IMPACT OF LAND USE DYNAMICS ON THE RESOURCE BASE:

A MICRO LEVEL STUDY

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I hereby affirm that the research for this dissertation titled '**IMPACT OF LAND USE DYNAMICS ON THE RESOURCE BASE : A Micro Level Study**' being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy was carried out by me at the Centre for Development Studies, Thiruvananthapuram.

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Certified that this dissertation is the bonafide work of Kumari Rose Miranda Fabiola Joseph and has not been considered for the award of any other degree by any other University. This dissertation may be forwarded for evaluation.

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CHAPTER 1

INTRODUCTION

The changing perceptions about`Development' and `Environment',have given a new dimension to the economic problems. This convergence of the two, have witnessed the emergence of a new branch of economics- `Environmental Economics', which is currently gaining significance in the research agenda of governmental and nongovernmental organisations, international institutions and individual researchers. Three decades have already gone, since (Stockholm Conference,1972) international attention is focused on environment, in ascertaining its role in supporting the biological system of the planet[1]. Discussions on related issues have been going on, from region to region and from country to country and had won millions of adherents, generated new bodies of legislation, created new political parties,instigated a rethinking of the economic priorities and had become an issue in domestic policies and international relations.

Certainly, environmentalism has triggered a reorientation in the priorities and principles of the growth process and there had been a shift in emphasis over the issues related to environment and development in these three decades.

The concern for environment, which began as a conservation movement in the fifties- in parts of America and Western Europe, had emerged as a matter of international concern in the sixties and seventies.[2] But then, the main focus was on the quality of life, which was impaired by the type of development strategy

pursued by the developed countries. As a result, the outlook on the issues related to environment by the less developed countries were more or less passive. Taking the clue from the industrialised countries their perception was that environment becomes a matter of concern only after a specific stage of economic growth.

But within a decade, our understanding about environment and development have witnessed further changes. This change in perception was the result of accelerating inflation, rising unemployment and slowing economic growth[3]. Since then, terms such as`eco-development', `sustainable development' and `environmentally sound development' had been widely used[4].

Currently, `sustainable development' is the focus in almost all discussions related to environment and development. But, what is this sustainable development? In short, it can be said that it is a strategy meant for the satisfaction of basic needs, welfare and survival[5]. The concept was popularised with the publication of the Brundtland Commission Report[6] which defined sustainable development " as one that meets the needs of the present without compromising the abilities of the future generations". The concept have attracted the attention of many, had been defined from different dimensions by economists, politicians and individual researchers.

While there is no dearth of literature discussing about the environmental issues[7] and sustainable development[8], there is hardly any that had discuussed in detail how to look it in an operational level. Looking into the magnitude, necessity and the urgency with

which these issues are to be tackled, the concept of sustainable development needs to be operationalised.

But what had given rise to the fear that, we cannot sustain the process of development? It had been realised that the deterioration of the social, ecological and economic environment can cripple the developmental mechanism[9]. This points out the fact that, sustainability of the development process is not possible unless the relationship between these factors are examined properly. The concept, hence at an operational level, needs to recognise the relationship between man and nature, economic growth and development and the development policies and broad social objectives[10].

We shall here deal with the relationship between economic growth and development. Development is not a matter of mere growth in national income. It represents only the monetary equivalent of the production and consumption that had taken place in the economy, the raw material for which is derived from the biological system. Each and every economic activity derives its raw material from the physical environment[11]. In fact, capital creation is largely determined by the resource base[12] potential and hunger, famine, pollution and poverty are all consequences of the resource base degeneration[13].

In this context, it would be worthy to examine how the technological strides meant to improve the resource availability had interacted on the resource base to bring out the diminishing returns. The exponential growth in population had necessitated an

increase in the world food grain production. With the given supply of land, the technological strides had in fact, helped in improving the food grain situation considerably. Availability of more and more fertilisers, use of pesticides, new varieties of seeds, improved farming equipments, and introduction of irrigation had all helped in increasing the food grain production. Table 1.1 gives details about the world food grain production from 1934 to 1980. It appears that the application of fertilisers in agriculture had drastically increased after the fifties. Perhaps, this might be the time when the effect of land scarcity was intensely felt everywhere. Moreover, late sixties had witnessed the diffusion of green revolution technologies[14] that are more technology oriented.

Table 1.1

World Grain Production
(in Million tonnes)

Period	Grain output	Incremental output	World fertiliser use	Incremental use	Fertiliser Response ratio
1934/38	651	--	10	--	--
1948/52	710	59	14	4	14.8
1959/61	840	138	26	12	11.5
1969/71	1165	317	64	38	8.3
1978/80	1451	286	106	42	6.8

Source: Brown 1981: p.114.

The fertliser response ratio had declined from 4.15 M per tonne in 1969/70 to 3.4 M in 1979/80 (estimated from table 1.1). The initial high response might be due to the more effective utilisation of the soil nutrients, facilitated by the more effective ploughing on account of mechanisation and improved water

delivery system and the like[15]. But it seems that the consistent use of fertilisers had resulted in reducing the inherent qualities of the soil, reducing the fertiliser response ratio.

Despite the quantum leap in the fertiliser use it led to diminishing returns indicating the depletion of the resource base with the accumulation of the high entropy matter-energy[16]. This can be taken as an indication to suggest that, technology can only postpone the advent of diminishing returns but ultimately cannot overcome the resource scarcities. The above example is sufficient to point out how growth and development leaves its imprints on the resource base, thus affecting the quality of the resource base. But the role of growth and type of development is determined by the development policies and objectives that are formulated. Thus it can be said that the most important relationship that affects the resource base potential is the one between man and nature and the development policies and objectives. These are designed and formulated depending on the demand. Demand on resource base had drastically increased with the exponential growth in population, especially so in the case of the developing countries[17]. The large scale clearance of forests that is continuing in tropical Africa and South America for purposes of cultivation as well as for meeting the industrial demands of the developed countries would ultimately impoverish these tropical environment. This is so because the tropical soil derives its fertility from the biomass which -when devoid of forests, under conditions of intense rainfall gets leached and loses fertility.[18] In parts of tropical Africa the consistent use of land without adequate improvement had led to the rise of `environmental refugees' who even crossed their

national boundaries in search of food[19].

Further, intense deforestation leads to soil erosion, loss in crop productivity, floods, droughts etc. further extending its consequences to other areas. Only 10% of the world's population live in mountainous areas, but another 40% live in the adjacent plains; the lives and livelihoods of half the world are thus directly dependent on the way in which watershed ecosystems are managed[20].

While afforestation, construction of dams etc. are all policies aimed in reducing the effects of the misappropriation of the resource base, they are in no way a solution to the causes that had led to the situation[21]. In most cases the solutions to these problems need to be looked in from the broader socio-economic set up.

The recognition of the importance of the resource base in bringing out sustainability necessitates an examination of the prevailing methods in dealing the issues related to environment. Despite our grave concern for environment, the assessment of the issues so far were more or less confined to the neoclassical framework of Cost-Benefit analysis, that treats environmental disorders[22] as the outcome of the imperfect functioning of the market mechanism and assumes that the environmental problems are solved once full cost pricing is done[23] when in reality most of the forces that threatens sustainability falls outside the realm of market forces[24].

This helps in focussing the essence of sustainability to resource base management. The why of this arises from the reckless resource use pattern that does not take into account the resource base potential which ultimately emerges as a structural constraint in intensifying the resource use further resulting in adverse changes on the resource base[25]. Resource base degeneration occurs when there is a mismatch between the basic characteristics of natural resource components and patterns and their utilisation. The latter can change indefinitely but it is difficult for the former to be changed unless the whole resource base is transformed. Hence it is argued that to 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[26].

Resource base degeneration can be avoided if the present day atomistic approach[27] is replaced by a contextual approach[28]. In this it begins from the human element as an economic agent to the exploitable subsystems as parts as well as wholes. This aspect of the development process seems to have been increasingly ignored in the conventional development strategy, directed towards the appropriation of the resource base. 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 situation.

Following the above mentioned arguments, the present study conceptualises the issue as " the interaction of the socio-economic

and political factors on the resource base that poses threat to sustainability". Considering these aspects it can be said that while the aggregate objective of sustainability is welfare, the aggregate constraint is the resource base[29].

With this basic premise, it assumes that development process can be made more meaningful if sufficient weightage is given to the resource base constraints/potentials in formulating the socio-economic objectives aimed at welfare.

But the diversity in the resource base characteristics and the wide variation in the socio-economic set up between the regions results in variations in the mode of appropriation of the resource base. Accordingly, the impact of the interaction of these different factors on the resource base also varies.

Present Study

Recognising the relevance of the resource base analysis at a micro-level, the present study makes an attempt to examine the impact of land use dynamics on the resource base of a Kerala Village, for which the required resource maps were available. With this the study examines the scope for evolving a methodology to comprehend the changes on the resource base due to human intervention. The study is concentrated on one village in Kerala, in understanding the resource base use as a method of analysis towards resource base study.

The main objectives of the study are:

(a) to examine the need for a resource base management in the state.

(b) to assess the scope and potential of the application of resource maps in an integrated eco-development strategy.

(c) to explore the interaction of the socio-economic and institutional factors on the resource base.

The Approach

The study is different from the conventional economic analysis because of its interdisciplinary approach in examining the issue. The analytical tool of resource maps is integrated into the socio-economic situation of the study area to match with the objectives of the study.

Scope and Limitations of the study

In the absence of a systematic methodology for a resource base approach, the study has its own limitations. However, taking into account the potentials of the above mentioned approach, the methodology can further be improved and modified to evolve a socially acceptable development strategy. Further, the scope of resource maps can be extended for purposes of decentralised planning.

The scheme of the study

The theme of the study is condensed into three chapters.

The second chapter discusses the interaction between the resource base and the population in the state in detail. It covers the broad aspects of the evolution of the resource base

appropriation and the role of the state in influencing the resource base utilisation, the impacts of population on the resource base, the resource use pattern with regard to the structural specificity of the region. The chapter further highlights the need for a resource base approach for evolving a sustainable development strategy.

The third chapter introduces the concept of resource maps, its scope in applying it to a theoretical planning model to evolve an integrated eco-development strategy and the resource mapping programme carried out in the state.

The fourth chapter is an application of the methodology discussed in the earlier chapter to a micro region. With the help of the resource maps an attempt is made to assess the resource endowments, and resource use pattern of the region. By examining the resource base status of the region, the chapter explores the structural reasons leading to resource base degeneration and looks into its long-term implications.

NOTES AND REFERENCES

1. Stockholm Conference of 1972 -United Nations Conference on Human Environment- sponsored by the United Nations, participated by 113 nations of the world and had enabled it to launch an environmental programme, the United Nations Environment Programme (UNEP)1974.

2. The changing notions about environment over time is discussed in detail in Sanbach (1980).

3. Brown 1981.

4. Tolba 1987.

5. Braat & Steetskamp 1991.

6. WCED 1987.

7. See for example, Eckholm 1976:1982.

8. For example, See Brown op.cit.: Adams 1990.

9. Hussein 1990: Kadekodi 1991.

10. Tolba op.cit.

11. Serafy 1991: Garrot 1991: Kadekodi op.cit.

12. `Resource base comprises of the physical environment including the climate, relief, soil, hydrology and vegetation to the extent that these influences the potential for land use', Benne (1990).

13. Kadekodi op.cit.

14. Brown op.cit.

15. Brown op.cit.

16. Nimas & Stephan 1987; Garrot 1991. Rachel Carson's Silent Spring was one among the pioneer works that had pointed out the negative effects of excess use of fertilisers on

environment. It contributed to altering the perspective of environment from a resource to be utilised and managed to suit human requirements beyond limits. She had argued that deterioration of the natural quality is the direct result of human interventions.
The different dimensions of the use of harmful pesticides had been discussed in detail in `The Ecologist' vol.10, No.3 1980.

17. This is so because in addition to meeting their own demands from the existing resource base, these countries are the greatest suppliers of raw materials to the developed countries. Thus, an increase in demand for the raw materials by the developed countries exerts pressure on those countries' resource base, depriving them the prospect of development. See for example, Lutzenberger 1987; Nation & Komer 1987.

18. Grainger 1980.

19. NORAGRIC 1990.

20. World Conservation Strategy 1980, cited in Tolba 1987.

21. Eckholm 1976 Brown op.cit.

22. These disorders in economics is referred to as externalities, the unintentional side effects of consumption and production.

23. Nijkampf 1978; Garrot op.cit.

24. See for example, Hirsch 1987, This is further discussed in Ch.3.

25. Barret & Steetskamp op.cit; Jodha 1991; Norton 1991.

26. Muller 1982; Hussein 1990; Jodha op.cit.; Daly 1991; Norton 1991.

27. In this approach, forestry, agriculture, fishery, industry etc. are all treated as individual sectors with no mutual linkages.

28. Norton 1991. Contextualism is the view that the parts of the ecological system like fishery, forestry, industry etc. should be understood and managed in parts as well as wholes.

29. Barret and Steetskamp op.cit.

CHAPTER 2

INTERACTION BETWEEN RESOURCE BASE AND POPULATION IN KERALA

An Overview

Introduction

The objective of this chapter is to enquire into the interaction between human beings and the resource base in the State over time. Focussing on the evolution of resource base use in the State, it tries to identify the factors that had influenced its appropriation. Further, the resource potential in the State is examined briefly, with a view to explore the scope of utilising it efficiently by suggesting an alternative development strategy.

Evolution of Resource Base Use in Kerala:

Travancore-Cochin, the Princely States of Kerala and the Malabar district of the former Madras Presidency constitute the present state of Kerala. The landscape of the State is highly diversified; its topography ranges in altitude from 2 mts below the mean sea level (MSL) to 2694 mts above MSL. It has a long and continuous stretch of three distinct physiographic units- the highland, midland and lowland, constituting about 48.14 percent, 41.76 percent and 10.09 percent of the total area respectively, extending from north to south[1]. Its geological formation and the resultant physiographic features have tremendously influenced the rainfall and topography of the region which in turn have led to

the evolution of the soil complexes, cropping patterns and other potentials for agricultural development. The well drained soils in the highlands with its sloping terrain is conducive for growing crops like tea, coffee, rubber, cardamom etc; the midlands with its rich and fertile soil is favourable for growing a variety of garden crops and paddy and the lowlands are suitable for growing paddy[2].

The unique land scape with its natural harbouring facilities all over the West Coast has influenced the trade relations of the state from historic times and had tremendously influenced the life style of its people. This specificity itself had helped Kerala in maintaining trade relations with many countries like Malaysia, Singapore, Burma, Thailand etc. from time immemorial. Throughout, if we trace the history of the crops that were grown in the State it had always been in favour of the cash crops that were highly marketed outside. In fact, despite the limited availability of land suitable for growing food crops, the State had never experienced a famine because of its ability in capturing an almost stable external market for the cash crops that helped her in funding the food imports[3].

In this context, it would be interesting to examine the conditions under which the resource use in the State is undergoing changes. Considering the significance the plantation agriculture has on the State's economy and its cultivation on the forests of

the State, let us begin the history of the resource base use in the State by examining the history of forest clearance[4]. The forest wealth of Kerala is confined to the Western Ghats, a highly erosion prone region due to the asymmetrical distribution of area, relief ratio, high rainfall and the high degree of average slope. Moreover, the soils of the Western Ghats are laterites which if left barren would react with the atmospheric oxygen and get hardened- the process technically referred as laterisation, reducing the productive capacity of the land[5]. Further, the Western Ghats form the catchment area of all the rivers in the State. Invariably, all rivers are directly dependent on forests for a sustained flow. By regulating the peak flow, the forests check flash floods in the valleys during rains and prevents extreme drought conditions in the off-season. Further, by regulating the flow it helps preventing the saline water intrusion in the lower reaches in summer, by maintaining a minimum water level[6].

Large scale forest clearance in the State had essentially been for extending the cultivation of plantation crops. Apart from that, the food shortages in the State during the second world war had necessitated in increasing the internal food production. The Government, in a desperate attempt to meet the situation had opened up the reserve forests (as a part of the Grow More Food Campaign) and leased it out to cultivators on a temporary basis. Accordingly, between 1940- 1944 about 13600 acres of forests were offered for cultivation of which 8000 acres were actually taken up

for cultivation, in and around the Cardamom hills[7].

Further, during the time of the State reorganisation it was announced that the reorganisation would take place on a linguistic basis. The Cardamom hills had a large proportion of Tamil plantation labourers. Hence the Tamil-Malayali ratio in the region was not favourable for the State, if reorganisation is on a linguistic basis. The State, which was heavily dependent on the plantation economy to avoid the economic debacle of losing it to Tamil Nadu, then encouraged settlement in the High Ranges. Thus the High Range Colonisation Scheme was initiated, to settle 8000 families at four different sites in the Cardamom hills[8]. This had resulted in a higher growth rate in population in the districts of Idukki and Wynad (74.98% and 31.95 % respectively) during the fifties[9].

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 agriculture[10]. For example, the construction of the Idukki Hydel Project necessitated construction of communication network which made the region more accessible facilitating movement of people to these regions for settling down. Further, the labourers who were engaged in the construction works also had cut down forests and started on agriculture. Table 2.1 explains the changes that had taken place

in the resource base of Idukki district in the two time periods, 1973-75 and 1975-83.

Table 2.1

Vegetation Cover Changes in Idukki

Category	1973-75	1975-83
Dense Vegetation	-32%	-24%
Sparse Vegetation	-15%	-22%
Area under agriculture	+87%	+39%
Barren/blank area.	-53%	+31%

Source: Menon 1992:

The resource base in the region had tilted in favour of agriculture which is marked with an increase of 87% in the first phase. This had amounted to a decline in the total area under forest cover as well as the area under barren lands (see table 2.1). The percentage rate of increase in the area under agriculture had declined by 39% between 1975-83. Forest clearance in the region is a continuing process, but the effective rate of depletion is coming down. Between 1973-75 the clearance of dense vegetation had taken place which in the latter phase (1975-83) had given way for the sparse vegetation. The induced agricultural activities in the region had resulted in the reduction of barren lands initially, whereas the anthropogenic factors itself had resulted in its increase in 1983, 31%[11].

Till 1973, the extent of forest lands cleared for agricultural purposes throughout the State is 946 sq.km. Another 121.21 sq.km. of forested areas are being alloted to the Plantation and State Farming Corporation by the Forest Department. River valley projects claimed about 241.41 sq.km. of pristine forests till 1973. Apart from that, forest encroachment had been to the extent of 238.07 sq.km[12]. In fact, many of the encroachments were being carried out with sufficient political backing and hence eviction became rather difficult/ sensitive[13].

Presently as per official estimates, 27% of the State's total area is covered with forests. But estimates based on satellite imageries and ground observations had revealed that the actual coverage is much less than what is being estimated. Their estimate was that the area under forests in the State is only about 17.07% of the total area. The effective rate of depletion till 1965 was 0.27% per annum but afterwards the period between 1965 and 1973 had seen an accelerated pace of deforestation, about 1.32% per annum (estimated from table 2.2). This was the time when many of the development projects were initiated in the State.

Almost 40% of the area under legal forests had been depleted (table 2.2). The broad trend of deforestation for the State indicates that the effective rate of depletion is coming down. It had declined from 16.46% in the beginning of the century to 10.55% in 1973. But there exists an interregional variation.

Table 2.2

The area under legal forests and the vegetative cover

Districts	Legal areas under forests	Present vegetative cover	Percentage change
Trivandrum	49861	30271	-39.29
Quilon	236048	181226	-23.22
Alleppey	518	182	-64.87
Kottayam	8141	2108	-74.11
Idukki	260993	172026	-34.08
Ernakulam	8123	5154	-36.55
Trichur	103619	22634	-78.16
Palghat	136257	69578	-48.94
Malappuram	103417	64800	-37.34
Kozhikode	90876	63021	-30.65
Cannanore	83656	51772	-33.11
State	1081509	662772	-38.72

Source: Chattopadhyaya pp.10.

In districts like Malappuram, Kozhikode and Cannanore the rate of depletion had in fact, drastically declined (table 2.3).

Table 2.3

District wise percentage rate of depletion of forests in Kerala

District	Depletion 1905-65	1965-73
Trivandrum	13.82	9.21
Quilon	14.63	8.73
Alleppey	0.11	0.17
Kottayam	9.76	2.93
Idukki	22.04	31.64
Ernakulam	10.53	13.07
Trichur	6.87	10.65
Palghat	8.88	9.11
Malappuram	12.43	2.70
Kozhikode	36.66	2.70
Cannanore	15.44	2.70
State	16.46	10.55

Source: Chattopadhyaya pp.9.

The rate of depletion in Idukki, Ernakulam and Trichur are higher than the rest of the state. The annual rate of depletion for Idukki in the second phase is 3.95% while it was only 0.36% in the first phase. A similar trend is discernable for Trichur and Ernakulam which indicates that deforestation is gaining momentum over the years in these regions.

A land use survey conducted in Idukki had revealed that there is a 12% variation in the actual forest cover of the district. Due to the existing cropping pattern nearly 1,19,000 ha in Idukki are either eroded or is susceptible to erosion[14]. Also to be noted is that 60% of the waste lands in wynad, 40% of in Palghat and 65% of in Idukki districts falls under degraded forest lands; most of which in the catchment areas of projects[15]. It should be noted here that the catchment areas of the rivers, Kuttiyadi in Kozhikode, Kadalundi in Malappuram, Muvattupuzha, Meenachil and Manimala in Ernakulam, Kottayam and Pathanamthitta districts respectively, are extremely degraded[16]. This induces soil erosion in the catchment areas leading to an increase in the amount of silt carried by the rivers bringing down the storage capacities of the reservoirs, thus wasting large amounts of public investment. These degraded forests mainly include grass lands, the catchments of reservoirs, failed forest plantations or disputed private forests. Most of these areas have moderately deep to deep soils. In many cases these forest lands are state properties[17]. As a result, quite often exploitation out paces regeneration and the forest

wealth is depleting annually.

The importance of forests cannot be ruled out in its overall role in maintaining the resource base balance. Grainger (1980) had pointed out that a watershed covered with natural rainforest loses one tonne of soil per ha per annum owing to soil erosion but once forests are removed and the land cultivated the loss is around 20 to 30 tonnes per annum. As discussed in the previous chapter the effects of deforestation is not confined to the micro region hence needs to be looked in properly.

The capitalist tendencies cropped up in the plantation sector had influenced some enterprising entrepreneurs in the low lands who decided to venture in cultivating the low lying marshes on the eastern margins of the backwaters. They have decided to reclaim those lands so as to bring more areas under paddy cultivation. This is in fact, one of the most successful stories of the resource base use in the State. To an extent, this had helped in overcoming the limitations imposed by the physiography in cultivating rice in the State. The initiation of this process had been in Kuttanad of Alleppey district, located on the drainage basin of the four rivers of Pampa, Manimala, Achencoil and Meenachil, which later on spread to other low lying regions of the State. The annual silt brought about by these rivers makes the region agriculturally fertile which had enabled the farmers to recoup their expenditure, despite the high investments required for reclamation[18].

Government level investments on reclamation was started only in the fifties as a part of the Grow More Food Campaign followed by the Central Government's decision restricting the inter state mobility of food grains[19]. To help the Kuttanad farmers in overcoming their extreme susceptibility to floods, the State Government had initiated flood mitigation programmes in the region. The area is prone to floods because the discharge water of the four rivers raises the water level in the 'Kayal' during the rains which has only a narrow outlet to the sea near Cochin. Soil erosion in the catchment area of the rivers raises the bed of these water bodies leading to a reduction in the storage capacity thus aggravating the flood intensity. A study by the National Institute had revealed that the depth of the Vembanad lake is reduced from 6.7 mts to 4.4 mts in 1984, due to excess siltation[20]. Many of the developmental activities carried out in and around the region had further worsened the flood situation. For example, with the construction of the Alleppey-Changanacherry road with no criss-cross drainage, the surface run off had increased considerably, increasing the flood intensity in the rainy season[21]. The additional flood protection for the reclaimed land in Kuttanad is being taken up by the Kerala Land Development Corporation. At present, the extent of cultivable marshes in the State is 1,20,700 ha[22]. A programme is on the anvil, to provide protection to the low lands of Trichur, Kattampilly, swamps of the Cannanore dt, Ponnani, Kadalundi of Malappuram dt. Kayamkulam and Paravoor Kayals[23].

Another problem which the farmers of the region (Kuttanad) faces is the saline ingression in summer. Because of its low lying nature, the sea water intrudes into when the water level in the Kayal recedes. The Thanneermukkam Barrage commissioned in the early seventies was essentially meant for maintaining a steady water level in the region[24]. To an extent it was helpful in mitigating the effects of it. However, no permanent solution had been made so far.

Coming to soil erosion about 15000 sq.km of land area in the State is susceptible to soil erosion[25]. Government level investments on soil erosion had been made. The important works done under this include soil and water conservation in the arable lands, conservation measures in the Kundha Valley in Attapady, and subsidies alloted to improve the productivity of the lands belonging to the Scheduled Castes and Scheduled Tribes. The works done include bunding, terracing, gulley plugging etc. In 1987/88 altogether 1599 ha of land were protected from soil erosion of which about 64% is in the Kundah valley project[26].

If we look into the agricultural front of the State one of the most important aspect is the reckless conversion of paddy fields for cultivating other crops. The reasons given for this is mainly the higher margin of profitability accrued to the other crops[27]. Conversion, though a common phenomena in the state, might have a differential impact on the resource base in different

regions depending on the specificity of the resource base. For example, take the case of coconut cultivation in Kuttanad practised in the paddy fields of the region. The resource base of the region necessitates construction of bunds for cultivating coconuts here. What happens with the construction of bunds is that it prevents the free flow of water from one field to another. This might lead to water stagnation in the adjoining fields obstructing the cultivation. Consequently, the drainage channel gets silted up, intensifying the flood proneness of the region[28].

Let us examine the irrigation performance in the State as an important factor in the resource base use. Large scale investments on irrigation was started only in the fifties. At present there are altogether 10 completed and 19 ongoing major projects in the State[29]. The estimated irrigation potential for the State is about 14 lakh hectares, but the effective utilisation so far is only 27.36% (Table 2.4).

Table 2.4

Performance of Irrigation Works

Source	Physical Achievement (in lakh ha)					
	1989/90		Till 1989/90		Potential	
	Net	Gross	Net	Gross	Net	Gross
Major& Medium	0.01	0.011	1.84	3.83	-	-
Minor	0.10	0.13	1.26	1.52	-	-
Total	0.11	0.14	2.10	5.35	6.00	14.00

Source: Economic Review 1990/91.

The performance of the minor irrigation schemes in the State had been well above satisfactory in the year. It had registered an increase of 7.94% (net) or 8.55% (gross) in the year while the achievement of major and medium irrigation for the corresponding year was only marginal- 0.54%(net) or 0.29%(gross). Though 65% of the total irrigated area in the State is accounted by the major and medium irrigation projects, 92.86% of the additional area brought under irrigation in the year was through minor irrigation schemes alone.

It should be noted here that only about 17% of the total outlay was spent on minor irrigation in the year but the cost effectiveness of it is remarkable, about Rs.4022 per ha whereas for major irrigation it is almost Rs.19036[30]. This high cost incurred to major schemes is mainly due to the delay in the commissioning of the projects. On the other hand, minor irrigation works are much more quicker in delivering the supply.

These changes marked on the resource base use has not been sudden but is evolved over time. But certain factors had necessitated this. What are the factors that had contributed to these changes? Within the context of the present analysis, it is felt that population is the most important single variable that had directly and indirectly influenced the resource base use in the State. It has been argued that an increase in population or even an attempt to improve the standard of living of the existing

population would exert considerable pressure on the resource base. The incremental population exerts pressure on the resource base which necessitates either extending the area that is being appropriated or by increasing the use intensity of the existing resource base. In the following section we present the changes in the population overtime and its impact on the resource base.

Changes in the Demographic Profile and its Impact on the Resource Base

At the beginning of the century the population of the State had only been 6.39 M which by 1991 had increased to 29.01 M. The growth rate in the State had been significantly higher than the national average, right from the beginning of the century, to be precise till the fifties[31]. Afterwards, the gap between the two had been progressively declining until the seventies, when ultimately the State's growth rate had registered an obviously declining trend which is considerably lower than that of India[32].

Population density is another important factor that imposes strain on the resource base. The density rates for the State had always been much higher than the all India average. It was 6.39 M in 1901 and by 1991 it had increased to 747 persons per sq.km. It had been increasing at an annual average rate of 3.6% per annum from 1901 to 1981[33]. However, the distribution had not been uniform within. These density variations had always been related to the nature of the terrain. Thus, the districts with maximum

area under highlands have the lowest population density (see table 2.5). Current trends, however, indicate that these regions are experiencing an increase in the land- man ratio. These are the relatively new areas of settlement and hence have a sparser population than the rest of the State (for example, Idukki and Wynad). The impact of population pressure on the resource base varies with region. It is largely determined by the proportion of the total population who are directly dependent on the resource base and the type of economic activity that is being carried out. In such a situation the increasing land-man ratio in these regions will be felt much higher than in other areas because of its land based economy and the specificity of the terrain where a large proportion of the land area comes under fragile zones.

Table 2.5

Percentage Area under different Physiographic Units and Population Density (Persons/Sq.km.) 1901-1981

State/District	1981			1901	1911	1921	1931	1941	1951	1961	1971	1981
	Low land	Mid land	High land									
Trivandrum	5.21	68.52	26.27	221	260	304	391	463	606	796	1003	1184
Quilon	7.51	29.78	62.73	114	130	155	198	248	320	421	522	609
Alleppey	65.53	34.47	-	354	406	482	599	675	806	959	1129	1748
Kottayam	18.14	58.66	21.20	204	221	266	352	428	514	596	698	770
Idukki	-	3.68	96.32	9	20	22	37	48	66	115	151	192
Ernakulam	24.29	66.78	8.93	268	183	328	408	487	579	705	899	1053
Trichur	15.55	51.66	32.79	225	254	268	328	381	463	557	702	805
Palghat	34.91	65.09	0.03	171	183	191	210	229	271	306	376	456
Malappuram	2.93	80.14	16.92	192	211	215	246	275	324	391	523	677
Kozhikode	15.32	57.86	26.82	260	279	289	340	380	476	598	777	957
Wynad	-	-	100.00	35	39	40	43	50	79	129	194	260
Cannanore	5.30	53.71	40.99	153	164	169	195	219	265	341	451	565
All India				73	77	77	85	97	110	134	167	225
Kerala	10.09	41.76	48.14	165	184	201	245	284	349	435	549	655

Source: Col. 2, 3 & 4, Land Resources and Land Use in Kerala, KSLUB, 1989. Density Figures: Census of India, 1981.

Population increase in the initial phase is invariably linked with the extension of area under crops[34]. A historical overview of this aspect reveals that in Malabar between 1826 and 1911 the increase in area was to the extent of 1.45% per annum, when the rate of increase in population was only 1.14%. Information related to the subsequent period for the region is not available to make a similar assessment. In the case of Travancore also, the growth in population was less than the increase in area under cultivation in the initial period, 1.11 and 1.95 respectively[35]. In later years, the growth in population was registered with an annual increase of 2.57 percent when the expansion in area under cultivation was only 0.38 percent[36].

However, structural specificity of the resource base is one factor that determined the area under individual crops. The increase in the internal production of foodgrains was constrained by the nonavailability of land conducive for its cultivation. The internal supply of rice was sustained through constant imports from outside at a relatively low price[37]. The increasing area under non food crops had helped in funding the food supply for the increasing population[38]. Shortfalls in supply as well as high open market prices have influenced the area under paddy[39]. Within the cash crops, the area under each was mainly determined by the market value of the commodity. As a result it was mainly dependent on the fortunes of the crop in the external market as well as the internal

situations in the country with which the trade is being carried out[40].

Further, the increase in area is preceded by migration to those regions where land was available for cultivation. But migration as a process was induced or intensified by the immense population pressure experienced in the mid and low lands of Travancore which had necessitated the people to look in for new lands to cultivate. This had induced migration of people from the low lands to the High Ranges in the second decade of the present century. In fact, migration is an important element in the State's agriculture and the important zones of migration in the State were the present Idukki and Wynad districts[41]. There is a close correlation between the areal expansion of agriculture and migration intensity in the State. The maximum area brought under cultivation was in the decade between 1921 and 1931- an average of 1.5 percent per annum[42]. Incidentally, the growth rates in population for Idukki registered maximum growth during the same period, about 72.59% while for the State it is about 21% only[43]. Migration to the northern parts of the State started only in the fourties and the major difference between the migration in Travancore and Malabar is that it was the big farmers who initiated migration to Malabar as against the small farmers of Travancore who started the process there[44].

Migration had considerably influenced the commercialisation of agriculture in the State. Apart from that, it had resulted in drastic changes in the socio-economic life of the native community which even brought out changes on the local resource base. The migrants from the low lands who were culturally and technologically more advanced than the native tribals overpowered and dispossessed them. This alienation of the tribals had been a part of the migration process in the State which was more conspicuous in the Malabar region[45]. The direct effect of this land alienation is that the tribals were pushed in further interiors. All the prime lands (agriculturally more productive) had been occupied by the migrants and the tribals were forced to cultivate on slopes. Most of these marginal land are used for cultivating crops like tapioca that are highly unsustainable for being grown on slopes. Cultivation on the slopes without adequate land protection measures increases the susceptibility to erosion[46]. An example to this extent can be cited from the Attappady region in Palghat District. Nearly 28% of the total forest area in this region is classified under degraded lands[47]. The tribals in this region are living under conditions of persistant poverty, despite government efforts through the Integrated Tribal Development Programmes.

Inspite of the migration, the recurring increase in population, the break up of the joint family system and the prevailing laws of inheritance all had resulted in the fragmentation of holdings in the State. Each successive increase

in population brought down the per capita availability of land. It had declined considerably from 0.65 ha in 1901 to 0.09 ha in 1981[48]. The average farm size in the State is only 0.43 ha, while for the whole of India it is 1.50 ha. Further, the decline in farm size between 1975/76 and 1980/81 was to the extent of 24.56%[49]. In 1971 more than 63% of the total holdings in the State were less than 0.5 ha covering 17.49% of the total area which in 1981 had gone up to 78.69% and 24.29% respectively. Similarly, the percentage share of the area under the size class above 20 ha was 10.10% in 1971, which by 1981 had declined to 5.29% of the total. This indicates that fragmentation of the holdings is pervasive in all size classes[50].

This fragmentation has its own implications in the State's agriculture. Recent researches in the related areas had revealed that the State's agricultural sector is characterised by a general stagnation in the area, production and productivity of most of the crops[51]. The net sown area (NSA) in the state had declined from 57.08% in 1975 to 56.23% in 1986[52]. The cropping intensity is 132% as against the all India average of 125%. The proportion of the area under current fallow is much less in the State, 1.10%, when compared to the all India average of 8.17%[53]. The specific crop mix of the State, characterised by perennial crops offers little scope to increase the cropping intensity further. The decline in area was mainly due to the marginal lands going out of production[54]. A disaggregated analysis of the paddy crop revealed

that most of these holdings go out of production owing to poor soil quality and that public investment on soil quality augmenting schemes and irrigation might be helpful in bringing them back to production[55]. It had been further noted that the miniaturisation of farm sizes restrict additional investment for basic infrastructure build up and the scope of profitability[56]. Estimates on the cost of production of paddy also confirms this. It is found that there exists a 20% difference in the cost of cultivation between small and large farms[57] (This is not to say that farm size is the sole determinant of productivity, there are other factors as well; but a discussion on that line is beyond the scope of the present study).

In 1985 the State Land Use Board had conducted a survey to find out the reasons for the land being kept fallow, covering 28 villages spread out all over the state. In total, they had covered 6128 plots accounting for an area of 3,375 ha. Among the plots covered 64% of the holdings were less than 0.20 ha (9% of the total area covered) in size. Table 2.6 gives the percentage distribution of plots in the two size class according to the reasons for them being kept fallow.

Table 2.6
Percentage Distribution of Fallow Lands According to Reasons (size in ha)

Reasons	0.04-0.20	above 0.20	Total
Lack of finance	4	2	2
Dispute	1	1	1
Indifference	3	2	3
Threat of animals	6	2	2
Lack of irrigation	13	7	8
Poor soil	14	3	4
Poor yield	6	2	2
High cost of cultivation	5	2	10
Uneconomic	12	25	23
Other reasons	36	45	45

Source: Government of Kerala 1985, Fallow lands of Kerala- A Diagnostic Study.

Note: other reasons includes mainly water logging.

The major reasons cited by the small cultivators is the lack of irrigation facilities, declining soil quality, poor returns and the high cost involved in cultivation. Within the sample size 20% of the small and 5% of the relatively larger size holdings had been kept fallow due to poor yield and poor soil conditions (a total of 6%). Waterlogging is a major factor, but is confined to the districts of Cannanore, Kottayam, Ernakulam and Alleppey irrespective of the size class. 45% of the total holdings are kept fallow because of this. 33% of the total holdings are not cultivated because of the high cost of cultivation and uneconomic returns. At a theoretical level it can be argued that most of these are manifestations of the resource base degeneration. Poor

soil quality result in poor yield. To improve the yield one has to invest more on land augmenting schemes raising the cost of cultivation. Beyond a limit cultivation becomes uneconomic and the farmers will leave the land fallow. A separate analysis of the two size holdings marked with lack of irrigation facilities, it is found that the problem is more intense among the small holdings (13%). Most of these land thus gone out of production in this way might remain unutilised or as waste lands, if no attempt is made to bring them back under cultivation.

Agricultural situation in the State can be improved by increasing the area under irrigation and by improving the irrigation efficiency. First we will examine how additional area can be brought under irrigation in the state. As per government estimates the total irrigation potential of the State is 1.4 M ha through major, medium and minor irrigation works. However, it is found that due to delay in commissioning and the resultant cost escalation involved in the construction of major and medium projects minor irrigation works as more effective and efficient. This necessitates the need to look in for improving the minor irrigation works. This can be achieved through rehabilitating the existing surface water which is not used to its optimum. A survey conducted by the state government in 1981 had revealed that in Palghat district, (a district characterised as drought prone) there exists a number of unutilised or underutilised perennial ponds with potential for being used. With little efforts the water in these

ponds can be optimally utilised, giving adequate concern to the genuine interests of the owners. This is a better way of improving the agricultural scenario in the state. The gaining significance of dry farming as a part of intensive cultivation[58] coupled with the high paddy productivity figures for the region[59] emphasises the significance and need for maintaining and optimally utilising the existing sources of water.

Further, irrigation efficiency can be achieved by reducing the delay in commissioning the irrigation projects and by adopting land improvement techniques like bunding, and terracing to keep the fields for a longer time so as to retain the soil moisture for a longer period of time. By adopting irrigation practices specific to crop, soil and slope irrigation efficiency can be further improved[60]. The Tawa Project in Maharashtra can be cited as a classic example for faulty planning and mismanagement. Introduction of irrigation into the thick black cotton soils of its command area had resulted in water logging and proliferation of weeds. As a result large agricultural areas had gone out of production and agricultural productivity had also come down[61].

There is further scope in increasing the irrigation potentials in the state by adopting new ways of water application systems like sprinkle and drip irrigation which had not so far found its way in the State[62]. These if introduced into the State, can drastically improve the irrigation efficiency and can economise the use of

water. Moreover, this type of irrigation is more adviceable to slopes than the conventional gravity irrigation which induces erosion on the slopes.

Another less explored area in the state's irrigation is the exploitation of ground water. The total replenishable ground water potential in the State is estimated at 0.8117 M Ha/year. The quantity of it available for irrigation is approximately 0.6871[63]. In 1981, only about 4% of the total ground water potential had been exploited[64], which by 1991 had rose to 10%. of the total potential. The percentage rate of exploitation for the whole of India is about 27%[65]. The estimated scope for extending irrigation by 2025 in the State, is about 2.6 M ha out of which 1.7 M ha is by surface water and 0.3 M ha by ground water[66].

Another avenue for improving the agricultural scenario is by reclaiming the waste lands in the State. Waste lands are defined as `that plot of land presently lying unutilised except as current fallow due to different constraints'. The criteria chosen in classifying a piece of land as waste land is, the period for which the land is left fallow and the cost involved in making the land suitable for cultivation[67]. In the State, due to the predominance of tree crops it is unlikely to have large patches of uncultivated area. As per the Establishment of an Agency for Reporting and Survey (EARS) the extent of waste lands in the State is 10.15% ie.3165 sq.km. excluding the forests[68] of which 6.35% falls under

culturable waste[69]. The type and nature of waste lands varies according to climate, soil, vegetation, physiography, water availability etc. and also the use to which each plot of land is put to. Five districts of the State are characterised by a higher proportion of waste lands than the rest. They are Kasargode (26.92), Palghat (11.56), Idukki (13.56) Malappuram and Cannanore. Five categories of wastelands had been identified viz. upland with or without scrub, barren rocky waste, underutilised degraded forest lands, sands and steep sloping lands. Among these the barren rocky waste and sands are non reclaimable piece of land[70].

The major share of the wastelands in Kasargode (74.8%), Cannanore (71.9%) and Malappuram (50.81%) falls under scrub lands which can be reclaimed for productive purposes. Approximately 18% of the wastelands in Malappuram and 13% in Palghat are characterised under steep sloping lands.

The formation of waste lands can be due to excess human pressure leading to over grazing, over exploitation of soil and water resources, excess demand for fuel, construction of big dams, a shift in cropping pattern, change in land use, poor management etc. Besides these the poor quality of the soil, lack of proper drainage facilities and inadequate water supply can also affect land productivity[71]. Efforts should be made to reclaim these lands for productive purposes. In many cases, the individual might not be in a position to invest on reclamation of this. Under such

circumstances, institutional level investments on irrigation and soil conservation measures can induce the farmers to carry out agricultural operations. But prior to that the elementary requirement is to assess the type and nature of the waste lands and the potentials of the individual region. Also important is the knowledge about the requirements of the people involved. As such the extent of waste lands in the State is much less, but is more or less concentrated in the above mentioned districts. So a regional level approach can be more appropriate in reclaiming these lands.

The Need For An Alternative Approach

The above mentioned aspects covers the different dimensions of the resource base use in the State, the constraints and potentials of it. From the above discussions what appears is that the State's resource base had crossed both the extensive and intensive margins of agricultural expansion. To revive the agricultural sector that is characterised by a generalised stagnation it seems that a micro level resource base analysis is a better option. This is because irrespective of the region in question the resource base undergoes changes in response to human interventions. But the type and intensity of changes varies between the regions according to which the problems also vary. The resource base in any region is optimally suitable for a specific set of uses, the alteration of which might affect its intrinsic qualities. This amounts in arguing that in matters pertaining to

resource base use it is the regional factor that determines the type and level of appropriation. That is, the physical limits of the resource base determines the amount of manipulation which can be accommodated by it. For instance, take the case of Kuttanad where crop conversion is going on. But the impact of crop conversion here is felt much more severely than in the midlands which is manifested as increasing incidence of floods/siltation of the drainage channels/ water logging of adjoining fields etc. But despite the physical constraints, the resource base use every where is determined by the human element and hence is a very dynamic concept. For example, take the case of the tribals in the Attappady region. Despite the Tribal Welfare Programmes of the Government their living conditions are below the subsistence level and the resource base also is degenerated. The failure of the policies might be due to the inconsistency between the requirements of the tribals and the objectives formulated. Another factor might be the near absence of feed back mechanism from the people to the decision makers or the lack of monitoring[72]. Thus it can be argued that while the physical constraints is an inbuilt limiting factor on the resource base use it is the `social limits to growth' that intensifies the impact of the resource base manipulation. This makes it evident that the problems pertaining to resource base changes should be looked in from a broader perspective. To ensure the successful implementation of the planning objectives each set of problems related to it should be looked in from the resource base point of view as well as the broader social framework. Thus,

the solution to deforestation is not afforestation but instead, looking in to the contributory factors in the different eco-units under varying socio-economic situations and then formulating strategies that would help in overcoming this. In many cases it is not the absence of institutional interventions but the incompatibility between the two that intensifies the problem. What is wrong with the type of interventions we have is that it ignores this relevant aspect and thus leads to the undermining of the resource use. The solutions to many of the resource base problems are much more complex and varied in different socio-economic and ecological situations which needs to be examined thoroughly at a micro level. A better alternative can be formulated by giving adequate weight to these aspects. This type of a realistic approach calls for an in depth analysis of the micro-level resource base.

In tune with this argument, a brief discussion is carried out in the next chapter about the need and significance of inducting the knowledge about the resource base status in consonance with the socio-economic aspects in the planning process in evolving a sustainable development strategy at the micro level. Analysis at the micro level is not a substitute for analysis at the macro level as well as devising appropriate policies. The idea is to explore the possibilities of a sustainable resource base management in consonance with the resource endowments and societal requirements at the micro level. This level of analysis is the focus of the present study.

NOTES AND REFERENCES

1. The classification of area is according to elevation above mean sea level. Thus lowlands less than 7.5 mts from mean sea level(MSL), midlands between 7.5 to 75 mts and high lands above 75 mts from MSL. Government Of Kerala 1989, Land Resources and Land Use in Kerala.

2. For details see ch.1, NARP 1989. Status Report, Special Zone, Vol.1.

3. Panikar et.al. 1978.

4. Even now about 48% of the total foreign earnings of merchandise export from Kerala is accounted by the plantation crops (Mani 1992) Plantations in Kerala State: An analysis of its role, constraints and labour conditions.

5. Laterites when exposed to sun, in the absence of proper vegetative cover will evaporate the soil moisture from the soil and drains more water from beneath the surface by capillary action which will bring with it oxides of iron and aluminium that are left behind on the surface when the water evaporates. This process is called laterisation. Grainger 1980.

6. Government Of Kerala 1982. First Report On the State Of Environment in Kerala.

7. Moench 1990.

8. ibid.

9. Estimated from Census of India 1981.

10. Chattopadhyaya (year not mentioned).

11. Menon 1982; Kerala Forest Research Institute

12. Chattopadhyaya op. cit; Government Of Kerala 1982 op.cit.

13. Moench op.cit.

14. Government of Kerala 1982, op.cit.

15. Government Of Kerala 1989, Wastelands in Kerala.

16. Government Of Kerala 1982. op.cit.

17. Government Of Kerala 1989, Waste Lands in Kerala.

18. Panikar 1965.

19. Panikar et.al. 1978.

20. Koshy 1992, " Vikasanathinte Baliyadukal" Mathrubhoomi Weekly No.14.

21. Chattopadhyaya & Sidharthan 1985.

22. Government Of Kerala 1989, Land Resources and Land Use in Kerala.

23. Government Of Kerala 1982, op.cit.

24. Sidharthan 1984: Chattopadhyaya & Sidharthan 1985, op.cit.

25. Government Of Kerala 1984. Report of the Highlevel Committee on Land and Water Resources.

26. Government Of Kerala 1990/91, Economic Review.

27. Kannan & Pushpangadan 1988.

28. Government Of Kerala 1981. Report of the One Man Commission on the Problems of Paddy Cultivation in Kerala.

29. Government Of Kerala 1990/91, op.cit.

30. Government of Kerala 1990/91, op.cit.

31. The relatively low growth rate in the state in the decade between 1941 and 1951 is explained as either an under estimation of the state's population or an over estimation for the country (Bhat and Rajan 1990).

32. This decline had been attributed to the demographic transition that had transcended into the state and had been discussed in detail by many. See for example, T.N.Krishnan 1972; Bhat and Rajan 1990.

33. Estimated from Census of India 1981.

34. Boserup 1962, had discussed this aspect in detail.

35. Verghese 1973.

36. Estimated from Panikar et.al.(op. cit) and Census of India, various issues.

37. Panikar et. al, op. cit.
In fact this option of getting food grains cheaply from outside had acted as a disincentive on the part of the individual as well the government in increasing the area under paddy through investing more on irrigation.

38. Panikar et.al. op.cit.

39. During the second world war internal supply was disrupted for quite some time which necessitated the government in looking for options.

40. op.cit.

41. Tharakan 1976.

42. Panikar et.al., op.cit.

43. Census of India 1981.
Travancore was the first region to experience intense pressure on land. As a result migration as a phenomena is initiated here and the extension of it to other parts of the state was only a continuation of the process. Idukki was the zone of migration in Travancore.

44. Tharakan op.cit.

45. Kunhaman 1982.

46. Ibid.

47. Kerala Forest Research Institute 1986.

48. Panikar 1965: Government of Kerala 1981, Report of the One Man Commission on the Problems of Paddy Cultivation in Kerala.

49. Government Of Kerala 1982 & 1988. Agricultural Census Report for Kerala State.

50. ibid

51. Kannan & Pushpangadan 1988 op.cit.

52. Ibid.

53. Central Statistical Organisation 1989. Statistical Abstract, Ministry of Planning.

54. Ibid.

55. Kannan and Pushpangadan 1990.

56. IRTC 1991. Environmental Centre and Integrated Rural Technology Centre (1991).

57. Government Of Kerala 1988, Eighth Five Year Plan, Workshop on Agricultural Development.

58. Sivanappan & Rajagopal 1986.

59. Kannan & Pushpangadan 1990, op.cit.

60. Easter and Welsch 1986.

61. Kothari and Bhantari 1984.

62. Sivanappan & Rajagopal 1986, op.cit.

63. Government Of India 1992, India 1991: A Reference Annual.

64. Sivanappan & Rajagopal 1986, op.cit.

65. Government Of India, op.cit.

66. Sivanappan & Rajagopal 1986, op.cit.

67. Centre for Science & Environment 1984. Developing India's Waste lands, A briefing Paper.

68. The estimate was based on a village level survey and hence the forest area is not covered under the survey, since it does not come under the village administration.

69. Kerala was a non reporting state and there is no village level measures to collect and estimate the land utilisation pattern thus discrepancíes are likely to occur. To cover up this the EARS was set up in 1975 and accordingly 20% of each village was covered in 5 years between 1980/85. It had undertaken complete enumeration covering the area plot wise. However, it did not cover the forest areas which was included in the state land utilisation figures. Moreover there is a difference in the definition followed by the Agricultural Department which includes current fallow also under waste lands.

70. Government of Kerala 1989, Wastelands in Kerala, Kerala State Land Use Board.

71. Government Of Kerala 1982, Centre for Science & Environment 1986. State of India's Environment, The Second Citizen's Report.

72. The Kerala Forest Research Institute (KFRI) have undertaken a five year project on "Eco-restoration and Tribal Resettlement in the region. The information were collected on the basis of a primary survey and personal discussions.

CHAPTER 3

RESOURCE MAPPING - SCOPE AND APPLICABILITY

This chapter deals with the concept of Resource Mapping, its scope and applicability in the action plan of an Integrated eco-development strategy that could ensure sustainability through resource base management at the micro-level. After discussing the limitations of the existing development strategies the chapter suggests resource mapping technique as an approach to integrated eco-development strategy. It also gives a brief description of the resource mapping programme carried out in the state.

Limitations of the existing planning strategies for micro-level development

The conventional approach to socio-economic development that had been followed is the establishment of a national medium term development plan for a period of five years which specifies the important social and economic objectives to be implemented through various planning levels.

In the existing centralised planning network, the objectives and strategies are formulated by the central agencies in such a way that it does not give sufficient weightage to the resource base specificity as well as the socio-economic environment of the individual region. As a result, it is likely to generate conflicting situations between the resource base and the socio-economic objectives.

Moreover, the development strategies that had been followed so far was more or less resource intensive that failed to recognise the dependency of the economic system on the resource base[1]. This dependency of the economic system on the resource base makes `the task of the environmental decision maker much more complex where he has to face the uncertainties and ambiguities of a larger ecological system than under the traditional economic decision making model. Here each decision ought to take into account the uncertainties into which it is exposed - at the individual, societal and resource base level[2]'.

Further, the sectoral plan outlays are channelled through the various departments which are functioning more or less independently. Thus, we have separate departments for agriculture, irrigation, forest, forest plantation, environment, tribal welfare and rural development, all functioning as individual units when they are all integral parts of the same economy. In fact, all these subsystems are directly or indirectly linked to the resource base, hence needs to be looked into as parts of the economic system dependent on the larger resource base. In the absence of a comprehensive planning strategy for these various departments one department's action undermines the other[3].

In a situation where `the ideology of development is equated with economic growth' the strain it imposes on the resource base needs to be recognised. Further, a development strategy that intensifies the unequal accessibility to the resources creates a dichotomy between the local economy and the macro level economy[4].

This can be avoided ensuring the satisfying the basic human needs. Such an approach can ensure sustainability as well. Development models which encompasses the concept of sustainability into the analytical framework does not overlook the satisfaction of the basic needs of all sections of the society as against the conventional ones aimed at GNP growth alone. It had been correctly pointed that there is a well evidenced nexus between the sustainability of the development process, poverty and resource base degeneration. In the absence of a comprehensive planning body to look into the different dimensions a government decision unleashes on the different sections of the population, the very development strategies that enriches the national economy would erode the resource base thus undermining the development process. Public investments on projects are invariably carried out on the basis of a favourable Benefit-Cost analysis. But what is missed in this whole exercise is the distributional aspects of whose costs and whose benefits, it is often these trade offs that result in the undermining of the resource base itself. Hence development strategies should be formulated in such a way that, it is in conformity with the needs and aspirations of the people involved whose lives and livelihoods are much dependent on the availability of resources in which they have a stake. This should be the fundamental principle on which the success of any planning strategy is based[5].

In many an instance, plan failures are recorded on account of overambitious and conflicting objectives, the insufficiency of data for plan design, monitoring and evaluation, lack of communication between the planning agencies, decision makers and those who are

affected by the decision making process[6]. This calls for a planning model that will reduce the uncertainties involved in the decision making process or to be more specific a transparent model that permits reformulations that could accommodate these uncertainties. What is expected from the decision making bodies is to take decisions where the societal conflicts are minimum giving sufficient weightage to the resource base potentials. This necessitates an approach that gives due emphasis to the resource base in terms of the socio-economic environment.

Integrated Eco-Development Strategy: Concept, Approach and Model

Taking into account the changing perceptions about environment and development an attempt is made here to suggest Integrated Eco-Development Strategy as an alternative way of development that could ensure sustainability.

The Concept

Integrated eco-development strategy had been defined as - "development at the regional and local level consistent with the potentials of the area involved with attention given to the adequate and rational use of natural resources and to applications of technological styles and organisational forms that respect the natural eco-system and socio-cultural patterns[7]."

This type of a strategy can be justified on the grounds that it takes into consideration the resource base potential and gives sufficient weightage to the socio-economic environment of the region. Further, it gives due attention to the conflicting interests that exists within the society.

The Approach

A Resource Base Approach

We have already discussed the dependency of the development process on the resource base which necessitates a different level of approach in sorting out the issues related to sustainable development. It is argued that one of the major deterrent in operationalising the concept of sustainable development is the lack of proper understanding about the relationship between the resource base, the prevailing institutional framework and the people's needs.

Considering these aspects, it is felt that the approach should be from the resource base to the socio-economic factors. Since human life all over is conditioned by the spatial distribution of resources an approach on a similar line can be justified.

In this context it is necessary to know what constitutes a resource. It can be viewed in terms of three functional relationships viz. human wants, human abilities and the appraisal of the environmental aspects. Resource exploitation is determined by the resource availability, its capability in satisfying human wants and a certain level of technological development in accepting a socially acceptable goal in the given situation.

Mode of resource exploitation in any region varies with the diversity of wants and vice versa. Accordingly, the type and extent of problems also vary- ranging from declining crop productivity and scarcity of drinking water to increasing incidence of poverty and the like. Similarly, the resource use anywhere is

considerably influenced by the society, the resource base and the institutional aspects. As a result, it has become increasingly necessary to consider proposals for resource development in a broader framework taking into account these aspects as well as their economic consequences[8]. This suggests that resource management should begin from the values of society, rather than from positivist scientific paradigms[9].

On account of the increasing awareness on the role of resources in sustaining life, resource management is currently gaining considerable momentum. A closer look into many of the problems related to resource base reveals that most of them have their origin in the socio-economic environment of the region as well as the prevailing institutional set up. To put it differently, it can be said that most of the problems to which people are exposed to have their very manifestation in the resource base itself. In short, a degenerating resource base is a symptom of non conducive socio-economic set up. This interlinkages suggests the necessity of identifying the people's problem from both the physical and socio-economic plane.

Resource Survey and Mapping

A resource base approach to planning calls for a detailed knowledge of resource endowments and the resource use pattern. In such a strategy three aspects are important viz. the availability and the status of the resource base (resource survey), the different approaches to resource use (resource management) and the strategies that can be evolved out to achieve the socially set goals (role of the development planner)[10].

Resource Survey provides the spatial information regarding the resource endowment and the resource use pattern of the region. With the help of resource survey it is possible to identify the potential areas where further resource base manipulation is possible and at the same time point out areas susceptible to resource base degeneration. In other words, it helps in identifying the local level problems that can be used in linking it with the prevailing socio-economic environment.

Once survey is done, the relevant information can be articulated using standard Cartographic Techniques. In fact, Resource Mapping is an evolving branch of cartography[11] in the realm of thematic maps[12]. It gives a detailed information on the spatial distribution of the resources in a given region. It provides information about the relief and drainage conditions, the slope and gradient, the water potential, bed rock exposures, geomorphology, soil conditions etc. In short, it gives details regarding resource endowments and resource use pattern. It opens up the scope of inducting the knowledge about the resource base in the decision making process.

The work of the resource manager starts with interpreting these maps and finding the cause effect relationships. Successful management of the resource base requires information regarding the cause-effect relationship like what are the major factors that influence the resource base use? What are the major resource base impediments? What is the level of conflict within the societal groups with regard to the resource base appropriation and to what extent the institutional factors do influence the resource base

use? What is the extent to which the resource base has undergone changes as a result of the various interacting forces-the individual, the society as well as the institution?

Resource base use is a function of the pattern of social evolution and the values and perceptions of the people in general; but can be influenced by exogenous factors as well. Since the life and livelihood of the people is so dependent on the resource base at their immediate vicinity any decision that might affect it should be taken in consultation with the people involved[13]. This calls for an active people's participation at all levels from the resource survey to the plan implementation stage.

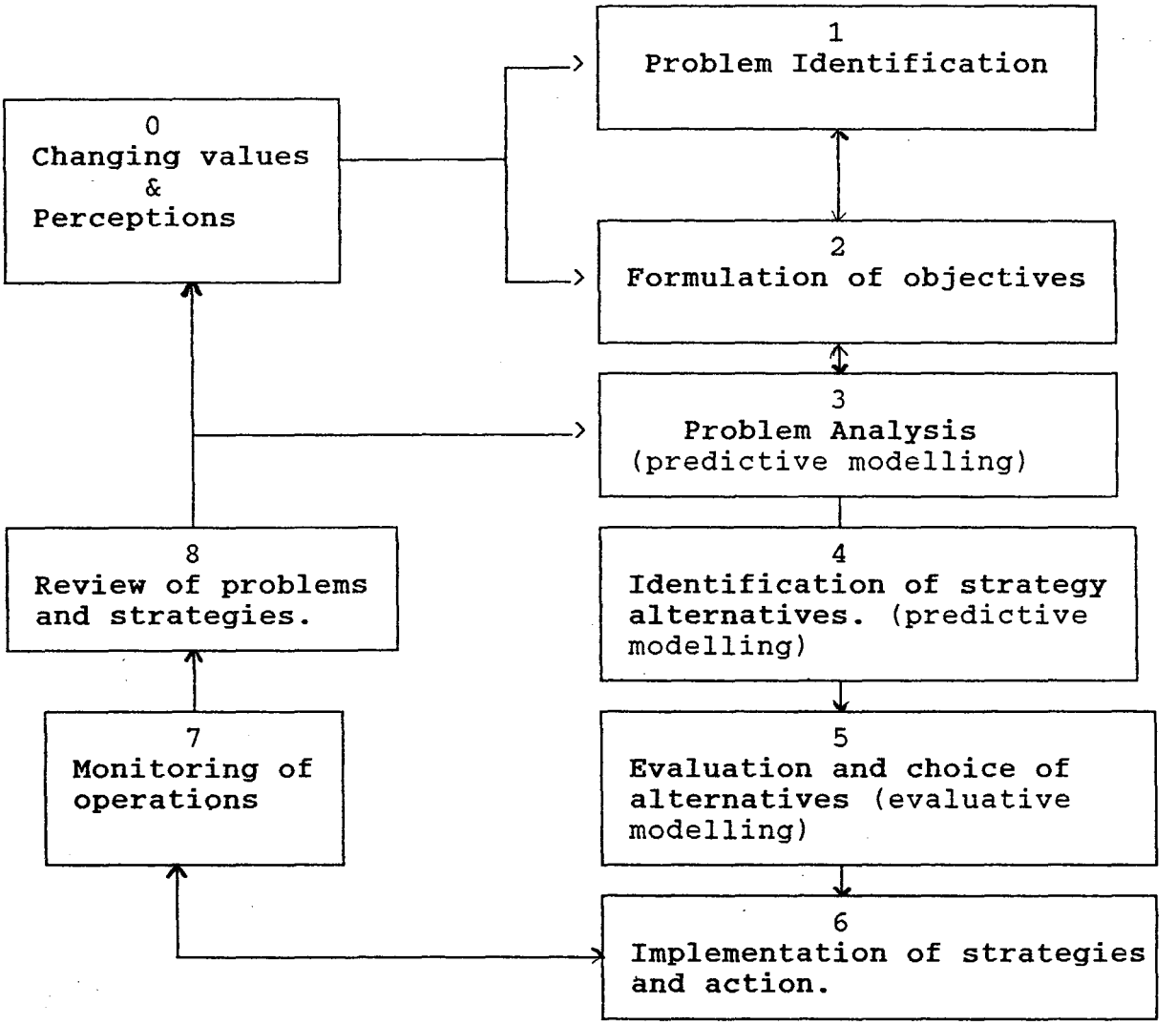
The setting

Once the approach is set the immediate question is what should be the size of the planning unit? The intrinsic qualities of the resource base varies even within a small region. Accordingly, the nature and type of resource utilisation also vary; depending on the availability or non availability and over/under exploitation of resources the life and livelihood of the people also show variations. This suggests that the type and nature of the problems also vary from region to region which is further determined by the values and perceptions of the people. So the size of the planning unit should be kept sufficiently small enough so that the resource base management can be carried out efficiently.

The Model

In tune with the above argument a planning model that can be fitted into the context of the resource base is suggested below.

Figure 3.1.
THE PLANNING MODEL



Source: Bertalamus 1981.

The planning process begins with the identification of the problems at the local level (see fig.3.1). Once it is identified successfully the objectives to mitigate it, can be formulated in conformity with the constraints to which the particular resource base is exposed to and the values and perceptions of the different societal groups in the region (stage 2). Such an approach has an obvious advantage over the conventional cost-benefit analysis in the sense that it takes into account the distributional/social

costs involved which makes it possible to set the objectives accordingly.

To make the whole exercise more competent, the model calls for problem analysis at a later stage to examine the extent to which the objectives were satisfactory in solving the problems (stage 3). And also considering the dynamic nature of the values and perceptions of the society it is necessary at this level to find out what are the new set of problems to which the resource base is exposed to.

Accordingly a new set of strategies that fits into the new socio-economic environment is looked in for (stage 4). A proper evaluation of the choice of the alternatives needs to be carried out-the implementation and operation of which should be monitored from time to time, based on which a review of the problems and reformulate the strategies accordingly. This would go on continuing and as far as the feedback mechanism is working on efficiently where the decision maker and the people are in direct contact one can guarantee the success of the model. The success of this type of a plan model depends on to what extent the results of the decisions are fed back to the decision makers.

The success of any planning model depends on how successful they are in identifying the problems which helps in formulating objectives to suit the socio-economic environment of the region. In the conventional model, the socio-economic environment is expected to adjust to the welfare objectives in an abstract level without taking into account the physical resource base. As a

result, it had resulted in a conflicting notion of welfare at the individual,local and macro level economy. The given model with the resource base approach can, in that manner be considered as a better alternative.

RESOURCE MAPPING IN KERALA[14]

The Resource Mapping Programme carried out in the state, is a massive one with varying dimensions. From the point of view of resource base management, it can be taken as a tool for deciding the management of the resource base in consonance with the geomorphic conditions.

In the state the programme was started in March 1991. The project funded by the Department of Science and Technology (DST), Government of India (GOI), is jointly undertaken by the Centre For Earth Science Studies (CESS) Trivandrum, the Kerala State Land Use Board (KSLUB), and the Kerala Sasthra Sahitya Parishad (KSSP). The DST fund is given to cover 25 panchayats (villages) in the state and the KSSP has sponsored another 10-altogether 35 Panchayats to be covered under the Panchayat Resource Mapping Project(PRMP). The DST project is mainly to concretise a methodology to create a cadastral level data base for National Resource Development and Management System (NRDM).

Later on, the Government of Kerala had issued an order (G.O.(MS)48/96 plg,15/12/1990) to cover all the panchayats in Kerala and the CESS had been identified as the nodal agency to work out the programme. Around 50 post graduates in geology and geography have been appointed for doing the mapping. The CESS and

the KSLUB will provide the scientific and technical training in mapping while the KSSP organises the volunteers work and take care of the implementing process. Voluntary Organisations and the individual villages are expected to supply the volunteers required for this work.

Planning and Approach

Resource Mapping in Kerala is primarily based on a micro level- at the village level. This is the first of its kind in India. Mapping being done on Cadastral[15] scale[16] it facilitates detailed data incorporation and an in depth survey. It is a programme jointly conducted by the scientific and technical personnel, local volunteers and Panchayat functionaries.

The main objectives of the Panchayat Resource Mapping (PRM) is to formulate a strategy that might help in evolving a desirable land use in consonance with the geomorphic features of the region, taking into account the constraints and options of it which helps in improving the crop productivity and ensuring economic development through the effective utilisation of land and water resources which patterns the sequence of the process of development. Further, it intends to check environmental degradation and gradually restore the degraded areas after preparing a local level action plan.

The strategy adopted for this, is an Integrated Resource Survey at the village level with complete assessment of the geo-environmental situations that could facilitate in conceiving a proper land-use pattern in accordance with the terrain conditions.

The Project envisages active involvement of the local people from planning to the implementation stage so that the local interests are always given weightage. It aims in organising a village level Land And Water Resource Inventory and Monitoring Group (LAWRIMOG) for periodic monitoring of land use changes, soil erosion and water resources- particularly well water depth and pond conditions. Based on these information a cada /land based information system (CIS) can be formulated that detects the changes in land and water resources over time. This can be synthesised with the state and country georeference which can be used for further planning.

The plan of action of Resource Survey in the state can be summarised as follows:

Table.3.1

Survey & Planning - Phase of Activities

Phase	Activity	Participants
1	Resource survey/Basic data collection including training of volunteers.	Volunteers, panchayat functionaries and scientific& Technical personnel.
2	Interaction plan preparation.	Scientific personnel, panchayat functionaries and planning personnel.
3	Supplementary data collection pertaining to socio-economic aspects and land use productivity.	Volunteers, line departments, Panchayat functionaries& Scientific personnel.
4	Action plan preparation	Scientific personal,Volunteers, Panchayat functionaries and planning personnel.
5	Implementation	Local people, volunteers, and Panchayat functionaries.
6	Monitoring& alterations	Scientific personnel,Volunteers and panchayat level functionaries.

Resource Survey

The resource survey work includes training of the volunteers in land use and asset mapping and its mapping by them, land and water resource mapping by scientific and technical personnel- the collation of data, map preparation and interpretation and data storage and developing an information system. The training of the volunteers include giving them working knowledge in mapping. To facilitate the task a handbook is prepared and distributed to the participants who are given theoretical deliberations for three days to give them the basic knowledge in mapping. After that, five days of field demonstrations is carried out when they do the mapping on a cadastral map. It is made sure that at least five persons from each ward take part in this project. The features can be mapped exactly by them because of their local knowledge of the terrain and land use pattern.

The data to be collected by the volunteers relating to land and water are given in Appendix 1A, 1B & 1C. It includes the existing land use covering crops, settlements, industries etc. that are mapped with distinct symbols. Further, it includes all types of infrastructure. Apart from that, they also record the number of houses in a plot, status of water availability, environmental problems and other problems faced by the village people in general (Appendix 3).

Scientific Mapping

Mapping by the scientific and technical personnel is done on a cadastral map. A set of five maps had been prepared that include land forms, land use, basement configuration and potential water

availability (for data format see Appendix 2A, 2B). By collating the information from these an environmental appraisal map is prepared that gives the resource status of the region.

The following six types of maps are prepared:

Land form

Land forms are classified by the following landscape approach considering the slope process. The landform details that are required for scientific mapping include local relief, the nature of the terrain and the amount of dissection of it. The slope is classified according to the gradient as steep, moderate and gentle and accordingly the erosivity is estimated as high, medium and low. Details on the drainage conditions is also done by the scientific personnel. The landform maps so prepared are helpful in assessing the capacity of land for various land use. The details on slope and gradient are helpful in estimating the susceptibility of the region to erosion. Site selection for different land use operations can be made possible with the help of this maps.

Land use

In this map agricultural land use, institutional areas, industrial areas and settlement density have been depicted. This gives information on the resource availability as well as the resource use pattern of the region.

Basement configuration

The map prepared on basement configuration is important in appraising the landform qualities. This map is prepared on the basis of well sections, cuttings, rock exposure etc. By basement

configuration, we mean the depth to which the bedrock is covered. In simple terms, it refers to the amount of unconsolidated materials over a landscape. The map on basement configuration is useful in determining the landscape fragility and water availability.

Surface Material

The type and distribution of the surface material is depicted in this map. Though not exactly a soil map, it provides information about the generalised soil types. The surface material has been categorised as clayey soil, sandy clay soil, sandy soil, colluvium and laterites. This is important to know the broad soil conditions of the region. Further it helps in finding out areas of potential water availability.

Potential Water Availability

In preparing the map for potential water availability a number of well inventories is to be carried out in the study area. All the springs and ponds are mapped. In addition to this, details on lineaments from remote sensing imageries are also taken. This brings out three zones of water potential viz. good, moderate and poor. By estimating the number of well inventories, the existing ponds, springs and the terrain lineaments etc. the potential water availability in any region can be found out. It is helpful in assessing the well density over the years. Moreover, since the depth of each well is recorded accordingly to the well bottom as well as to the water table it is possible to find out whether the water table is receding over time. It gives a fare amount of the idea regarding the quantity of water drawn and the type of use of

each well. In addition to this, it gives information regarding the water quality.

Environmental Appraisal Map

The environmental appraisal map shows the spatial distribution of the degraded lands in the region (the problem identification). Supplemented with sufficient socio-economic data this map helps in finding out the cause-effect relationship of the resource base changes. This map is made by collating the information from the other maps. Synthesis has been based on landscape units and hence the approach may be termed as land scape based (Appendix 11 B). Combining land forms with surface material 5 units has been identified. For each of these units slope, water availability potential, level of erosion, susceptibility to erosion, existing land use, conservational requirements, desirable land use and the physical constraints had been worked out. The classification of the land surface into different geomorphic units make it easy to categorise it in terms of the slope and erosivity of the region. This can be correlated with the existing land use pattern so as to find out the relationship between the two, the information of which can be used in suggesting alterations of the existing land utilisation patterns and to suggest conservation measures to avert long term calamities.

These set of resource maps are really helpful in pointing out the constraints of the resource base, the knowledge of which can be efficiently made use of in relation to the socio-economic condition prevailing in the individual region. With the help of these information it is possible to examine the possible changes

in the resource base due to the operation of the various interacting agents.

Further, the decision taken by the Government to formulate a cada based information system (CIS) with regular monitoring of the resource base recording the changes, the resource base undergoes over time extends its scope further similar to the GIS (Geographic Information System) (See Appendix 4).

The following chapter is an illustration to see how informative resource maps are in assessing the resource endowments and resource use patterns and to what extent the socio-economic as well as institutional factors are responsible in influencing the resource base changes.

NOTES AND REFERENCES

1. See for example, Bandyopadhyaya and Shiva 1989; Hurting 1991.

2. Petak:1980; Muller:1982.

3. Kothari and Bhantari 1984; Bandyopadhyaya & Siva, Vandana op.cit.

4. Bandyopadhyaya & Siva Vandana op.cit.

5. Kothari and Bhantari 1984, Vaidyanathan 1991.

6. Kothari and Bhantari op.cit; Jayal 1985; Bandyopadhyaya & Siva Vandana op. cit.; Singh 1987.

7. United Nations Environment Programme 1975.

8. Muller 1982; Hussein 1990; Jodha 1991.

9. Muller 1982; Wenner,1987.

10. Cloke and Park: 1985.

11. Cartography is the science and arts of Map making.

12. Thematic maps convey a specific theme in detail. Maps on population, crop distribution, density, rainfall etc. are all examples of the same.

13. Nelkin 1982: Kothari and Bhantari 1984 op.cit., Ray 1988: Vaidyanathan 1990:

14. This section is taken from the `Micro/Village Level Resources Survey with People's Participation for Sustainable Development (CESS 1991).

15. Cadastral maps are the large scale maps prepared to show the boundaries of properties based on its ownership. It is specially prepared by the government for purposes of revenue assessment. Its scale is 1:3960,1:7820,1:5000.

16. Scale of a map is the ratio of the distance between two points on the map and their corresponding distance on the ground.

CHAPTER 4

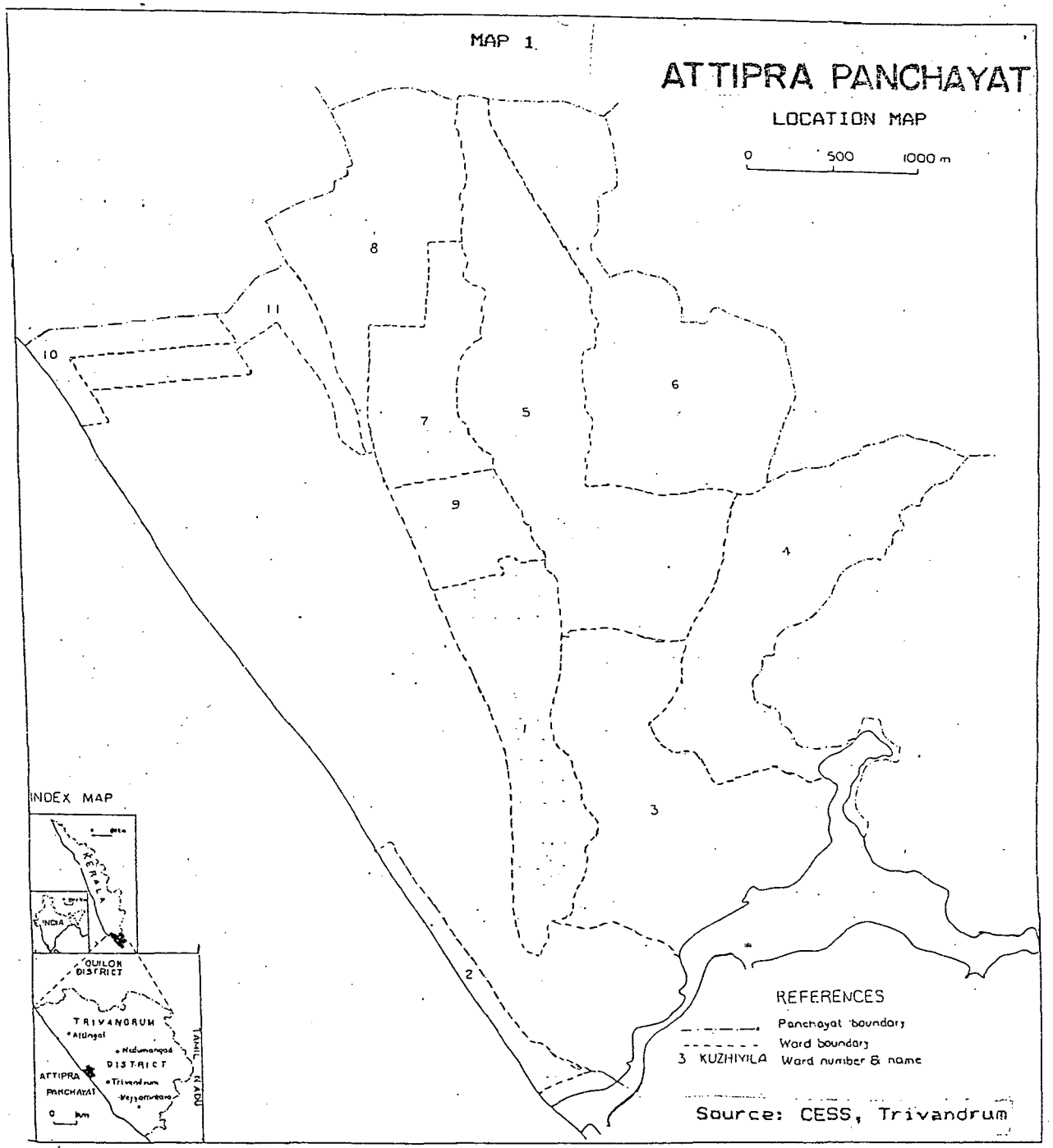
IMPACT OF LAND USE DYNAMICS ON THE RESOURCE BASE

A Micro level study

Based on the application of Resource Maps, this chapter appraises the resource endowments and resource use pattern of a village. Further, it examines the resource base status of the region with respect to the specific socio-economic environment and examines in what way these aspects, together with the institutional factors interact on the resource base to bring out changes on it.

The major thrust of the study is to find out the type and pattern of changes that is marked on the resource base of the region. To evolve at this, the objective of the study is set as one to assess (1) the resource use pattern, (2) the resource endowments, (3) the resource base status (4) the level of institutional interventions and (4) the driving forces that might have influenced the resource base status.

The study is concentrated on a Southern village of Kerala, **Attipra**-in Trivandrum district, situated 18 km away from Trivandrum City (See Map 1). The rational in choosing the village was mainly the availability of the resource maps. Though at present the team had covered more than twenty five villages in the state, this was the only panchayat where the resource maps were finalised when the study was initiated.



1. Poundkadavu
2. Veli
3. Kuzhivila
4. Kizhakkumkara
5. Arasinmoodu
6. Manvila
7. Mukkalikkal
8. Attinkuzhi
9. Kulathur
10. Pallithura North
11. Pallithura South.

Data Base and methodology

Resource maps were the primary source of data, details of which were quantified by using the standard Conversion Techniques ie. a centimetre graph paper is superimposed on each map, the areal extent of which is calculated according to the map scale. Thus, in the maps drawn on the scale 1:15,000, one sq.cm represented 1.5 ha on the ground. Apart from that, institutional level information pertaining to the study area is collected from the concerned offices. In addition to that to examine the seasonal variations in the resource base status of the region, regular field visits spread out over the year was carried out. In the absence of time point details regarding the resource base position local level information were collected from the farmers.

Limitations

Resource mapping in the village was done as a pilot project, before the methodology was standardised. Hence the study has its own limitations. For example, the well inventory in the village was done on a sample basis without being supplemented with its depth and year of digging. Further, the rate of withdrawal is not accounted, which if available, would have been helpful in finding the rate of exploitation.

The scope of the study is further limited due to the non agrarian nature, a recently emerging phenomena of the village economy. This sets its own limit in explaining in concrete terms the extent to which resource base changes induce land use dynamics and thereby its impact on agriculture[1]. Further, the study would have been more effective had the size of the farm holdings and the

cropping pattern been available.

The Village Profile

Attipra, extends over an area of 1603 hectares with a total population of 33,000 and a density of 2059 persons per sq.km as per 1991 Census (the density figures for the state is only 747 persons per sq.km). The literacy rate for the village is more than 75% (1981 Census). The village is a fast growing one due its proximity to the city as well as due to the presence of the Vikram Sarabhai Space Centre (VSSC) of the Indian Space Research Organisation (ISRO).

Between 1971 and 1981, the rate of change in population in the village was to the extent of 28%, much higher than the state average of 19% while between 1981 and 1991, the growth rate had declined to 18.42% but which is higher than the state average of 13%. The density levels within the village is also much higher than the state figures (see Table 1).

Table 4.1

Distribution Of Population[2]

Ward	Popn.	Density
Poundkadavu	2723	2127
Veli	2210	12278
Kuzhivila	1829	1136
Kizhakkumkara	2434	1656
Arasinmoodu	2767	1618
Manvila	2454	1506
Mukkalikkal	2902	4331
Attinkuzhi	2455	2192
Kulathur	3657	4933
Pallithura N.	1105	2210
Pallithura S.	3829	10636
Total	27868	1738

Source: Estimates derived from the Primary Census Abstract,Trivandrum, 1981.

About 78% of the village people are engaged in the non agricultural sector. Within the decade of 1971 and 1981, the percentage share of the working force engaged in the primary sector was marked with a decline of more than 16%. In absolute terms the agricultural labourers had shown an increase of 68% whereas the number of cultivators had declined by 13%. The most noticeable aspect about the change in the proportion of the working population is that the decline in the primary sector is absorbed in the tertiary sector. In absolute figures the number of main workers had increased, while the dependency ratio had shown a decline of 3% (Table 4.2).

Table 4.2

Occupational Structure (1971-1981)

Category	1971	1981	% change
Total Population	21579	27689	28.31
Total Main Workers	6185	8486	37.20
Total Non-Workers	15394	18896	22.75
Share Of Non-Workers to total population	71.34%	68.24%	-
Primary Sector	2135	1778	-16.72
Other Sectors	4050	7015	73.21

Source: Primary Census abstract & Village directory,Trivandrum,1971 & 1981.

Within the village, the occupational structure varies. Regions that are more accessible like Attinkuzhi, Mukkalikkal, Kulathur and western parts of Arasinmoodu are dominated with tertiary activities (the development process within the village is considerably influenced by the proximity to VSSC). In the coastal areas of the village, like Veli and Pallithura fishing is the major economic activity whereas the interior portions of Arasinmoodu, Kuzhivila and Manvila have agriculture as their predominant

occupation.

It is seen from the table 4.3 that about 25.02% of the total population persists under conditions of poverty which is almost equivalent to the state average of 26%. Approximately 13% of the total poor people live in Pallithura South. However, the incidence of poverty is highest in Pallithura North where more than 46% of the population are living under conditions of poverty. This is followed by Veli (34.41%), Kuzhivila (30.16), Kizhakkumkara (32.45%) and Manvila (29.4%). If the occupational structure of the poor are examined most of them are found to be engaged in agricultural activities. Similarly, in regions like Kulathur, Mukkalikkal and Attinkuzhi where services constitute the dominant economic activity, the incidence of poverty is considerably less than in those regions where agriculture is the main activity.

Table 4.3
Population below poverty line (1990/91)

Ward No.	Name	Total Population	Population BPL	% of Popn. BPL to total popn.	% of BPL popn.
1	Poundkadavu	2723	553	7.93	20.30
2	Veli	2210	753	10.80	34.10
3	Kuzhivila	1829	734	10.80	30.16
4	Kizhakkumkara	2434	790	11.33	32.45
5	Arasinmood	2767	536	7.69	19.40
6	Manvila	2454	723	10.37	29.44
7	Mukkalikkal	2902	445	6.38	15.33
8	Attinkuzhi	2455	445	6.38	18.10
9	Kulathur	3157	595	8.53	18.84
10	Pallithura N	1105	517	7.42	46.79
11	Pallithura S	3829	881	12.64	23.01
	Total	27868	6972	100.00	25.02

Source: Rural Development Registers 1990/91: BDO, Kazhakkuttam.
Note : For details regarding the estimations of poverty (See Section on Institutional Aspects: Block Development Office).

Resource use pattern

In general, the resource use pattern is influenced by a complex set of factors ranging from the individual, the society, the resource endowments/availability and the institutional factors. Hence resource use pattern is the result of the interaction of these forces over a period of time.

In the context of this, an attempt is made here to capture the changes in the land use pattern over time. As per the Census classification agricultural land is classified as irrigated and un irrigated. Between 1971 and 1981 the irrigated area in the village remained at 200 ha or 12.48% of the total area. But the area under the un irrigated category had registered a marked decline of about 31%. This reduction is captured in the land put under non agricultural activities. Between the ten years the proportion had increased from approximately 31% to 72%.

The village is devoid of any forest cover.

As per the revenue records at the village level, land is classified into wet lands-land suitable for cultivating paddy, and dry lands; 88% of the total area in the village falls under the dry land category. But the conversion of wet lands that had been going on for the years in the village is not accounted in these registers and to that extent the reliability of the data is limited.

For the purpose of the study the land use in the village is broadly classified into agricultural and nonagricultural uses. The proportion of land available for agricultural use is being

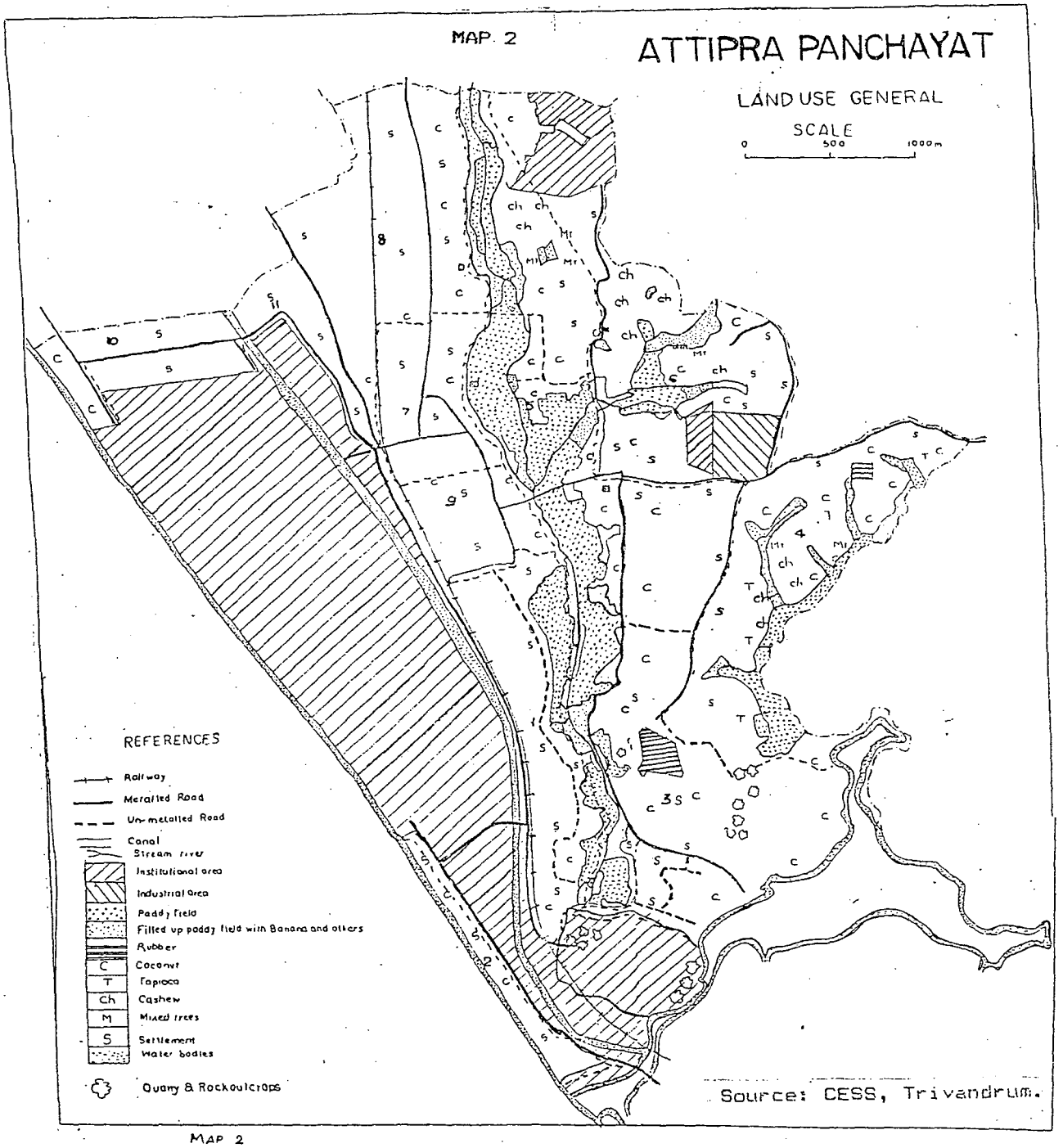
considerably reduced due to conversion to nonagricultural uses on account of the increasing urbanisation and the higher returns from non agricultural activities.

Agricultural land use

The most important crops grown in the region include paddy, coconut, cashew, tapioca and plantain. Paddy is the dominant crop but its cultivation is confined to the wards of Arasinmoodu, Kizhakkumkara, Kuzhivila, Poundkadavu and Manvila. Since land use is a function of physiography, soil, water availability, etc. paddy cultivation is more or less confined to the valley lands adjoining River Thetty and its tributaries where riverine alluvium conducive for paddy is available. Moreover, cropping in the village is mostly rain fed. Hence cultivation is limited to places where there is easy access to river water. In the relatively dry and slopy areas of Manvila and Kizhakkumkara cashew and tapioca are grown. Coconut is a common crop every where in the village but more so in the case of the coastal tracts (See Map 2).

Non agricultural land use

The major non agricultural use include the area put under industrial (31.63%), institutional (23.79) and communication (13.33) purpose. The industrial units include The Keltron unit, and the Industrial Estate run by the State Industries 'Development Corporation. The major institutions that comes under the village include the VSSC, the Agricultural Co-operative Training College, and parts of the Kerala University Campus.


MAP 2
ATTIPRA PANCHAYAT
LAND USE GENERAL
SCALE
0 500 1000m
REFERENCES
Railway
Metalled Road
Un-metalled Road
Canal
Stream river
Institutional area
Industrial area
Paddy field
Filled up paddy field with Banana and others
Rubber
C Coconut
T Tapioca
Ch Cashew
M Mixed trees
S Settlement
Water bodies
Quary & Rockoutcrops
Source: CESS, Trivandrum.

MAP 2

Resource Endowments

This mainly covers the water resources of the region. The specificity of the RE is that it undergoes changes according to the type and nature of use, change in the values and perceptions of the people as well as the level of technology. RE is considerably influenced by resource use pattern and vice versa. In short, resource use pattern and resource endowment are complementary.

The village is drained by River Thetty and its tributaries; has 19 ponds spread out all over the village; six perennial springs-four in Kizhakkumkara, one in Kuzhivila and one in Manvila.

Attipra is a drought prone village, the intensity of which is increasing annually. The effect of drought is most severe in certain areas of the village where water is supplied in lorries in summer. The water supply facilities existing in the village are not sufficient to maintain the supply throughout the year due to poor pumping facilities. In the absence of surface water owing to its highly skewed distribution, to overcome the water shortage the alternative left is exploitation of ground water. To facilitate this, an assessment of the potential water availability is required.

Like surface water the distribution of ground water also is not uniform (See Map 3). The factors that influence ground water availability in any region include soil texture, thickness of the weathered material and the number of fractures and joints on the rock bed that permit percolation. The depth of the subsurface

water is a function of the topo-sequence and there are two distinct zones for water recharging and discharging (CESS 1991). All the elevated areas are the recharging areas which points out the necessity of adequate vegetal and soil cover in the slopes and uplands to maintain the ground water supply. Places that are less than 20 mts in elevation have a water table less than 3 mts in depth (see map 3 & 4)

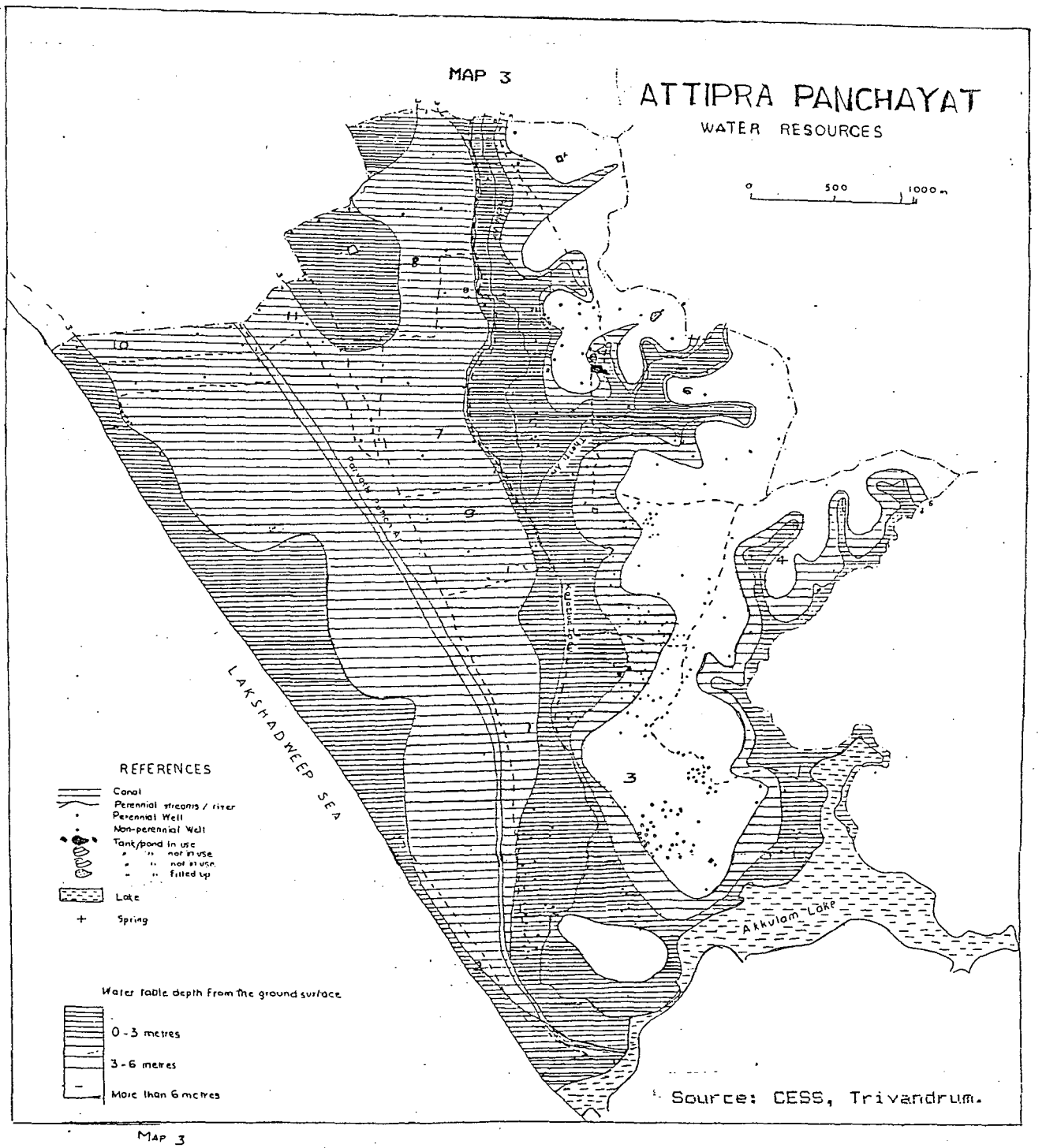
Table 4.4

Ground Water Availability
Depth Of Water Table
(Area in hectares)

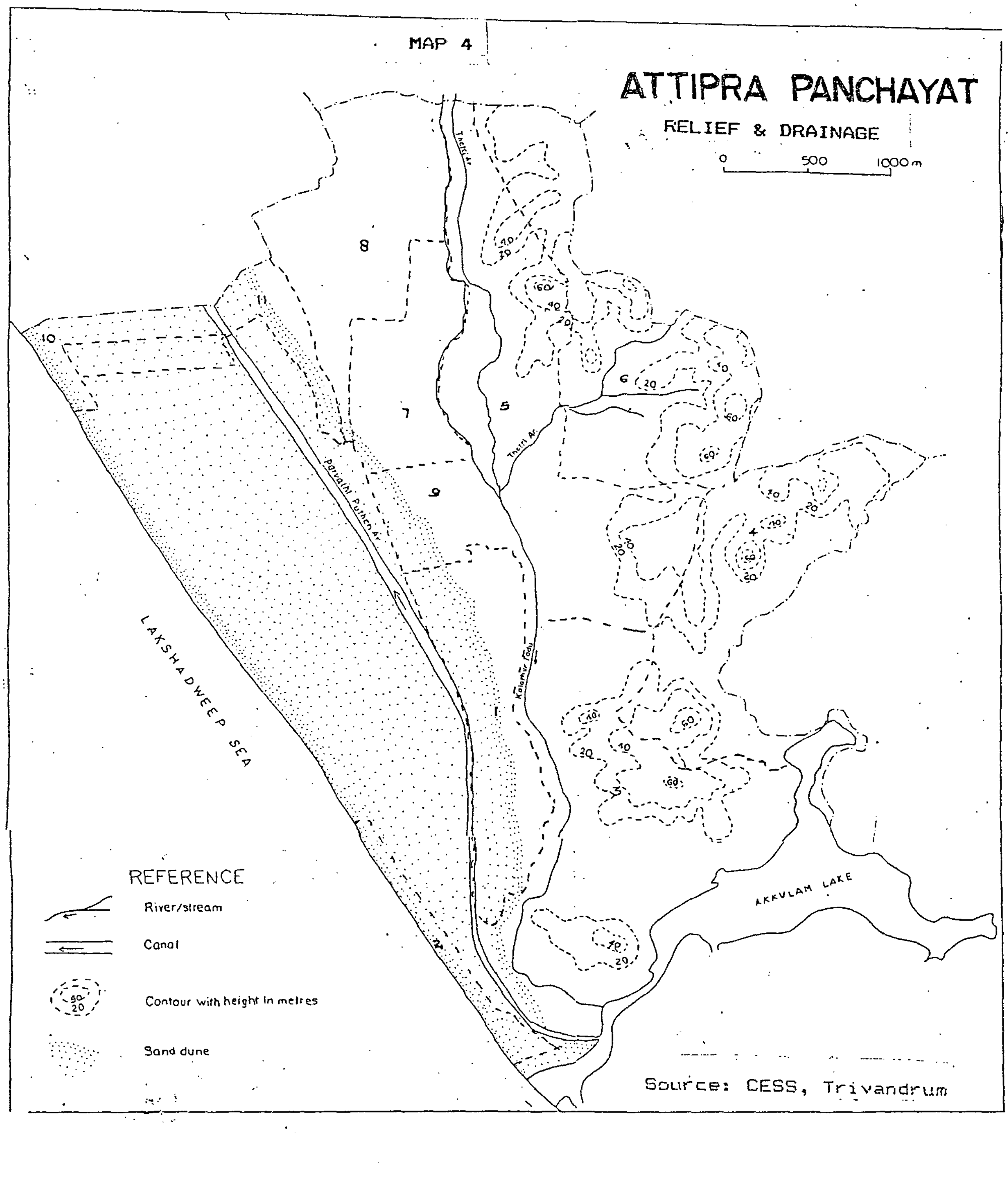
Ward name	0 - 3 mts	3 - 6 mts	above 6 mts
Poundkadavu	85	43	-
Veli	15	3	-
Kuzhivila	62	33	66
Kizhakkumkara	41	32	74
Arasinmoodu	131	40	-
Manvila	44	35	84
Mukkalikkal	-	67	-
Attinkuzhi	64	48	-
Kulathur	-	64	-
Pallithura.N.	10	40	-
Pallithura.S.	1	35	-
TOTAL	453	440	224

Source: Area calculated from map 3.
Note: The depth is calculated from the surface to the water table level. For example, 3 mts. depth means that water is available at that level from the surface.

About 41% of the total area have a potential water availability at a depth of less than 3 mts, nearly 40% between 3 to 6 mts and 14% have a depth of more than 6 mts (does not add up to 100% because the VSSC region is not included). The most conspicuous aspect about the ground water distribution in the village is that its constraint is confined to the wards of Manvila,


MAP 3
ATTIPRA PANCHAYAT
WATER RESOURCES
0
500
1000 m
LAKSHADWEEP SEA
Akkulam Lake
REFERENCES
Canal
Perennial streams / river
Perennial Well
Non-perennial Well
Tank/pond in use
not in use
not in use
filled up
Lake
Spring
Water table depth from the ground surface
0 - 3 metres
3 - 6 metres
More than 6 metres
Source: CESS, Trivandrum.

MAP 3


MAP 4
ATTIPRA PANCHAYAT
RELIEF & DRAINAGE
0
500
1000 m
LAKSHADWEEP SEA
AKKULAM LAKE
REFERENCE
River/stream
Canal
Contour with height in metres
Sand dune
Source: CESS, Trivandrum

Kuzhivila and Kizhakkumkara - the relatively elevated portions of the village with 51%, 41% and 50% of their total area respectively, having a water table deeper than 6 mts. Mukkalikkal, Kulathur, Pallithura north and south have a moderate ground water potential while the rest of the village have good water potential.

Resource Base Status

Based on the available information an assessment of the resource base status is carried out here. We have already discussed the complementarity of the resource use pattern and resource endowment and resource base status is the result of the interaction of the two. So it is as dynamic as the concept of resource endowments and resource use pattern and accordingly changes either positively or negatively depending on the type of intervention that is taking place.

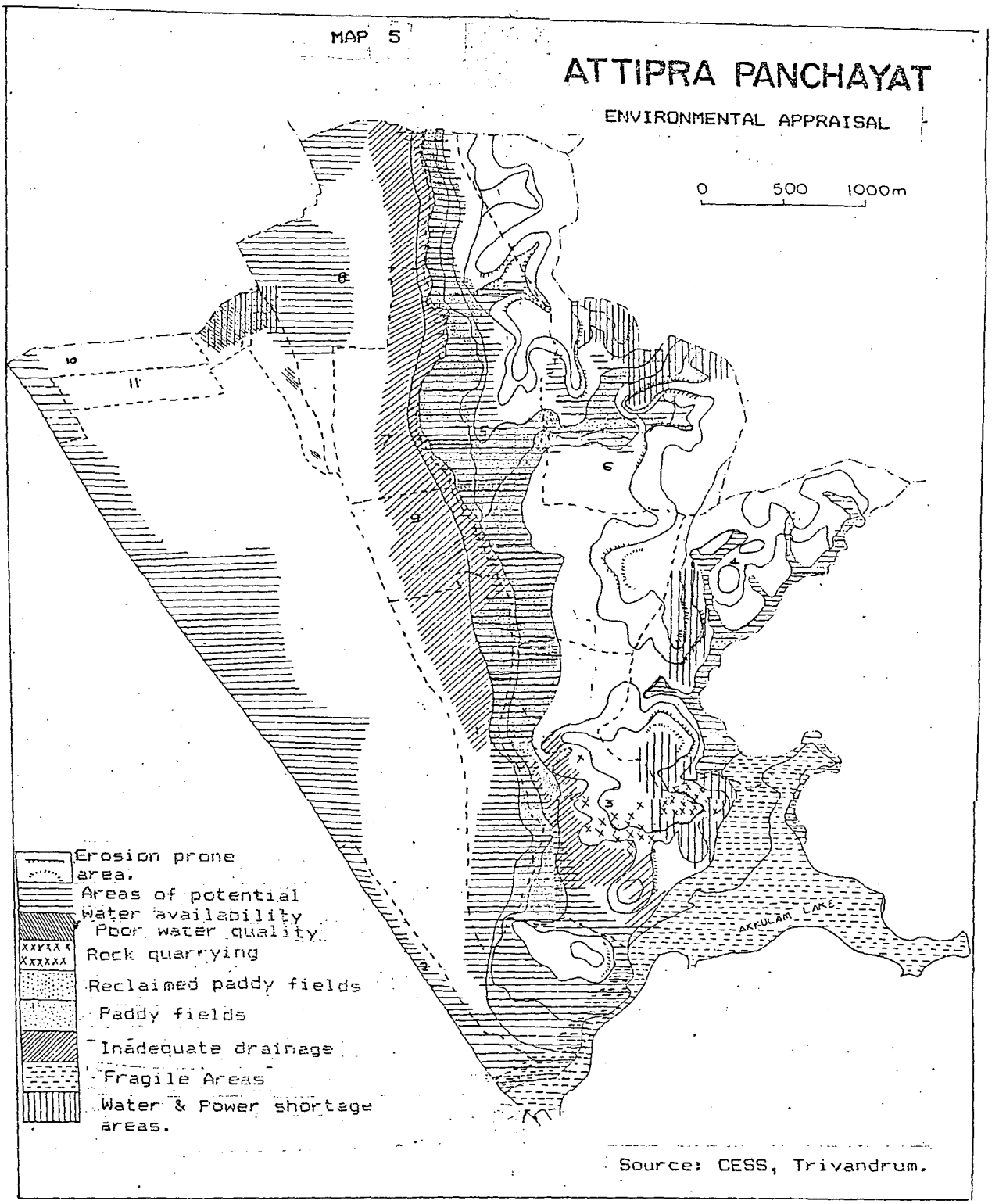
Soil erosion is a problem in Kuzhivila, Kizhakkumkara, Manvila and Arasinmoodu (See Map 5). About 5.12% of the total area in the village is subject to this problem.

Table 4.5

Erosion Prone Areas

Ward	Area in ha	% to total area
Kuzhivila	4	9.82
Kizhakkumkara	11	7.43
Arasinmoodu	13	7.92
Manvila	28	17.07
Total	56	5.12

Source: Area calculated from Map 4.5


MAP 5
ATTIPRA PANCHAYAT
ENVIRONMENTAL APPRAISAL
0 500 1000m
Erosion prone area.
Areas of potential water availability
Poor water quality
Rock quarrying
Reclaimed paddy fields
Paddy fields
Inadequate drainage
Fragile Areas
Water & Power shortage areas.
AKKULAM LAKE
Source: CESS, Trivandrum.

Manvila have the maximum area prone to erosion which is about 17% of its total area, followed by kuzhivila (9.82%), Kizhakkumkara (7.43%) and Arasinmoodu (7.92%).

There is a close correlation between physiography, land use, water availability and susceptibility to erosion (CESS,1991). This is quite true with the study area also. All the regions prone to erosion are the relatively elevated portions of the village. Actually, the eastern elevated portions of Manvila was taken up by the Government as surplus land and redistributed through the local bodies for rehabilitating the landless people who were spread out all over the village and have about two hundred and fifty houses at present. The entire area is sparsely vegetated with a few cashew trees spread out here and there. Vegetative cover is a primary requisite for seepage of running water and checking soil erosion. Incidentally, the industrial zone of the village is also located here. All these factors together contribute for the relatively high erosion rate of the region. In Manvila and Arasinmood, the developmental activities are responsible for the induced erosion. Another factor that contributes to it in Manvila is the cultivation of tapioca in the slopes which is the case with Kizhakkumkara also; in Kuzhivila it is the quarrying process that had resulted in resource base degradation.

Reclamation of the wet lands continues unabated in the village for purposes of cultivating crops other than paddy as well as for non agricultural activities. The use to which it is converted to and the degree also varies. While in Kuzhivila and Kizhakkumkara the conversion had mainly been for cultivating crops like plantain

and coconut, in Arasinmoodu and Poundkadavu conversion for non agricultural activities also contributes to a significant share in addition.

Table 4.6

Extent And Rate Of Reclamation
(Area in hectares)

Ward	Area under paddy	Reclaimed Area	Percentage of col.3 to 1.
Arasinmood	86.84	19.48	22.43
Kizhakkumkara	28.29	12.16	42.98
Kuzhivila	26.49	9.91	37.41
Poundkadavu	26.10	5.22	20.00
Manvila	18.32	8.66	47.27
Total	186.04	55.43	29.80

Source: Unpublished Report prepared by B.Sukumar et. al Centre for Earth Science Studies & State Land Use Board, Trivandrum 1991.

The proportion of reclamation is highest in Manvila and Kizhakkumkara (47 and 42 respectively of their total wet land share) where the conversion had mainly been for growing crops other than paddy and is followed by Kizhakkumkara (37%).

Drainage problem is recurring in the regions adjoining River Thetty. The regions include Poundkadavu, Mukkalikkal, Attinkuzhi and Kulathur (see map 5).

Table 4.7

Areas Prone to inadequate Drainage
(in hectares)

Ward	Area
Poundkadavu	25.39
Mukkalikkal	23.59
Attinkuzhi	9.00
Kulathur	15.44
Total	73.22

Source: Area calculated from Map 5.

About 4.52% of the total area in the village is subjected to inadequate drainage facilities. Within the village 35% of the total area in Mukkalikkal, 22% in Kulathur and about 19% in Kulathur are exposed to this problem (estimated from Table 4.7).

Waterlogging is an obstacle for growing paddy especially during the rainy season in parts of Arasinmood. One possible reason that might have led to the present situation apart from the soil texture, is the reckless conversion of paddy fields for other purposes. This might have hindered the ground water circulation which together with the clayey soil might have led to water stagnation and conditions of water logging.

In parts of Pallithura South, the quality of drinking water is very poor mostly due to inadequate sanitary conditions. About 9% of the total area in the region is affected by water pollution. The well water in the region is found to be yellow in colour and smelt of hydrogen sulphide. Apart from being inhabited by the low income people, illicit liquor extraction is an important activity that is prevalent here, the waste materials of which is being dug

into the earth. The consequence of this is that the ground water gets contaminated. This is because the sandy soil of the region acts as an aquifer.

Water scarcity and Power shortage is indeed a problem at least in some parts of the village; in most cases it coexist. However, chronic water scarcity is limited to Manvila, Kuzhivila, Kizhakkumkara and Pallithura north.

Table 4.8
Areal Extent of Regions with Drinking Water and shortage of Electricity

Ward Name	Area (in ha).
Pallithura N.	3.85
Kuzhivila	11.79
Kizhakkumkara	18.10
Manvila	23.20
Total	56.94

Source: Area calculated from map 5.

Approximately 4% of the village is bound with drinking water shortage. Among the areas identified with the problems except Pallithura north are incidentally characterised with ground water scarcity too which highlights the magnitude of the problem; even within these regions water shortage is experienced in pockets. 8% of the total area in Pallithura and Kuzhivila and approximately 13% of the total area in Manvila and Kizhakkumkara are under the grip of chronic water scarcity (calculation based on table 4.8).

Rock **quarrying** as an economic activity is confined to Kuzhivila, where approximately 10% of the total area has become

economically unproductive due to this (estimated from map5). The geology of the region, characterised with granite is highly conducive for quarrying. Further, with the increase in the rate of urbanisation there is an increase in the demand for building materials. This, coupled with the lack of other economic options and the low investment required for quarrying acts as an incentive for the people to take up quarrying in the region.

The long run impact of quarrying is that it will leave a bad land topography unsuitable for any economic activity.

The Institutional Aspects- A Regional Perspective

In any region there exists a set of institutions to implement the socio-economic objectives set by the planning machinery. In this section we will examine the institutional set up involved in the village's development and the level of operation.

The Institutional Set Up:

There exists a wide range of institutions to look into the affairs of the village from different angles. Almost all of them are functioning more or less independently.

The Panchayat Office

The Panchayat is the lowest administrative unit in the state[3]. Each Panchayat is divided into different wards for purposes of administration. The administration of the village rests with the Panchayat Office. The functioning is carried out by an elected body comprising of the President and a Council of ward members. Local level decisions are taken up by this council on

demand from the people who were represented by the members. On recommendation of the Council, the decision is executed by the village level government employees.

The Panchayat Act of 1960, empowers the Panchayat to carry out the developmental activities of the village. But policies related to agriculture, industry etc. are still under the control of the concerned departments, limiting the power of the local bodies considerably. At present, the developmental activities that are undertaken at the village level include public works, education (limited), water supply and drainage, public health, street lighting and some other miscellaneous works.

Village Office

The functioning of the village office is directly under the control of the Village Officer. It does not have any direct involvement in the village's developmental activities-functioning is mainly limited to the paper work like issuing income certificates, keeping the land registers, birth and death registers etc. The function of the village office is more or less confined to the revenue administration.

Krishibhavan: Agricultural Development Office

A village level Krishibhavan, an extension office of the Agricultural Department, was opened up in each village, with the objective of improving the agricultural situation through diffusion of technical knowledge, disbursement of subsidies and distribution of seeds among the farmers. With this objective, the Bhavan provides subsidies in digging wells so as to help in achieving cent

percent irrigation. Further, it undertakes land improvement programmes like bunding, terracing, levelling etc.

Block Development Office

As a part of the Community Development Programme, the villages in the state is covered under a net work of different Blocks. A District Rural Development Agency (DRDA) is set up in each District comprising all the blocks in a district. Since it is set up as a part of the Community Development Programme, the functions of it includes all activities related to the rural development, ranging from animal husbandry to poverty alleviation.

The Government of India had initiated the Small Farmers and Marginal Farmers Development Agency in 1979/80 to help the small and marginal farmers. In 1980 the DRDA had launched the Integrated Rural Development Programme (IRDP), at the instance of the government with a view to improve the living conditions of the poorest among the poor. Evaluation reports had revealed that the programmes were insufficient to look into the interests of the poorest among the poor. As a result, the Antyodaya Scheme was set up to identify the families that falls below the poverty line and categorised them as the IRDP families.

In 1984/85 a Family Survey was conducted to investigate the families that falls below the poverty line (the criteria for identifying the same was an annual income of less than Rs.3500 at 1983/84 prices). To overcome the loopholes a resurvey was conducted in 1990/91. Accordingly, financial assistance is given to them, depending upon the availability of local resources. Till

1990/91 cash payment was given but to avoid fund diversion now assets are given.

The Block level programmes include various schemes like the IRDP, National Rural Labour Employment Programme(NREP), Rural Labour Employment Guarantee Programme(RLEGP), Training of the Rural Youth For Self Employment, Million Well Housing Scheme etc.

The Kazhakuttam Block, under which the sample village falls comprises 7 villages under its jurisdiction. Each village is divided into two or three Circles, each under a Village Extension Officer (VEO).

Financial Institutions

The role of financial institutions are important in the regional context because of their power in extending credit facilities to the people. Further, the fund disbursement for the rural development programmes initiated by the government are disbursed through these financial institutions. The coverage of the financial institutions within the village include a District Co-operative Bank and a Commercial Bank. Besides this, there are four other banking institutions that caters the needs of the village- two in Kazhakkuttam village, one in Srikariyam and the other in Trivandrum city.

The Level Of Institutional Interventions

The Panchayat Office

It will be interesting to examine the type and nature of the development activities taken up by the Panchayat Office with its

limited power so as to get an idea about the development perspectives of the region.

The table 4.9 shows that tax revenue constitute about 85% of the village's income, of which professional tax constitutes the lion's share (58% of the total income) followed by house tax (13%) and the duty on transfer of property (10.44%).

Table 4.9
Revenue Budget (1990/91)
(Amount in Rs.lakhs)

Category	Amount	perc.
House tax*	2.31	13.00
Show tax	0.01	0.86
Profession tax	10.04	58.00
Vehicle tax	-	-
Entertainment tax	0.17	1.00
Service tax@	-	-
Additional tax on entertainment	0.11	0.67
Surcharge on show tax	0.003	0.06
Income tax mkt	0.19	1.11
Surcharge on building tax.	-	-
Land cess#	-	-
Licence	0.10	0.60
Duty on transfer of property	1.88	10.44
Deposits	0.99	5.60
Miscellaneous	1.49	8.66
Total	17.29	100

Note:* Tax revenue- Compulsory; @ Tax imposed by the panchayat
Non tax revenue.

Source: Annual Administration Report,1990/91, Panchayat office, Attipra.

On the expenditure side, establishment charges accounted for 23.43% of the total amount spent (25% of the total revenue)[4] (Table

4.9). 54% off the total expenditure was spent on public works that mainly covers construction and maintenance of roads, bridges etc. Education, water supply, drainage & public health together constitute 7.71%, street lighting about 3.88% (Table 4.10).

Table 4.10
Expenditure Budget (1990/91)
(in lakhs)

Category	Amount	Perc.
Estabt.charges	4.27	23.43
Public works	9.94	54.51
Education	0.45	2.45
Water supply Drainage& Public health	0.26	1.43
Street lighting	1.41	7.70
Other items	1.91	10.48
Total	18.24	100.00

Source:Same as for Table 4.9.

Because of the existence of village level agricultural extension offices under the direct supervision of the agricultural department, the expenditure on agriculture and allied activities by the local bodies is negligible. However, the local bodies has the power to carry out some minor irrigation works (the limit is Rs.10/hectare)

Table 4.11

Details on Minor Irrigation Works

Year	Exp.(Rs.)	Type of work done
1986/87	Nil	-----
1987/88	4218	bunding of R.Thetty Ar
1988/89	9786	bunding of Thetty R.
1989/90	3992	bunding of R.Thetty & dredging of Kotturkalam pond.

Source: Same as for table 4.9.

The irrigation works carried out by the local bodies was more or less confined to the bunding of River Thetty. It is in fact, surprising to note that in spite of the presence of a number of unused ponds in the village (see map 4.3), no conscious effort from the local bodies had so far been made to rehabilitate them. Local enquiries attributed the reason as lack of demand from the people. In the absence of people's demand the local bodies are powerless and cannot take the initiative. In a water scarce region like Attipra, it is surprising to note such a negligence in rehabilitating the ponds. If properly maintained, these ponds would be of immense help in mitigating the effects of drinking water shortage here.

The Krishibhavan

As a part of the Special Employment Programme (SEP) initiated by the Department in 1989, the Bhavan had disbursed subsidies for digging wells. The purpose is to extent the irrigational facilities as well as to make use of the existing local resources. In the two years between 1989/90 and 1990/91 the Bhavan had given a subsidy amount of Rs.30250 for digging 23 wells. Almost all the subsidy allocation were in Kizhakkumkara, Arasinmood and Manvila[5].

A fertilizer subsidy scheme is also operating through the Bhavan. The subsidy extent disbursed is about Rs.100 per ha. In 1990/91 fertiliser subsidy was allotted for 125 farmers for the first crop and to 111 farmers for the second crop, a total amount of Rs.11435. In 1989/90 the total amount distributed was about Rs.13805. There involves considerable delay in distributing the amount in time. One major reason for this is the lack of proper

infrastructure.

The Bhavan further undertakes Land Development Schemes like bunding, terracing, levelling etc. One fourth of the amount required for this is distributed as subsidy.

Table 4.12

Details of Land Improvement Schemes

Year	Beneficiaries	Amount(Rs.)	Per Capita(annual)
1987/88	75	4902	65
1988/89	63	3461	55
1989/90	112	8000	71
1990/91	10	1130	103

Source: Krishibhavan, Attipra.

Another programme channelled through this office is the disbursement of the flood and drought relief measures. The task is supervised by the District Collector and the amount is allocated from the District Collector's relief fund. The details of the relief measures operated through the office is given in Table 4.13.

Table 4.13
Flood Relief Assistance

YEAR	Number	Amount (Rs.)	Per capita
1989/90	75	9375	125
1990/91	12	3550	295
1991/92	188	28844	153

Source: Same as on table 4.12.

Except a small patch near the Aakkulam lake, the village in general is not susceptible to floods. The whole of the village exposed to heavy rains and storms. The intensity is high in the wards of Kulathur, Kizhakkumkara and Kottur areas.

The Block Development Office

The Block level assistance is given under two schemes viz. IRDP and CSS (Centrally Sponsored Scheme). In the village, the IRDP have a wider coverage than the CSS. The IRDP assistance in the village has mainly been for the purchase of cattle, sheep, catamaran (in the coastal areas for making fishing canoes), petty shops, tailoring units etc. Between 1985 and 1990 the IRDP had covered 256 families in the village, the details of which is given in the table.

Table 4.14

The IRDP Coverage

Year	No.of ben.	Amount disbursed Loan	Perca.	subsidy	perca.
1986/87	27	79036	2928	39304	1456
1987/88	68	156711	2305	78506	1155
1988/89	58	267645	4614	142117	2451
1989/90	62	263683	4253	131810	2126
1990/91	41	383897	9363	193519	4720
TOTAL	256	1150972		585256	

Source: Block Development Office, Kazhakkuttam.

There is a distinct variation in the functioning of the two IRDP circles (Attipra and Attinkuzhi) regarding the type of assistance given. In Attipra circle, the assistance was mainly given for primary activities whereas in Attinkuzhi it was mainly for nonagricultural activities. In Attipra Circle, it was mainly

for purchasing cattle, especially so in the wards of Arasinmoodu, Kuzhivila and Manvila (more than 50% of the subsidy). The minimum requirement for subsidy allotment in buying cattle is an asset base of minimum 7 cents ie. the capacity to set up a stall. In Veli, mostly inhabited by the fisher folks most of the subsidy requirement was for buying catamaran. As distinct from the previous years, in the current year, an effort is being made to distribute saplings like jack, mangoes etc. as a part of the programme to households with an asset base of 7 cents or more.

Apart from this, between 1985 and 1989 under the NREP and RLEGP 65 houses were constructed in the village. A new Scheme called the Million Well Housing Scheme is also under operation. It is aimed at improving the irrigational facilities of the people in the low income group. But since the demand on wells for irrigation purpose among the target group is negligible, to avoid fund lapsing the due amount is disbursed for digging wells for purposes other than irrigation.

Financial Institutions

The District Co-operative Bank:

The District Co-operative bank has 10 Primary Credit Societies under its jurisdiction, 9 Handloom Weavers Societies and one Primary Co-operative Credit Society. The District Cooperative Bank issues credits to these societies which in turn distributes the loans to the individuals. Over the years, from 1988/89 to 1990/91 the share of short term loans issued by the District Co-operative bank had declined from 2.78% to 0.27%. This reduction is reflected in the loans issued by the Primary Credit Societies

also. The Handloom societies were given more than 60% of the credit in the three years.

The functions of the Primary Credit Societies include issuing loans to the members, to collect and distribute seeds, fertilisers, agricultural equipments, pesticides, raw materials for agro and cottage industries, to implement agricultural development schemes, to provide ware housing facilities to them etc. Further, it assists in buying milch animals, acts as intermediaries in the sale of agricultural products and on special circumstances, with the help of the registrar, helps in carrying out agricultural improvement schemes like land protection irrigational facilities etc.

Each member is assigned to a credit limit, depending on his asset value, experience in cultivation, estimate of production for the year etc. This credit limit is generally sufficient to cover the annual agricultural expenditure. While sanctioning loans, the member is expected to sell a part of his product, at least sufficient enough to cover the loan amount, through a marketing agency recognised by the Society.

The Society issues different types of loans, the details of which are given in table 4.15.

Table 4.15

Credit Details
(Amount in Rs.lakhs)

Category	1986/87	1987/88	1988/89	1989/90
Ordinary loan. (3 years)	4.46	11.16	9.04	6.18
Short term (1 year)	-	1.55	1.76	0.54
Others	0.57	0.50	0.29	5.34
Total	5.03	13.21	11.09	11.96

Source: Primary Co-operative Credit Society, Attipra.

The short term loans, meant for agricultural purposes alone had shown a decline over the years, in actual terms as well as in its proportion. Its share which was 15.16% in 1988/89 had declined to 4.48% in 1989/90. A similar decline is evident in the number of loans issued also, from 31 in 1987/88 to 11 in 1989/90. However, the share of other types of loans had also increased from 11.31% in 1986/87 to 54.28% in 1989/90.

Among the commercial banks that looks into the requirements of the village, only The Union Bank of India falls within the village boundary. In addition to the issuing of loans based on their own criteria, these banks are specifically directed to co-operate with the Government in the rural development programmes initiated by it. Most of the IRDP and other loans are distributed through these banks only.

To examine the kind of services they render, the loans issued by a commercial bank during the three years from 1989/90 1991/92 is given in detail (Table 4.16).

Table 4.16
Loan Details Of A Commercial Bank
(Amount in Rs. Lakhs)

Year	Agri.	IRDP	Indu.	Tert.	Total
1989/90	16.05	1.18	1.26	3.52	22.01
1990/91	13.10	0.70	0.42	4.0	19.22
1991/92	16.0	0.60	0.50	1.50	18.60

Source: Union Bank Of India, Attipra.

The overall picture shows that the amount of loans sanctioned in the region is declining each year. 89% of the total loans in 1990/91 is issued in the primary sector. Though the proportion of loans issued in this sector had been increasing annually, the actual amount remained more or less the same (Table 4.16). This decline lull in the amount sanctioned is evident in the other sectors too. However, the number of loans issued had increased from 200 in 1989/90 to 348 in 1991/92 despite the reduction in the number of IRDP loans from 40 to 16.

The resource base changes

The interaction between man and nature had been the secret of human survival. Human intervention might be manifested on the resource base as positive or negative changes. For example, introduction of irrigation can improve the crop productivity. At the same time, it can also result in water logging or salinisation and a consequent decline in crop productivity. Because of the resource base's sensitivity to the resource use pattern, the concept of resource base status is as dynamic as that of resource use pattern and more or less determines the resource endowment. As long as the resource use pattern does not impoverish the resource base potential, it can be assumed that the manipulation

is not in conflict with the `ecological integrity' of the region. But if it shows signs of degeneration, it invariably necessitates a change in the mode of appropriation of the resource base or corrective measures to check the natural imbalance. Corrective measures can be evolved only with perfect knowledge of the factors that had led to the resource base changes and to find out the extent to which each of these factors had contributed to the degeneration. On the basis of the assessment so far made, the driving forces that had induced changes on the resource base in the study area are identified as changes resultant by population, poverty and ill conceived policies (This is not specific to the study area, everywhere it is the intervention that generates resource base changes). However, one cannot pinpoint any one factor as responsible for the changes. On the contrary, it is the effect of the interaction of a complex set of factors. Quite often it is the socio-economic factors that induces resource base degeneration[6].

Population Induced Changes

We had seen that the large scale inmigration of the people had drastically altered the occupational structure of the region in ten years time. This sudden influx of population had further set a differential demand on the local level resources. Further, it have influenced the regional economy in such a way that the local people's perception and approaches in the resource utilisation also underwent changes. A new wave of commoditisation of land is activated by the migrant people who were on the look out of it for purposes of settlement. Because of the stimulation of the local land market agricultural land ought to compete with

nonagricultural activities. It should be recalled here that between 1971 and 1981 there was a 76% decline in the un irrigated area of the region which was registered in the land under nonagricultural uses, a staggering 137%. The large scale reclamation of wet lands going on in the region further testifies this.

Apart from that, the differential composition of the commodity basket of the migrants and the local people had further influenced the economic activities pursued by the locals. These forces might also might have acted as a catalyst in encouraging reclamation, at least in some parts of the village, for example, in Arasinmood and Poundkadavu. Further, the spread out of settlements all over the region necessitates provision of accessibility within and between the regions. Irrespective of the physiography, the village has a very good communication net work (about 24% of the roads in the village is asphalted) and is well connected to the City..

The increasing population had exerted demand on water resources of the region. Inadequate surface drainage in parts of the village had necessitated exploitation of ground water in the region. It should be recalled here that in three years time, 23 wells had been dug in the three wards of Manvila, Kuzhivila and Kizhakkumkara. Also to be noted is that this estimate do not be actual number of wells dug in the region. It can be much higher, here the estimate is with regard to the subsidy allocation channelled through the Krishibhavan while there are other institutions providing funds for the same apart from the wells dug at the individual level without institutional assistance.

We have seen how exogenous forces influence the resource use pattern. It can even undergo changes without any direct influence of these forces. This change in resource use pattern might either be motivated by profit or by a change in the resource base status. As mentioned earlier, this can bring out changes in the resource base instigating further resource base changes. The reclamation of 'Melakonath Chira' (a privately owned perennial pond) in the Manvila region can be cited as an example to this extent. This had been a major source of irrigation for the farmers in the adjoining valleys. A few years back this was reclaimed to a coconut grove. With this the amount of water available for irrigation to the farmers had come down. And The farmers left with no option started growing less water intensive crops.

Similarly, inadequate facilities to utilise the existing resources can also result in changes in the resource use pattern. Resource presence should be supplemented with the ability to convert it for the optimum use in the absence of which it fails to be tapped effectively. This can be illustrated with the help of an example. The Kollayi pond in Manvila- another perennial source of water, with considerable water potential, was remaining unutilised due to scarcity of power. The adjoining areas of the pond is ideal for growing paddy for which the water in the pond can be efficiently used. In the absence of power supply to lift and pump out the water, the farmers could not make use of it. Now most of the adjoining paddy fields are used for growing crops other than it.

Poverty induced changes

It seems that there is a close correlation between poverty and resource base degeneration. Human poverty makes the resource base poorer and vice versa. The living pattern of any region is considerably influenced by the availability of resources. In a region inhabited by the low income people this is especially so due to their direct dependence on the resource base for subsistence. What needs to be recognised here is the relationship between these structural constraints arising out of poverty. Under conditions of necessity surpluses are extracted from the resource base resulting in changes in the resource base status.[7]

Applying poverty in the context of the study area to assess the resultant changes on the resource base, one can find a direct correlation between poverty and the resource base degeneration. The degraded areas of the village is confined to the four wards of Arasinmood, Kuzhivila, Kizhakkumkara and Manvila. These wards together accommodate 34% of the total population and 40% of the total low income people in the village. Further, these regions are characterised with the predominance of land based primary activities. Manvila with 17.07% of its total area degraded, accommodates its poor people in the slopes on the eastern side where they cultivate crops like tapioca. These areas are largely the settlement colonies[8]. What is unsustainable about growing tapioca in the slopes is the loosening of the top soil involved in its cultivation with each successive crop. The impact of this is that when the rainfall intensity increases the top soil is washed off and the soil cover gradually lost. the initial manifestation of this will be a decline in productivity for the subsequent crops.

In Kuzhivila, in the absence of alternate means of livelihood and the very poor investment potential of its population in other economic activities had resulted in their natural recourse to the resource base. A good proportion of the population are engaged in quarrying. More than 9% of its total area is already categorised as bad lands- due to quarrying[9]. Once quarrying is done in any region, the land becomes unsuitable for any other economic activity. In the long run, a situation might even occur that quarrying also becomes uneconomical.

Another evil effect of poverty is manifested as polluted drinking water, but is more or less confined to Pallithura South. The region which accommodates about 13% of the total poor people in the village (23% of the people here live under conditions of poverty), has very poor sanitary condition. This lack of basic amenities in the region is manifested as a problem in the quality of drinking water. Another contributory factor as mentioned before, is the illicit liquor extraction arising out of poverty and the associated waste dumping coupled with the porous nature of the region's soil.

Looking into the differential effects of poverty in relation to the study area, it can be said that human poverty contributes to changes in the resource base status (this is not to say that other factors are not relevant; there are other interacting forces as well).

Policy Induced Changes

Quite often, government policies also lead to changes in the resource base status. Invariably, all government decisions and policies are aimed at welfare only. Sometimes it happens that the overall welfare of the economy involve some distributional costs on others which might be manifested either directly or indirectly on the resource base.

For example, the developmental activities initiated in Manvila had resulted in an increase in soil erosion in the built up areas. This has led to a reduction in the storage capacity of the `chira' (pond) down the hill. The siltation rate is so high that even a portion of the pond is being utilised for cultivation. Farmers of the region complained that the chira that the areal extent had been more than 25 cents. But over the years it shrunk to a little more than 15 cents.[10] The siltation of the pond is obviously induced by the developmental activities carried out in the upper slope. In spite of being dredged twice silt accumulation continues. The pond which was perennial is nearly dry during the lean season. Further, the spring that had been the source of water for the chira had shifted its course from the right side to the left side. Another grave problem that confronts the `chira' is the present decision of setting up a sanitary sewerage at the water table level. In addition to that the outlet of the sewerage system is opened to the pond. This decision has its adverse impacts on the people who are directly dependent on the chira for their water requirements as well as on the people who are indirectly dependent on this source of water but who comes under the same ground water regime, some times even without their knowledge. In fact, a large number of

people are affected by this, many are not even aware of. After all who knows from which ground water regime their domestic well draws water?

We have seen that in Attipra Circle, the thrust of the IRDP aid was disbursed for the purchase of cattle. Manvila and Kizhakkumkara do not have any pasture or other grazing facilities. In the absence of adequate follow up measures for an ensured fodder supply, the distribution of cattle would only help in impoverishing the resource base. These regions are further characterised with persistent poverty to make the matters worse.

Another major draw back of the existing institutional set up is the lack of co-ordination between them. There exists no communication between these different power structures who functions more or less autonomously. For example, take the case of sanctioning of the loans for digging wells. Within the village, the Krishibhavan, the Block Office, the Primary Co-operative Society and the financial institutions allot funds for the same. None of these while allotting loans take into consider the distance between the wells.

Interaction of the Driving Forces On The Resource Base

The fundamental aspect about the resource base is that it is extremely fragile. Fragility is a relative concept and any piece of land is vulnerable when subjected to a use intensity higher than its capacity and for uses other than specific, in areas where the scope for resource manipulation is limited[11]. Hence each plot of land should be considered as an entity in itself with linkages to

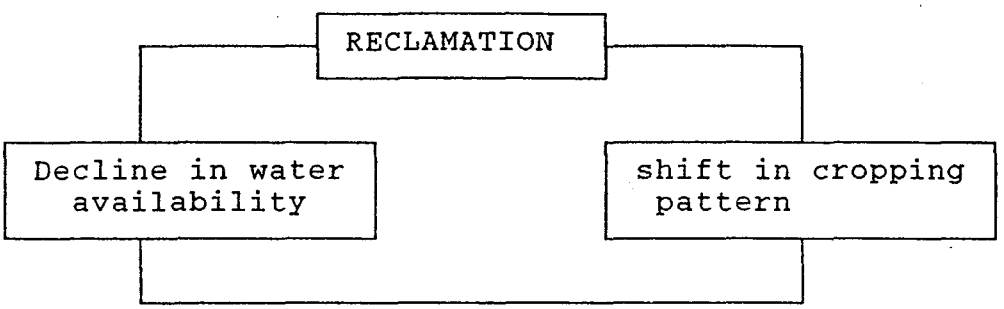
the entire system. This concern should be the essence of all decisions relating to resource base use. We have seen how population, poverty and policies have induced changes in the resource base status of the study area. It would be interesting to examine in what ways they interact on the resource base and what are the possible long term consequences that are associated with these dynamics.

A schematic representation of the resource base changes would be helpful in understanding the resource base changes[12].

RESOURCE BASE CHANGE

Visible changes	increased soil erosion siltation of water bodies reduced water availability for irrigation, Contamination of water. Conversion of wet lands.
Changes resultant due to a change in resource base	increasing number of wells conversion of wet lands change in cropping pattern

Reclamation is a process experienced all over the village. The reasons attributed to are many, varying from reduction in profitability to increasing trends of urbanisation. This is not challenged here, but what is being explained here is that the reckless conversion of wet lands might bring in considerable changes in the resource base status as cited earlier. To be more explicit in the argument the process of reclamation is plotted as a three way phenomena (interacting each other).



We know that the cultivation of paddy involves flooding of the fields. This in one way helps in replenishing the water table. Because of this, when paddy is replaced by other crops like plantain and coconut which does not involve flooding, there is the possibility of the water table receding to lower depths[13]. This might probably, in the long run affect the total water availability of the region. It is a fact that despite a good monsoon, recently summer is characterised with water scarcity. Poor ground water recharging might be one reason for this recurring water scarcity. An illustration from the study area will be relevant in this context. We have seen that the intensity of reclamation and the consequent crop diversification is very high in Kizhakkumkara. Some of the perennial springs here are on the verge of drying up. This non availability of water can also be one factor that might have attributed a shift to less water intensive crops like plantain and coconut from paddy (The example of Melakonath chira cited earlier). Similar is the case in the valley region in Manvila immediately below the area where developmental activities are taking place. The increase in developmental activities in the area had resulted in an increase in the soil erosion in the slopes which had reduced the recharging of ground water thus affecting the water potential of the region. The storage capacity of the` chira' is

also reduced considerably. One can not clearly say which is the cause and which is the effect. Local enquiries had revealed that some ten to fifteen years ago it was possible to raise two crops a year using the water from this chira but now it is difficult to raise one crop. This water was supplemented with the water in the River Thetty but now its storage capacity also have declined. The people say that the rainy days had gone down, but the rainfall intensity is high and results in flash floods. This reduction in water availability is cited as one reason that had led to a change in the crop mix of the region from paddy to coconut.

Water potential is further influenced by conversion of wet lands for nonagricultural activities. The impervious nature of the roads hinders the seepage and all the rain water is wasted as surface runoff[14]. When the land is paved in recharging areas serious reduction in recharging ground water and of summer stream flow results[15]. An increasing intensity of tarred roads can possibly influence the recharging of ground water negatively. About 24% of the roads in Attipra are tarred. The impervious nature of the tarred surface no way helps in percolation. The people in Arasinmoodu had complained about recurring water scarcity in recent years. The possible reason that can be attributed to this phenomena is the large scale reclamation and the consequent increase in the proportion of the built up areas[16].

We have seen the ground water exploitation in the village is expanding each year and many of the recharging areas no longer retain the same status in the changing scenario. Sustained withdrawal of water at a rate higher than the recharge rate creates

undesirable effects on the ground water[17]. Since each well spreads into the limits of an aquifer a reduction in the storage is felt when too many wells are installed[18]. That is when the use intensity is higher than the recharging intensity[19].

The social costs of resource base depletion

Apart from the reduction in the ground water regime accompanied with the installation of too many wells, it results in other types of externalities. This increase in the rate of exploitation should be looked in from the accessibility of the population in general to the resource base.

In the study area, Pallithura North, Kuzhivila, Kizhakkumkara and Manvila are characterised with drinking water scarcity (Table 4.8). Moreover, considerable areas in Kuzhivila, Kizhakkumkara and Manvila are characterised with acute ground water scarcity (Table 4.4). Further, these four wards together accommodate about 40% of the total population below the poverty line (table 4.3). Subsidy details allotted by the Krishibhavan points out that most of the fund allotted for digging wells was in these four wards alone.

What is to be kept in mind in this context is that constant installation of new wells within the limits of the aquifer will deplete the ground water table. Underground water is a resource over which nobody has any control over. Exploitation of ground water is a classic example of `riparianism' where the owner of each plot of land is permitted to exploit the ground water according to his requirements. Since no body knows about the original lay out of the ground water its exploitation involves maximum uncertainty

were every body's action has an effect on the water level itself. To avoid long term catastrophe ground water should be treated as a common resource base[20].

Over exploitation of ground water will marginalise the poor since an additional well shares the existing water base. Moreover, if the source is not regenerative enough, an additional well incurs additional investment not only to the new but also to the existing ones, in which case there exists a trade off of the interests of the economically well off and others.

NOTES AND REFERENCES

1. More than 75% of the population in the village is engaged in non agricultural activities, as a result 65% of the total area of the village was included under Trivandrum Urban Agglomeration in the 1981 Census.

2. The data on ward wise population is not available. Here it is arrived at by multiplying the average family size with the no:of households in each ward. Average family size is arrived at by dividing the total number of population with the total number of households in the village. Discrepancy exists in this estimates -the average family size might vary across the wards.

3. Panchayat and Village are two different administrative units. The Panchayat is a political administrative unit for developmental purpose in a region where decisions are taken by the people,s representative. A Panchayat may comprise of one or more village or sometimes even only a part of a village. A village on the other hand is an arbitrary administrative demarcation for purposes of revenue collection. In this context, it may be noted that the forest area within the village is not considered as a part of a village. But for the study the panchayat is equated as a village.

4. Establishment charges include administrative expense, salaries and grants, pension,TA and DA of members, office expense, telephone and electricity charges etc.

5. Arasinmood is not figured as a water scarce region in the study. But the topography is such that a portion of it suffers from water scarcity.

6. Bojo 1987: in one of his articles suggests the need for understanding land degradation as a socio-economic as well as a physical process.

7. This aspect of resource base degeneration had been discussed by many; see for example, Blaikie 1985: Bernstein 1979: Redclift 1984: Hussein 1990.

8. The Settlement Colonies were set up in these region to provide housing facilities to the poor people spread out over the village. This region alone has around 250 houses under this category, including a Harijan Colony.

9. Bad lands are characterised with ravines that are deep and the entire region will be devoid of any soil cover.

10. Though this might be an exaggerated version this can be taken to show the level of dependency of the people on this particular source of water and their concern for its slowly declining importance.

11. Those plots of land where the rate of manipulation is limited is referred as fragile land by Jodha (1990).

12. A similar approach had been adopted by Jodha. Sufficient modification is made here so as to fit in the context of the study area.

13. This is not a scientifically proved fact. But discussions with the farmers (not strictly confined to the study area) and a few scientists in the CESS, Trivandrum, amounted to in suggesting this as a reason for the water table to recede.

14. A study conducted in Trivandrum city had revealed that the reckless conversion of paddy fields for construction purposes had resulted in increasing the flood intensity during monsoon season (Sukumar, Ahilya 1987).

15. Frank and Mc Clymonds 1972.

16. The Sahel disaster has mainly been attributed to years of inappropriate land use. Large scale clearance of forests and extraction of ground water had depleted the water table that receded year after year (Mann 1987).

17. Singh and Dogra,1975. This phenomena had been observed in Shahkot-Nakodar areas of Bist Doab Tract, around Samrala-Chamkur Sahib areas and around Chandigarh. Here the problem cropped up due to the installation of too many tube wells.

18. Dayal (1985) in one of his articles points out that despite the heavy financial outlays for drinking water schemes, fewer people in South East Asia have access to clear and adequate drinking water than they did in the seventies which amounts in suggesting that technological solutions for supplying scarce drinking water are no longer effective since the water crisis is the failure to sustain water availability (pp.22).

19. Singh & Dogra 1975; Dunne & Leopold 1978; Singh 1987. The long run impacts of excess withdrawal of ground water amounting to a hydrological drought had been explained by Bandyopadhyaya 1988.

20. Gupta 1982.
This is being applied to common properties where each member of the community has accessibility to but no body has the responsibility to maintain/manage it.

CHAPTER 5

SUMMARY AND CONCLUSION

A quick review of the selected literature, on the current issues on environment and sustainability, pointed out that the issues have their origin on resource base degeneration and is often manifested in poor developing economies in different ways as poverty, famine, floods, droughts, declining crop productivity etc. This realisation of the complex interlinkages the resource base has on human survival, pointed out the fallacy in isolating issues related to environment and development. This have made one realise that, there exists no panacea for deforestation or soil erosion, floods or droughts, famine or hunger, when they are all manifestations of the impairment of a larger system.

The study was thus began with the basic premise that the interplay of a set of socio-economic and political factors on the resource base undermines the development process. Further, any developmental activities aimed at this need to look in from the resource base to the socio-economic factors that interact on it.

Considering the importance of the resource base, the study was attempted in that direction assuming that it can in some way provide an operational meaning to the concept of sustainability. The study was directed in the context of a developing economy, characterised with intense population pressure, the resultant low per capita availability of land and a moderate level of state intervention in deciding the resource base use. The focus was at the micro level, taking a village in Kerala.

The overview on Kerala's resource base appropriation had pointed out that the state is overpopulated with intense pressure on its land resources and had crossed the scope of extending cultivation to further margins. Moreover, the scope for intensifying cultivation is also limited on account of the specific crop mix. With additional population, the number of ownership holdings had increased, reducing the size of the operational holdings (the 1987 statistics show that more than 80% of the operational holdings in the state comes under the size class of less than one hectare). The impact of this is manifested in the agrarian sector in terms of the marginal lands going out of production has become a phenomena.

The study had highlighted the structural specificity of the region and explained briefly how it had influenced the cropping pattern of the region and the dependency of the state's economy in the cash crop sector. The effect of this structural constraint was mainly felt in the food crop sector which ultimately had necessitated reclamation, intensification of cultivation by means of irrigation and even forest clearance; in spite of this, the paddy sector in the state is competing with other crops for cultivation.

While examining the type and level of state interventions,it is found that some of the Government policies were not satisfactorily implemented to suit the objectives set; for example, the existence of the failed forest plantations and the deforestation in the catchment areas. The difference noticed in the area under legal forest cover and the actual vegetative cover in the state further points to an extremely grave situation of the

unauthorised clearance of forests going on in the state.

Further, the irrigational expenditure of the state and the differential performance of the irrigation schemes revealed the scope of investing more on minor irrigation schemes which is both speedy and cost effective.

The studies conducted among the small cultivators of the state had brought forth the fact that, in many cases a governmental level intervention like investment on irrigation or soil quality augmenting programmes can, to a certain extent- bring the lands back to cultivation, which the farmer at an individual level might not be in a position to invest on. The same holds good in the case of the waste lands in the state.

The study further briefly pointed out the impacts of marginalisation of communities in impoverishing the resource base. Taking into account all these factors that affects the resource base appropriation, the second chapter ends up by suggesting the need for an alternative approach.

This aspect of developing a methodology to integrate the socio-economic objectives within the framework of the resource base at the micro-level is discussed in chapter three. It discussed briefly the limitations of the existing planning process, that does not give adequate weight to the resource base specificity of each region as well as the variations in the socio-economic environment.

The chapter suggested "Integrated eco-development strategy" as an alternative strategy in ensuring sustainability. The suggestion was based on the premise that the improper understanding of the relationship between the resource base, the institutions operating in the region and the needs and aspirations of the people are the factors that lead to the undermining of the development process as well as the resource base status.

To develop the required methodology for the study an argument is directed there to emphasize the relationship between human wants and the resource availability. In the course of the discussion it was arrived that the resource use pattern is considerably influenced by the level of technology and the dynamic nature of the society and that both are interlinked. It had further argued that considering the level of dependency on the resource availability and resource base status, the management of resources should begin from the values of the society.

As a starting point, the discussion emphasised the need and acceptability of a resource survey to make an assessment of the existing resources. Such a survey can possibly provide information on the resource endowment and resource use pattern and resource base status, the knowledge of which can be effectively used in finding out the cause-effect relationship of the three.

The chapter carries the discussion to a theoretical planning model, where it is addressed how the knowledge about the resource base can be made use of in the decision making process. Accordingly, the suggested planning model- which begins with the

identification of the problem at the micro level, can make use of the knowledge about the resource endowment, resource use pattern and resource base status; the complementarity of the three is discussed and had pointed out that they are directly responsible to the socio-economic environment of the region. Further, it is argued that with these information it is possible to find out the cause-effect relationship of the resource base status.

Accounting for the dynamism of the human society, the model had suggested for the reformulations of the strategies, reaffirming the need for a periodic monitoring of the socio-economic objectives at an operational level. Taking into account the wide variations in the resource base as well as the socio-economic environment, the model is suggested to be more effective at a micro level. However, it is argued that the success of the suggested model is dependent on the success of the feed-back mechanism from the people involved to the decision maker, where it emphasises the need for wide public participation. Any socio-economic objective becomes fruitful only if it conforms to the needs and aspirations of the people and hence needs to be articulated by the people involved.

The chapter further focussed attention on the Resource Mapping Programme, that is being carried out in the state. The purpose of the project being implemented in the state is to formulate a strategy that would help in evolving a desirable land use in consonance with the topography of the region through the effective utilisation of the land and water resources at a local level. The further objective of the programme in the state was to check environmental degradation and to restore the degraded areas after

preparing a local level action plan.

The strategy adopted was an integrated resource survey, with active participation of the scientific and technical personnel, panchayat functionaries and the local level volunteers. The programme is to be carried out in five successive phases viz. resource survey/basic data collection, preparation of an interaction plan, additional data collection with respect to the socio-economic aspects and land use productivity, preparation of an action plan and monitoring and alterations. But so far no advancement in the above mentioned line is made, except perhaps for one or two villages where the socio-economic data is collected. The success of the programme is that it envisages people's participation from resource survey to the implementation stage.

Based on the resource survey, six sets of maps prepared by the scientists viz. land forms, land use, basement configuration, surface material, potential water availability and environmental appraisal for their use in understanding the resource use in the area.

The fourth chapter focussed on a micro region to facilitate the application of the above mentioned approach. The discussion here is not confined to mere resource endowment, resource use pattern and resource base status; instead, it had emphasised in identifying the causative factors leading to resource base changes. Thus the study, in the context of the micro region, had identified the driving forces as population, poverty and policy that induces changes on the resource base.

With the help of this, the study had revealed how exogenous factors can influence the resource use pattern of the region. The influx of the migrants had drastically influenced the land use pattern of the region, that agriculture is losing its significance, gradually.

It had further brought forth the fact that, even without an exogenous factor the resource use pattern and resource base status can undergo change by a change in perception at the individual level. In addition to this, it highlighted the need for a sufficient level of technology for the optimum utilisation of an already existing resource.

Overtime, in the prevailing institutional and socio-economic set up, the resource base has undergone changes. Influenced by population, poverty and policy many areas within the village has shown signs of resource base degeneration. In the study area, a direct correlation is found between the resource base status and poverty. Invariably, all the regions characterised with resource base degeneration is inhabited by the low income people. Soil erosion, drinking water shortage, water quality problem are all problems faced by the people in the lower strata of the society. Thus the study makes it possible to say that poor environment results in poverty or poverty leads to environmental degeneration.

The policy induced changes brought out in the study area is essentially confined to the developmental activities carried out by the state government that had induced soil erosion in the region. Further, the unilateral decision of the State Government

in setting up establishments without local level involvement considerably affects the living conditions of the local people, especially when the benefits of it goes beyond the village economy without trickling down at the village level.

The study had further discussed about the interaction of these forces on the resource and the long term implication it has on the resource base status of the region.

The important resource base changes manifested in the region include increased soil erosion, siltation of water bodies, reduced water availability for irrigation, reclamation, contamination of ground water and increasing rate of exploitation of ground water.

The study discussed in detail how reclamation itself acts as a factor in determining the water availability of the region as well as how decline in water availability determines the process of reclamation. It is felt that in the absence of rational intervention in the utilisation of the ground water resources the region might even face a hydrological drought (excess withdrawal of ground water might deplete the natural hydrological cycle), the impact of which will be much more severe than that of the meteorological one. And this would amount in effecting acute shortage of water in the region on a lasting scale. In the concluding section, the study focuses on the social costs involved in the resource base degeneration. The discussion is focussed with regard to the increasing intensity of the ground water exploitation and the recurring droughts the village faces presently.

Hence, the study makes a remark on the changing resource use pattern of the region that if the changing interaction of the Population-Poverty-Policy (PPP) is not rationalised ecologically and economically to arrest the ongoing depletion of the resource base for sustaining the resource endowments, the very nature of the resource base that the region characterises, might possibly act as a constraint in sustaining the process of development.

Appendix-1 A

DETAILS TO BE COLLECTED/MAPPED BY THE VOLUNTEERS

1. Boundaries : Panchayat, village, ward and forest.

2. Transport : Road network, railway network, water ways etc., including stations

3. Communication : Post and Telecommunication.

4. Health Services : Hospital, Primary Health Centres, Dispensary etc.

5. Educational : School, College, Technical School etc.

6. Social/Religious : Community Halls, Temples, Church, Mosque, etc.

7. Recreational : Library, Cinema theatre, Play ground etc.

8. Commercial/ Co-operatives : Market, Shopping Complex, Rationshops, Banks etc.

9. Other Services : Police Station, Court, Government Offices etc.

10. Mining & Industry : Types

11. Power : Power Station, H.T. Line/Transformer.

12. Water related : Rivers, Canals, Ponds & Wells, Springs including their state of use.

13. Landuse/land cover types :
    i) Agriculture - Seasonal, Annual, Tree Crops & Plantations.
    ii) Irrigation facilities.
    iii) Barren lands/vested lands.
    iv) Marshes
    v) Forests
    vi) Scrub, grasslands
    vii) Rock outcrops/sandy patches/laterite surface etc.

Appendix 1 B

PROFORMA FOR WATER RELATED DATA COLLECTION

Wells/Ponds/Bore Wells/Tube Wells

Name of the Panchayat: Ward No:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sl. No.	Survey No.	Well No.as noted in map	Site location	Owner ship	Year of construction	Perennial (P) or seasonal (S)	Diameter Length & breadth of ponds (m)	Depth to water Table (m)	Depth to well Bottom (m)	Material at the bottom of the well	Nature& depth of lining	Energised(E) of non-energised(N) Diesel(D)/ Electric(C)	Quantity pumped (lps) & Total pumping hours	Use	Area Irrigated (Acres)	No.of families using	Remarks including Quality problem if any.

* Item 4. Site Location - Hill top (H), Upper Slope (US), Lower Slope (LS), Valley (V)
* Item 5. Ownership - Public (P), Private (PR), Temple/Church/Mosque (T)
* Item 11. Material at the bottom of the well (Water bearing formation) - Sand (S), Clay (C), Laterite (L), Rock (R), Weathered Rock (WR)
* Item 12. Lining at bottom (B), Middle (M), Top (T), Complete (C)
* Item 15. Use - Domestic (D), Irrigation (IR), Industrial (S), Combination of D, IR or S.
* Item 16. Quality (G), Saline (S), Brackish (B), Unused(U).

Appendix-1 C

PLOT WISE DATA TO BE COLLECTED BY THE VOLUNTEERS

(Enter in the diary during survey)

1.	Survey, Plot No.	:	
2.	Geomorphic Location	:	
3.	Landuse	:	i) Agricultural ii) Others iii) Status of crops
4.	Irrigation	:	Type
5.	Service facilities	:	Bank, School etc.
6.	Settlement	:	Number of settlements and type
7.	Wells	:	Total number, seasonal, perennial
8.	Ponds	:	Area, Status, Management, Requirement.
9.	Springs	:	Use
11.	Water Bodies	:	

Appendix-2 A

PARAMETERS TO BE INVESTIGATED FOR LAND & WATER RESOURCES SURVEY

(For Mapping by Scientific & Technical Personnel)

1. Landscape aspects:

   Landform type, Local relief, Elevation, Dissection
   Slope: Gradient, Direction, Length
   Erosion: Degree, Type
   Drainage condition

2. Geology

   Ethology, Structure, Degree of weathering, Depth to hedrock, Laterite thickness, Thickness of Loose/unconsolidated materials.

3. Surface material

   Type of material, Textural Class, Thickness of soil, Stoniness, Colour, Soil drainage.

4. Water: Pond/Tank

   Lined/unlined, Public/private, Area, Depth to water table Depth to bottom. Present use, energised/non-energised. Management requirement, Ownership & Descriptions.

5. Water: Wells

   Depth to water table, Well depth, Fluctuation of water table, Perenniality, Use, Energised/non-energised, Approximate Yield, Water bearing formation, Quality & Ownership.

6. Landuse

   Agricultural use: Crop type, Stage, Intensity
   Irrigation, Crop rotation, Crop calender, Plantation, Annual crop, Broad settlement stretches, Land Management particulars,
   Natural: Forest, Grass land, Scrub land, Wet land, Waste land, Afforestation

7. Environmental concern
   Flooding, landslides/slump/slope failures etc. Draught prone areas, Water logging, Salinity/alkalinity,
   Habitat/destruction: Reclamation status, Pollution, Waste dump, Deforestation, Beach erosion, riversand mining and Mining etc.

Appendix-2 B

D A T A F O R M A T

Village/Ward ..... Panchayat ..... Taluk .....

C.D. Block ..... District .....

Observer ..... Date ..... Sample No. .....

Map references: Grid Index .... Cadastral Survey Plot No.

Locational aspect: .....
(Major geographical units - coastal area Lowland, Midland, Palghat gap etc.)

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1. LANDSCAPE ASPECTS

1.1 Landform type.....
(Refer Landform legend)

1.2 Approx.Elevation above MSL (m)....

1.3 Local relief .....

1.4 Dissection .....

1.5 Slope: (a) Gradient (in degrees) .....
(b) Direction ..... (c) Length (in meter)

1.6 Erosion (a) Degree ..... (High, Medium, Low)
(b) Type ..... (Gully, Sheet, Slope failure etc.)

1.7 Drainage condition ..... (Poor, Moderate, Well)

1.8 Position in Toposequence (Draw section)

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2. GEOLOGY

2.1 Lithology .....

2.2 Structure ..... (foliation/bedding, joints)

2.3 Degree of weathering . (partly weathered, fully weathered)

2.4 Depth to bedrock (in meter) .....

2.5 Laterite thickness (in meter)

2.6 Thickness of loose/unconsolidated materials ....
Draw the well sections ....
Sample taken

3. SURFACE MATERIAL

3.1 Type of material....
(Alluvium, Colluvium, Laterite, Residum etc.)

3.2 Textural Class ..... (clay, sand, slit)

3.3 Thickness of soil 3.4 Stoniness: .....

3.5 Colour .....

3.6 Soil drainage

3.7 Other descriptions (if required)

Sample taken?

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4. WATER: POND/TANK

4.1 Lines/Unlined 4.2 Public/Private

4.3 Approx. Area..... 4.4 Depth to water Table below ground level

4.5 Depth to bottom below ground level.....

4.6 Present use .....

4.7 Energised/Non-energised & details: ///////

4.8 Management requirement .....

4.9 Ownership .....

4.10 Descriptions (covering adjoining topographic condition & status)

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5. WATER: WELLS (Representative of the terrain)

5.1 Depth to water table (bgl)

5.2 Well depth: (bgl)

5.3 Fluctuation of water table .....
(with local enquiry)

5.4 Perinniality ..... 5.5 Use .....
5.6 Energised/Non-energised & Details

5.7 Approximate yield ..... 5.8 Water bearing formation....

5.9 Quality ..... 5.10 Ownership ...

5.11 Remarks .....

6. **LANDUSE**

6.1 Agricultural use: ..... Crop type, Stage, Intensity

6.2 Irrigation: Status

6.3 Crop rotation: ..... 6.4 Crop Calender
(on local enquiry)

6.5 Plantation:..... 6.6 Annual Crop.....

6.7 Other Use (Specify the type of use)

6.8 Board settlement stretches: .....

6.9 Land management particulars (indicate degraded land)

6.10 Natural: Forest Status
Grassland
Scrub land
Wet land
Afforestation

---

7. **ENVIRONMENTAL CONCERN**

7.1 Flooding .....

7.2 Landslides/slump/ slope failure etc.....

7.3 Draught prone areas (Edaphic)

7.4 Waterlogging .....

7.5 Salinity/alkalinity.....

7.6 Habitat destruction

Reclamation status
Pollution
Waste dump
Deforestation
Beach erosion
Riversand mining
Mining
Others

Appendix-3

LIST OF PARAMETERS TO BE COLLECTED FOR EACH SURVEY PLOT

(To be compiled from the volunteer's diary, landuse & asset maps and scientific maps for LIS/CIS)

1. Survey Plot Number
2. Name of the owner/owners
3. Area (in hectares)
4. Geomorphic Location
5. Surface material
6. Soil texture
7. Slope
8. Depth of weathered material
9. Depth of water below ground level
10. Fluctuation of water table
11. Number of wells
12. Status of wells
13. Ponds - Area
14. Status of ponds
15. Number of settlements
16. Road length
17. Other amenities
    (School, College, Hospital etc.)
18. Landuse type
19. Type of crops/ground cover
20. Crop rotation
21. Cropping intensity
22. Irrigation status

23. Source of Irrigation

24. Soil erosion type

25. Gully - Length & Width
26. Rills/sheet - Area affected

27. Runoff character

28. Soil salinity/alkalinity

29. Water salinity/alkalinity

30. Area affected by pollution

31. Area affected by flood

32. Conservational measures - Type

33. Area covered by conservational measure

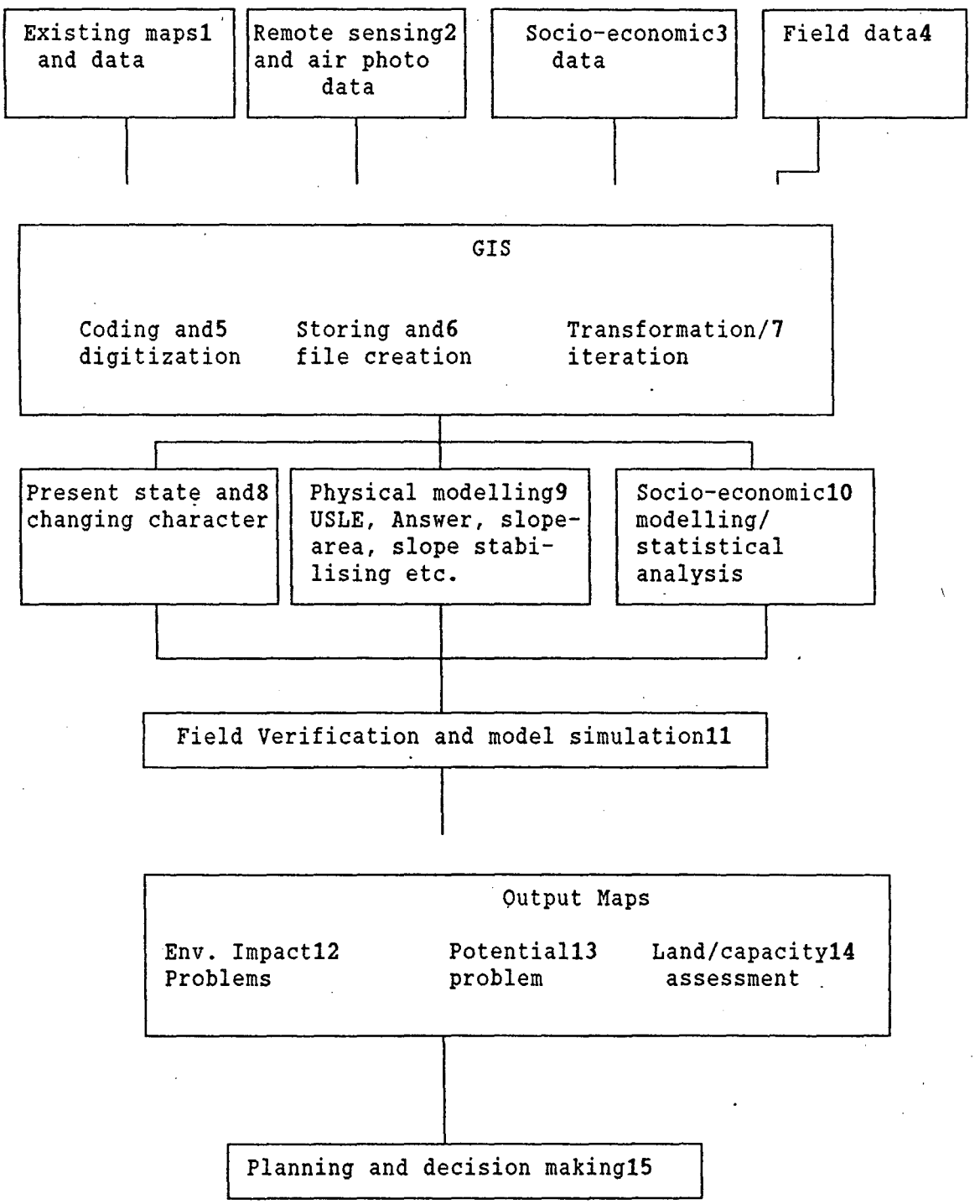
34. Integrated Environmental Capacity assessment Rating for Landuse (IECAL rating)

    a) Seasonal agriculture
    b) Tree crops (specific)
    c) Settlement
    d) Industry
    e) Commercial

35. Capacity assessment for a particular Landuse (CAPL rating)

Appendix-4

GIS Flow Chart



REFERENCES

Adams, W.M. (1990) — Green Development: Environment and Sustainability in the Third World. Routledge, London & New York.

Bhat, P.N.M. and Rajan, S.I. (1990) — "Demographic Transition in Kerala Revisited", Economic and Political Weekly, September 1-8, pp. 1957-79.

Boserup, Ester (1965) — `The Conditions of Agricultural Growth', Allen & Unwin Ltd., London.

Brown, Lester (1981) — Building a Sustainable Society, W.N. Norton & Co., New York, London.

Bernstein, H. (1979) — `African Peasentries: A Theoretical Framework', The Journal of Peasant Studies, cited in Redclift, 1984.

Benne, G., Agyepong (1990) — Land Degradation in Ghana, Food Production and Rural Development Division, Commonwealth Secretariat, Malborough House, Pall Mall, London.

Braat, Leon, C. & Steetskamp (1991) — "Ecological Economic Analysis for Regional Sustainable Development" in Coztanza et.al. Ecological Economics, The Science and Management of Sustainable Development, Columbia University Press, New York.

Blaikie, Piers (1985) — `The Political Economy of Soil Erosion in Developing Countries', Longman, London.

Bandyopadhyaya, Jayant (1988) — "The Ecology of Drought and Water Scarcity", The Ecologist, Vol. 18, Nos. 2/3, 88-96.

Bandyopadhyaya, Jayant, Siva, Vandana (1989) — "Political Economy of Ecology Movements", Economic and Political Weekly, Vol. XXIII, No. 24.

Bojos J.P. (1991) — `Economics of Land Degradation', AMBIO, Vol. 20, No. 2, April.

Bertelamus, Peter (1981) — Environment and Development, Allen and Unwin, London, Boston, Sydney.

Centre for Science & Environment (1986) The State of India's Environment, The Second Citizens Report, New Delhi.

_____(1986) Developing India's Waste Lands, A Briefing Paper, New Delhi.

Centre for Earth Science Studies (1991) Micro/Village Level Resource Survey with People's Participation for Sustainable Development. (paper prepared for the International Seminar on Monitoring Geosystem : Perspectives for the 21st century held at New Delhi, December 6-9).

Centre for Earth Science Studies, Kerala State Use Board & Kerala Sastra Sahitya Parishat (1991) Panchayat Level Resource Mapping - Use A Handbook for Volunteers, CESS, Trivandrum.

Central Statistical Organisation (1989) Statistical Abstract, Ministry of Planning, Government of India.

Census of India (1981) Series-10, Paper 3, General Population Tables, Kerala, Director of Census Operations.

_____ (1991) Provisional Population Totals, Kerala, Director of Census Operations.

Centre for Water Resource and Management (1981) Proceedings of the Seminar on Development Resource Potentials in Kerala, State Committee on Science and Technology, Kerala.

Chapman, Duane; Balker Randolph (1991) Environmental Protection, Resource Depletion and the Sustainability of Developing Country Agriculture in Agriculture in Economic Development and Cultural Change, Vol. 39, No. 4, July.

Chattopadhyay, Srikumar & Sidharthan, S., (1985) Regional Analysis of the Greater Kuttanad, Kerala, Technical Report, No. 45, CESS, Trivandrum.

Chattopadhyaya, Srikumar Deforestation in Parts of Western Ghats Region (Kerala), India. CESS, Trivandrum (year not mentioned)

Cloke Paul J. & Park Chris C. (1985) Rural Resource Management, Croom Helm, London & Sydney.

Daly, E, Herman (1991) "Elements of Environmental Macro Economics", in CCoztanza et.al., Ecological Economics - The Science and Management of Sustainability.

Dasgupta, Partha (1982) The Control of Resources, Basil Blackwell, Oxford.

Dayal, N.D. (1985) "Destruction of Water Resources - The Most Critical Crisis of East Asia", The Ecologist, Vol. XV, Nos. 1 & 2.

Dunne, Thomas & Leopold, B. Luna (1978) Water in Environmental Planning W.H. Freeman and Co., San Francisco.

Eckholm, P. Erick (1976) Losing Ground Environmental Stresses and World Food Prospects, W.W. Norton & Co. Ltd., New York.

Environment Centre & Integrated Rural Technology Centre (1991) Group Approach for locally adapted and and Sustainable Agriculture, Preliminary Report, KSSP & IRTC, Trichur & Madras.

Eckholm P. Erick (1982) Down to Earthh, Curtis Brown Ltd., New York.

Garrot, Hardin (1991) `Paramount Positions in Ecological Economics' in Coztanza et.al. Columbia University Press, New York.

Government of Kerala (1981) Report of the One Man Commission on the Problems of Paddy Cultivation in Kerala, Department of Agriculture, Trivandrum.

_____ (1982) Agricultural Census Report for Kerala State, Detailed Tables, Kerala, Bureau of Economics and Statistics, Trivandrum.

_____ (1982) First Report on the State of Environment in Kerala, State Government on Science and Technology.

_____ (1984) Report of the Highlevel Committee on Land and Water Resources, State Planning Board, Trivandrum.

Government of Kerala (1985) Fallow lands in Kerala - A Diagnostic Study, Kerala State Land Use Board, Trivandrum.

_____(1986) Extent of Waste Lands in Kerala - An Analytical Study, Kerala State Land Use Board, Trivandrum.

_____ (1988) Report on Agricultural Census (1980-81) V2, Kerala, Bureau of Economics and Statistics, Trivandrum.

_____(1988) Eighth Five Year Plan, Workshop on Agricultural Development, Co-operative Bank Towers, Trivandrum.

_____ (1989) Land Resources and Land Use in Kerala, Kerala Land Use Board, Trivandrum.

_____ (1989) An Account of the Waste Lands in Kerala, Kerala State Land Use Board, Trivandrum.

_____(1990/91) Economic Review, State Planning Board, Trivandrum.

Government of India (1992) India, 1991 - A Reference Annual, Publications Division, Ministry of Information and Broadcasting, New Delhi.

Goldsmith, Edward (1981) "Thermodynamics or Ecodynamics", The Ecologist, Vol. II, No. 4, 1981.

Grainger, Allen (1980) "The State of the World's Tropical Forests", The Ecologist, Vol. X, No. 1&2, January-February.

Hirsh, Philip (1987) Nam Choan: Benefits for whom? The Ecologist, Vol. XVII, No. 6, November-December.

Hussein, Atmal (1990) "Resource Base Erosion and Sustainable Development in Asia", Vol. XXV, No. 33, Economic and Political Weekly, August 18-25.

Jodha, N.S. (1991) "Sustainable Agriculture in Fragile Resource Zones - Technological Imperatives", Economic and Political Weekly, Vol. XXVI, No. 13, March.

Kadekodi, G.K. (1991) Operationalising the Concept of Sustainability, ICSSR, New Delhi.

Kannan, K.P. and Pushpangadan, K. (1988) `Agricultural Stagnation in Kerala', Economic and Political Weekly, Vol. XXIII, No. 39, September.

Kannan, K.P. and Pushpangadan, K. (1990) Dissecting Agricultural Stagnation in Kerala: An Analysis Across Crops, Seasons and Regions, Working Paper No. 238, Centre for Development Studies, Trivandrum.

Koshy, Mathew (1992) Vikasathinte Baliyadukal (Malayalam), Mathrubhhoomi Weekly, Vol. 70, No.14, June.

Kothari, Ashish & Bhantari, Rajiv (1984) "Narmada Valley Project Development or Destruction", Economic and Political Weekly, June 2, Vol. XIX, No. 22 & 23.

Krishnan, T.N. (1976) "Demographic Transition in Kerala: Facets and Factors", Economic and Political Weekly, Special Number, August 1203-24.

Kunhaman, P. (1982) Tribal Economy of Kerala: An Intra-Regional Analysis, M.Phil Dissertation submitted to Jawaharlal Nehru University, Centre for Development Studies, Trivandrum.

Lutzenberger, Jose (1987) "Who is Destroying the Amazon Rainforests?" The Ecologist, Vol. XVII, Nos. 4 & 5, July-November.

Mani, Sunil (1992) Plantations in Kerala State: An Analysis of its Role, Constraints and Labour Conditions. Working Paper, Centre for Development Studies, Trivandrum, June.

Mann, Robert (1987) `Development and the Sahel Disaster: The Case of Gambia', The Ecologist, Vol. XVII, Nos. 2 & 3, March-June.

Menon, A.R.R. (1992) Change Detection Study of Idukki Region and Endemism, Seminar paper presented in KFRI, May 17-20, Trichur.

Moench, Marcus, Henry (1990) From Forest to Agro-Forest : Land Use Dynamics and Crop Successions in the Western Ghats of Kerala, South India, Unpublished Ph.D. thesis submitted to University of California.

Muller, F.G. (1982) `Environmental Management : Issues of an Integrated Planning Approach' in Yusuf J. Ahmed & Frank G. Muller et.al., Integrated Physio-Socio Economic and Environmental Planning.

Muraleedharan, P.K. (1986) Human Ecology in Attappady Region, Kerala Forest Research Institute, Trichur.

Nadkarni, M.V. (1987) Agricultural Development and Ecology - An Economist's View, Indian Journal of Agriculturla Economics, Vol. 42, No. 3, July-September.

Nation, James, D. & Komer, I, Daniel (1987) "Rainforests and the Hamburger Society", The Ecologist, Vol. XVII, Nos. 4&5, July-November.

NARP (1989) Status Report, Special Zone, Vol. 1, Kerala Agricultural University, Trichur.

Niemas, M. Faberl & Stephhan G. (1983) Entropy, Evironment and Resources : An Essay in Physio-Economics, Springer Verlag, Berlin, New York, London.

Nijkamp, Peter (1979) Theory and Application of Environmental Impacts, North Holland Publishing Co., Amsterdam.

NORAGRIC (1989) Proceedings of the Symposium on the Sustainability of Agricultural Production Systems in Sub-Saharan Areas, Norway.

Norton, Bryon (1991) "Ecological Health and Sustainable Development", in Coztanza et.al.

Panikar P.G.K. et.al. (1978) Population Growth and Agricultural Development : A Case Study of Kerala, FAO, Rome.

Panikar, P.G.K. & Pillai, V.R. (1965) Land Reclamation in Kerala, Asia Publishing House, London.

Petak, W. (1980) Environmental Management : A System Approach, Vol. 5, No. 5.

Sanbach, Francis (1980) Environment, Ideology and Policy, Basil Blackwell, Oxford.

Seraffy, Salah, E. (1990) The Environment as Capital, in Coztanza et.al. Ecological Economics, The Science and Management of Sustainability, Columbia University Press, New York.

Sidharthan, S. (1984) `Impact of Development Projects on Kuttanad', Centre for Earth Science Studies, Trivandrum.

Singh, K.P. (1987) Groundwater and Environment, in R.K. Sapru et.al. Environmental Management in India, Vol. 1, Ashish Publishing Co., New Delhi.

Singh, K.P. & Dogra, S.D. (1975) "The Environmental Impacts of Groundwater Resource Development and Management - A Case Study of Punjab State" in R.K. Sapru et.al. (1987) Environmental Management in India, Vol. 1, Ashish Publishing Co., New Delhi.

Singh, Satyajith, K. (1990) "Evaluating Large Dams in India", Economic and Political Weekly, Vol. XXV, No. 11, March.

Siva, Vandana, Sratachandra H.C. & Bandyopadhyaya (1982) "Social Forestry - No Solution within the Market", The Ecologist, Vol. 12, No.4, July-August.

Sivanappan, S. and Rajagopal, G. (1986) `Irrigation Development needs in India', in Easter, William et.al. Irrigation Investment, Technology and Management Strategies for Development, Studies in Water Policy and Management, No. 9, West View Press, London.

Sukumar, Ahilya & Raju K. (1987) Impact of Urbanisation and Environmental Problems in Trivandrum City, Northern Geographher, Vol. 11, No. 2.

Tharakan, P.K.M. (1976) `Migration of Farmers from Travancore to Malabar from 1930-60. An Analysis of Its Economic Causes ', M.Phil Thesis submitted to Jawaharlal Nehru University, Centre for Development Studies, Trivandrum.

Tolba, M.K. (1987) Sustainable Development : Constraints and Opportunities, Butterworths, London.

UNEP (1975) The Proposed Programme (UNEP/GC/3) Nairobi, cited in Bertalamus, 1981.

Vaidyanathan, A. (1991) `Integrated Watershed Development: Some Major Issues'. Foundation Day Lecture, May 1st 1991, Society for Promotion of Wastelands Development, New Delhi. Supplement to Wasteland News, Vol. VI, No. 4.

Varghese, T.C. (1972) Agrarian Change and Econmic Consequences, 1850-1960, Allied Publishers, Bombay.

Wijkman, Anders & Timberlake, Lloyd (1985) `Is the African Drought An Act of God or Man', The Ecologist, Vol. XV, No. 1 & 2, January.

William, K. Easter & Welsch, Delane, E. (1986) `Priorities for Irrigation Planning and Investment', in Easter William. Irrigation Investment, Technology and Management Strategies for Development, Studies in Water Policy and Management, No. 9, West View Press, London.

World Conservation for Environment and Development (1987) Our Common Future, Oxford University Press, Oxford.

World Conservation Strategy (1980) World Conservation Strategy, Switzerland.

World Bank (1992) World Development Report, Development and Environment, World Bank, Oxford University Press.