually limited and the macrolevel decision making is usually done with scant regard to the local nuances of the land and water system. This is one of the reasons why the well conceived programmes fail at the implementation level. Some studies like GALASA and PRM were done in Kerala probing into these problems for an effective solution.

GALASA

A study known as the GALASA (Group Approach to Locally Adaptable and Sustainable Agriculture) by a voluntary organisation (IRTC, 1991) studied in detail the problems of paddy cultivation. It also reviewed the Group Farming programme and pointed out certain pitfalls that can happen to the Group Farming since it is implemented by the same bureaucratic machinery that implemented the earlier IADP, IPDP, HYV programmes. GALASA perceived a plot level collection of data with local people's participation on the land and water characteristics of paddy growing areas to assess the existing state of affairs. Problems of water control were noted. Input requirements like quality seeds and green manures required were quantified and areas of local production of these were identified. By these, production was to be enhanced. Pooling of departmental resources and subsidies in a collective way was suggested. This was supposed to ensure the resources for cultivation, especially for longterm ones like land development. Most importantly, GALASA perceived an institutional structure with local level participation by which crucial operations in paddy cultivation could be organised (See Appendix V.2.a).

If this kind of an institutional structure (particularly the functional teams) could be organised with the real cultivators (who are interested in full time cultivation or can cooperate with the group), it can take care of the efficiency, equity and sustainability considerations of paddy cultivation and thus the sustainable use of valleys can also be ensured.

Panchayat Resource Mapping programme (PRM)

In a land and water system, the valleys cannot be taken as a separate entity. So there should be a total plan for the whole system. PRM was an experiment in these lines, implemented on a pilot basis, by an interdisciplinary team of scientists and voluntary activists.

It has two main thrusts: One is to scientifically assess the potential of land and water system and second, to derive an optimum landuse (maximise the productivity without detriment to ecological sustainability) for the different landform units and hence check further environmental degradation. This is to be done by preparing a series of thematic maps at the local (panchayat) level. Correspondingly, an effort to make the local people aware of their resource potential and problems is also perceived. For this they are trained to first spatially assess the cropping pattern and infrastructural facilities of the panchayat. After collating the information from all these, a dialogue between the local people, scientific and technical personnel on the relevant problems and the scope of the panchayat is brought out -- and this is prioritised so that a people's plan can be formulated for the area. This will be a blend of the traditional wisdom (acquired by 'learning by doing' and passed on through the generations) and appropriate elements from the technology packages to suit the local land and water system.

For example, in the landform map of Madakkathara, the summits and upper slopes have a gentle slope, laterite soil, poor water

availability. So a dry crop such as cashewnut is the best land use for this area. The midslopes are steeper,water availability and soil thickness are moderate. Here there is limited moisture retention.So this is ideal for tree crops like mango, jackfruit etc. and plantations such as rubber. The lower slopes have moderate to good water availability, moisture retention,soil depth and there is scope for leached in nutrients from the upper parts. Here crops like coconut, vegetables, tapioca, banana etc. can be grown and the valleys can be devoted for paddy, vegetables and legumes in rotation. But we have seen the deviations from the 'practiced' to the 'desirable' and phenomena like the unbalanced support given to crops like rubber etc. This affects the landuse decisions at the local level in an unbalanced way, the consequences of which is beginning to being felt, especially in the midland terrain which has affected the sustainability of the system.

It is therefore important to adopt a balanced and co-ordinated way of encouraging the various crops from government or commodity boards based on the criterion of landform ecological peculiarities of the holding. This will ensure a balanced cropping pattern especially in a State like Kerala where there is scope for an array of diversified cropping pattern in the various agro-climatic regime.

Thus there are three levels of intervention. The first level is identifying the problems and scope of the land and water system at the local level by a detailed inventory. Along with this, a 'land literacy' function is also done to the local people or the users of the resource. This knowledge can empower them in taking

the right landuse decisions.

At the second level, local level institutions such as Group Farming Committee and the Land and Water Resources Inventory Monitoring Group (LAWRIMOG), conceived by PRM, involving the people are evolved for a continuous monitoring of the state of land and water system. Here the scientific and planning personnel can give technical support. The decisions taken at the first level can be implemented with the help of these local level institutions. A more decentralised machinery of the line departments can play a facilitative role in the implementation. Thus the ecologically sustainable uses can be made economically viable.

At the third level, there should be suitable government policies to encourage land uses with an eye on the landform ecological characteristics at the local level. There should be a landform -- landuse correlation in deciding the policies. Any kind of subsidy or support given to crops may be on the basis of this.

However, three years have elapsed since these studies have been initiated. No attempt was made from any quarters to operationalise GALASA. Though Panchayat Resource Mapping continues as a mapping programme, it has not yet been used in any major way to implement a local level plan. The main impediment to these is the absence of a machinery and hence initiative to co-ordinate these at the local level.

Concluding Observations

The study investigated the problem of conversion of paddy lands to other uses in the valleys of the midland and highland terrains of Kerala from an ecological point of view. The need for conservation of valleys for paddy cultivation was identified in the light of sustainable land use. A review of the physical/social/economic/institutional factors affecting land use showed that historically they are all moving against paddy cultivation. At the turn of the century, save the highlands where plantation crops had taken root, paddy cultivation was an important economic variable which shaped rural power structures. The collapse of these structures naturally affected paddy cultivation. The spread of education was identified as an important reason which accelerated the shift away from traditional agriculture. The availability of imported rice depressed paddy prices as compared to other competing crops.

The microlevel physical and socio-economic appraisal in a representative terrain highlighted the phenomenal decline of area under paddy. The shrinking of paddy area upto early seventies was mainly due to physical constraints and resulting shift away from marginal lands. The shift that occurred after that was of the fertile wet land ecosystem of valleys due to economic and institutional reasons which were making paddy cultivation unremunerative compared to other agricultural/non-agricultural uses. The unstinted support offer to competing crops like rubber was found to have affected the farm-level decisions in these terrains.

These issues may be viewed in the larger perspective of the decline of paddy cultivation in other Asian countries. In the present international economic order these countries are facing intense pressure from the developed economies in the west to change their policies. The shift away from `food self sufficiency' by subsidies to food grain production, to a more efficient market oriented production is characteristic of the new phase.

Macro economic changes taking place at the national and international levels also affect landuse decisions. This is particularly so in a state like Kerala where the agricultural scenario is dominated by perennial and plantation crops. The new economic policy may have wide ranging implications for production of crops like rubber. The trade liberalisation and opening up of the domestic market may result in larger imports of rubber, particularly because cost of production in the state is higher than that in other rubber producing countries. Already the reduction in fertilizer subsidy has increased the cost of fertilizers and there is every likelihood of a reduction in fertilizer consumption. Yield and relative profitability of the crop would be affected This may further reduce the attraction for conversion of paddy land. In other words "rubber effect" on paddy mentioned earlier may get arrested in the longrun. But this is from a narrow view point of sustainable use of valleys which will have real detrimental effects on the larger agricultural economy of Kerala.

The earlier interventions to boost paddy production seem to have been conceived in the wrong 'positivist' module of high input cultivation which do not conform to the inherent soil

characteristics . Coupled with this, non-availability of organic manure has resulted in low yields. Further, fragmentation and resulting uneconomic size of holdings was a major institutional constraint which reduces paddy to a subsistence crop. To alter this, an integrated approach with the sector as the basic unit and collective action at different levels were perceived by later programmes. Though lacking the sustainability component, interventions like Group Farming were supposed to take care of this. But the fact that these also failed at the implementation level raises the questions regarding operationalisation of conceived strategies. The failure was partly due to the absence of local initiatives and lack of administrative co-ordination. Experiments like GALASA and PRM identified the need for making the users 'land literate' and thus enable them to take ecologically sustainable land use decisions.

These Programmes came in the wake of the fairly successful "Hundred percent literary" campaign which could ignite a certain amount of local initiative in the development process. But the change of government in 1991 turned the fate of these programmes and so a proper assessment on their viability is still to be proved. But given the conditions in Kerala marked by divided political loyalties, it is doubtful to what extent such projects can successfully be pursued, even under an enthusiastic government.

Local level institutions like co-operatives run by cultivating farmers and unemployed youth could be the one answer to make the sustainable use like paddy cultivation economically viable

Lessons from the democratic co-operative traditions in Kerala will be worthwhile to ponder, in deciding the structural and functional role of these.

Yet another problem relating to paddy cultivation is the negative attitude of the new generation towards it. Hence, even if the above mentioned institutional changes happen, in the absence of positive attitudinal changes towards paddy cultivation, the future scenario of sustainable use of valleys remain a bleak proposition.

This study would like to raise certain questions like : Would it be possible to develop a political will that would cut across the partisan attitudes and facilitate implementation of conceived programmes ? How can local level institutions be evolved by taking lessons from the democratic co-operative tradition of Kerala? Can these be operationalised at the local level in the background of the individualistic and politicised behaviourial pattern of Keralites? Would it be possible to develop positive attitudinal changes towards paddy cultivation to ensure the conservation of at least the remaining paddy fields ?

Appendix V.1

A note on some of the earlier programmes (Central and State) to boost paddy production

a. Intensive Agriculture District Programme (IADP)

IADP was a Ford Foundation sponsored programme formulated during the Third Five year Plan covering 140 districts (one in every state in India). Altogether the programme covered 308 blocks and 5 percent of the cultivated area in the country. IADP's basic objective was described as contributing to rapid increase in agricultural production in selected areas and for suggesting new innovations and combinations of practices. To increase foodgrain production it was recognised that a multipronged concerted and coordinated approach is needed and stressed on the adoption of a package of improved practices (selected seeds, fertilizers, pesticides, improved implements, proper soil treatment and adequate water management) as also the provision of a package of services (technical staff, production supplies, research information, land and water improvement, storage and marketing and price assurance). The operational significance of focusing attention on selected districts was to concentrate on the scarce capital and scarcer trained manpower in the most productive areas. In Kerala alone, the programme was extended to two districts Palakkad and Alleppey.

b. Intensive Agricultural Area Programme (IAAP)

This was also introduced during the Third Five year Plan Period covering 646 blocks in 75 districts in the country. The objectives were the same as IAAP and the programme was to cover the entire area in the IAAP and IADP districts in the Fourth Five year plan period with improved packages and practices.This programme also covered only the Palakkad and Alleppey districts of Kerala.

c. HYV Programme

The Fourth Five year Plan, envisaged the introduction of a new strategy which stressed the use of High Yielding Variety of seeds and improved scientific methods of cultivation. Experiments conducted at different research centres on exotic and hybrid varieties of seeds had shown their responsiveness to heavy dosages of fertilisers over extensive areas were irrigation was assured. This objective was expected to be operated mostly in the IADP and IAAP areas as these programmes offered maximum potential for production and were provide either better staff and other facilities. The importance of cropping pattern was also emphasised and made it the central theme of agricultural production during the Fourth Plan period.

d. Intensive Paddy Development (Ela) Programme

In the Fourth Plan the new approach envisaged organising paddy production with the Ela or padasekharam as the basic unit of planning and implementation of the production programme. A long

term perspective for the production of rice in Kerala State was evolved during this time whereby the gap between production and requirements was expected to reduce progressively by the end of Fifth fiver Year Plan. It was expected that the new Ela production programme will bring about at least 100 percent increase in the yield per acre of paddy in the areas covered. The Ela production programme launched towards the middle of 1971 was envisaged as an improvement on the package programme implemented in the districts of Alleppey and Palakkad which was discontinued. According to the new scheme all the farmers in the Ela are supposed to add jointly in the procurement and timely application of inputs as well as adoption of improved farm practices. The scheme aimed at securing the advantages of large scale operations thereby facilitating the rapid and integrated development of the agricultural sector in the state. The programme also visualised the mechanisation of agricultural operations to a certain extent.

e.Group Farming Programme

This was introduced by the Government of Kerala in 1989 in an area of 61398 ha in 3069 ha involving 918 Krishi bhavans in the state. From 1990 onwards, the programme was extended to the entire state. From 1990 onwards, the programme was extended to the entire state. Group Farming programme was introduced with the following objectives:

(1) To facilitate effective management of resources by pooling the individual resources, exclusively for the purpose of management ;

(2) To achieve the benefits scale economies by collective

management;

(3) To maintain the individual incentives and enterprises by retaining ownership of land;

(4) To enhance the linkages between production, technology transfer, input supply and marketing.

APPENDIX V.2

a. GALASA (Group Approach to Locally Adaptable and Sustainable Agriculture)

GALASA study (IRTC, 1991) reviewed the Group Farming programme and studied in detail the problems of cultivation in three panchayats in Trichur district. The main thrust in the approach is to ignite and maintain local initiative for solving their own problems. Government shall play only a facilitative role in encouraging the local community to discuss and evolve a strategy to bring out the problems and prospects of the area in question (IRTC,1991).

GALASA starts with a thorough inventorying of the local climate, water, (natural and constructed) soil, vegetation, animals, land availability, organic recycling potentials, socio-economic profile etc. of the area with participation of the local people.

The following programme of action is envisaged:

1. Regenerate and make functional the existing natural and constructed waterways including deepening of existing ponds, digging of new ponds, renovation of existing artificial water control structures.
2. For consolidation of operations the additional requirement of field equipments is quantified.
3. Quality seed requirement for each Padasekharam (sector) is quantified.
4. Green manure requirements are quantified.

5. An integrated pest management blending cultural, biological and chemical measures to reduce cost and minimise ecological risk.

6. Pooling of Departmental Resources: The work of various departments responsible for agriculture is to be integrated at the panchayat level.

7. Pooling of subsidies: Though treated as a production incentive, many farmers are not receiving the subsidies because of procedural difficulties. The subsidy amount can be pooled and utilised for any of the facility creation activity.

8. Institutional Structure: A four tier system of District Agricultural Development Committee, Panchayat Agricultural Development Committee, Panchayat Paddy Development Committee. The lowest level can be the Padasekharam Development Committee (PDC).

A set of 4 functional teams under PDC namely:

(a) Team for water control work

(b) Team for Green manure production

(c) Team for Seed production; and

(d) Team for farm machinery and facility build up are envisaged.

All these need a collective action at the local level. If by a proper functioning the above mentioned teams are made workable, the cost of cultivation can drastically be reduced, and the sustainability of the agricultural system can also be assured.

b.Panchayat Resource Mapping Programme[1]

The broad strategy for development has been based on large projects or multi crore packages (in a national scale) that hardly

[1] See Panchayat Level Resource Mapping Programme - An Approach Paper - A Model for Microlevel Resource Survey with People's Participation, (Government of Kerala, 1991).

consider the micro level variations in terrain, climate, geology and socio-economic factors, apart from the land holdings. Land use has to be planned to conform to micro level variations for sustainable productivity. A proper intervention strategy can only be worked out if the status of natural resources along with their spatial distribution is understood fully by the planners, the land owners and the users. Involvement of local people in this process brings out the relevant problems that affect productivity. In addition, it would generate not only a sense of participation among the local people but also a desire to improve their landuse.

The Panchayat Resource Mapping (PRM) programme is conceived here as a process of integrating scientific evaluation of each panchayat on its land and water resources, on the one hand, and the mapping of existing landuse and assets by local volunteers, on the other, leading to a desirable and eco-conformable developmental strategy evolved through a series of action plans at panchayat level with people's participation. In other words, a 'Land Literacy' programme involving science for and by the people is what is conceived here.

Objectives

1. To introduce a sustainable landuse and water utilisation pattern conformable with terrain characteristics.

2. To increase productivity through such a pattern and to facilitate economic development based on local resources and labour.

3. To check further environmental degradation and to restore degraded areas (through the process).

4. To prepare comprehensive local (panchayat) area action for sustainable development with active participation of local people.

Resource Survey (Mapping)

The Resource Survey has the following salient components:

(i) Training of volunteers for landuse and asset mapping;

(ii) Mapping of landuse and local assets by the trained volunteers;

(iii) Land and water resource mapping by scientific and technical personnel.

(iv) Collation of data, finalisation of maps and interpretation by scientific personnel.

(v Data storage and developing information system.

The following maps are considered to be the 'minimum-needs-module' for the evaluation of a particular terrain.

Landform

Surface material/soil

Thickness of weathered mantle/depth to bedrock

Potential areas of water, availability

Environmental appraisal for landuse planning (based on 1 to 4)

The first four maps, while depicting the respective parameters, will help in bringing out the crucial factors that determine the desirable landuse pattern. The fifth map, integrated from the first four, depicts land potentials, environmental constraints, alternative mode of use, etc. and is fully plotted on a cadastral scale.

The last map, i.e., environmental appraisal for landuse planning is an integrated map of the ones already described, of landform and surface material, unit wise slope, water availability and the existing landuse taken from the volunteers' maps,

suggesting the recommended landuse, as also the essential, conservational requirements and restrictions for various uses to arrest further degradation. In addition, this depicts areas with environmental degradation, drainage congestion, floods, salt water intrusion, inappropriate agricultural practices, land degradation, etc. This map is necessarily user oriented for planning and development at panchayat level.

Such synthesised information is vital for landuse planning, consistent with the natural settings. Further, it becomes an effective tool for local dialogue to initiate suitable action plans for each panchayat. Actual change to suggested landuse specific to plots is to be initiated only after proper dialogue with the local people and their acceptance. The plot-wise data generated by the volunteers and the scientific staff are stored with proper geo-references so that details on landuse, assets etc. in a plot are available from a central place.

Monitoring

Monitoring forms an integral part of the processes for planned development in order to ensure its success. It is required, primarily, to understand the changes taking place in the land-water system and to update the maps, accordingly. A group of interested volunteers form a group to monitor the changes and a Land and Water Resource Inventory and Monitoring Group (LAW-RTMOG) is to be organised in every panchayat/village. Landuse is monitored by updating the cadastral maps, periodically with the proper guidance of scientific personnel attached to each district.

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