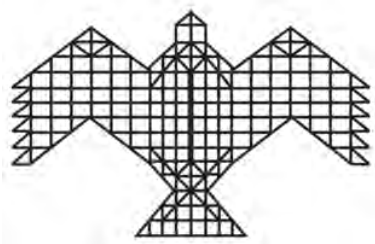


**Emergent non-agrarian livelihoods and resource linkages in the agroecosystems of a river basin: A case study of Chalakudy river basin, Kerala**

A thesis submitted in fulfillment of the requirements  
of the degree of  
**Doctor of Philosophy**

by  
**Sreeja K. G.**



**NIAS**

School of Natural Sciences and Engineering  
**NATIONAL INSTITUTE OF ADVANCED STUDIES**  
INDIAN INSTITUTE OF SCIENCE CAMPUS  
BANGALORE, INDIA - 560012

NOVEMBER 2013

## Declaration

I, Sreeja K. G., hereby declare that the work presented in this thesis entitled “*Emergent non-agrarian livelihoods and resource linkages in the agroecosystems of a river basin: A case study of Chalakudy river basin, Kerala*” has been carried out under the guidance of Dr. P. K. Shetty and has not formed the basis for the award of any other degree, diploma or fellowship. The particulars given in this thesis are true to the best of my knowledge and belief.

Place: Bangalore

Date: .....

.....

Sreeja K. G.

## Certificate

The research embodied in this thesis entitled “**Emergent non-agrarian livelihoods and resource linkages in the agroecosystems of a river basin: A case study of Chalakudy river basin, Kerala**” and submitted to Manipal University was conducted by Ms. Sreeja K.G. (Registration Number: 080900049) in the School of Natural Sciences and Engineering, National Institute of Advanced Studies under the supervision and guidance of Dr. P.K. Shetty. It is hereby certificated that the thesis submitted is a bonafide record of research done by the candidate in fulfillment of the requirement for PhD degree and that the thesis has not previously formed the basis for the award to the candidate of any degree, diploma, fellowship or any other similar title of any other university.

Place: Bangalore

Date: .....

.....

**Dr. P.K. Shetty**  
(Guide)

*Dedicated to  
My acha and amma*

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*Sreeja K. G.*

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## Abbreviations

<i>ADS</i>	<i>Area Development Society</i>
<i>AEZ</i>	<i>Agro-Ecological Zone</i>
<i>AHEP</i>	<i>Athirappilly Hydro Electric Project</i>
<i>CCDP</i>	<i>Comprehensive Coconut Development Project</i>
<i>CESS</i>	<i>Centre for Earth Science Studies</i>
<i>CGWB</i>	<i>Central Ground Water Board</i>
<i>CRDS</i>	<i>Chalakydy River Diversion Scheme</i>
<i>CTC</i>	<i>Crush Tear Curl</i>
<i>DEM</i>	<i>Digital Elevation Map</i>
<i>DFO</i>	<i>Divisional Forest Officer</i>
<i>DPR</i>	<i>Detailed Project Report</i>
<i>DWS</i>	<i>Drinking Water Scheme</i>
<i>EFL</i>	<i>Ecologically Fragile Land</i>
<i>EIA</i>	<i>Environmental Impact Assessment</i>
<i>EMS</i>	<i>E.M. Shankaran Namboothiripaadu</i>
<i>EPA</i>	<i>Environmental Protection Act</i>
<i>EU</i>	<i>European Union</i>
<i>GIS</i>	<i>Geographical Information System</i>
<i>GMF</i>	<i>Grow More Food</i>
<i>GoI</i>	<i>Government of India</i>
<i>GoK</i>	<i>Government of Kerala</i>
<i>GoTN</i>	<i>Government of Tamil Nadu</i>
<i>GWP</i>	<i>Global Water Partnership</i>
<i>HP</i>	<i>Horse Power</i>
<i>IAMWARM</i>	<i>Irrigated Agriculture Modernisation and Water-bodies Restoration and Management</i>
<i>IAS</i>	<i>Idamalayar Augmentation Scheme</i>
<i>IBWT</i>	<i>Inter Basin Water Transfer</i>
<i>ICDS</i>	<i>Integrated Child Development Scheme</i>
<i>IMD</i>	<i>India Meteorological Department</i>
<i>IRBM</i>	<i>Integrated River Basin Management</i>
<i>IWRM</i>	<i>Integrated Water Resources Management</i>
<i>KB</i>	<i>Krishi Bhavan</i>
<i>KFDC</i>	<i>Kerala Forest Development Corporation</i>
<i>KHDP</i>	<i>Kerala Horticulture Development Project</i>
<i>KSEB</i>	<i>Kerala State Electricity Board</i>
<i>KSLUB</i>	<i>Kerala State Land Use Board</i>
<i>KWA</i>	<i>Kerala Water Authority</i>
<i>LA</i>	<i>Legislative Assembly</i>
<i>LBC</i>	<i>Left Bank Canal</i>
<i>LI</i>	<i>Lift Irrigation</i>
<i>LSG</i>	<i>Local Self-Government</i>
<i>MGNREGS/NREGS</i>	<i>Mahatma Gandhi National Rural Employment Guarantee Scheme</i>



<i>MID</i>	<i>Minor Irrigation Department</i>
<i>M-Sand</i>	<i>Manufactured Sand</i>
<i>msl</i>	<i>Mean sea level</i>
<i>MW</i>	<i>Mega Watt</i>
<i>MWS</i>	<i>Micro-watershed</i>
<i>NBSS &amp; LUP</i>	<i>National Bureau of Soil Survey and Land Use Board</i>
<i>NGO</i>	<i>Non-Governmental Organisation</i>
<i>NIC</i>	<i>National Industrial Classification</i>
<i>NRM</i>	<i>Natural Resource Management</i>
<i>NTFP</i>	<i>Non-Timber Forest Produce</i>
<i>NWP</i>	<i>National Water Policy</i>
<i>OBC</i>	<i>Other Backward Caste</i>
<i>PAP</i>	<i>Parambikulam Aliyar Project</i>
<i>PCA</i>	<i>Primary Census Abstract</i>
<i>PCK</i>	<i>Plantation Corporation of Kerala</i>
<i>PKTR</i>	<i>Parambikulam Tiger Reserve</i>
<i>PLA</i>	<i>Plantation Labour Act</i>
<i>RBC</i>	<i>Right Bank Canal</i>
<i>RBO</i>	<i>River Basin Organisation</i>
<i>RF</i>	<i>Rain Forest</i>
<i>SC</i>	<i>Scheduled Caste</i>
<i>SHG</i>	<i>Self Help Group</i>
<i>SRTM</i>	<i>Shuttle Radar Topography Mission</i>
<i>ST</i>	<i>Scheduled Tribe</i>
<i>TBGRI</i>	<i>Tropical Botanic Garden and Research Institute</i>
<i>TVA</i>	<i>Tennessee Valley Authority</i>
<i>UNESCO</i>	<i>United Nations Educational, Scientific and Cultural Organization</i>
<i>UPASI</i>	<i>United Planters Association of South India</i>
<i>VFPC</i>	<i>Vegetable and Fruit Promotion Council of Kerala</i>
<i>VSS</i>	<i>Vana Samrakshana Samithi</i>
<i>WAPCOS</i>	<i>Water and Power Consultancy Services</i>
<i>WGEEP</i>	<i>Western Ghats Ecology Expert Panel</i>
<i>WLS</i>	<i>Wild Life Sanctuary</i>
<i>WPR</i>	<i>Work Participation Ratio</i>

## Glossary

<i>adivasi</i>	<i>ethnic tribal groups who are the indigenous population of India</i>
<i>aar</i>	<i>stream</i>
<i>anganwadi</i>	<i>government sponsored child and mother-care center in India</i>
<i>benami</i>	<i>transaction or contract usually of property made under the name of a third party</i>
<i>chira</i>	<i>temporary bund across streams; also denotes the water impoundment</i>
<i>dalit</i>	<i>a member of the lowest caste in the traditional Indian caste hierarchy</i>
<i>gramasabha</i>	<i>obligatory ward level meeting held by the panchayath as a part of Panchayath Raj Act in Kerala</i>
<i>jalanidhi</i>	<i>Japan aided Rural Water Supply and Sanitation project</i>
<i>kaitha</i>	<i>the Pandanus plant leaves of which are used for weaving mats</i>
<i>kankani/mestry</i>	<i>contractor/middle men in charge of labour recruitment in the plantations</i>
<i>kootumundakan</i>	<i>specialized paddy farming technique of sowing two season crops together</i>
<i>kovilakom</i>	<i>royal house</i>
<i>layam/pady</i>	<i>plantation labour quarters</i>
<i>mundakan</i>	<i>second season paddy crop (October-January)</i>
<i>nendran</i>	<i>Commercially important premium variety of banana</i>
<i>nilam/padam</i>	<i>paddy lands</i>
<i>padashekharam</i>	<i>collection of paddy fields contiguously situated with a specific name owned by one or more persons</i>
<i>parambu /garden land</i>	<i>elevated land parcel situated above wetlands with or without a house</i>
<i>pattayam/ patta</i>	<i>first and original record on the ownership of a property</i>
<i>poramboku</i>	<i>government land on which there is no ownership deed /title</i>
<i>pottuvellari</i>	<i>a gourd variety preferred for its high juice content</i>
<i>puncha</i>	<i>summer / third season paddy crop (February-April)</i>
<i>purayidam</i>	<i>Homestead land</i>
<i>puzha</i>	<i>river</i>
<i>samithi</i>	<i>registered organisation</i>
<i>taungya</i>	<i>contracting of forestland for growing agricultural crops during the initial years of raising forest plantations</i>
<i>thodu</i>	<i>brook</i>
<i>virippu</i>	<i>first season paddy crop (May-August)</i>

## **Abstract**

River basin as a nascent unit of natural resource governance based on the principles of equity, subsidiarity and sustainability is yet to be appraised as a socio-ecological entity that can move beyond centralisation tendencies in resource governance. The frequent and prevalent conceptualization of it as exclusive, homogenous and largely agricultural was investigated in the present work by analysing the multiple boundaries, emergent livelihoods and resource relations in the various agro-ecological zones of the Chalakudy river basin which is one of the most heavily exploited inter-state and inter-linked river basins in the highly populated biodiversity hotspot of the Southern Western Ghats in peninsular India.

The coexistence of multiple, dynamic and often overlapping boundaries was found to encompass an inclusive region of resource engagement which was coined as the 'inclusive basin' within which natural resource governance was envisaged through polycentric interest groups. Within the inclusive Chalakudy river basin, the livelihood patterns and processes in the various agro-ecological zones (AEZs) were observed to be shifting out of agriculture which was reflected in the relations to the resources of land and water. It was observed that the transformation of livelihoods and resource relations followed varied patterns in the AEZs significantly different from each other. In the high hills contractual casual plantation employment was replacing the permanent labour system along with diversification into manufacturing and service sector occupations, in the foothills the emergent and dominant characteristic was noted to be a mix of casual employment activities in tourism, agriculture and other NR based activities, in the midlands largest share of main workforce was in casual or temporary service sector activities, in the lowlands service sector was the main work provider along with construction and informal manufacturing and in the coastal lands service sector casual works, construction sector and traditional and emergent manufacturing activities prevailed. These non-agrarian work emergences had resulted in households being primarily non-farm or pluri-active in their main livelihood orientations.

The land in the river basin was found to be owned by these non-farm and mixed means households in the various AEZs. Agriculture was still found to be the major land use in private land holdings even though it was undertaken in highly fragmented holdings

dominated by market oriented perennial tree crops cultivation as a subsidiary livelihood activity. Landless and marginal land holders with non-agrarian occupations were also found to undertake agriculture as a subsidiary activity in leased in lands. While in the highlands, intensive irrigation was noticed as emergent phenomena, in the foothills irrigation was no longer a grave concern due to large scale shifts to rubber. In the mid and lowlands, irrigation water from surface water sources was seen to ensure domestic water security rather than livelihood security through recharge of groundwater aquifers. In the coastal lands, groundwater aquifers were intensively tapped for irrigating fragmented homesteads. There were clear caste and gender differentials in livelihoods, resource ownership and access across the zones. The multiple boundaries of concern including livelihood and resource use boundaries were also found to be differently drawn in the various AEZs.

The non-prominence of agriculture as a livelihood option and the changed resource relations in these zones had led to formation of various interest groups outside of agriculture which has significant influence on river basin governance envisaged through communities of interests. These also include the non- ownership based interest groups such as the women, *tribals*, *dalits*, lease farmers, migrant labourers and a large casual labour force in the informal non-farm sectors having varied and nebulous relationship with the basin resources. A mosaic of these diverse and significantly different AEZs and interest groups that forge multiscalar connections according to the issues of concern in an inclusive basin forms the hybrid socio-ecological identity of a river basin as a natural resource management unit.

**Keywords:** *River basin, governance, inclusive basin, agro-ecological zones, livelihoods, non-agrarian, interest groups*

# Chapter 1

## Introduction

### 1.1 Background of the study and problem statement

River basins as units of natural resource management have found wide and renewed acceptance across the world since the early 1990s in the form of Integrated River Basin Management (IRBM) and Integrated Water Resources Management (IWRM) and at present form the foundation of water policies across the world (GWP, 2010). Markedly differing from its earlier avatar during the Cold War era as a backdrop for gigantic multipurpose projects and technocratic management that would ensure that *'no water would flow waste to the sea'*, the river basin unit post Dublin and Rio conferences is visualised as a space where *'a coordinated development and management of water, land and related resources can be promoted in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'* (UNCED, 1992; GWP, 2000).

The practical experience with the implementation of IRBM in many developed and developing countries of the world since then have generated various criticisms and revisitations of the concept (Biswas, 2004; Mollinga, *et al.*, 2007; Molle, 2009a; Graefe, 2011). One of the more glaring critiques of the neo-basin is the insufficiency in the conceptualisation of the socio-ecological basin as a 'space of engagement'

(Venot *et al.*, 2011). The scholarship on basin management also signifies the need to study the composition and characteristics of the basin community and the myriad linkages they forge with the basin resources beyond the romanticism of traditional resource dependent livelihoods such as agriculture, fisheries and forestry (Wester *et al.*, 2003; Cleaver *et al.*, 2005). Moreover, the integration inherent in the name – IWRM/IRBM- speaks of not only vertical integration across the downstream upstream basin but also integration of the management of the various natural resources other than water (Moss, 2004), which signals the need for a careful analysis of the livelihood scenario in the basin that affects the land and water use therein. Thus, the various aspects of linkages to the basin such as ownership of and access to resources, the multitude of livelihoods engaged in both inside and outside the basin, politics of resource access that is inexorably linked to caste and class as well as the interlinkages between the various resources of land and water are yet to be given proper attention and focus in most of the river basin studies across the world. As (Swyngedouw, 1999) had so graphically observed,

*These flows would narrate many interrelated tales, or stories, of social groups and classes and the powerful socioecological processes that produce social spaces of privilege and exclusion, of participation and marginality. The networks that constitute and the processes that produce socionatural hybrids are left unreconstructed when the social and the natural are seen as two contradictory, yet complementary, poles that construct a reality.*

Such an analysis would also lead to a reappraisal of the sacrosanct natural boundaries of a river basin. Whereas, as a natural unit, river basin boundaries are quite distinct and easily delineated, its adoption as a management unit signals a more rigorous engagement with the boundaries of concern. One of the ways in which the river basin boundaries are renegotiated is through the various livelihood and resource networks that are forged in a basin through the occupations engaged in by the basin community. Even though a large section of river basin literature still works on an assumption of largely agricultural basins, realisations are also afoot that it is important to recognise the emergent livelihood scenario in the basin which affects the land and water linkages therein (Hillman, 2006; Lankford *et al.*, 2007).

Thus, these implicit assumptions in the conceptualisation of a river basin viz. *i)* the basin as an exclusive entity within its hydrological boundaries, *ii)* the basin as largely agricultural in its livelihoods and resource use and *iii)* the basin as a homogenous entity across its various stretches lead to the following research questions that are addressed as part of the present work.

- i)* Can a river basin from a management perspective be limited to its hydrological boundaries?
- ii)* What are the dominant livelihoods and resource relations across a river basin and do these differ across a river basin?
- iii)* How are livelihood resource relations translated into stewardship and governance in a river basin?

## **1.2 Research objectives**

These research questions are addressed through a case study taken up in a river basin in the Western Ghats of peninsular India which is a thickly populated hottest biodiversity hotspot and World Heritage Site where the natural resource management concerns and governance mechanisms in conjunction with the resource user and interest groups are being avidly debated and contested (WGEEP, 2011; UNESCO, 2012). The Chalakudy river basin spread across the Western Ghats in the states of Kerala and Tamil Nadu was selected for the study with the following research objectives:

- i)* Delineate and characterise the various agro-ecological zones (AEZs) in the Chalakudy river basin
- ii)* Identify the dominant economic activities (agrarian and non-agrarian) in the various zones
- iii)* Trace the linkages of labour, capital, land and water within these dominant economic activities identified
- iv)* Analyse the intra-basin and out-basin links through these dominant economic activities
- v)* Examine the nature of stewardship and conservation issues raised in the various zones

### **1.3 Scope and relevance of the study**

The implementation of IRBM/ IWRM has raised some pertinent questions on the conceptualisation of river basin as a management unit and its assumptions on resource relations in a rapidly changing livelihood scenario from traditional sectors across the developing world. This research work addresses these questions in one of the thickly populated biodiversity hotspot regions in the world where natural resource governance is highly significant for the survival of both human and natural systems and where such natural resource governance regimes are currently under intense discussion and debate (WGEEP, 2011).

River basin as a unit of management has been enthusiastically embraced by the National Water Policy of India 2002 and finds reiteration in the draft National Water Policy 2012 (GoI, 2002; GoI, 2012). The actual implementation of the policy rests with the respective state governments, water being under state jurisdiction in the country. The states of the Kerala and Tamil Nadu, wherein the Chalakudy basin is situated have committed themselves to management of natural resources of the basin within the river basin framework (GoK, 2008; GoTN, 2011). In such a scenario, the study of river basins as a socio-ecological entity, with a history of resource use evolving over time through constant interactions, conflicts and meaning making between the society and the ecosystem becomes extremely relevant in understanding and addressing the changing nature of stewardship concerns in river basin landscapes of the country. The study is first in its nature which explores the novel forms of basin stewardship arising out of emergent livelihoods and resource use and related injustices and marginalisations either as resistance movements or as interest groups.

### **1.4 Organisation of the thesis**

The thesis has been organised into a total of 8 chapters. The second chapter sets the stage through a review of literature on the history of conceptualisation of the unit of river basin and a critical examination of the concept from the various perspectives of boundary exclusions, homogeneity of the unit and agricultural identity in livelihoods and resource use. The stewardship and governance concerns raised within the preview of the unit are also reviewed in the chapter. Chapters 3 and 4 describe the data and the methodology of procurement and analysis and the study region. Chapter 5 deals with



the delineation of the basin and its agro-ecological zones, the issues encountered therein and the implications for an inclusive basin management framework thus addressing the first research query on exclusivity of the river basin unit. It also brings out the contextual significance of studying emergent occupations in river basins. Chapter 6 addresses the question on homogeneity of the river basin unit and brings out the differences and similarities between the zones and proceeds to examine the dominant livelihoods of the basin in its various AEZs based on the analysis of primary data on occupations and resource relations. This chapter has been divided into 5 major sub-sections that elaborate the livelihoods, resource linkages, governance concerns and interest groups in the five AEZs of the river basin. Chapter 7 is a summary of the results, conclusions drawn, policy implications and the scope for future work.

## Chapter 2

### Review of Literature

#### 2.1 Introduction

The novel imagining of the river basin as a participatory space for institutionalising efficiency, equity and environmental sustainability in natural resource governance transforms the basin from a technical concept to a management unit (Vogel, 2012). Even then, most often river basins are viewed as exclusive, homogenous entities with the territorial and social aspects reflected only in the agricultural water uses and/ or conflicts over resources that take place therein (Howe, 1997; Kindler, 1998; Kemper *et al.*, 2005; Gordon *et al.*, 2007). But, river basins as sites of emergent non-agrarian interactions, critically analysing the livelihood and resource use scenarios within, becomes necessary at a time when several of the agricultural economies of the developing countries are going through a phase of transition to non-agrarian livelihoods (Edmonds, 2001; Rigg, 2006; Zimmerer, 2007; Haggblade *et al.*, 2010). River basins as management units, therefore, have to be revisited in the light of these transformations.

The review of scholarship on river basins in the following sections traces the history of development of the concept of river basin as a governance unit, details the Indian experience with river basin planning across the years, analyses the criticisms that ensued after it was put into practice in various parts of the world and captures the various resource relations that go into sculpting the experienced basin as opposed to

the technical definitions to arrive at a conceptualisation of the river basin as a socio-ecological space beyond a technical and conceptual one.

## **2.2 Birth and rebirth of the concept and trajectories of its development**

Agriculture as a major driver of resource use and development has historically directed the trajectory of control and management of river basins. It is a common consensus that the river basin as a unit of development became established from the ancient agricultural civilisations that arose in the lower reaches of the Indus, the Yellow, the Nile and the Tigris-Euphrates river basins (Wittfogel, 1957; Worster, 1985; Newson, 1992; Biswas, 1997; Harris and Alatout, 2010). Beyond the enormous influence of agriculture over the deployment of river basin resources and the development of centralised control, the river and its basin were also perceived to be sites of various other connections such as navigation and transportation and as a strong and useful tool to elucidate physical unity of a region (Teclaff, 1967; Parker, 1976).

The western conceptualisation of a river basin as a natural spatial unit has been pointed out to be spurred on by the industrial revolution and the parallel scientific and technological development which would establish the perspective of the river basin as the locus of human conquest of nature (Newson, 1992; Molle, 2006a). The progress in the sciences of geography, hydraulics and hydrology as applied to the conceptualisation of river basin also had profound influence in the development of the idea that natural territorial divisions should help produce an ideal social organisation (Smith, 1969; Downs *et al.*, 1991; Reynard, 2003). The earlier political and scientific experiments with river basin as natural units for management in the second half of 19th century are to be seen spread across Europe and the United States under various political agendas and exigencies (Newson, 1992; Swyngedouw, 1999; Molle, 2006a; Grigg, 2008). These nebulous efforts at societal reorganisation were dominated by creation of agricultural frontiers through large infrastructure projects based water resources development. This river basin perspective was further advanced by the colonial enterprises that aspired to generate engineering solutions to combat droughts as in various basins of India (Sreeja, 2001; Madhusoodhanan and Sreeja, 2010) and for the expansion and increased productivity of cash-crop agriculture as in the Nile basin in Egypt, Mekong and Irrawaddy basins in Indonesia and the Indus basin in

India (Ertsen, 2006; Molle, 2006b). The land and its development and deployment were the common threads that ran through all these basin developmental trajectories.

The cold war era that followed close on the heels of colonialism took the large-scale water resource development at basin scale to greater heights. River basin management was projected as a progression from mere water development to the development of all resources and as an effective and unifying instrument for the conservation of natural resources and for emphasising social responsibility and stewardship (Kraenzel, 1957). The US Tennessee Valley Authority (TVA) established in 1933 as a part of the New Deal pioneered this shift from simple resource exploitation to that integrated with other aspects of development, and directed at improving human welfare (Wengert, 1957; Foltz, 1957; White, 1963). Irrigated agriculture was believed to be the most certain of the products of river basin development to induce economic expansion so that gradually river basin development came to be synonymous to expansion of irrigated agriculture. For most of Europe during this period, the central issues of concern were drainage, pollution and hydropower generation which elicited institutional changes into river basin as a management unit (Molle, 2009a). On the other hand, the American model of the TVA was made 'a new export commodity' in the context of Cold War politics after the World War II (Ekbladh, 2002). River basin development, planning and management through centrally planned large multipurpose river valley projects modeled on the TVA were initiated in the newly independent and aspiring nations of Asia, Latin America and Africa (Barrow, 1998; Tortajada, 2001; Waalewijn *et al.*, 2005). Thus, the 1960s, regarded as the watershed decade of modernism, was equally the decade of the great Third World dam and river regulation projects. Engineering control of water would, it was argued, act as the mechanism for a great leap forward into the industrial future for developing countries (Cosgrove, 1990). It was found to appeal to both governments and donor agencies alike since it brought in concrete, visible and large-scale changes which could be projected as nation-building, with minimal project-management costs (Scudder, 1994; McCully, 2001; Sneddon and Fox, 2006).

The next phase in the trajectory of the concept was from the 1970s to the early 1990's when the 'construction' phase began to lose its appeal in the industrialised nations which began to awaken to the ever increasing pollution and environmental

degradation problems of such large-scale projects. The concept of river basin management as Integrated Water Resources Management (IWRM) which aimed at integrated management of land and water interests on a watershed basis is pointed out by Margerum (1997) as a major bottom-up alternative that emerged during the 1980s in the developed world, mainly Australia and North America, as part of the trend towards more decentralised and participatory environmental governance. The domination of irrigation in the development of river basins was succeeded to sustainable and integrated development of basin resources. Even though Biswas (2004) expresses his dissatisfaction with this reinstatement of the concept by calling it 'old wine in new bottle', IWRM markedly differed from its earlier conceptualisations in that issues of equity, environment and efficiency were more clearly spelt out (Ferreyra *et al.*, 2008; Molle and Wester, 2009). This phase of river basin management has also been noted for the possibilities of diverse institutional arrangements in the process of management (Akpabio, 2012). The endorsement of the concept by the 1992 Dublin Principles and the Rio Conference's Agenda 21, the 1993 World Bank water policy, the 2002 Johannesburg World Summit on Sustainable Development etc. led to rapid acceptance of river basins worldwide as units which would ideally help combat the ecological issues of resource use and generate stakeholder participation in governance (Mitchell, 2005; Graefe, 2011). In 2000, the European Union Water Framework Directive (EC, 2000) accepted the river basin as the unit of management, thus establishing the dominance of the concept of river basins in the years to come in world resource use policies (Moss, 2004). The criticisms of the large dam model of river basin development which had gained momentum after the World Commission on Dams had also helped in legitimising the move towards IWRM (WCD, 2000). The setting up of the multistakeholder World Water Council and the Global Water Partnership in 1996 and the acceptance of the concept by international banks, scientists and research organisations such as the International Water Management Institute (IWMI), UN organisations, NGOs including the World Wide Fund for Nature and several other multilateral agencies has led to an exploration of multitude of institutional arrangements to implement river basin scale governance especially in the developing nations.

At the governmental and policy level, IWRM has been adopted by all major countries of South and Southeast Asia, Africa and Latin America. Government

dominated river basin management is noted to involve either one government agency or a council that brings together the major government institutions involved in water management taking a central role in managing the water resources and major infrastructure on a river basin excluding non-government participation (Merrey, 2000). Even when stakeholder participation is promoted by the government bowing to donor agency stipulations, it is found to be in varying degrees of intent and success (Sneddon and Fox, 2006; Jingling *et al.*, 2010; Lankford and Hepworth, 2010). These countries also continue to be the site of continuing programmes of development projects through project-financing mechanism involving the international development sector albeit now cloaked in IWRM terminology (Tortajada, 2001; Wester *et al.*, 2003; Kemper *et al.*, 2005; Franks *et al.*, 2011). As Conca (2006) had observed, even with vociferous adoption of the IWRM framework, rivers continue to be ‘pushed around’.

Deep discontent with the appropriation and capture of the concept by the governments and international lending agencies has led to civil society and research initiatives experimenting with various other institutional arrangements which are often multi-layered and polycentric integrating formal and informal mechanisms of governance (Saravanan, 2006; Mollinga, *et al.*, 2007; Ferreyra, *et al.*, 2008; Lankford and Hepworth, 2010; Nesheim *et al.*, 2010; Te Boekhorst *et al.*, 2010). Grave concerns regarding the environmental and equity issues have also recently led to demands for eco-system based river basin planning and adherence to bottom up approaches (Joy and Paranjpye, 2011).

The review of history marks the progress of river basin from a unit whose cohesion largely hinged on the land under agriculture irrigated by the waters of the river and the various upstream downstream conflicts in its use to a unit which is more concerned with sustainable and participatory management of its resources. The experience of India with the river basin as a unit of resource management moving from one phase to the other over the years according to the international inclinations of the respective period provides an enlightening illustration of the life of the concept and a historically textured understanding of the background of the present study.

### **2.3 Indian experience with river basin planning**

The importance of river basins in early Indian history is dominated by its contribution to the commencement and success of agriculture, from state control over settlement of land for irrigated agriculture to locally and individually/ communally managed provincial systems (Sharma, 1991; Chakravarti, 1998; Shah, 2003). These local systems were superseded to a large extent during the 19<sup>th</sup> and early 20<sup>th</sup> century by colonial experiments with large scale irrigation structures initially intended for protective irrigation later to be replaced as strategic engineering feats for expansion of cash-crop agriculture (Whitcombe, 1972; Attwood, 1993). The continuation of the colonial legacy through predominant interest in centrally controlled large irrigation infrastructure projects is evident from the first to third five year plans of the country (1951-1969) dedicated to rapid and planned development of irrigation potential (Shah *et al.*, 2005). Mollinga (2003) sees this post-independent trajectory of development as an attempt by the newly formed government to regulate the pattern of agrarian change and to legitimate state power by particular forms of resource distribution. The Damodar Valley Corporation (DVC) was created in 1948 modeled on the TVA (Chitale, 1992; Barrow, 1998). The formulation of the River Boards Act of 1956 that followed for the planning and management of interstate river basins became an official recognition of integrated basin development as the tool to combat India's water problems even though no River Board was constituted under this Act due to the non-cooperation of the states (Iyer, 2003). River basin organisations were formed later which were highly techno-centric, bureaucratic structures oriented towards multipurpose water infrastructure development. None of these organisations went beyond the rhetoric in achieving any comprehensive understanding of river basins or bringing in community involvement (SANDRP, 1999).

Meanwhile, jurisdiction on water had already been allocated to the states by the Government of India Act, 1935 (Briscoe and Malik, 2007). This was carried forward after independence when water was declared as a state subject and the centre could intervene only as a last resort when disputes arose between neighbouring states over interstate rivers. As most Indian rivers crossed state boundaries, Interstate Water Disputes Tribunals established under the Interstate Water Disputes Act 1956 became another important feature of river basin based management in the country (Rao, 1998). Though technically a Tribunal is free of conventional political considerations,

it has not been able to fully act in justice to river basin considerations because of the overriding strength of the state who most often file review petitions or proceeds to seek the intervention of the Supreme Court or of the Centre over the tribunal awards (Pani, 2010; Venot *et al.*, 2011). Following the constitution of the National Water Resource Council (NWRC) in 1980s, the first National Water Policy (NWP) was formulated in 1987. The 1987 NWP of India recognised the river basins as the way forward for water resource management in the country which gained fresh momentum and direction after the 1992 Dublin-Rio conference when IWRM was internationally accepted. On the stipulations of various international funding agencies that water resource development in various state of India be streamlined along river basins, many states resorted to revamping their existing institutional arrangements to river basin levels. These are noted to be mostly top down approaches with cursory public participation (GoTN, 2001; GoK, 2008a; Mollinga and Tucker, 2010). The draft NWP 2012 out for public review reiterates the government's commitment to move ahead with river basin approach to water resource development with the individual states given the space to device their guidelines for achieving river basin based planning and management (GoI, 2012).

As opposed to these centralised initiatives, the implementation of watershed development programme for natural resource management (NRM) in various states gave credence to river basin level planning from yet another direction. The 1990s and early 2000s saw various micro-watershed initiatives that were comprehensive and community participation oriented though they have been pointed out to have remained isolated from the mainstream thinking on water resources management in the country (Shah and Prakash, 2007; Sen, 2008). To reap the benefits of these successful yet scattered NRM efforts at the micro-watershed level, river basins began to be regarded as potential scaled up versions of watershed development programmes, especially by the civil society organisations working towards making headway in the bottom-up approach to river basin governance (Joy and Paranjpye, 2011). The increasing water scarcity and related conflicts, environmental degradation and continued large dam based development of river basins in the country had led to various civil society initiatives demanding river basin management of natural resources which would be ecosystem based, decentralised and with significant community participation.



As a spate of such wide ranging experiences from the implementation of the river basin unit in its latest definition and capacity have started flowing in from all the countries which have adopted this unit, various criticisms of the concept and shortcomings of this widely accepted unit have surfaced which have thickened the scholarship in this area. The next section is an exploration of these critical assessments.

#### **2.4 Critiques on the concept and issues in implementation**

The implementation of IWRM both in the developed and developing countries have fleshed out the numerous field level problems with the river basin as a management unit. Diverse studies on these experiences have pointed out the issues that have surfaced when a natural division of territory is relied upon to make management decisions in a social context. The validity of the concept was mainly questioned from the perspective of its vagueness, the influence of existing administrative boundaries which are difficult to be broken free of, unwieldiness to social situations and the political and power relations that could easily hijack the concept given the arbitrary nature of its adoption (Biswas, 2004; Conca, 2006; Iyer, 2006; Jairath, 2008; Molle, 2008a; Graefe, 2011). Further, the delineation of river basin boundaries, the structuring of stakeholder representation and the creation of institutional arrangements for river basin management were observed to be political rather than technical processes (Warner *et al.*, 2008).

The hydrologic basin delineation itself presented various challenges as the basin boundaries were often incongruent with other natural systems boundaries, such as those of ecosystems (Omernik and Bailey, 1997; Mollinga *et al.*, 2007) and groundwater flow (Winter *et al.*, 2003; Molle and Wester, 2009). The resource transactions between basins such as inter-basin water transfers also lead to extensions of boundaries and scales of water management beyond the natural basin (Allan, 2006; Turton *et al.*, 2006; Gupta and van der Zaag, 2008; Pani, 2010; Graefe, 2011). As a result of these hydrologic options, Cohen and Davidson (2011) had remarked that the choice of the basin boundary to be used for the purposes of governance is very often socially and politically meditated. In the Cauvery basin in India, it has been pointed out that the upper and lower riparian areas were primarily determined by the political divisions of the period when the early conflicts over the Cauvery waters began (Pani,

2009). Basin organisations had been observed to have no effective powers for regulating water resources exploitation or enforcing conservation as its powers were in conflict with existing state, local government and other federal institutional boundaries in the countries of Nigeria and Mexico (Kramer, 2006; Akpabio, 2012). It has been reported in the Colombia basin in the United States that none of the social or political divisions within the basin have receded even after implementation of river basin based management for over 75 years (Vogel, 2012). Besides these incongruencies of political and natural boundaries, the social and resource relations among the basin population were often ignored and limited to token consultation by state controlled centralised river basin management attempts. Implementation of IWRM in China is reported to face many challenges mainly due to priority given to technical details ignoring the social factors. The public also found it hard to accept common river basin values applied to the whole basin (Jingling *et al.*, 2010). Sneddon and Fox (2006) had noticed that participation was limited to a doctored list of stakeholders in the case of the Mekong basin initiative. Moreover, the recent era of Mekong development is noted to entail a rescaling of human environment interactions to privilege the basin-wide level as the primary scale which would in effect make illegitimate all local resource users who depended on the river for sustenance and livelihoods (Bakker, 1999).

The conceptualisation of river basins therefore requires careful consideration of multiple factors and scales and acceptance that it also involves a socio-political process of renegotiation that would question the exclusivity and curtaining off of the river basin from their surrounding physical, social and economic milieu (Cumming *et al.*, 2006; Warner *et al.*, 2008; Vogel, 2012). Case studies of river basin management experiences which were explored above bring out the pressing need to grapple with the river basin as a social unit over and above as a technical/ natural unit which is being explored in the next section.

## **2.5 Resource use and livelihood scenarios in river basins**

One of the criticisms with the concept of the river basin has been the failure to make sense of it as a socio-ecological unit integrating the everyday lives of the people who inhabit it to the necessities and inevitabilities of ecological management. The transitions and upheavals faced by agriculture as a livelihood option in the developing

countries of the world leading to a reforging of the connections of the basin population to the natural resource base stresses the need to visualise the various livelihood options that people pursue in a river basin and the resource links and networks that are established in their wake. This section attempts to trace the previous scholarship in this area especially in relation to developing countries to establish the various resource linkages and livelihood interactions in a river basin that has a direct bearing on river basin governance. Establishing a viable governance system would require one to gain an in depth understanding of the numerous ways in which livelihoods and economy in a river basin, especially emergent non-agrarian ones, would influence resource use and management. This would in turn help to establish a link between the various resources of the basin such as its land, labour and capital in relation to water and envisage a basin that would include its region of influence beyond the hydrological limits.

The agrarian identity of a river basin is found to be prevalent in literature dealing with river basins of the developing world. As land and water use in any basin is often found to be predominated by agriculture and irrigation, most of the studies from those presenting empirical researches to policy analyses on river basins work with this primary assumption of agricultural basins (Gordon *et al.*, 2007; Cook *et al.*, 2009). Besides, it has been a basic tenet of these studies and the foundation of all international river basin ventures both financial and philanthropic that the majority of people in the developing countries are still dependent on agriculture for their livelihoods (Molden and de Fraiture, 2004; Molle and Wester, 2009). Therefore, the mainstream studies on river basin management focuses mainly on water as the major resource, agriculture as the major user of this resource and farmers as the major stakeholders in any river basin. As a result, resource relations examined within river basins have often been limited to land use and cropping pattern shifts and irrigation and water productivity analyses (Moss, 2004). The powerful upper hand of irrigation in the utilisation of river basin resources had made land use in river basins tantamount to agricultural land use. The occupation of the people and their linkages with the basin resources has also been frequently seen through the lens of these static conceptions. Cleaver and Franks (2005) in their work on institutions in river basin management and sustainable livelihoods point out the complexity and dynamic context of

livelihoods in a river basin against the partial and simplistic understanding of basin resource users as ‘farmers’, ‘irrigators’ and ‘fishermen’.

Moss (2004) who examined institutional gaps in river basin management in the context of the EU Water Framework Directive indicate that it is important to recognise the livelihood scenario in the basin which affects the land and water use therein. Lankford *et al.* (2007) while suggesting an expedient framework for river basin management in the developing countries had stated that the first step in an expedient water resources management consists of characterising the land, water, people and institutional behaviours and understanding the context and problems in the river basin. Despite these assertions that human interactions in basins and their livelihood networks are important in defining a basin beyond water, the agrarian character of river basins have rarely been subjected to a critical review from the perspective of human livelihoods and resource linkages. Very few studies are seen to look at the employment scenarios in river basins over a time period to capture the dynamics of the engagement with the basin resources. Even then, the non-agricultural character of a basin is briefly captured in the growing sectoral demands over water other than agriculture (Ringler *et al.*, 2009). The complex web of factors that is resulting in such a scenario is vastly understudied due to focus on the resources disjointed from the users of these resources. Cook *et al.* (2009) analysed linkages between water, agriculture and livelihoods based on secondary literature on four river basins across the world and concluded that increased demand for water and food will place stress on the agricultural systems and on the poorer sections of society. They argue that factors other than water such as land tenure, connectivity with markets or finance and the institutional coherence with which water and land resources are shared add to the complexity of poverty though the study is actually limited to analysis of water productivity and does not seriously attempt any analysis of issues of accessibility to resources and the rapid changes to livelihood portfolios due to these issues.

The basin population, in most of the studies caged in within the IWRM principles, comes out as stagnant in its resource deployment and relations and is often viewed as a few categories of stakeholders with their relation to the basin limited to the role they play or don't in stakeholder negotiations (Nesheim *et al.*, 2010). Some of

the stakeholder participation studies do address the issue of differential accessibility to resources revealing the inherent and faulty assumption that all important interests in a basin would be able to articulate their views effectively. Woodhouse (1995) had very early noted that the black farmers in the Sabie river basin in South Africa have scant access to water due both to their disadvantages position as downstream users and the established upstream water use patterns of commercial forestry and white agriculture. Fishermen and women gardeners were seen to be excluded from irrigation-project management committees in Sri Lanka (Bakker *et al.*,1999), women and indigenous communities were excluded from Water User Association membership in the Andes (De Vos *et al.*, 2006), and the rural poor including small-scale irrigators were not represented in Mexico's river-basin councils (Wester *et al.*, 2003). Karar (2004) cautions that establishing livelihood linkages should also take into consideration the critical marginal users in a basin who may primarily depend on other water-ecosystem services than the agricultural production function but who are often excluded from or have limited access to decision-making processes. The lack of consideration of these disadvantaged and often voiceless communities facing 'water deprivation' has been decried as a strategic failure in IWRM efforts geared solely towards 'efficient management' (Waalewijn *et al.*, 2005). Even when they are of the opinion that past inequities in resource distribution need to be redressed, a more textured analysis of the current resource relations of these marginal sections of the basin population is found to be largely missing.

A few river basin studies have been able to break free from the preoccupation with the IWRM framework and perceive the basin as a space with myriad and dynamic linkages to resources. Little (2007) in an ethnographic exploration of the Aguarico river basin in Ecuador from a political ecology perspective looks at the basin from the changes that has occurred that have realigned the people of the basin to its resources. The rise of the oil industry and spurt in tourism activities find place in his work which tries to analyse their influence over the people and ecosystem of the basin. Molle (2007) has reported that the dwindling average farm sizes and declining prices have fueled a process of diversification from paddy towards cash crops in the Chayo Phraya river basin in Thailand which resulted in a massive transfer of labour of more than one million out of agriculture to other sectors. Moench *et al.* (2003) describe the resource relations in the Tinau basin in Nepal where resource use

conflicts arise between the low income migrant families who pursue sand mining from the rivers as an emergent livelihood activity and the traditional agricultural communities whose irrigation systems are disrupted due to the severe mining. They succeed in bringing out that resource relations in river basins of today are diverse and management and conflict resolution requires a firm understanding of these emergent aspects and constructs of the basin also. Sneddon and Fox (2006) based on long term work on the Mekong basin offer the framework of a critical hydropolitics which would set the stage for alternative imaginings of river basins that derive from diverse non-state actors as they struggle for livelihood security along trajectories that see river basins in quite different terms. They point out that governance arrangements such as the Mekong Agreement, designed to prevent inter-state conflicts, have little to say regarding water conflicts involving the livelihoods of basin residents. This follows what Sneddon *et al.* (2002) had envisaged through insightful assessments of the pathways of human interaction with the basin and of the social relations of power operating based on gender, class, and ethnicity which result in unequal access to and use of water and water-related resources.

In the Yellow river basin in China, Webber *et al.* (2008) identifies the economic transition that has been underway in China since 1978 to have caused changes in organisation of household production, increasing urbanisation and urban affluence, rapid industrialisation, and large-scale spatial shifts in agricultural production, all of which have affected water use in the Yellow river. This is also one of the few studies that link the reduction in land tenure security to livelihood changes and resource relations in a river basin. The low rate of landlessness in China is pointed out to lead to fragmented land holdings, allocations of narrow 'spaghetti land', and use of marginal and less productive land which has minimised the possibility of water saving through investments in large-scale irrigation. A threefold increase in the area under perennial crops was also noted. In the regions where industrialisation has been most rapid there have been the largest declines in allocation of labour, land and finance for agricultural purposes. This shift of capital away from agriculture occurred rapidly in the southern and coastal regions that have the most abundant water resources and are the most suitable for agricultural production. They conclude that at least some solutions to water problems in the Yellow River lie outside the basin which are related to national policies towards ensuring lengthier and

more secure land tenure rights, subsidies on certain forms of production to encourage farming in the most ecologically suitable places, and subsidies on water conservation technologies.

In a case study on livelihoods diversification in Kerio river basin in Kenya, Iiyama (2006) provides empirical evidence gathered through interviews of how livelihood diversification patterns affect resource use in one of the communities of the river basin. In a study of the hydropolitics of Johannesburg, Turton *et al.* (2006) tackles the issue of migrant labour system which is deeply entrenched in the South African economy and society. They indicated that the remittances of these migrant men labour to the rural areas all over the continent of Africa had completely resketched the socio-economic scenarios in these rural spaces where the women now till the land even though the implications of these to resource management has not been pursued further. Swatuk and Motsholapheko (2008) chronicling the IWRM experience from the Boteti river sub-basin in Botswana records linkages between the livelihoods in the region and the environment. The population concentration in the region during the 1980s had led to increased pressure on local resources due to overstocking, overgrazing and over-harvesting which in turn resulted in large-scale migrations in the 1990s so that the basin now has a predominance of female-headed households. In Botswana cities, demand for water is found to increase due to more demand for private household connections triggered by increased wealth and economic activity. Moreover, the emergent focus on infrastructure development and construction activities is observed to have a huge impact on basin environments, from hardening of the soils to the over-exploitation of aquifers (Swatuk and Rahm, 2004).

In a comparative study of two basins in sub-Saharan Africa, Franks *et al.* (2011) asserts that the predominant drivers of change in basins continue to be socio-economic such as increasing population and expanding range of resource uses. They also briefly discuss the responses of the basin to these drivers and point out that a range of these linked and emerging forces provides a vivid example of the changing context of basin management. In a study set in the Nyando sub-basin of Nile in Western Kenya to discover the livelihood strategies of the poor in the various agro-ecological zones in the basin, Jensen (2009) discovers that lower yields and lower returns are pushing households to decapitalise, especially of livestock, and to adopt

coping behaviours, such as increased farming intensity, year-round production and slope farming, which can produce water transitions downstream. In the lower basin on the other hand, due to less-favorable agro-ecological conditions and upstream effects all households are forced to adopt diversified strategies to generate a livelihood. Non-irrigated crop farming as a singular livelihood activity is not sufficiently remunerative for the small hold farmer. Even irrigated crop production has become challenged through issues related to siltation, insecure property rights and changes in market conditions. Karoki (2000) taking the case study of Nyando basin had identified one of the critical factors affecting the basin management as land tenure.

Closure of river basins which induces drastic redistribution of the basin resources has been suggested to indicate a welcome and inevitable shift away from agriculture as a major livelihood activity and main user of basin resources in India, where non-farm livelihood options that require less water when compared to agriculture are foreseen as the emerging sectors in the closed basins (Phansalkar, 2005; Venot *et al.*, 2008). Venot *et al.* (2011) brings out that most of the river basin studies fail to acknowledge the multi-level drivers of basin development therefore failing to craft the river basin as a space of engagement. Mollinga and Tucker (2010) had laid down that new priorities and demands in water use and the changes in the economic and political role of water in agriculture as a result of the rapid urbanisation and industrialisation in India would vie for an examination of the equity dimensions of resource distribution. They remain silent on the drastic changes in resource perception and relations that such a transition would encompass though they do predict the possibilities for increased contestations over water. Shah and Prakash (2007) while exploring the possibilities of sub-basin level planning to aid in bottom-up approaches to IWRM, affirmed that mapping of resources and livelihood needs of the primary stakeholders at micro watershed level should be the starting point to provide base for a multi-layered planning of river basins in its divergent agro-ecological and socioeconomic settings. Singh and Bhaduri (2009) in a project based study on the Waghadi sub basin of Godavari basin in Maharashtra, India factor in the agrarian distress that had caused widespread changes in the land use of the area. Venot *et al.* (2008) addresses the major shift in occupation of the land owning agriculturists that occurred in the Krishna delta in Andhra Pradesh following the agrarian distress post 1990s liberalisation in India. There is reported to be a large-



scale shift into commercial aquaculture termed as ‘blue revolution’ which conveys the enormity of the occupational shift and the impact it has had on the landscape of the basin. The increased pressure on resources that the emergent profitable venture brought resulted in small farmers and fishermen being forced monetarily to either sell or lease out their lands to outside investors. This had resulted in social movements to limit the in-migration of outside investors and fresh legislations to regulate the growth of the sector. The smaller farmers and fishermen pushed out of their land had had to migrate to cities in search of other employment opportunities. The immense contribution of the venture on the state’s coffers had resulted in more favourable legislations despite decreasing yields, more paddy farms converted to aquaculture ponds and rapid development of infrastructure in the area. Moench *et al.* (2003) traces a comparable shift in the Sabarmati river basin in Gujarat which had heavily tapped into the groundwater resources in the basin following Green Revolution. In areas where groundwater levels have rapidly and severely declined, the traditional land owning castes are found to move away from primary dependence on agriculture to other occupations which include agricultural labour, business and the service sector. On the other hand, the landless scheduled caste population who were previously agricultural labourers has shifted to the service sector. Permanent migration is also noted to be another livelihood coping strategy. They observe that livelihoods and the resultant water use patterns are dynamically responding to a wide variety of influences that are changing the fundamental notions of resource governance, both in terms of resource use and the viability of its management.

Shah *et al.* (2005) in giving a succinct analysis of the resource use scenarios in developing countries that seriously undermine IWRM adoption, presents the case of Taiwan, where water institutions and management had undergone a fundamental transformation following the change in livelihoods and the resultant change in the relationship to resources. Rapid industrial growth had turned over 90% of Taiwan’s agriculturists into part-time farmers which consequently led to 40 % decline in irrigated areas and the former irrigation structures getting reinvented as touristic attractions. On the other hand, Moench *et al.* (2003) perceive that the rapid socio-economic changes in South Asia, transforming it into a peri-urban community whose relations with the resource base are characterised by seasonal and long term migration, shared water supplies, real or perceived urban opportunities and non-

agrarian livelihoods, nullify the incentive to contribute to sustainable resource management initiatives. These forceful illustrations that the basin spaces previously considered static are changing rapidly both socially and economically are proof that the transformation to livelihoods which in turn alters resource relations in river basins and redraws its experienced boundaries demands a more closer and detailed analysis than what has been accorded it in river basin literature till today. The issue is of particular relevance to the developing countries which are undergoing a formidable alteration in the structure of agrarian livelihoods and concomitant relations to natural resources (Ellis, 2005; Reardon *et al.*, 2007; Wiggins and Hazell, 2009; Haggblade *et al.*, 2010; Rigg *et al.*, 2012). The social movements and conflicts in various corners of the 'third world' are a testimony to these redefinitions that are affecting the previously largely agrarian communities in river basin landscapes (Sneddon *et al.*, 2002; Conca, 2006). Pani (2010) foresees that the growing divergence in India between the river basin and the area that uses a river's waters would only grow in the future with increase in the non-agrarian uses of water which would demand a whole new bag of tricks in basin management to be consistent with water availability in the basin. The river basin approach reborn in the 1990s in the developed nations of the West do not reflect these concerns as their demographic and agrarian concerns are vastly different from the heavily populated settings of Asian, African and Latin American countries. Therefore, the agrarian distress and transition situation that these nations have been facing for over two decades which has led to considerable turbulences in the land and social scapes cannot be swept under the carpet while dealing with river basin management in these very same spaces. Harris and Alatout (2010) puts this across succinctly when they remark that instead of taking territory, resources, or population as given in our scholarship, what needs to be uncovered are the various 'territorial expressions' that have emerged and are reinforced through discourse and practice.

It is clear from the above review that the livelihoods of the people, their relation to the basin resources and links that these occupations have to the non-basin areas create the social reality of a river basin which has an undeniable influence on evolving emergent governance mechanisms.

## **2.6 Resource use and livelihood linkages: Implications for resource stewardship and governance in river basins**

A multitude of grass root level natural resource stewardship efforts are on the rise across the world, linking the people and resource base of a region and its management efforts. These stewardship efforts in a river basin context can become important in understanding the possibilities of governance of basin resources based on the 'principle of subsidiarity'.

Bandaragoda (2000) argued for a change in traditional resource management institutions that clashed with the prevailing processes of urbanisation and modernisation. Livelihood diversification makes it very difficult to link a resource user to a particular territorially related, resource management institution. Odgaard (2002) has noted that people in South West Tanzania drew on a variety of institutional channels to legitimise their access to resources, utilising both 'traditional' and 'modern' institutions, often with a different spatial location, to make claims and secure access and rights. Therefore in cases where land and water interactions are critical, the definition of hydrological boundaries is not necessarily meaningful to local resource users. We can see that where boundaries exist they are permeable and often fluctuating and that they are overlaid with the multiple networks through which people access resources and manage their livelihoods (Berry, 1996). Imposing rigid resource management boundaries on these existing structures runs the risk of ignoring the social realities of resource use. Both the existing institutional structures and the livelihood strategies and understandings of the local people are established along different lines, and therefore Cleaver and Franks (2005) conclude that it is necessary that other approaches and institutional frameworks should evolve.

In one of the earlier explorations of the social nature of a river basin, Smith (1969) cautioned that in many cases river basin unity is achieved not in the drainage basin as a whole but in those parts which have relevance for a particular activity; very few recognising the interrelations of the whole drainage basin in any conspicuous way. Barham (2001) also made a note of this essentially local nature of identities by observing that the loose edges marking the limits of social relations, trade networks and indigenous knowledge of the environment, historically did not coincide in a strictly physical sense with the boundaries of the river basin in which they lived.

Cleaver and Franks (2005) on the strength of experience from the Usangu basin in Tanzania and later Venot *et al.* (2011) based on a case study of the Krishna basin in India, pointed out that numerous social networks through which people access resources and manage their livelihoods lead to permeable and fluctuating resource use boundaries across multiple scales and institutional levels. These heterogeneities of resource use and meaning making within a single basin led Ferreyra *et al.* (2008) to recognise the pitfalls in subsuming 'communities of interest' to 'communities of place' which are imagined to be homogeneous in recent river basin conceptualisations. Based on the detailed field research in South Asia, Moench *et al.* (2003) concluded that attempts to implement rigid IWRM are not likely to be successful as people focus on constraints and immediate tasks, and not on integration of numerous factors that may have an influence. Choices about water and land resources are posited to be value choices that involve distinct local communities of interest, even in the interdependent context of a shared resource (Blomquist and Schlager, 2005). Interest group formation has also been pointed out to be the mechanism by which cross scale interactions are triggered in resource management systems (Adger *et al.*, 2006). It is at this juncture of realisation of the primacy of the 'concrete setting of action' for basin management that Mollinga *et al.* (2007) arrives at the concept of 'issue networks' and 'problemsheds' as optimal units for strategic action in a river basin. The problemshed perspective is pointed out to be capable of assimilating the complexity of resource management problems because it takes into account the multiple boundaries of space and time and actually existing socio-political relations and power structures. It has been widely noted recently that the politics of scale in hydro-geographies which tend to consolidate centralised water management even in IWRM frameworks (Harris and Alatout, 2010) can only be challenged through a multi-scalar governance effort that would recognise the basin as a nested mosaic of subunits (Sneddon *et al.*, 2002; Görg, 2007; Andersson and Ostrom, 2008; Lankford and Hepworth, 2010; Molle and Mamanpoush, 2012). The emergence and growth of collaborative relationships is again highly political, consisting of a negotiation process in which stakeholders with differential access to and control over resources struggle for legitimacy and pursue their interests through strategic alliances (Edmunds and Wollenberg, 2001). Waalewijn *et al.* (2005) based on experience from the various transitions in resource policies and their actual implementation in South

Africa, do caution that while these negotiations result in a negotiated order, this order may not necessarily be democratic, equitable, or inclusive.

The dynamic nature of social responses is therefore perceived as a challenge infused with uncertainties to long term management of resource base. Moench *et al.* (2003) had rightfully observed that stakeholder forums would function more effectively in the context of a crisis when none of the involved stakeholders can afford to wait or waste time. Crises are seen as a ‘window of change’.

## **2.7 Closure**

From the above critical review of literature on changing livelihoods and resource relations in the context of river basin based management systems, it is quite evident that the socio-ecological identity of a river basin needs a careful analysis before embarking on governance frameworks. It is also clear from the above review that studies of natural resource linkages of emergent livelihoods are still nascent and require methodological deliberations, especially within a river basin context. The next chapter details the data and methodology adopted to investigate this greatly understudied aspect of river basin management.

## **Chapter 3**

### **Data and Methodology**

#### **3.1 Introduction**

The present study adopts a case study approach to examine the emergence of non-agricultural occupations and the concomitant resource use patterns in one of the river basins in the Southern Western Ghats of Kerala in its various agro-ecological zones (AEZs). The identity of the river basin both as a geographical unit as well as an emergent management and political entity required the meshing of geographical and socioeconomic tools in the study that has been brought together in a case study framework. The present chapter details the methodological and theoretical frameworks adopted, the research design and time frame, sources and methods of data collection and the difficulties and drawbacks of the case study method followed by an elaboration of the procedures for analysis of the collected data with reference to the objectives of the study.

#### **3.2 Case study framework in river basin management research**

The case study method acts as a meta-method that combines various research strategies to effectively investigate an issue from different vantage points. The case study research method had been defined as an empirical inquiry that investigates a contemporary phenomenon within its historical and real-life context, when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used (Yin, 2009). River basins present a typical

scenario for a case study approach with large and heterogeneous geographical extent and the nascent nature of social organisation that involves a large number of stakeholders and actors. The case study approach and its variations such as comparative case studies and multiple case studies have therefore been widely used in river basin management research to effectively bring together the geographical, historical, organisational and institutional contexts of the study region (Blomquist *et al.*, 2005; Stake, 2013). For the present study, the Chalakudy river basin in the Southern Western Ghats of Peninsular India was intrinsically selected as a case to study river basin based natural resource management in the context of emergent non-agrarian occupations. Within the river basin, five representative villages were selected statistically in each AEZ so that the results generated could be generalised for the respective zones. The use of multiple case studies within the Chalakudy basin case also enabled a comparison and contrast study of a single basin in its various stretches.

The drawbacks of the approach result from the combination of various techniques and the adoption of multiple cases that makes it time consuming and expensive. Generation of large amounts of data for analysis, interpretation and inductive generalisation are the other notable weaknesses of the framework (Gomm *et al.*, 2000). The criticisms of the method regarding the non-representativeness and small number of analysed cases (Siggelkow, 2007) is overcome in the present study by selecting multiple representative cases and through a random sample questionnaire survey involving 1080 respondents. Hence, the statistical rigour of the results is assured thus strengthening the case study approach and its capacities for context and issue specific analysis and inductive theory building.

### **3.3 Theoretical considerations**

The study was placed in the overall framework of river basin management within which the livelihood and resource relations were scrutinised with the objective of conceptualising the socio-ecological identity of a river basin as opposed to a strictly hydrological one. The emergent livelihoods in the river basin were examined within the vantage point of rural non-farm economy studies and the sustainable livelihoods framework although certain crucial differences in perspective were incorporated. The composition of individual and household occupational mix was determined and the caste and gender influences were analysed with the objective of obtaining a

‘differentiated reality’ of the basin occupational scenario (Jordan, 2012). Further, the tendency of the livelihoods approach to view the linkage between livelihoods and resource use as one of cause and effect, leading to serious explanatory limitations (McCusker and Carr, 2006; Carr and McCusker, 2009) was also addressed. In the present study, rather than consider the impacts of livelihoods on landscape, the livelihood-landscape interactions were explored for their power to influence governance possibilities in the river basin by affecting the constitution of communities of interest (Fig. 3.1). The incongruity between the hydrological and socio-political unit of the river basin was itself subjected to analysis to conceive an inclusive basin identity centred on people and processes.

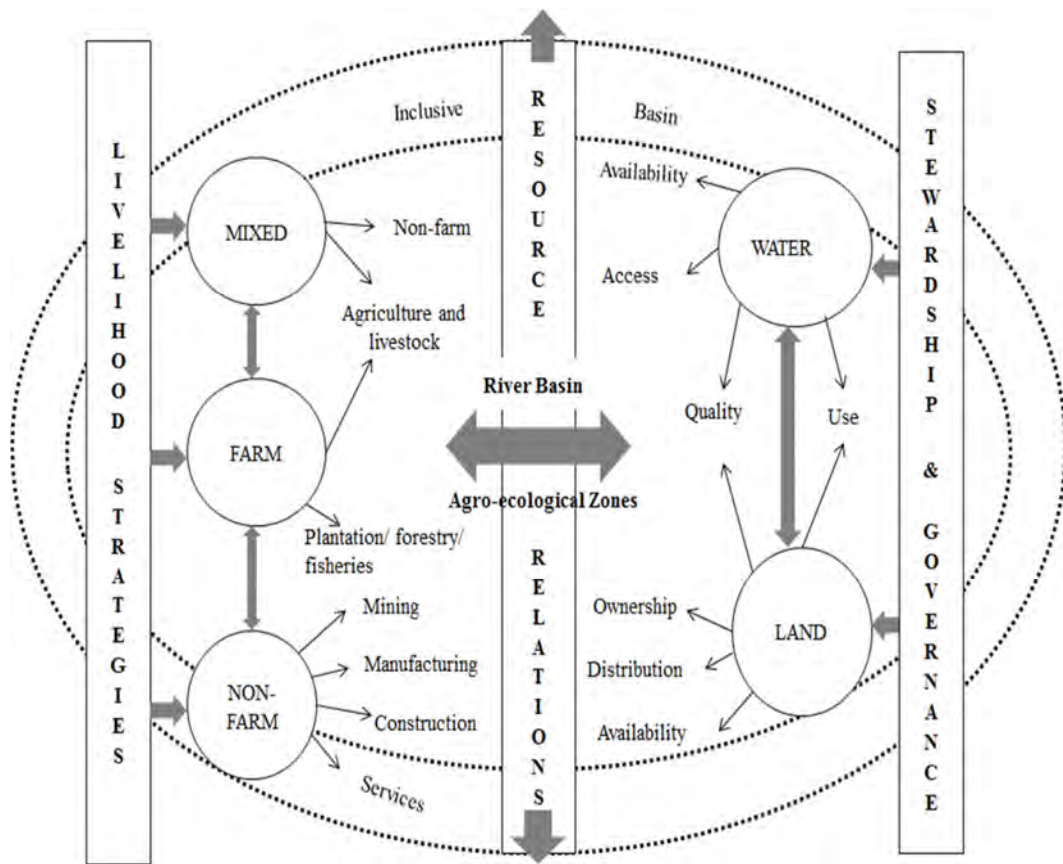


Fig.3. 1 Conceptual framework of study

### 3.4 Research design: The stages of the research process

The work was carried out in four distinct, continuous and at times overlapping phases spanning from 2009-2013. The research process and the details of work undertaken in each phase are provided in the following sections.



*Phase I:* The research process took off through identification of the basin, preliminary visits to the basin to recognise the nature of issues in agriculture and livelihoods in the context of river basin management in conjunction with a review of existing literature on river basin studies. This phase was essentially qualitative in nature wherein extensive visits to the various stretches of the basin and unstructured interviews with people were undertaken. This was followed by the formulation of the research problem, questions and objectives.

*Phase II:* During this phase, the administrative units within the basin were identified and relevant available secondary time series data on the basin land and water use, population and climate were collected from the relevant government departments and agencies. The secondary data at the lowest administrative level available were then integrated at the basin level followed by the delineation and characterisation of the basin and its AEZs to satisfy the first objective of the study.

*Phase III:* Within each AEZ, a representative site was chosen for primary questionnaire survey at the household level. The questionnaire was designed followed by pilot survey (35 samples) for field evaluation and relevant modifications were made to the questionnaire. Before undertaking the actual survey, initial connections and contacts in the villages were established through the Local Self Government (LSG) institutions and government agencies of Integrated Child Development Scheme (ICDS), Agriculture, Water Resources and Forest Departments and other location specific organisations such as Vegetable and Fruit Promotion Council of Kerala (VFPCCK), Planters Association, Plantation Corporation of Kerala (PCK), Anamala Co-operative Farming Society, Ex-Servicemen Co-operative Society, Rubber Board regional centres and by attending *Grama Sabhas*, panchayath meetings, *Anganwadi* workers meetings and various agricultural cluster meetings. Relevant secondary data on the villages were also collected from these agencies. Interviews were then undertaken with the panchayath president, members, and other key resource persons in the village. Reconnaissance walks through the village helped to identify the important land uses, cropping patterns, various establishments and water sources and to establish a connection and build familiarity with the landscape and the people. The proportionate random sample questionnaire surveys were then conducted in each of the selected sites followed through by interviews for livelihood and landscape history with specific respondents identified.

*Phase IV:* This was essentially the collation, analysis and writing phase. The mapping of the resource use and changes, data coding, entry and processing was followed by analysis of the primary data collected through questionnaire survey and interviews.

### **3.5 Data collection: Sources and methods**

The collected data can be classified broadly according to the source and method of collection as secondary data consisting of published data or reports collected from various governmental and non-governmental agencies and primary data collected from the field through multiple data collection tools. The detailed description of the nature and sources of data are discussed below.

#### **3.5.1 Secondary data**

The river basin being a fairly recent unit of management, none of the secondary data are available at the basin level. Rather, these have to be collected and collated out of the existing administrative units and agencies. Secondary data were collected for various aspects of the basin such as biophysical particulars for agro-ecological characterisation, demographic and occupation data, land use and water use data and various other location specific data on occupations and resource use from the panchayaths and villages in each of the AEZs identified.

The 1:50,000 scale topographic sheets published by the Survey of India (GoI, 1976) were used for delineating the hydrographic basin and obtaining the topographical features and previous land use of the Chalakudy river basin. The toposheet numbers of 58 B/7, 58 B/8, 58 B/10, 58 B/11, 58 B/14, 58 B/15 and 58 F/3 span the area of the Chalakudy basin. The digital elevation model of SRTM at 90 m resolution was also used to cross-verify the basin boundary and to derive elevation classes (Jarvis *et al.*, 2008). The political boundary maps for Kerala and Tamil Nadu states, Coimbatore, Palakkad, Thrissur and Ernakulam districts and the panchayaths within these districts were obtained from the respective state agencies for the administrative delineation of the basin. Other data sources included Government of Kerala and Tamil Nadu reports and documents such as the Detailed Project Reports (DPR) (KSEB, 1999) and their Environmental Impact Assessments (EIAs) of the proposed Athirappilly hydroelectric project (TBGRI, 1996; WAPCOS, 2003) and Kuriyarkutty – Karappara multipurpose project (KSEB, 1998), ongoing Idamalayar

Irrigation project report (GoK, 1978), the Legislative committee report on interstate diversions of Kerala (GoK, 1994), the PAP inter-governmental technical committee report (Anon., 2003), Western Ghats Ecology Expert Panel Report (WGEEP, 2011), state and central water policy documents (GoI, 2002; GoK, 2008; GoI, 2012). The AEZs of the basin were derived on the basis of the agro-ecological zonation for the state of Kerala carried out by the National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) (Nair *et al.*, 2011). This was further refined by using rainfall data collected for 54 stations in and around the basin from India Meteorological Department (IMD), Pune, Kerala State Electricity Board (KSEB) and Hydrology Project, Kerala. Soil data was obtained from Soil Survey Organisation, Kerala and NBSS&LUP, Bangalore (NBSS&LUP, 1996 a and b).

Demographic time series data on the basin and dependent regions at various administrative levels were collected from Census publications of the Government of India. The Primary Census Abstract (PCA) and the National Industrial Classification (NIC) occupation data for the decennial Census years from 1971 to 2001 served to reveal the general trend in population and employment pattern in the basin for the past 30 years prior to the detailed analysis of occupation patterns using primary data. The latest 2011 census data published so far, do not provide village level disaggregated information on occupational categories and therefore could not be used in the present study.

The majority of the area of the Chalakudy river basin in its upper reaches and the entire area in its middle and lower reaches were part of the erstwhile princely state of Cochin. Historical records on settlement, land tenure systems and land and water development in these regions for tracing the occupational and resource use histories of the river basin, were accessed from the Ernakulum Regional Archives of the Kerala Archives Department. The databases that were referred were: *i*) Service Files (paper records of Dutch and British period) (1684-1869) *ii*) Persian (1725-1835) and Portuguese (1793) records *iii*) files on boundary disputes (1816-1891), *iv*) Government Gazettes of Cochin (1867-1848), Travancore-Cochin (1949-1956) and Kerala (1956 onwards), *v*) Regulations and Proclamations (1835-1945), Administrative Reports (1892-1940), and Committee Reports of Cochin state (1912-1945), and *vi*) Census reports of Cochin (1891-1941), Travancore-Cochin (1951) and

Kerala state (1961). The resource use history of the Sholayar sub-basin, part of the Madras Presidency under colonial administration, was pieced together from United Planters Association of South India (UPASI) records (UPASI, 1965) and other secondary literature on the establishment of plantations in the area.

### 3.5.2 Field primary data

The field data collection involved the primary questionnaire survey at the household level and the semi-structured interviews administered to the key informants. The questionnaire survey was conducted between October 2009 and October 2011 in the five representative field sites of Parakkadavu (October- December 2009), Edavilangu (February- May, 2010), Athirappilly (June – August, 2010), Nelliampathy (September-October, 2010) and Pariyaram (January-March, 2011). The details of the primary questionnaire survey conducted are given in Table 3.1 and 3.2. The questionnaire sample is provided in Appendix-I.

Table 3.1 Sampling statistics of questionnaire survey

AEZ	Representative panchayath	Total households	Percentage of basin population	Surveyed households	Sampling fraction	Sampling weight
High hills	Nelliampathy	26901	11.1	99	0.004	1.0
Foothills	Athirappilly	2540	1.0	90	0.035	0.1
Midlands	Pariyaram	46390	19.1	191	0.004	1.0
Lowlands	Parakkadavu	99604	41.1	410	0.004	1.0
Coast	Edavilangu	67013	27.6	290	0.004	1.0
Total		242448	100.0	1080	0.052	

Apart from these, interviews with the key informants such as Local Self Government representatives, the local leaders of agricultural societies and Women Self Help Groups such as the *Kudumbasree*, elderly farmers, land owners, industrialists, entrepreneurs, middlemen and agents of agricultural inputs were also conducted in each site. These interviews were mainly focused on gathering the oral history of livelihood and resource use change in the region and tracing the resultant resource interlinkages within and outside the river basin. Details of the interviews conducted in each site are given in Table 3.3.

Table 3.2 Details collected through questionnaire survey

General	Age, religion, caste, education, occupation
Family	Age, education, occupation, place of residence of family members, details of education, occupation and residence of parents
Residence	Period of residence at the present locality, previous residence, ancestral home, reason for shift if any
Occupation	Main and subsidiary, place of work, mode of transport, nature of employment, months employed in a year, job shifts if any
Land details	Owned, leased-in and leased-out land (area, place, year of purchase, nature of land, purpose, present use)
Cultivation	Crop, area, input sources, output markets for the year 2008-09 Irrigation sources, cropping pattern shifts
Other occupation land use	Area, use, input sources, output market for the year 2008-09
Water use details	Source, availability, actions for meeting shortages/ excesses if applicable

Table 3.3 Details of interviews conducted in the survey sites

AEZ	Number of respondents	People interviewed
High hills	12	Estate managers, owners, LSG representative, Divisional Forest Officer (DFO), Government farm superintendent, Agricultural Officer
Foothills	12	Ex-servicemen society secretary, Anamala Cooperative farm secretary, LSG representatives, Homestay and resort owners and managers, ex-panchayath member, activists, Agricultural Officer
Midlands	15	LSG representatives, Panchayath secretary, Agricultural officer, Elderly farmers, VFPCCK secretary, Agricultural Officer
Lowlands	30	LSG representatives, Panchayath secretary, Agricultural Officer, Elderly farmers, VFPCCK secretary, Co-operative bank secretary, <i>Kudumbasree</i> ADS presidents, social activists, agricultural input agents, entrepreneurs
Coastal lands	20	LSG representatives, Panchayath secretary, Agricultural Officer, Elderly farmers, fishermen, <i>Kudumbasree</i> ADS presidents, the construction workers union secretary, market middlemen for screwpine mats

### **3.6 Difficulties and limitations in data collection**

The secondary data collection for the river basin proved to be a challenging and time consuming process exacerbated by non-cooperativeness from the government officials at many instances. The collection of rainfall data for the basin area to aid in the refinement of agro-ecological zonation was fraught with difficulties as the Hydrology Project of Kerala refused to part with much of the data citing sensitivity due to interstate water disputes. The Right to Information Act had to be exercised in order to obtain data on many occasions. The topographic sheets of the region were also hard to procure since much of the basin area falls under the 'restricted' category of toposheets of the Survey of India. Because of these difficulties, the collection of secondary information on the basin was a protracted exercise spread over almost half of the study period.

The primary data collection presented difficulties of a different hue. Though the respondents were forthcoming in their responses, the terrain of the basin and the remoteness of the location especially in the hilly reaches made the process of primary data collection spread out across a year and a half. The influence of the extended regions of resource dependence as part of the basin area for management also led to a great deal of practical difficulties in selecting the region for data collection. One major data gap in the primary questionnaire survey is the exclusion of data on income. This was deliberately not collected as the question on income invariably aroused the suspicion of the people and led to unreliable answers during the pilot phase. The question was excluded from the finalised version of the questionnaire. The financial status of the surveyed household was gleaned out of other indicators such as the types of employment resorted to by the members of the household, the landholding size, debts and other financial investments and liabilities.

### **3.7 Procedures for data analysis**

The analysis of the data has been undertaken in various stages. Basin delineation was carried out after the collection of secondary data on administrative and biophysical aspects. The various AEZs in the basin were classified according to the NBSS&LUP categories for agro-ecological zoning of Kerala and rectified using further raw data considerations. The methodological difficulties in basin delineation due to the various boundaries that existed in a river basin gave rise to theorisation on multiple basin boundary considerations and lead to the formulation of the concept of inclusive basins.

The conceptual framework of inclusive basins and the interest group based governance possibilities that it gave rise to are elaborated in the Chapter 5. In the ensuing sections, the methodological and analytical details of basin classification, AEZ delineation, representative site selection for multiple case studies and secondary and primary analysis of the data collected from the various AEZs are being pursued.

### 3.7.1 River basin delineation and characterisation

Biophysically, a river basin is the drainage area of the river, which includes sub-basins of tributaries and micro-watersheds of numerous streams. Geographical Information System (GIS) tools were found to be essential for the visualisation of the multiple boundaries and temporal-spatial analysis of resource use in the river basin. The GIS platforms of ILWIS 9.3 and ArcGIS 10 were used for the purpose. Delineation of the hydrological boundary was achieved through digitising the topographic maps of 1: 50,000 scale published by the Survey of India (GoI, 1976) with the help of Arc GIS 10 software. This was cross checked with the Digital Elevation Model (DEM) at a resolution of 3 arc seconds derived from the USGS/NASA SRTM data, processed by International Centre for Tropical Agriculture (CIAT) (Jarvis *et al.*, 2008). Even though such delineation is a natural division based on topography beyond administrative divisions, for the purpose of planning and management of the basin it is necessary to understand the administrative units and their boundaries that fall within the basin. The administrative units in a basin may consist of parts of countries/ states/ districts/ taluks/ panchayaths/ villages. The administrative delineation of the Chalakudy basin was achieved through overlaying of the state, district and panchayath/village level administrative maps of the states of Tamil Nadu and Kerala on the hydrological boundary of the basin. The administrative divisions which were technically outside the basin, but were dependent on it either for irrigation or for domestic water needs, were also delineated using the overlay of irrigation command area boundaries and panchayath boundaries over basin boundary.

The administrative delineation of the river basin facilitated the identification of states, districts, taluks, panchayaths and villages within the basin, from where statistical data on basin land and water use and basin demographics which are published at the level of these administrative units were collected. The integration of this secondary data on the basin from the disaggregated data at the panchayath/village level was carried out to provide the natural resource use pattern of the river basin in its various sub-basins and in

the river basin dependent regions. The land use of the river basin during 1976 was digitised using the toposheets for the basin. The Census 1971, 1981, 1991 and 2001 data on population and 9-way industrial classification of occupation at the panchayath level for the basin was correlated with land and water use of the basin to characterise the population and livelihood dependence and change therein of the river basin and dependent regions. Detailed methodology for each is given below.

### 3.7.2 AEZs and their delineation

Agro-ecological zoning refers to the division of an area of land into land resource mapping units, having unique combination of landform, soil and climatic characteristics and or land cover having a specific range of potentials and constraints for land use (FAO, 1996). GIS technology is very useful for automated logical integration of bio-climate, terrain and soil resource inventory information for the delineation of agro-ecological zones (Patel *et al.*, 2000). Topographic maps, land resource map and contour map having physiographic, geographic and bio-climatic information forms primary input for GIS for agro-ecological zoning activities. A zonal database can also be later integrated with non-geographic information such as socioeconomic data, which is relevant for making decision on development priority interventions about the sustainable management of zonal resources.

The bio-physical and extended basin was categorised into various AEZs on the basis of the agro-ecological zonation for the state of Kerala carried out by NBSS & LUP (Nair *et al.*, 2011). The agro-ecological zonation for the Chalakudy river basin derived out of the zones for Kerala was further refined by field verifications. The basin was delineated into 6 AEZs; two zones in the highland area, and one each in the foothills, midland, lowland and coastal reaches (Fig. 3.2). Out of these 6 AEZs identified, the Highland plateau AEZ has been excluded from primary data collection through questionnaire survey as the predominant area in this zone is reserve forests under the protected area of the Parambikulam Tiger Reserve. In the remaining 5 zones of the High Hills, Foothills, Lateritic midlands, Lowlands and Coastal lands, one site each has been selected for detailed questionnaire survey.



### 3.7.3 Selection of representative sites in each AEZ

Within the five selected AEZs, one representative location each was selected based on the 9-way industrial classification of labour force as estimated from the Census 2001. The major occupations in each of these zones were identified. The mean and median values for the number of people occupied in these occupational categories for each zone was arrived at and the panchayath showing number of people occupied closest to these values (showing the least value for the sum of square of the deviation from median) in each zone were selected for primary survey (Fig.3.2).

### 3.7.4 Occupational and resource use history

The history of livelihoods and natural resource utilisation in each of these zones was explored from the 19<sup>th</sup> century to the current times (1800s to 2000) on the basis of archival records, census documents, secondary literature and oral sources as corroboratory evidence. The trajectory of resource use in a river basin is intimately connected to the livelihood history of the people who had inhabited the basin, either being the native population or having moved into the basin in consecutive waves of settlement coinciding with various phases of livelihood creation linked with resource mobilisation. Such an enmeshed history of resource use and livelihood choices has varied trajectories in the various AEZs of the basin directly dependent on the production potential and conveniences of inhabitation.

### 3.7.5 Secondary data analysis

Statistical analysis of data on occupation and resource use for the representative sites in each zone was conducted. The Census data on population, gender, SC/ST population and employment, land use data from the toposheets and published by the Kerala State Land Use Board (KSLUB) and water use data on Chalakudy River Diversion Scheme (CRDS), Lift Irrigation schemes (LIS), various drinking water schemes (DWS) and the KSLUB data on irrigation and drinking water sources were analysed for each zone.

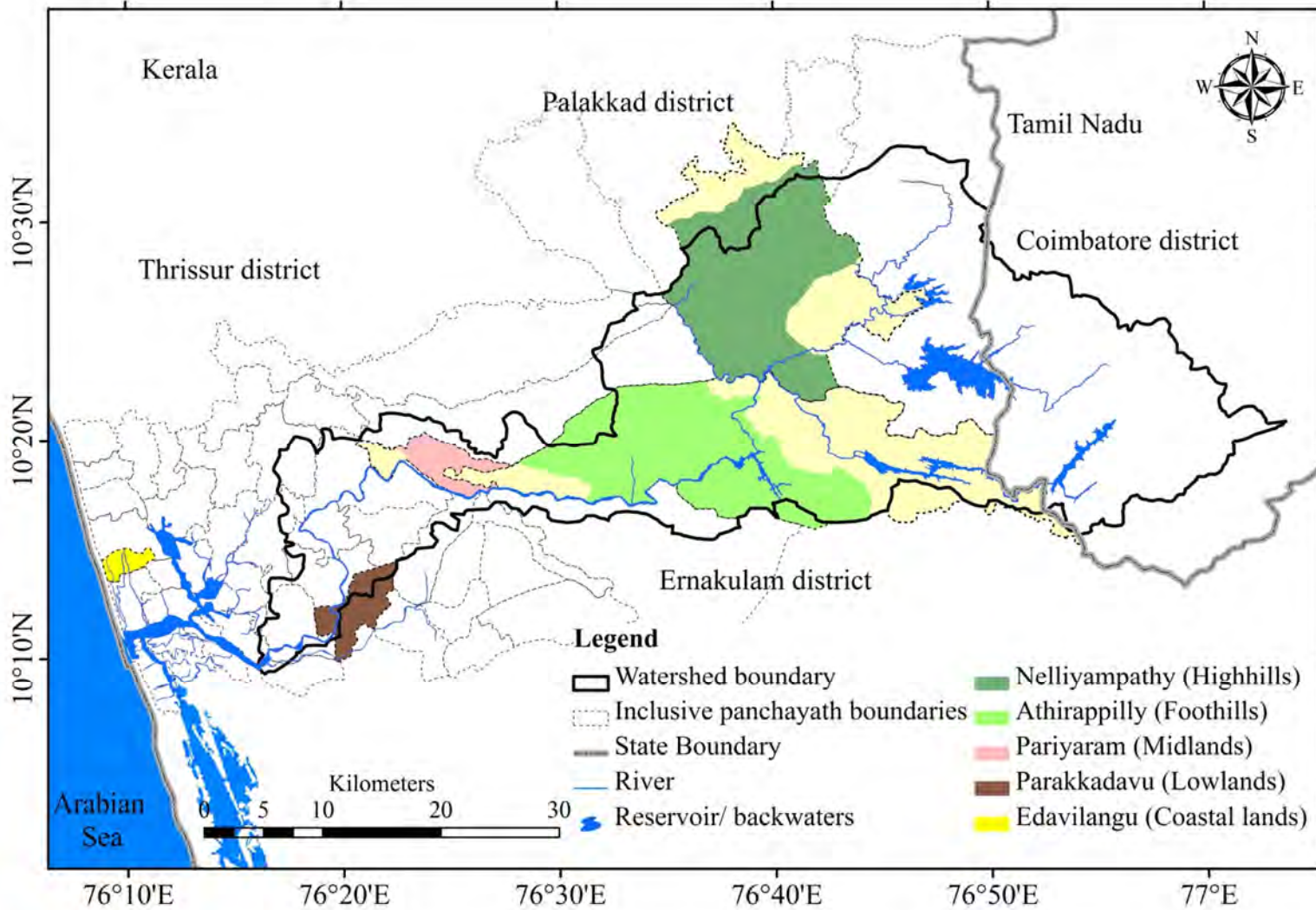


Fig.3.2 Representative sites in each of the AEZs

### 3.7.6 Primary data analysis

The data on gender, age, religion/caste, education, occupation and location of occupation collected through the questionnaire survey were analysed for all members of the sample households to arrive at the composition of the sample population in each of the surveyed representative sites. The assumption of homogeneity in the choice of livelihoods and resource use across AEZs were tested statistically using Pearson chi square test at 1 per cent significance level. These details were then subjected to frequency analysis to determine emergent patterns and processes both within and across the AEZs. The proportional distribution of castes, age groups and education were examined for the total sample as well as for the working population within. Age, education, caste, generation and location of occupation were cross-tabulated with the occupational category to determine the emergent patterns in occupations pursued in the various zones of the basin. In addition to these, intergenerational analysis of the place of origin and occupation was carried out to capture the geographical and occupational shifts that define the present occupational profile of these regions. The nature and agency of employment and subsidiary occupations engaged in were also looked into. The data collected through interviews were also examined to qualify the occupation trends, linkages and emergent patterns.

#### 3.7.6.1 Emergent occupations and patterns

The main occupations of the working members of the households surveyed were classified according to the 9-way census NIC categories into cultivators, agricultural labourers, plantation, forestry, livestock, fisheries and other allied activities workers, mining and quarrying workers, construction workers, manufacturing sector workers, trade and commerce related workers, transportation sector workers and 'other services' workers to allow for comparisons with the Census data. The frequency and percentage analysis of these workers were conducted using Matlab R12a software according to various criteria such as nature of primary occupation as permanent, temporary or casual, the agency of occupation as public, private or self, the caste, gender, education and age influences on these occupations, subsidiary activities engaged in other than the main occupation and the parental occupations of the current household head. Permanent employment were those in which the worker is employed

for an indefinite duration whereas temporary occupation was when the worker is employed in an activity for a specific time period and who can be laid off without incurring statutory redundancy payments and casual temporary occupations were when the worker finds work on a daily wage basis and there is no fixity of work days or tenure. Temporary and casual employment as a share of total employment has been reported to have recently increased in a number of countries (Booth and Dolado, 2002). Fig. 3.3 captures the classification of the various livelihood activities on the basis of which analysis was carried out.

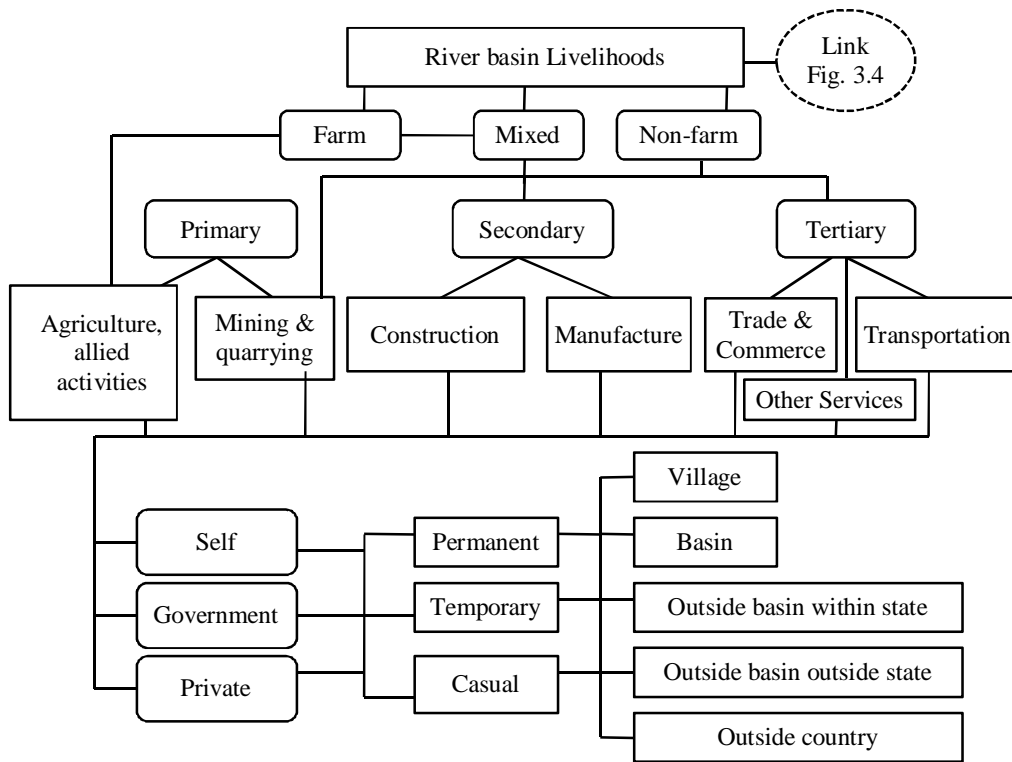
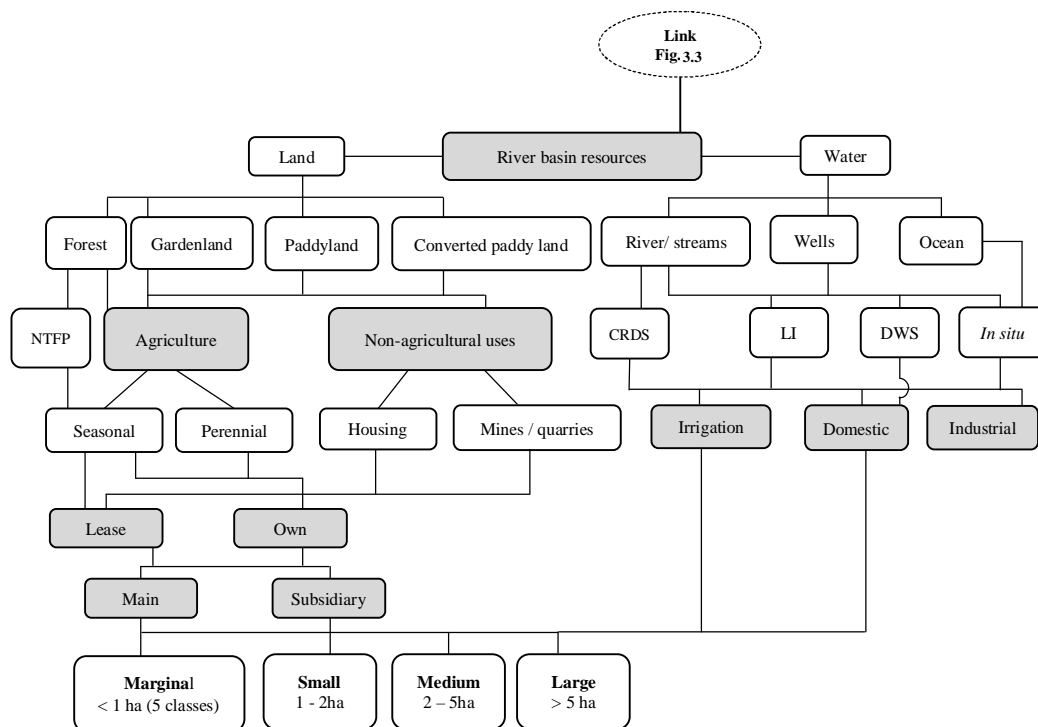


Fig. 3.3 Classification of livelihoods in the river basin

Depending on the primary occupations of its working members, the households were classified as purely cultivator households, purely agricultural labour dependent households, purely plantation, forestry, fisheries or livestock dependent (other natural resource based) households, purely non-farm employment households and mixed employment households having members pursuing both farm and non-farm based occupations. The resource relations were subsequently traced for these household groups.

### 3.7.6.2 Resource linkages

The linkages of the livelihoods to resources of land water were assessed at the level of ownership and access, distribution and use. These linkages were inspected both for the various livelihood based household groups arrived at in the previous analysis (purely own cultivation based, purely agricultural labour based, purely plantation labour/ fisheries/ forestry/ livestock based, purely non-farm based and mixed strategies based) as well as for the various caste and community groups identified in each zone. A schematic of the relationships traced is provided in Fig. 3.4.



Note: NTFP- Non-Timber Forest Produce, CRDS- Chalakudy River Diversion Scheme, LI- Lift Irrigation, DWS- Drinking Water Schemes

Fig. 3.4 Classification of resource linkages in the river basin

The land resources were classified as garden lands, paddy lands and converted paddy lands in each of the zones. Converted paddy land was recognised as a separate category due to the marked differences in the attributes of the land such as nature of soil, water characteristics and crops supported. The ownership of garden land was

further split into homestead land and other garden land. Ownership of these resources based on castes and major livelihood groups of households were found out in terms of average area possessed, percentage share of total households/ caste groups and percentage share of total area in each category. The distribution of these land types within the various categories of marginal (< 1 ha), small (1 – 2 ha), medium (2-5 ha) and large holdings (> 5 ha) were examined. Since majority of the holdings were falling within marginal class, the category was further split into sub-classes of < 5 cents, 5-25 cents, 25-50 cents, 50- 100 cents and 100-250 cents, 1 hectare of land being equivalent to 247 cents.

The deployment of land holdings in all categories was examined in terms of cultivated and uncultivated land holdings and household groups in possession of them. The cultivated land was further classified based on the crops grown and the mode of cultivation. The mode of cultivation was defined into the categories of own cultivation of land in which the cultivator farmed on land owned by him/ her and lease cultivation of land in which majority of the cultivation was undertaken on land area obtained on short term and informal lease arrangements. Each of these categories was further split into main and subsidiary occupation of the cultivator based on the household group. Uncultivated land was also analysed in terms of total and percentage share of area and household groups. Other emergent and common property resource uses of land were also evaluated.

The access to water resources was assessed in terms of the source of water for irrigation and domestic uses whichever was applicable. Along with access, the quality of water and other issues related to water such as water logging were also subjected to analysis. A caste-wise scrutiny of the access and quality options was also resorted to.

#### 3.7.6.3 Basin-Outbasin linkages

The linkages of the basin to the outbasin regions were examined at three levels in each of the zones studied.

- i) The linkages forged due to the deployment of basin resources, especially water, outside of the hydrographic boundaries. These regions were classified as falling

within the 'transboundaries of resource use' and included within the inclusive basin.

- ii)* The linkages formed due to the labour force from the basin working outside of it. These linkages were only peripherally examined in terms of the share of workers that work outside and their geographical locations. Further analyses in terms of the remittance capital that finds its way into the basin, the social networks forged by these connections etc. do not form part of this study.
- iii)* The linkages with outbasin molded through the resource mobilisation activities within the basin. These boundaries were determined on the one hand through the sourcing of capital, labour and other inputs for the major resource based enterprises in the basin and on the other through the markets for the produce/ outputs.

#### 3.7.6.4 Multiple boundaries, issues of concern and interest groups

The multiple boundaries that were arrived at through inclusive basin considerations including the socio-economic boundaries of livelihoods and resource use were examined at the zonal level in the context of the major issues of concern in natural resource management in the zone. The multi-scalar interest groups were arrived at by examining the diverse livelihood and resource linkages. The role of these interest groups in natural resource governance and the implications for river basin as a management unit were subsequently explored.

### **3.8 Closure**

The chapter detailed the multiple case study methodological approach and the theoretical framework adopted for the study of river basin livelihoods and resource linkages. It also presented the various database employed in the study, their sources, levels and the methods of procurement. The particulars of the primary questionnaire survey adopted in the sites and the difficulties and shortcomings of the methodology were also elaborated. The chapter then presented the methodology of secondary and primary data analysis according to the objectives of the study. The next chapter contextualises the study in the Chalakudy river basin in the Western Ghats of Kerala.

## Chapter 4

### Description of the Study Area

#### 4.1 Introduction

The monsoon-fed rivers originating from the Western Ghats, one of the world's heavily populated Biodiversity Hotspots and recently declared World Heritage Site, are the most important source of water for millions of people in South India (Myers *et al.*, 2000; Cincotta *et al.*, 2000; UNESCO, 2012). The tropical climate along with intense monsoon rainfall and undulating topography shaped the narrow strip of west coast peninsular India endowing it with biologically rich and seasonally torrential short rivers. This peculiarity often translated into these river basins being considered as 'surplus' on the basis of which inter and intra-state diversions were implemented starting from the late 19<sup>th</sup> century, a few of which involves multi-basin diversions.

These rivers and their basins sustain invaluable ecosystem diversities especially in the highland forested reaches, support diverse agro-ecosystems and have increasingly high human dependences in the middle and lower populated stretches. Most of these river basins are heavily developed with multiple inter and intra state water infrastructure projects for electricity generation and irrigation. The increasing resource utilisation through these diversions and abstractions, the resultant widespread scarcity and conflicts on the one hand and the inclination of the national water policy towards river basin level planning on the other has fostered river basin based management considerations in the water policy of Kerala state (GoK, 2003; GoK,



2008). In the event of such a major revamping of planning and management of natural resources, a case study of a river basin in the Western Ghats in Kerala is undertaken to understand the suitability, potentials and challenges in river basin level natural resource management especially at a time when livelihoods and related natural resource uses are undergoing drastic transformations.

#### **4.2 Chalakudy river basin**

The inter-state, interlinked Chalakudy river basin, in the southwestern corner of peninsular India, lying between  $10^{\circ} 10'$  -  $10^{\circ} 35'$  N latitudes and  $76^{\circ} 15'$  -  $77^{\circ} 15'$  E longitudes (Fig.4.1) represents a central cross section of the state of Kerala. The 130 km long Chalakudy river originates from the Western Ghats as four major tributaries viz. *Karappara Aar*, *Kuriyarkutty Aar*, *Parambikulam Aar* and *Sholayar* with the drainage area spread out in the states of Tamil Nadu and Kerala. (Fig.4.2). *Karappara Aar*, the northernmost tributary, originates from the Nelliampathy hills which form the southern and southwestern margin of Palakkad gap. *Kuriyarkutty Aar* and its sub catchments of *Veetiar* and *Thekkadiar* originate from Chemmanampathi hills and *Parambikulam Aar* and its smaller catchments of *Peruvarippallam* and *Thunakkadavu* from the foothills of Anamalai. The southernmost tributary *Sholayar* originates from the northwestern portion of Anamalai hills. After the confluence of these tributaries, the main river flows west across forested hills and agricultural valleys and wetlands joined by various tributaries and numerous rivulets en route such as *Anakkayam thodu*, *Charpa thodu*, *Kannankuzhi thodu*, *Kappa thodu*, *Parayan thodu*, *Alamattom thodu* etc. The river flows through forested tracts upto Athirappilly waterfalls from where it enters the midlands and plains, taking a tortuous course to join the right arm of Periyar river at Elanthikkara and later drains into the Arabian Sea. The Chalakudy basin shares its eastern and northern watershed boundary with Bharathapuzha basin, northwestern boundary with Karuvannur basin and southern boundary with Periyar basin (Fig. 4.2). The present chapter contextualises the Chalakudy river basin in the ecological and political milieu of the Western Ghats and the state of Kerala and provides an account of the resource development trajectory and dependences of the hydrological basin.

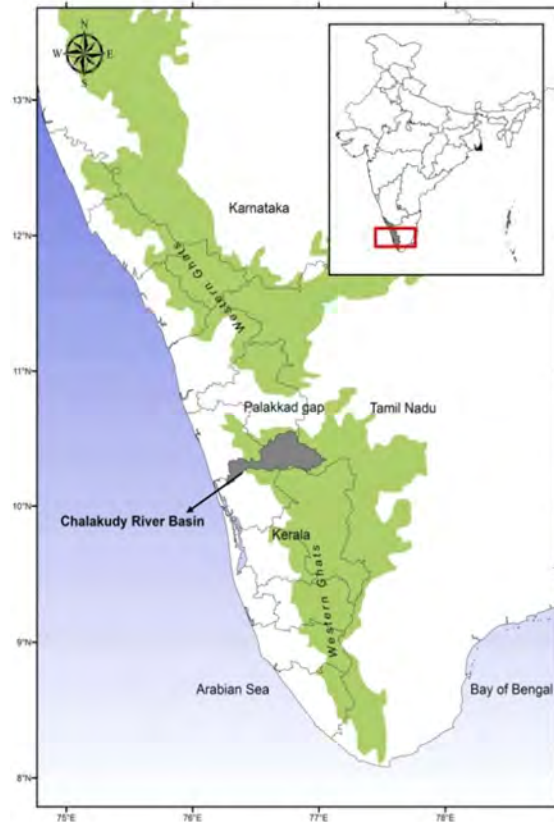


Fig. 4.1 Location of the Chalkudy river basin in the Western Ghats

#### 4.2.1 Physiography, climate and soils

Physical features of a river basin have a profound influence on the climate and the living communities it supports (Nair, 1991). The Chalkudy river flows through a cross-section of the physiographic units of the Western Ghats with the basin area spread out in heterogenous and distinctly different landforms. The upstream area of the basin is highly undulating with structural hills, steep valleys and plateaus. There are two distinctive plateaus in the upper reaches of the basin of which the Parambikulam plateau lies between 500 - 600 m above msl and the Valparai plateau lies between 1000 -1200 m above msl. About 17 per cent of the basin area lies below 100 m above msl, 12 per cent of area falls in the 100 - 500 m above msl elevation range, 66 per cent of the area falls within 500 - 1200 m range and 5 per cent of basin area lies above 1200 m msl. A major portion (64 %) of the catchment area of the Chalkudy river basin has a slope that lies between  $5^{\circ}$  -  $18^{\circ}$ . Only about 1 per cent of the basin area has slopes greater than  $27^{\circ}$ . The slope decreases gradually to less than

15 percent and reaches nearly level surface towards the confluence with Periyar (Chattopadhyay and Chattopadhyay, 1995).

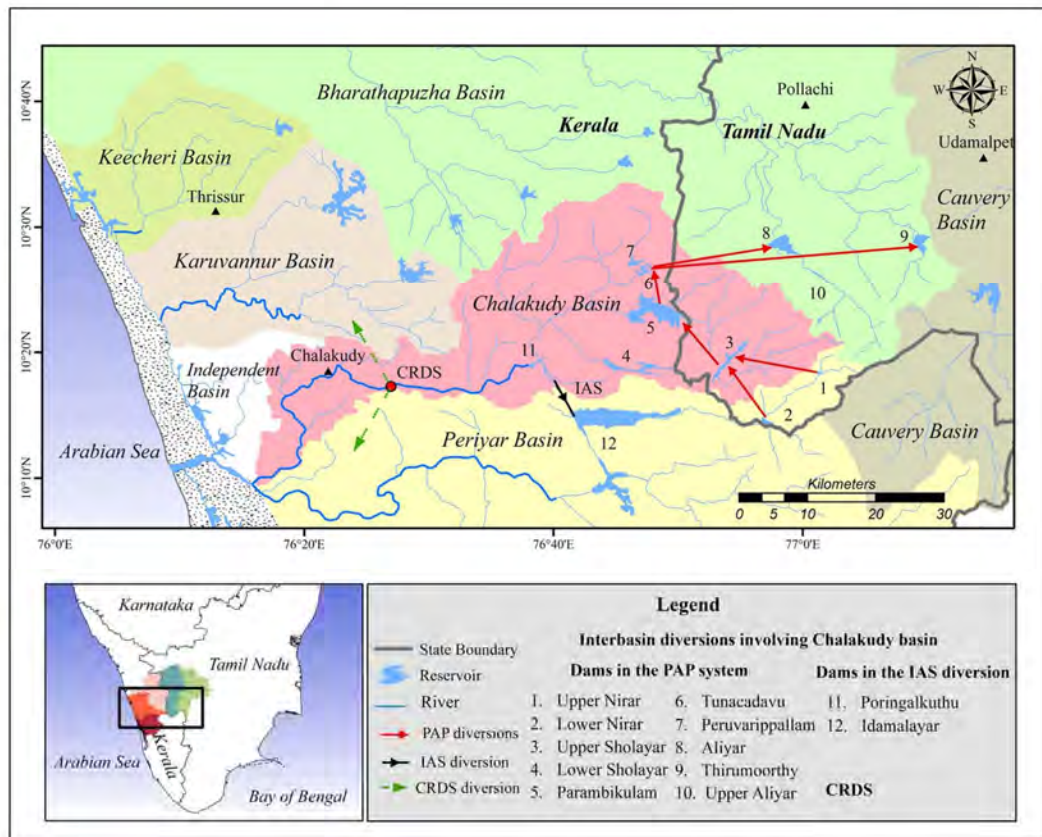


Fig. 4.2 Neighbouring basins and projects operational in the Chalakudy basin

According to the Köppen world climate classification system, Chalakudy river basin lies in the Tropical Monsoon Climate ('Am'). The basin is characterised by an average annual rainfall of 3250 mm from heavy Southwest monsoon during June-September contributing more than 70 per cent of annual rainfall, shorter Northeast monsoon during October- November, hot summers during March-May with pre-monsoon showers and a mild winter during December- February with minimum rainfall activity. There is high heterogeneity in the spatial distribution of rainfall in the basin. The average annual rainfall varies from 1400 to 4600 mm in various parts of the basin (Madhusoodhanan, 2009).

The underlying rock formations in the Chalakudy river basin consists of crystalline rocks of Achaean - Pre Cambrian age such as charanockite, biotite gneiss, hornblende gneiss and migmatitic gneisses (CESS, 2003). The soils of the river basin

are in the highly drained category and have high infiltration rates. The soil thickness in the southern region especially on the high hills is shallow and often with exposed rocks. The foothills and the northwestern region have deep soils (>10 m) of loam to silty loam texture. The characteristic soil type of the upper part of the basin is forest loam, though certain parts are covered by alluvial and lateritic soil. Very deep and well drained loamy soils describe the northeastern part of the basin while alluvial soil is mainly confined to the western part of the basin, where the stream takes meandering courses through the sandy alluvial flood plain (GoK, 2007).

#### **4.2.2 Ecological significance and land use**

The Chalakudy river basin is part of the larger Anamalai Landscape which has been recommended as a World Heritage site under UNESCO (UNESCO, 2012). The upper reaches of the basin in the Anamalai hills is defined by various protected territories which includes the Indira Gandhi National Park, the Parambikulam Tiger Reserve and the Anamalai Elephant Reserve. The basin has been attributed high ecological sensitivity and conservation value due to its rich and unique biodiversity in the highlands and foothills which includes highly endemic and critically endangered fish fauna, bird fauna with 75 per cent of the endemic species of the Western Ghats making it a globally Important Bird Area and low elevation riparian ecosystem unique to the Western Ghats (WGEEP, 2011).

The basin encompasses an area of 1704 sq.km which is spread over diverse agro-ecological zones from highland forests to lowland coastal belt with varied land use patterns (GoK, 1974). Out of the total area of Chalakudy river basin, about 54 per cent of the area is found to be under forest, 12 per cent under forest plantations such as teak, eucalyptus and several other softwood species and 14 per cent under agricultural plantations such as tea, coffee and cardamom on leased forest land and 16 per cent under homesteads with mixed tree crops and paddy lands (Fig. 4.3). Seasonal and perennial crops are often found in diverse combinations all along the mid and lowland stretches of the basin (Chattopadhyay *et al.*, 2005). Studies further indicate that there has been a drastic reduction in paddy lands in the basin from 21 per cent of the total agricultural lands during 1965 to merely 4 per cent by 1997 whereas area under settlements with mixed tree crops increased from 35 per cent to 44 per cent (Chattopadhyay, 2003; Padmalal *et al.*, 2004). Rising demand for other basin

resources of sand, stone and clay in the construction and allied sectors have led to unabated consumption of these resources that has resulted in near closure conditions in their availability and public protests against their abstraction.

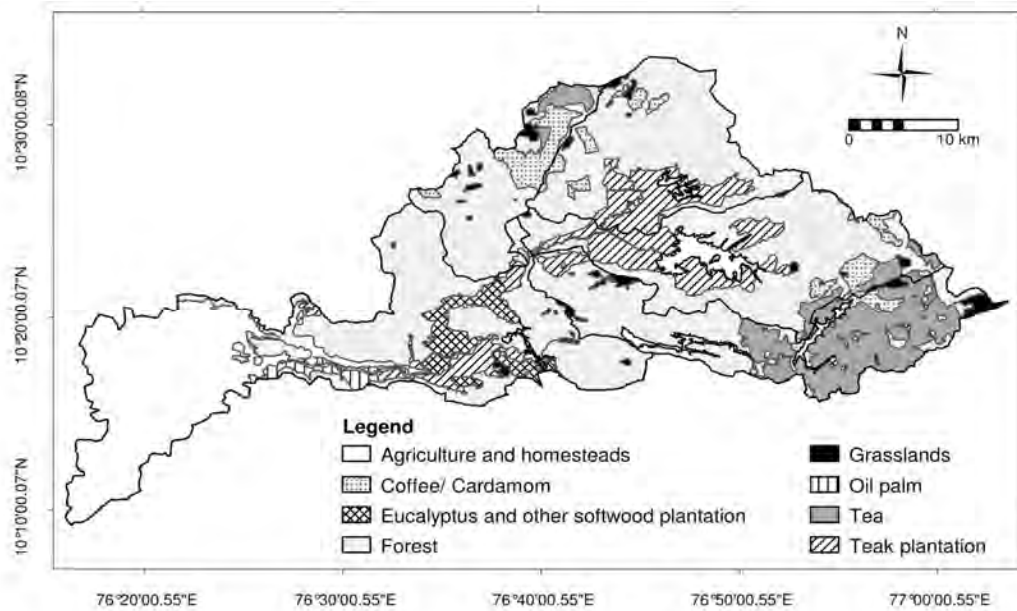


Fig. 4.3 Land use map of the Chalakudy river basin (2009)

#### 4.2.3 Population dependence and occupation demographics

The human population dependent on Chalakudy river has increased from 6.2 lakhs in 1971 to more than 11 lakh people by 2001 of which 8.8 lakh reside within the basin (GoI, 2001; Chattopadhyay, 2003). The population density widely varies from the highlands of the basin to the lowlands and coastal reaches. The average densities of population according to 2001 Census were found to be 125, 1160 and 2018 persons/km<sup>2</sup> in the highlands, midlands and lowlands respectively. Of the total population in the basin, 37 per cent constituted the total working population in 2001. The proportion of cultivators and agricultural labourers were at 6 per cent and 8 per cent respectively in the Chalakudy river basin according to the 2001 Census figures which was found comparable to the state trends (Table 4.1). The plantation, forest and fisheries sector is found to be a prominent presence in the basin taking up a sizable share (24 %) of the main workforce. The share of women in the activity (32 %) is especially found to be higher than that of women engaged in this category of work at the state levels.

Table 4.1 Occupational distribution of main worker categories- A comparison (1991 – 2001)

Work Category	Total main workers – 1991 (%)						Total main workers - 2001(%)					
	Kerala			Basin			Kerala			Basin		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Work Participation Rate	28.5	44.8	12.8	36.4	50.4	22.8	32.3	50.2	15.4	36.9	54.1	20.4
Cultivators	12.2	14.2	5.6	9.3	11.7	3.7	7.1	8.0	4.0	6.1	7.0	3.3
Agricultural labourers	25.5	22.4	36.1	17.0	14.6	22.8	12.4	11.1	17.3	7.7	6.9	10.0
Livestock, forestry, plantations, fisheries	9.2	10.1	6.2	21.5	19.1	27.2	12.9	13.3	11.3	23.7	20.8	32.0
Mining & quarrying	1.0	1.1	0.7	1.3	1.5	1.0	0.9	1.0	0.7	1.4	1.5	1.0
<b>Primary Sector</b>	<b>48.0</b>	<b>47.8</b>	<b>48.6</b>	<b>49.1</b>	<b>46.8</b>	<b>54.7</b>	<b>33.3</b>	<b>33.3</b>	<b>33.3</b>	<b>38.8</b>	<b>36.3</b>	<b>46.2</b>
Household industries	2.6	1.6	5.9	3.4	1.5	7.9	3.3	2.5	6.3	3.8	2.6	7.4
Non- household industries	11.6	10.7	14.8	15.2	14.7	16.4	12.8	11.2	18.6	13.9	13.4	15.1
Constructions	4.0	4.9	0.9	4.7	6.3	0.9	9.3	11.1	2.6	9.1	11.5	2.1
<b>Secondary Sector</b>	<b>18.2</b>	<b>17.1</b>	<b>21.6</b>	<b>23.3</b>	<b>22.5</b>	<b>25.2</b>	<b>25.4</b>	<b>24.8</b>	<b>27.5</b>	<b>26.8</b>	<b>27.5</b>	<b>24.6</b>
Trade & commerce	12.6	15.0	4.6	10.5	13.8	2.7	14.9	17.6	5.2	12.4	15.6	3.1
Transport, storage & communications	6.0	7.3	1.5	5.4	7.2	1.0	9.2	11.1	2.1	7.8	9.9	1.5
Other services	15.2	12.7	23.7	11.6	9.6	16.5	17.2	13.1	31.9	14.3	10.8	24.5
<b>Tertiary Sector</b>	<b>33.8</b>	<b>35.0</b>	<b>29.7</b>	<b>27.5</b>	<b>30.7</b>	<b>20.1</b>	<b>41.3</b>	<b>41.9</b>	<b>39.2</b>	<b>34.4</b>	<b>36.2</b>	<b>29.2</b>
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Census of India, 1991 and 2001

The proportion of main workers engaged in the secondary sector in the basin has always been more than the proportion engaged in it at the state level. Twenty five per cent women and 28 per cent men main workers were engaged in the secondary sector in the basin in 2001 while the tertiary sector was seen to employ 29 and 36 per cent women and men main workers respectively. It can be observed that the secondary and tertiary sectors together account for the highest proportion of the main working population of the basin in 2001. These sectors are found to slowly gain in prominence and prevalence in the basin as is amply clear from the percentage annual growth rate figures presented in Table 4.2.

Table 4.2 Annual growth rate of main occupation categories (1991- 2001)

NIC	Kerala			Basin		
	Male	Female	Total	Male	Female	Total
Cultivators	-4.3	-3.3	-4.2	-3.8	-2.8	-3.7
Agricultural labourers	-5.0	-5.5	-5.2	-5.2	-6.4	-5.7
Livestock, forestry, fishing, plantations, orchards and allied activities	3.2	6.8	3.8	1.2	-0.3	0.6
Mining & quarrying	-0.8	-1.0	-0.8	0.6	-2.0	0.1
<b>Primary Sector</b>	<b>-3.0</b>	<b>-3.6</b>	<b>-3.1</b>	<b>-2.1</b>	<b>-3.1</b>	<b>-2.4</b>
Household industries	5.9	0.0	2.8	8.1	-2.3	0.9
Other than household industries	0.0	1.5	0.5	-0.7	-2.4	-1.2
Constructions	12.9	16.0	13.0	8.8	9.6	8.8
<b>Secondary Sector</b>	<b>4.3</b>	<b>1.7</b>	<b>3.6</b>	<b>2.5</b>	<b>-2.0</b>	<b>1.1</b>
Trade and commerce	1.8	0.5	1.7	1.5	-0.4	1.4
Transport, storage and communications	5.3	2.8	5.2	4.1	2.6	4.0
Other services	9.7	-5.5	8.0	1.5	2.2	1.8
<b>Tertiary Sector</b>	<b>4.6</b>	<b>-4.9</b>	<b>4.6</b>	<b>2.1</b>	<b>1.9</b>	<b>2.1</b>

Source: Census of India, 1991 and 2001

### 4.3 Trajectory of resource use in the Chalakudy river basin

As in the case of other rivers draining the western slopes of Kerala, the direct human use of water from the Chalakudy river was minimal until the beginning of the 20<sup>th</sup> century. The domestic water needs in this river basin was almost completely met from wells and ponds or tanks. People near the riverbanks used the river directly for their daily needs. There was no public water supply for domestic uses until 1970s in the

river basin. Agriculture was the mainstay of the people and paddy was the main crop. Homesteads were surrounded by mixed trees viz. coconut, banana, mango, jackfruit etc. Agriculture was tuned to the rainfall season and harnessing of locally available water resources such as ponds or by constructing '*chiras*' (earthen bunds) across streams (Menon, 1911). The major share of agricultural lands was rainfed. There were negligible human or animal powered lifts from the river. The topography also restricted the direct withdrawal of water from the Chalakudy river due to the elevated banks in the downstream stretches (Ward and Connor, 1821). Another major use of the river was for inland navigation (Ibrahim, 1978).

Large scale river water abstractions started in the basin following the post World War II food crisis and the subsequent Grow More Food campaign during the latter half of the 20<sup>th</sup> century. The lift irrigation (LI) schemes in the Chalakudy river are among the first of their kind in the whole of Kerala (Menon, 2008). By the end of 1957, there were 14 major lift irrigation schemes operating from this river (GoK, 1958). In 1947, a major irrigation project called Chalakudy River Diversion Scheme (CRDS) with an ayacut of 14,000 ha was commissioned. The adjacent river basins of Karuvannur and Periyar also received water for agriculture and other needs through CRDS canals. The first major dam in the river, Poringalkuthu, was also commissioned in 1957 for power generation. In the 1970s, Chalakudy river basin became a part of the inter-state, inter-basin Parambikulam-Aliyar Project (PAP) Agreement and five more dams were constructed in the highlands of the basin in the Parambikulam and Sholayar subbasins. After the implementation of PAP, a large quantum of water was diverted from the basin into the eastern plains of Tamil Nadu, which led to operational difficulties in the previously constructed downstream projects due to reduced water availability. In 1997, Idamalayar Augmentation Scheme (IAS) was commissioned to divert water from the Poringalkuthu reservoir during the monsoon season to the Periyar basin for power generation. About 685 Mm<sup>3</sup> of water is being annually diverted from Chalakudy river to adjacent river basins through the two projects of PAP and IAS. The first drinking water supply scheme from this river was commissioned in 1975 in Meloor panchayath in the midlands of the basin. The river is at present the main source of irrigation and drinking water needs in the downstream areas. Apart from CRDS, there are numerous major water pumping stations (>25HP) under different departments viz. Minor Irrigation Department (MID), Kerala Water



Authority (KWA) and Local Self Governments (LSGs). Further, there are numerous small lift irrigation pumps operated by individual landholders who draw water directly from the river. A few industrial units located downstream are also directly pumping water from the river for meeting their requirements and simultaneously using the river as convenient sinks for waste disposal that has heavily polluted the downstream river water flow and groundwater reserves (Dwivedi, 2011). In 1998, barely 50 years since the organised development of water resources of the basin, a permanent regulator was commissioned downstream of the river at Kanakkankadvu to control the growing saline water ingress that was the inevitable result of the heavy water diversions and abstractions upstream. Chalakudy river is now one of the most heavily developed and utilized rivers in Kerala (Madhusoodhanan, 2009). The multiple water transfers in the basin and the resultant downstream scarcity and pollution has led to numerous water conflicts at various scales. These resource conflicts, planning of further water infrastructure projects and the threatened ecological significance of the area has initiated efforts at river basin level management of Chalakudy river basin both at the governmental and non-governmental levels.

#### **4.4 Closure**

The various inter-basin diversions, institutional arrangements, administrative units and livelihood transformations described in the chapter have expanded the boundaries of concern of the Chalakudy basin while contemplating the basin as a management unit. The next chapter proceeds to unpack the basin as a socio-ecological unit bringing in these multiple boundary considerations and dependences.

## **Chapter 5**

### **Delineation and characterisation of the river basin: Inclusive basin considerations in River Basin Management**

#### **5.1 Introduction**

The delineation and characterisation of the Chalakudy river basin and its classification into various agro-ecological zones are presented in this chapter which would address the research question on exclusivity of river basin boundaries. The delineation process for the demarcation of the study area and the identification of the representative sites for survey unearthed various issues and ambiguities related to the identity and boundaries of a river basin as a management and governance unit in contrast to the lucid boundaries of the natural hydrographic unit of the basin. The chapter proceeds to discuss the challenges of adapting a natural unit as a unit of governance in the light of these boundary issues and establishes the need for elaboration of the socio-economic identity of a river basin from a livelihood and resource use perspective.

The river basin has been identified as a natural and lucid unit for resource management in the context of international responsibility in environmental sustainability and stakeholder participation since the Dublin Statement on Water and Sustainable Development in 1992 (GWP, 2000). The experiences from the implementation of Integrated Water Resources Management (IWRM) and Integrated River Basin Management (IRBM) worldwide including in the developing countries, with river basin as the unit of management, have led to various contestations

regarding this seemingly technical and precise unit and its boundaries. The boundaries of a river basin especially have been critiqued widely from various standpoints. Some of the major contentions are based on the various issues in delineation of the basin boundary that range from hydrological ambiguities to managerial conveniences and the synthetic extensions brought in by inter-basin water transfers (IBWT) (Allan, 2006; Gupta and van der Zaag, 2008; Molle, 2009b). These criticisms have led to serious reflections and reconsiderations as to the fit of river basins and strict hydrological boundaries from a management perspective (Moss, 2004; 2012; Warner *et al.*, 2008; Ferreyra *et al.*, 2008; Venot *et al.*, 2011; Vogel, 2012) and outright rejection of it by others (Biswas, 2004; Shah and van Koppen, 2006; Graefe, 2011).

## **5.2 Delineation of Chalakudy River Basin: discerning and defining multiple boundaries**

The delineation of Chalakudy river basin from a management perspective gives rise to the recognition and later demarcation of various boundaries and its extents over and beyond the hydrological boundary. These multiple boundaries of a river basin reveal the vast range of complexities that emerge when the ‘technical tool’ of river basin is adapted as a governance framework (Cohen and Davidson, 2011). These boundaries may range across international to the regional and local scales and is affected by environmental, social, legal, and economic realities of resource use of a region (Jarvis, 2006). The delineation of these boundaries and the extended regions and networks that they encompass would bring to focus the challenges in basin level natural resource management especially in linked river basins.

The delineation of Chalakudy river basin for the present study started with a survey of published literature on the river basin and its perceived boundaries by various scholars and institutions. The various facets of the river basin such as its hydrology and water use, geomorphology, landscape ecology, bio-diversity and socio-economic aspects had been studied in the past. As a part of the various infrastructure projects in the basin, several technical reports such as DPRs and their EIAs were also available. The first assessment of ‘Water Resources of Kerala’ delineated the basin area to be 1388 sq.km of which 375 sq.km in the upper reaches is in Coimbatore district of Tamil Nadu and the remaining 1013 sq.km is in Kerala (GoK, 1958). Later revision of this report estimated the area to be 1704 sq.km of which 300 sq.km is in

Tamil Nadu and the rest 1404 sq.km is in Kerala (GoK, 1974). This enhancement in basin area is found to be due to affixing an independent drainage area and the coastal tracts as a part of Chalakudy river basin. This enhanced area of 1704 sq. km. is officially regarded as the basin area of Chalakudy river basin at present. On the other hand, the Kerala State Land Use Board in its Watershed Atlas prepared to bring in uniformity in watershed delineation for watershed management and development programmes in the state, projected the Chalakudy river basin area as 1118 sq.km (KSLUB, 1995). This difference is due to ignoring the independent drainage area and coastal tracts and disregarding the basin area that falls in the state of Tamil Nadu. Chattopadhyaya (2003), in a study of the landscape change and socioeconomic aspects of the basin, reported the basin area to be 2000 sq.km. This delineation was based on compilation of data at the lowest level of administrative units, which also included the beneficiary panchayats of the CRDS in the adjoining basins but disregarded the Tamil Nadu portion of the basin. In the same study, the hydrological area has been reported as 1525 sq.km while other scientific studies on the basin (Padmalal *et al.*, 2004; Madhusoodhanan, 2009; Amitha Bachan, 2010), stated the basin area to be 1448, 1447 and 1484 sq.km respectively. The variations even between these hydrologically delineated areas were due to individual choices in demarcating the unclear boundaries in the flood plains. The deviation in basin area in the various studies and reports (Table 5.1) reveals the existence of multitude of boundaries that offer varied boundary choices while considering the river basin as a management unit at the field level.

Table 5.1 Comparison of basin areas reported in various studies

Source	Area (sq.km)
Water Resources of Kerala 1958 (GoK, 1958)	1388
Water Resources of Kerala 1974 (GoK, 1974)	1704
Watershed Atlas (KSLUB, 1995)	1118
Chattopadhyaya, 2003	2000
Chattopadhyaya, 2003	1525
Padmalal <i>et al.</i> , 2004	1448
Madhusoodhanan, 2009	1447
Amitha Bachan, 2010	1484

### **5.2.1 Ambiguities in hydrological boundary delineations**

The physical boundaries of a river basin are defined by the land area between the source and the mouth of a river including all of the lands that drain into it (Ramsar, 1999). The hydrological boundary is usually decided by the flow of water above the ground. This boundary is normally distinct, easily mapped and seldom is there a gap between adjacent basins (Barrow, 1998). Understanding the hydrological extent of the basin and determining its physical boundaries involve tracing of the ridgelines of the watershed of streams and tributaries that join the river in its various stretches. The total catchment area of the Chalakudy basin thus delineated amounts to 1447 sq.km. The basin area can be further subdivided into subbasins by tributaries and into sub and micro watersheds by first or higher order streams. The sub basins of Chalakudy basin are identified as Sholayar, Parambikulam, Kuriyarkutty and Karappara with respective areas of 256, 287, 233 and 132 sq.km (Fig. 5.1). The remaining 539 sq.km area of the basin is lying after the confluence of these major tributaries. The hydrological basin is delimited to the confluence of the Chalakudy river with the Periyar river after which the combined river flows for a short distance through the coastal tract, where several short streams join it, before draining into the Arabian Sea. The coastal tract beyond the hydrological boundary of the Chalakudy basin is a continuous chain of lagoons or backwaters along the coast that are connected to one another by both natural and artificial canals which makes its delineation into any particular basin impossible. Another point of divergence in the hydrological basin area amongst various studies is the drainage from the floodplains between the two rivers of Chalakudy and Periyar which follows varied drainage paths making it difficult to draw definite boundaries in the lowland tracts.

In the Chalakudy river basin, groundwater is observed to be the major source of domestic water consumption. It is also a significant contributor to the irrigation requirements in the basin. This is largely found to be in the informal and unorganised sector, the ownership of which is related to land ownership and the boundaries at operational level are the boundaries of property. In the upper reaches of the basin, springs are the major sources of domestic water requirement while in the mid and lower reaches open dug wells depending on shallow groundwater flow systems are prevalent. There are 62,397 wells used for domestic purpose in the basin of which 19,892 were found to be dry during summer (KSLUB, 2001a). The downstream

summer requirements are mainly met from the groundwater storage zone and return flows from the irrigation canals since there is meager flow in the river during the non-monsoon period due to the considerable diversions upstream. The groundwater resources of the highly populated coastal tract beyond the hydrological boundary of the Chalakudy basin is already notified as ‘overexploited’ due to intense groundwater extraction (CGWB, 2007). Such over extraction coupled with extensive river and coastal sand mining and reduced river flow due to diversions has aggravated the saline intrusion into the river as far as 20 km upstream resulting in far reaching implications for resource management (WGEEP, 2011). The delineation of groundwater basin boundaries is especially important for India, which is the world’s largest user of groundwater (World Bank, 2011). Even though the importance of groundwater in the basin water use scenario makes it imperative to understand and demarcate the groundwater boundaries distinct from the surface watershed boundaries, such a delineation has not been attempted for the Chalakudy basin as thorough groundwater basin evaluation can only be accomplished through long-term accumulation, integration and evaluation of groundwater data which is nonexistent for the basin.

Asymmetries between the surface and groundwater boundaries mainly in the lower reaches and drainage ambiguities in the coastal regions and flood plains have been reported in many river basins across the world (Winter *et al.*, 2003; WFD, 2005; Molle and Wester, 2009). These regions in the lower end of the basins, receive groundwater inflow from shallow and deep flow systems that extend far beyond their surface watershed. Groundwater watersheds are not as easily defined as surface watersheds because they are not observable from land surface and the boundaries may move in response to dynamic recharge and discharge conditions. These peculiarities of invisibility and fluidity of boundaries make the coastal regions and floodplains of any basin difficult to delineate and the management and governance of groundwater resources extremely challenging and increasingly conflictive (Winter *et al.*, 2003). As Jarvis (2006) had remarked, very few river basin treaties and agreements and river basin organisations address these coastal aquifer systems which serve as the water supplies to densely populated coastal stretches or recognise the boundaries of the resource or user domains. Incorporating these coastal regions in the management unit of the basin is extremely relevant for India which has a large coastal tract of about 6000 km. Due to impossibility of strict hydrological delineation of the coastal tracts,

the selection of regions to be included finally becomes a political and managerial undertaking, which is evident in the Chalakudy river basin in the inclusion of coastal panchayats and in the affixing of the independent drainage areas as a part of the basin for the convenience of management.

### **5.2.2 Crosscutting boundaries of other emergent units of environmental governance**

The river basin is a part of a larger biophysical system with the various stretches of a basin falling into different ecoregions having heterogeneous biophysical characteristics and diverse resource endowments. These ecoregions and their boundaries extend beyond and cut across hydrological boundaries (Omernik and Bailey, 1997) and provide the limits of resource potential in various stretches of the river basin. The hydrological boundary of the Chalakudy basin is seen to be dissected by the various ecosystem boundary delineations of the larger biophysical complex of the Western Ghats. For example, the basin was delineated into seven agroecological zones as part of the study, viz. the High hills, Highland plateaus, Foothills, Midlands, Lowlands, Wetlands and Coastal plains whose boundaries were differentiated based on the bioclimatic characteristics and land use (Fig.5.1). The upper reaches of the basin in the Sholayar and Karappara subbasins are found to lie in the High Hills zone while the Parambikulam and Kuriyarkutty subbasins are in the Highland plateaus zone. The main river and its basin area are found to stretch out in the Foothills zone consisting of undulating low hills, Midland zone comprising of undulating lands intervened with narrow valleys and Lowland zone characterised by low-lying paddy lands interweaving isolated hilltops. The river after confluence with Periyar river flows through the Coastal zone comprising of low lying areas such as estuaries, backwaters and marshes and sandy beaches, plains and coastal laterites (Table 5.2)

Table 5.2 Agro-ecological zones and share of inclusive basin area

AEZ	Share of land area (%)
High hills	28
Highland plateau	15
Foothills	16
Midlands	10
Lowlands	18
Coastal lands	13
<b>Total</b>	<b>100</b>

The growing concern over rampant destruction of the unique ecosystems and threatened biodiversity of the Western Ghats has stimulated various recommendations for environmental management at natural scales of governance, other than the river basin. Based on the agro-ecological classification for the state of Kerala, NBSS&LUP has suggested agro-ecological zone based planning of natural resources with the AEZ as the planning unit (Nair *et al.*, 2011). The Western Ghats Ecology Expert Panel has recommended various ecologically sensitive zones in the Western Ghats which are to be managed within a new institutional mechanism of a Western Ghats Ecology Authority (WGEEP, 2011). These units for ecological governance need not coincide strictly with the basin boundaries and form additional boundary considerations within a river basin as a management unit. These emergent spaces provide the opportunities for decentralised but nested systems of management that takes into consideration the differential capabilities and sensitivities for development and management within a single river basin. The challenge is of creatively integrating institutional mechanisms within shared boundaries of nascent systems of environmental governance such as river basins and ecosystem units to avoid redundant and/ or conflicting management efforts.

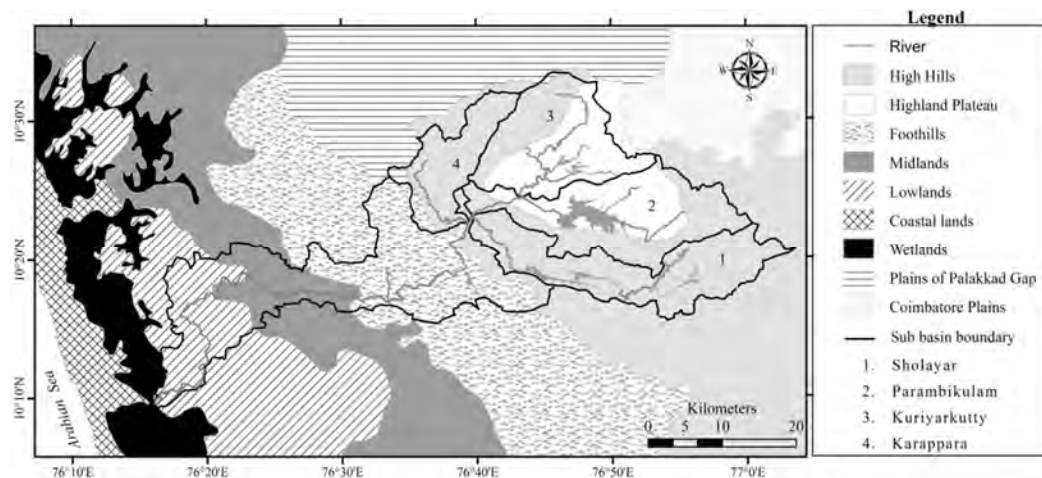


Fig. 5.1 Agro-ecological zones and sub-basins of Chalakudy river basin

### 5.2.3 Transboundary spaces of physical boundary extensions

There are three major river diversion projects in the Chalakudy basin which connects the basin to the west-flowing Bharathapuzha, Karuvannur and Periyar basins and the southern portions of the east flowing Cauvery basin (Fig.5.2). The largest of these diversions is the interstate multi-basin multi-purpose Parambikulam - Aliyar Project



(PAP) which diverts on an average 944 Mm<sup>3</sup> of water annually to the eastern plains of Tamil Nadu for power generation and irrigation of which 445 Mm<sup>3</sup> (47%) is diverted from the upper reaches of the Chalakudy river alone. The project was intended to irrigate 97,128 ha of new ayacut in Tamil Nadu in the Aliyar and Palar sub-basins of Bharathapuzha basin and the Amaravathi sub-basin of Cauvery basin along with 185 MW of power generation and also to stabilise old ayacuts in Kerala and Tamil Nadu. The project presently irrigates 1,73,254 ha spread across 185 village panchayats in the Pollachi taluk of Coimbatore district and Udumalpet, Palladam, Madathukulam, Tirupur, Dharapuram and Kangeyam taluks of Tirupur district in Tamil Nadu. It also stabilises 8094 ha of old ayacut in the Chittur taluk of Kerala in the Bharathapuzha basin. The ratio of wet and dry crops in the PAP ayacut is now at 49:51 although it was originally conceived to be 20:80. The Project now generates 591 MW of power in Tamil Nadu from eight power stations and 54 MW of power from the Sholayar Hydro Electric Project in Kerala (Anon, 2003; Ravi *et al.*, 2004; GoTN, 2007a; GoTN, 2007b). The Idamalayar Augmentation Scheme (IAS), downstream of the PAP, diverts on an average 240 Mm<sup>3</sup> of water annually during the monsoon months from Poringalkuthu reservoir in the Chalakudy river basin to the Idamalayar reservoir in the Periyar river basin for additional power generation of 60 MU annually (KSEB, 2006) and for other downstream requirements through the Periyar Valley Irrigation Scheme. Further downstream, the Chalakudy River Diversion Scheme (CRDS) diverts about 250 Mm<sup>3</sup> of water annually during the post monsoon months for irrigating 14,000 ha in the mid and lowland plains benefitting 21 panchayats in the Thrissur and Ernakulam districts of Kerala in the three basins of Chalakudy, Karuvannur and Periyar (GoK, 1967; GoK, 1978). Major part of the ayacut area of the project lies outside the basin. More proposals are underway for water diversion in this river basin.

The presence of water diversions that has restructured river basins across the world has raised the issue of considering the altered scales of management in terms of the way it functions today rather than its 'natural' contours (Blomquist and Schlager, 2005; Graefe, 2011). Water transfer projects across basins and states add further layers to boundary extensions which ebbs and flows according to alterations in the command area of these diversion projects. It also raises pertinent questions of who and what decides the span of these boundaries and to what extent the recipient basin

population can be regarded as part of the donor basin community. It has been observed that many of the water diversion projects, despite scientific uncertainties, huge economic costs and potentially large environmental impacts are made possible through a nexus between engineers, politicians and financiers (Gupta and van der Zaag, 2008). In the Chalakudy river basin, it is evident that transboundary spaces due to water transfers and even their further expansions resulted out of a complexity of ecological, hydrological and political reasons. The diversion of west flowing rivers including Chalakudy through the PAP project to irrigate the dry lands in the eastern plains of Tamil Nadu, even though driven by engineering solutions to remedy ecological differences in resource endowments, was deeply mediated by power politics. This was evident in the terms and conditions of the agreement, the choice of basins involved, quantity of water diverted and command area covered (Ravi *et al.*, 2004). It has also been reported that the then Central Government had made consent to the PAP by Kerala a pre-condition for sanctioning many development projects of the state at the time of negotiations for PAP way back in the late 1950s (GoK, 1994). Beyond the creation of these new transboundary spaces of water transfer, their further expansions are also found to be driven by the socio-political climate that can push through such demands. On the other hand, the formerly expanded transboundary limits of CRDS started shrinking after the implementation of PAP due to diversions upstream which reduced water availability downstream. The inadequacy in water supply in the canals of the project has resulted in the collapse of irrigation practices that existed prior to PAP in the donor basins in Kerala and has led to conflicts between farmers within these boundaries.

In the discussions over the inclusion of transboundary interest groups in river basin management, varied issues ranging from notions of justice to intricate power balances and politics of identities play out (Blomquist and Schlager, 2005; Pani, 2010). While Bates *et al.* (1993) argue strongly that everyone affected by or affecting a water resource should be included for the sake of fairness, whether located within the basin or not, it has been conversely pointed out that extending participation to all potentially affected communities may “provide arenas in which the interests of powerful, nonresident players often dominate the interests of small-scale local users” (Young, 2002). The ‘hydropolitical complex’ created in Southern Africa through multi basin water transfers, has been recognised as a region where conflicts or

cooperation over the shared resource plays out (Turton *et al.*, 2006). On similar lines, Kramer (2006) based on the case study of river basin management in Mexico, had referred to the connections between river basins through hydraulic infrastructure as 'hydropolitan region'. The 'hydropolitan' region is seen as an appropriate scale of evaluation given the complex hydrologic situation in the Mexico Valley as it takes into account the transfers of water in and out of the basin. Even though the Mexico Valley alone itself has proved to be too large an administrative region to work with successfully, the importance of recognising the interconnections of the basins is stressed as there is immense interdependence which if left unaccounted for could lead to grave problems in the future especially related to conflict resolution. The Colombia basin in North America has been reported to have stretched its boundaries to accommodate various people, places and interests that use and impact the river, from political jurisdictions that extend beyond the basin. This inclusive region acts together partially and strategically for shared gains though it continues to be an area of competing territories and jurisdictions (Vogel, 2012). The lack of such an inclusive understanding can lead to grave miscalculations and deliberate omissions in the planning of future projects in the basin. For instance, the Chalakudy river basin has not even been mentioned in the Karappara-Kuriyarkutty inter- basin multi-purpose project proposed by the Government of Kerala which intends to divert water from the head waters of Karappara and Kuriyarkutty tributaries of the Chalakudy river basin to the Bharathapuzha basin. The EIA for the project considers the impacted area as the recipient Bharathapuzha basin. The impact of diversion on the donor Chalakudy basin has not been included in the scope of the EIA study (KSEB, 1998). The reasons for such an omission can be traced to deficiency in the visualisation of multiple basin boundaries in the case of IBWT projects as well as to political exigencies to reduce the negative impacts of the project for the techno-economic and environmental clearance mechanisms. Therefore it becomes very important to delineate the transboundary spaces *i)* to understand the extend and impacts of resource transfers, *ii)* for planning of future projects in the donor basin, *iii)* to aid conflict resolution mechanisms and *iv)* to envision possibilities and scales of integrated management of resources in a linked basin in the entirety of its challenges. If the recipient basin is not part of the picture at all when integrated management of the donor basin is under consideration, it can heavily skew the modalities of resource use. Shared

responsibilities for resource conservation can only be initiated within such a framework.

#### **5.2.4 Political boundaries and entrenched spaces of power**

The administrative divisions of India compose of a nested hierarchy of subdivisions which include the states, districts, tehsils, blocks, panchayats, villages and urban local bodies such as municipalities and corporations. In the Indian context, the lowest administrative unit is the village though the lowest elected body with administrative powers is the gram panchayat subsequent to the implementation of the 74th Constitution Amendment Act of 1992. Even though the hydrological boundaries of a river basin cut through the various administrative and political boundaries, one will have to consider the lowest of the administrative units as a whole while delineating the basin administratively to avoid management difficulties entailed in considering parts of villages/ panchayats. The basin area in Tamil Nadu is part of the Coimbatore district encompassing one panchayat and one municipality. In the Kerala state, two panchayats of Palakkad district, seven panchayats and one municipality of the Thrissur district and six panchayats in the Ernakulam district have their administrative areas either fully or partly within the Chalakudy basin. In addition to these, 21 panchayats in the Thrissur and Ernakulam districts in the nearby basins of Karuvannur and Periyar respectively depend on the Chalakudy river for irrigation and domestic water through CRDS (Fig.5.2). The water diverted from Chalakudy river through IAS and PAP systems merge with waters from other basins involved in the transfer forming common beneficiary areas so that the dependency boundaries of these schemes become much more obscure.

The coastal region lying below the confluence of the Chalakudy river with the river Periyar, were administratively delineated by considering all those panchayats whose drainage void into the joined river or backwaters and those who depend on the Chalakudy river for their domestic water needs. An independent drainage area between north of Chalakudy and south of Karuvannur river basins which is too small to be considered as an independent management unit was also included as a part of Chalakudy river basin by the state of Kerala (GoK, 1974). Following these criteria, 14 panchayats in Thrissur and Ernakulam districts respectively were found to fall into the Chalakudy basin. The existing state and central institutions entrusted with the

management of the basin resources viz. water, land and electricity authorities, boards and commissions, departments of irrigation, agriculture, rural development, revenue, groundwater, forest, fisheries, mining and geology, function within these administrative divisions at various scales from the local to the national. The boundary of electoral constituencies is yet another political boundary that crosscuts the basin and even the administrative divisions. The Chalakudy basin is spread across 10 state legislative assembly and four parliamentary constituencies in the state of Kerala and one each in Tamil Nadu state.

The delineation of political boundaries provides the alignments and intersections of the basin and its dependent regions with the political and administrative institutions at various scales that need to be negotiated for basin management. These boundaries are also ultimately unstable as these will further divide or merge depending on the demographic, social and political changes in the region. For example, the number of districts in India increased from 356 to 593 between 1971 and 2001 (Kumar and Somanathan, 2009). A major portion of the PAP ayacut area in the dependent region of Chalakudy waters which was earlier part of the Coimbatore and Erode districts of Tamil Nadu, now falls in the newly formed Tirupur district. Such reconfigurations and multiple political boundary changes over time lead to difficulties in assessing temporal changes in resource use. The assessment of resource base and characterising the land, water, people and institutions of the basin forms the initial step in its integrated resources management (Hillman, 2006; Lankford *et al.*, 2007) which requires collection and integration of data at appropriate scales. One of the major hurdles in the management of river basins in developing countries like India has been pointed out to be the lack of reliable and sufficient baseline data on resource availability and use (Shah *et al.*, 2005). Though water availability data consisting of rainfall and river gauge data are available station wise, resource use data consisting of land use details published by the state land use boards and the source wise water use data from the economic survey reports have to be compiled from the lowest of the administrative levels for which they are published. In the Chalakudy river basin, the demographic data is available village-wise but land-use, water use and other basic secondary details regarding the basin area and resource use are available only at the panchayat level. Since the lowest unit of village/ panchayat/ ward cannot be disintegrated further, these will have to be considered as a

whole while collating the data for the basin. The dividing and merging of these administrative boundaries over time create additional difficulties in the analysis of spatial and temporal changes in the basin and its dependent regions. Boundary mismatch between river basins and conventional administrative units has led to difficulties in data collection and monitoring in various basins across the world (Cohen and Davidson, 2011). The central and state institutions that play decisive roles in the use and management of the basin resources function at the level of administrative divisions at various scales thus intersecting the basin boundaries. Moreover, boundary asymmetries between the river basins and conventional electoral constituencies at various scales of the national, state, municipal and local is perceived as a major challenge in ensuring the accountability of basin-scale decisions and allocation of plan funds. The ultimate loyalty and responsibility of the elected representatives were found to lie with the jurisdictions in which they were elected (Sneddon, 2002; Cohen and Davidson, 2011). In the Chalakudy river basin, it can be seen that many of the administrative and electoral divisions at various scales lie only partially within the basin boundaries which may create institutional operational difficulties and conflicts. These boundary disparities can be further complicated by policy overlaps between the different scales leading to multiple policy clashes and fragmented and uncoordinated implementation both within and beyond the basin (Schlager and Blomquist, 2000; Ferreyra and Beard, 2007; Harsha, 2012). Kramer (2006) had noted in the case of Mexico that even though river basin boundaries had been recognised, the government activities and investments were still based on and limited by political jurisdictions. Even while river basins are resorted to as a means of overcoming the political divisions in natural resource management, often the hydrological boundaries of the basin get truncated by the political boundaries of the state or the nation which sometimes leads to hydrological misrepresentations. The extent to which the strength of political boundaries can distort the concept of a river basin can be seen in the creation of a separate imaginary 'PAP Basin' while delineating the river basins in Tamil Nadu, by integrating the upper reaches of the three west flowing river basins of the Periyar, Chalakudy and Bharathapuzha, lying within Tamil Nadu which are involved in the PAP (GoTN, 2012). Hence in interstate and linked river basins, overcoming the superior influence and domination of the political boundaries can be the most extremely challenging aspect of integrated basin management.

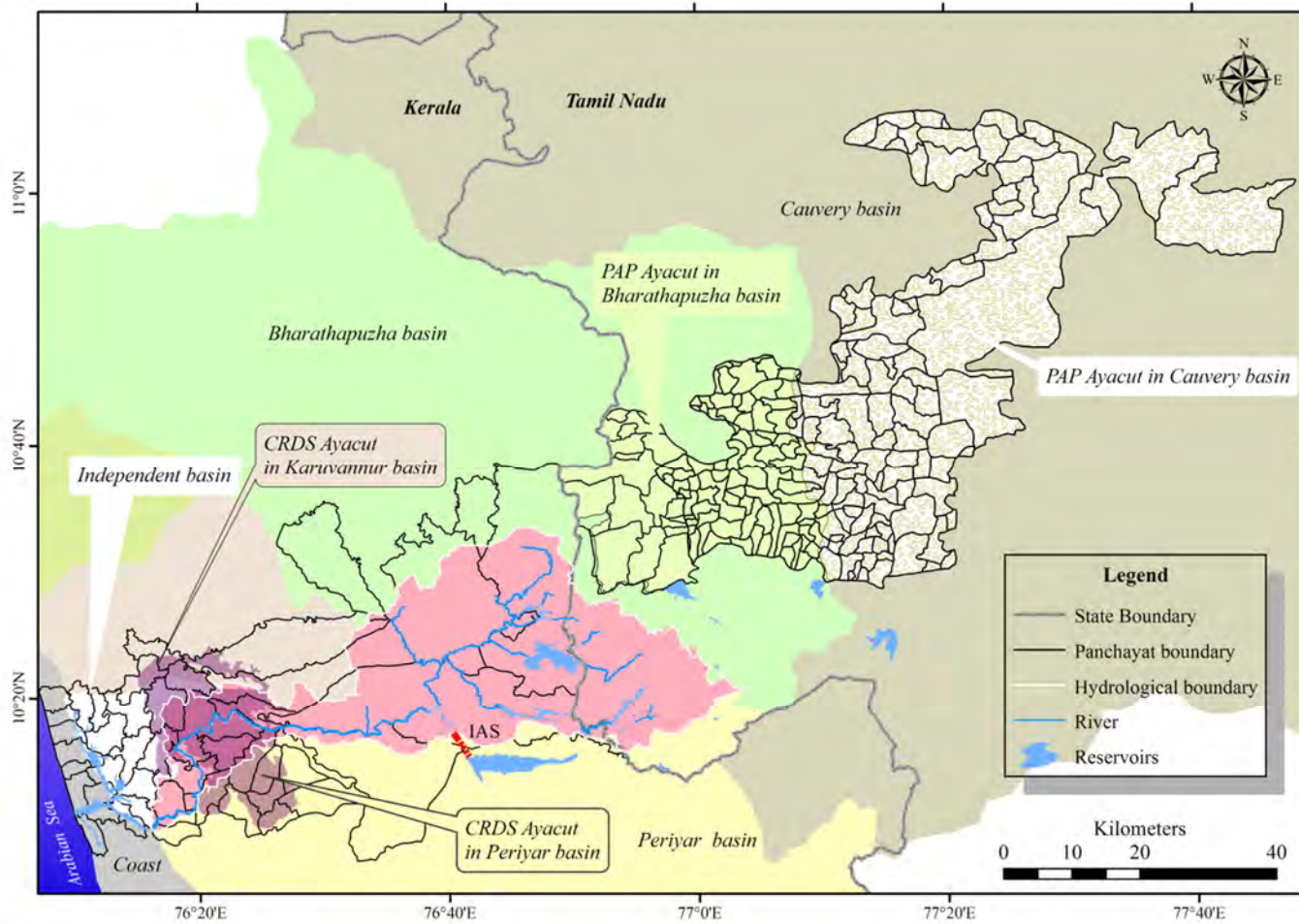


Fig. 5.2 Transboundaries and political extents of the inclusive Chalakudy basin

### **5.2.5 Permeable boundaries and dynamic spaces of social networks**

While river basins are fundamentally material units of measure, social systems of organisation rely much more heavily on shared expectations of behaviour that are not always so easily observable (Barham, 2001). The resource relations in a society therefore tend to get expressed through a proliferation of various interests groups which may act beyond the basin boundaries (Molle, 2007; Mollinga *et al.*, 2007; Ferreyra *et al.*, 2008). In the case of Chalakudy river basin, various communities of interests linked to resource use and management can be identified which operate within complex power hierarchies and are often overlapping or competing networks of actors. In the highlands, the plantation sector consisting of the planters and labourers, various tribal groups, state departments related to forests and development of water resources and the joint forest management committees form the major interests groups with varied stakes in the forest related resources and their management. In the plains of the basin and the extended resource dependent regions in both the states of Kerala and Tamil Nadu, different water user groups were identified. Apart from PAP and CRDS beneficiary groups, there are numerous major and minor lift irrigation beneficiary groups under various departmental schemes, industrial units and organised and unorganised domestic water users. Resource relations are also influenced by various political groups, NGOs, farmer groups, merchant and industrial groups, religious and caste associations, labour unions, self help groups and the interplay of various state and local level institutions.

The socio-economic boundaries of a river basin get permeated by the livelihood decisions of the people inhabiting the basin. One of the major assumptions of IRBM in the developing countries is that the livelihood and resource use revolves around agriculture. Shifts in livelihood from agriculture, which is the major user of water and land in any basin, is to be properly understood and analysed in order to incorporate the agency of the basin people in the management of the basin resources. The resource networks forged by these emergent non agrarian sectors help to define the river basin beyond the hydrological confines. The river basin as a proposed unit for resource management is yet to capture these dynamics of social realities which decide and drive the resource interactions and therefore the river basin as a 'space of engagement' (Venot *et al.*, 2011). The human spaces evolve through the dynamics of power relations, cultural and socioeconomic processes that link the locality of the



basin to the surrounding regions, to the state, the national and international spaces. These interest groups function at various geographic and power scales with permeable and dynamic boundaries both within and beyond basin boundaries. Conflicts and convergence of interests in resource use, planning and management can emerge between and within these groups which are largely issue based (Moench *et al.*, 2003). Though major resource planning operates at the higher institutional levels of the nation and the state, resource use, degradation and its impacts directly affect the institutions and interest groups that operate at the lower level of the spectrum. In the Chalakudy river basin, various instances can be seen of such issue based conflict and convergence of interest groups. The proposals for a hydro electric power project initiated by the state institutions and approved by the Centre and a cement factory proposal by a private sector undertaking met with stiff resistance and were rejected by local self government institutions and various communities of interests in the basin and the downstream dependent regions. The processes involved moved beyond the boundaries of the basin to rigorous and continuous public discussions, debates, employment of legal apparatus and conflict with institutional interest groups of the state. Such issue based convergence of interest groups across multiple scales in the basin, dependent regions and even beyond have significant influence on basin level resource use, planning and management.

Case studies from basins in Canada, Nepal and South India reveal that resource uses and user perspectives are shaped by considerations that have little relevance for the entire basin. Instead they are related to location specific issues such as groundwater pumping, agricultural and industrial pollution problems etc. Proposals for IWRM at the basin level were found to rarely match the sociopolitical and physical realities of resource management encountered in the field (Moench *et al.*, 2003; Ferreyra *et al.*, 2008). On the other hand, Pani (2010) cautions that conflicts that are generated amongst these diverse interest groups over the shared resource of water can foster a politics of identities. These potential spaces of resource management and conflicts are embedded in an ongoing process of rapid social and economic transformation. This is especially true in the case of Chalakudy basin where livelihoods are undergoing rapid diversification with concomitant changes in the resource use spaces, patterns and linkages. Resource management strategies therefore will have to capture and creatively respond to these emerging social realities of

resource use established along permeable and dynamic boundaries of multiple livelihood and social networks.

### 5.3 Inclusive basin: Governance challenge of working across multiple boundaries

The multiple boundaries that were discerned in the Chalakudy basin, portray the river basin as a dynamic and negotiable unit which can encompass the drainage ambiguities in the floodplains and coasts, the socio-economic realities of resource transfers, dependences and power relations along its various stretches and the political and institutional scapes that shape it as a managerial unit. The overlapping geographies of a river basin and its dependent regions encompassed by the multilayered boundaries of resource interactions and power relations has been coined as the ‘inclusive basin’. These inclusive spaces in the case of Chalakudy river basin are being represented graphically in Fig. 5.3 and the governance challenges in these multi-scalar spaces are discussed in detail below.

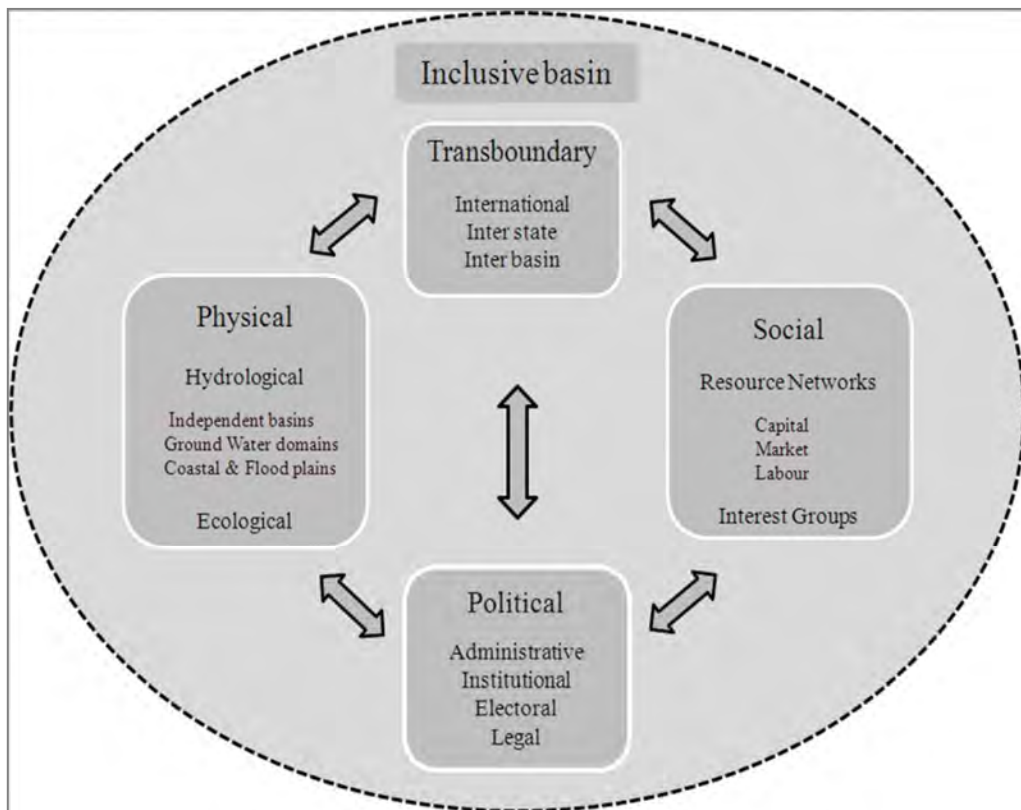


Fig. 5.3 Inclusive basin and the various boundary interactions

### **5.3.1 The scale politics of basin management**

The need for river basin level management had been thought unavoidable due to the highly fragmented nature of natural resource development and exploitation and the increasing nature of conflicts at various scales over the scarce resources. The recognition of natural limits to resource development and the rationale of respecting the flow paths of nature have been qualified with the belief that it is the very people who interact with these resources at the local level that have to be part of the process of its management. Such a conceptualisation of river basin management brings in what has been termed ‘the dilemma of scale incompatibility’ (Perry and Easter, 2004). River basin level authorities denote a new form of centralisation whereas stakeholder involvement and decision making at the ‘at the lowest appropriate level’ necessitates decentralisation. But, practical experience with river basin governance has shown that stakeholder participation is often translated into token consultation or domination of the existing institutional and power hierarchies in the process (Wester *et al.*, 2003; Waalewijn *et al.*, 2005; Sneddon and Fox, 2006; Swatuk and Motsholapheko, 2008). Even the experience with decentralised governance in natural resource management across the world since late 1990s have not contributed substantially to devising effective means of ensuring community level involvement in river basin decision making. Further, these decentralised spaces envisioned for effective river basin management are seen to be non-perceptive of the interdependence and inter connectedness of resources in a river basin (Andersson and Ostrom, 2008). The modalities of achieving decentralised governance and integrating it at the river basin level with responsible and equitable involvement of the stakeholder communities are yet to be worked out. Hence, most of the proposed or practiced institutional mechanisms for river basin management today, even if they integrate the existing institutional arrangements for natural resource management and invoke stakeholder representation, are seen to be essentially redundant leading to institutional ‘capture’ in the long run (Waalewijn *et al.*, 2005; Molle, 2008a).

The experience of natural resource management at micro scales, as watershed management in India, has revealed that the effectiveness of community led natural resource management was partly because it was implemented at the lowest scale rarely crossing the various boundaries of resource engagement (Narayanamoorthy and Sreeja, 2006). Whenever there were boundary crossings, the emerging conflicts were

difficult to be tackled even at the lowest scale. This was evident from the struggle against the exploitation of groundwater by the Hindustan Coca-Cola Beverages company located in Plachimada in the Bharathapuzha basin wherein the local self governance body of the panchayat was forced to legally battle for primary decision-making rights over water (Bijoy, 2006). It is clear that as scales increase and boundaries are crossed, there is divergence of stakes at which point the power relations come into play between various communities of interests, existing institutions, government and corporate interests. Debates on the ownership of the resources become intractable and mired in the judicial process. The trajectories of the various conflicts over interstate water sharing in India such as the Mullaperiyar, Cauvery and Krishna river water disputes highlight that river basin considerations are easily eclipsed by the extremely powerful boundary of the state which is in charge of the water infrastructure projects in India and which is the chief negotiator in interstate conflicts over transboundary and shared waters (Madhusoodhanan and Sreeja, 2010; Pani, 2010; Venot *et al.*, 2011). Water and land resources being subjects under the state legislative purview in the country, the formation of river basin authorities is deemed the prerogative of the respective state governments. The Kerala and Tamil Nadu state water policies suggest river basin as the basic unit of resource management which will be under a state level River Authority in Kerala and Basin Management and Development Boards in Tamil Nadu (GoTN, 2001; GoK, 2008a). On the other hand there are also attempts to move water into the concurrent list of legislature towards bringing in more centralised control over the water resources of the country.

The politics of scale and the dynamics of power that operates at these boundaries of the states and the nation and their influence on proposed river basin management in the country are starkly evident when a river basin is considered as an inclusive entity. While the inclusive river basin portrays the levels upto which a multi-scalar process can and should proceed especially in the interstate and/or linked basins, it stops shy of those boundaries which refuse to be obfuscated in the face of best of intentions for basin level management. The built-in contradiction of river basin management is kicked into action wherein at a particular scale of the bottom-up approach, centralised notions of resource control transform the process into a top-down one. Inclusive basin with its multiple boundaries is an indication that any

transition into an integrated bottom-up approach in management of river basin is not going to be smooth or voluntary.

### **5.3.2 Multi-scale governance opportunities in the inclusive basin**

The inclusive river basin as an extended geography of resource use and power hierarchies also reflects the difficulties and complexities in managing the basin as a single unit. The inclusion of coastal regions, the beneficiary regions of various inter basin water transfer projects, the extended spaces of institutions and resource networks results in an unwieldy and often incomprehensible entity. River basin as a novel institutional space is being envisaged where historically people have been negotiating and dealing with individual and disjointed systems along the established lineages of power and hierarchical relationships. The multiple boundaries of the inclusive river basin reveal that it would be difficult to instill any coherent conception of a strict natural unit of management much less build an entirely new institutional mechanism based on expectations of perception of river basin unity, continuity and connections. In such a dynamic system as the inclusive river basin, stakeholder rights and responsibilities cannot be anticipated over abstract notions of river basin management. But, at the same time, truncation of this inclusive basin for conveniences of conception and/or administration would negate integrated management incorporating realities of resource exploitation and degradation.

The inherent complexity involved in inclusive basin management calls for a polycentric issue based approach to overcome the operational difficulties in governance when the entire inclusive basin is considered together. Such an approach would also provide opportunities for devising decentralised yet integrated management systems which may have the potential to override the scale politics of basin management. Inclusive river basin governance therefore will have to be dealt at multiple scales by forging issue based interest groups beyond the dualism of centralisation-decentralisation. The nature of issues will decide the scale of management and the extent of stakeholders thus arriving at a mosaic of nested river basin interest groups with active political participation at various scales according to the boundaries of interest. Such polycentric arrangements have been noted to be a means by which communities assert and negotiate contested claims for inclusion and protect their values and interests in river basin level decision making processes

(Blomquist and Schlager, 2005; Lankford and Hepworth, 2010; Bach *et al.*, 2011). Even where official stakeholder participation had been limited to a doctored list of participants as in the case of the Mekong basin, unofficial influences on the river basin governance were found to occur through resistance movements that involved such communities of interest (Sneddon and Fox, 2006). As discussed in Section 5.2.5, in the Chalakudy river basin such issue based struggles had led to significant influences on the planning of resource use in the basin. Various other issues that involve communities of interest at multiple scales in the inclusive Chalakudy basin include the pressures on the invaluable biological wealth of the basin ensconced in the Western Ghats, the upstream inter basin diversions and the changed operation pattern of upstream reservoirs that create uncertainty in downstream projects and acute water scarcity downstream during non-monsoon period, the conflicts over the shared resource within the projects at the intra and inter basin levels and between states, issues related to unprecedented river sand mining, groundwater depletion, river water pollution due to point industrial sources to nonpoint agricultural and urban sources, saline water intrusions in the downstream and further inconsiderate planning of new projects in the basin. As Conca (2006) had remarked, even though these ‘nascent regimes’ are yet to become a system of accepted rules governing river basins, they carry the seeds of viable institutional mechanisms for multi-scale basin management. Democratic institutions that ensure political accountability and transparency are needed that incorporate these interest groups at multiple scales which can decide on allocations, entitlements and uses and which should interact directly with a river basin monitoring and regulatory agency that would coordinate the efforts of these interest group networks and mediate in conflict resolution processes across the boundaries. Such an agency could also be vested with data collection, consolidation and publication, cross-scale communications, environmental monitoring and budget allocation. The relative strength and political power relations of various boundaries would decide the effectiveness of cross-scale interactions and integration since it’s clear that the multiple boundaries that have been discerned over and above the hydrological boundary in a river basin are mostly politically mediated and structured.

#### **5.4 Closure**

The technical concept of the river basin, when adopted as a unit of governance is seen to function within a multitude of other boundary considerations which were found to

be dynamic and often politically mediated, posing extreme challenges to natural resource management under IRBM framework. The multiple boundaries that were discerned in the Chalakudy river basin include the drainage ambiguities in the floodplains and coasts, the extended boundaries of resource use due to interbasin water transfers, political, administrative and institutional boundaries, the emergent boundaries of environmental governance and the permeable boundaries of livelihoods and resource use networks. The coexistence of these multiple, dynamic and often overlapping boundaries existing within and beyond the hydrological boundary encompasses an inclusive region of resource engagement coined as 'inclusive basin' which embeds in it various communities of interests. The inclusive basin brings out the possibilities of river basin governance based on interconnectedness and long term conservation of basin resources primarily mediated by the communities engaged with it at various scales. A mosaic of such communities of interest and issue based networks within a democratic framework are posited as the way forward to a politically conscious basin management that incorporates the realities of resource use established along permeable and dynamic boundaries. In the next chapter, homogeneity and agrarian identity of the basin in livelihoods and resource relations and the various interest groups that would influence river basin governance are examined with respect to the inclusive Chalakudy basin.

## **Chapter 6**

### **Emergent livelihoods, resource linkages and stewardship implications in the agro-ecological zones of the Chalakudy river basin**

#### **6.1 Introduction**

The agro-ecological zones representing the river basin from the mountain ridges to the sea are being examined in the present chapter to test whether the basin is a homogenous space in its socio-economic and resource relations and to evaluate the dominant livelihoods and resource linkages specifically in each of the zones. An inter-agro-ecological zone analysis of the Chalakudy basin was undertaken first to examine the assumption of a river basin as a homogenous space with respect to occupational composition and resource relations. This was followed by a detailed analysis of the representative villages in each of the agro-ecological zones to understand the historical process of livelihoods and resource use in the region that has led to current patterns of resource relations. The composition, nature and processes of the emergent and dominant livelihoods and the diverse relationships that they etch to the resources of land and water such as ownership, access and use in each of the zones are analysed. The multiple interest groups in the AEZs based on the livelihood-resource linkages were arrived at within the major issues of natural resource management and stewardship concerns in these zones. A multi-scalar linking of these AEZs in their livelihoods, resource relations and interest groups is then undertaken to arrive at the socio-ecological entity that is the Chalakudy river basin.



## **6.2 Livelihoods and resource relations in the Chalakudy river basin**

The assumption of homogeneity in livelihoods and resource relations across the river basin was statistically tested in pairs among various AEZs with all possible combinations using Pearson chi-square test at 1 per cent significance level on primary survey data (Table 6.1). The test was conducted within main occupations, nature and agency of main occupations, subsidiary occupations, land use, distribution of landholdings, source of irrigation and domestic water between the AEZs. The divergence in the choices of livelihoods across the five identified AEZs across the river basin, viz. High hills, Foothills, Midlands, Lowlands and the Coasts, within the main occupations under the 9-way classification is found to be highly significant between the AEZs. The nature and agency of employment was also analysed for the main occupation to assess the similarities and differences existing in the livelihood securities across AEZs. Except for the foothill-midland, nature and agency of employment was found to be significantly different between the AEZs in the main occupation. Diversification through subsidiary occupations was also found to be a strong trend in the various AEZs of the basin. The subsidiary works engaged in, in the high hills and coast were significantly different from that of the other zones whereas the foothills, midlands and lowlands were similar in the nature of subsidiary occupations of the working population.

The homogeneity in resource linkages forged by the river basin population in the various AEZs were investigated at the level of the distribution of land holdings, access and patterns of use of the major natural resources of land and water. Resource linkages were examined at the household level and the households were grouped on the basis of the main occupations of the working members into purely cultivator, purely agricultural, purely other NR based, purely non-farm, pluri-active/mixed households that depended on a mix of farm and non-farm means of main livelihoods and those with no main working members. The distribution of landholding in the basin by the various household groups was found to be significantly different in the high hills and coastal lands compared to other zones, whereas the differences in the distribution of landholding in the foothills, midlands and lowlands were found to non-significant (Table 6.1). The highlands being reserved forests vested with the state with leasehold plantations presented a different case altogether as there was absolutely no ownership of land in the zone and 30 per cent of the households owned land outside

the basin. The use to which private land holdings were put to in the various AEZs was also analysed. Except, foothills-midlands and lowlands-coastal lands, among all other AEZs there is a significant difference in the pattern of land utilisation (Table 6.1). The linkages to water in the various AEZs were also subjected to analysis. The sources of both irrigation and drinking water were observed to be significantly different among all the AEZs (Table 6.1).

The 9-way classification of main occupations are further grouped into four categories to assess the prominence of agriculture as a livelihood option within each of the AEZs and presented in Table 6.2. It can be seen that the presence of agriculture as a main livelihood activity had receded in all the AEZs, but with distinct zonal overtones as is evident from the share of agriculture related occupations (both cultivators and agricultural labourers) which tended to decline as one descended the basin from the foothills to the coast. High hill zone had no workers engaged in agriculture either as cultivators or as agricultural labourers but had majority of the workers in other natural resource (NR) based activities which included plantations and forestry. On the other hand, these other NR activities were a negligible presence in all the other zones and steadily declined from the foothills and midlands to the lowlands. In the coastal land, the people employed in this sector showed a slight increase due to the presence of fisheries sector. The non-farm activities on the other hand, revealed an increasing presence across the zones (Table 6.2). While in the high hill zone, non-farm/non-NR activities were a fledgling presence, the foothills and midlands were found to have a more diverse mix of non-farm activities in which various tertiary service sector activities dominated. In the lowlands and coastal tracts, with even higher share of non-farm occupations, secondary sector became more prevalent along with the service sector work opportunities. A detailed analysis is conducted among these occupation categories within each of the AEZs to assess the nature of these emergent non agrarian livelihoods and its resource relations.

Table 6.1 Test of homogeneity in livelihoods and resource relations among AEZs

Particulars	HH-FH	HH-ML	HH-LL	HH-CL	FH-ML	FH-LL	FH-CL	ML-LL	ML-CL	LL-CL	* $\chi^2_{0.01}$
Main Occupation	<b>212.0</b>	<b>337.4</b>	<b>660.2</b>	<b>350.2</b>	<b>26.9</b>	<b>77.5</b>	<b>105.9</b>	<b>33.8</b>	<b>135.3</b>	<b>115.7</b>	20.1
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.0007)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	
Nature and Agency of Main Occupation	<b>110.3</b>	<b>124.4</b>	<b>132.7</b>	<b>128.8</b>	15.1	<b>37.3</b>	<b>77.5</b>	<b>20.9</b>	<b>95.8</b>	<b>65.2</b>	16.8
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.019)	(<0.0001)	(<0.0001)	(0.002)	(<0.0001)	(<0.0001)	
Subsidiary Occupation	<b>57.3</b>	<b>71.5</b>	<b>146.2</b>	<b>25.3</b>	5.2	15.5	<b>24.1</b>	9.6	<b>21.8</b>	<b>34.0</b>	20.1
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.737)	(0.051)	(0.002)	(0.291)	(0.005)	(<0.0001)	
Landholding distribution	<b>#127.0</b>	<b>#221.4</b>	<b>#657.0</b>	<b>#337.0</b>	5.6	7.5	<b>43.8</b>	17.9	<b>42.6</b>	<b>78.6</b>	18.5
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.593)	(0.278)	(<0.0001)	0.012	(<0.0001)	(<0.0001)	
Land utilisation	<b>189.0</b>	<b>260.9</b>	<b>398.4</b>	<b>359.2</b>	3.5	<b>13.2</b>	<b>13.0</b>	<b>10.2</b>	<b>14.0</b>	5.0	9.2
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.169)	(0.001)	(0.002)	(0.006)	(0.001)	(0.083)	
Source of Irrigation	<b>44.2</b>	<b>88.0</b>	<b>119.3</b>	<b>206.7</b>	<b>129.1</b>	<b>113.7</b>	<b>138.1</b>	<b>181.1</b>	<b>252.5</b>	<b>214.2</b>	16.8
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	
Source of Domestic water	<b>52.8</b>	<b>108.9</b>	<b>321.4</b>	<b>227.1</b>	<b>14.6</b>	<b>123.3</b>	<b>85.8</b>	<b>62.1</b>	<b>82.5</b>	<b>73.8</b>	9.2
(p value)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(0.0007)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	

HH- High hills, FH-Foothills, ML-Midlands, LL-Lowlands, CL-Coastal lands

Statistically significant values ( $p \leq 0.01$ ) are shown in bold, \* Critical values of chi-square at 0.01 significance level

# In the high hills all landholdings are outside the basin

Table 6.2 Distribution of main occupation in the AEZs

Occupational categories	Share of working population (%)				
	High hill	Foothill	Midland	Lowland	Coast
Agriculture	0.0	30.3	22.2	16.3	4.8
Other NR based	69.2	6.2	2.5	1.2	6.4
Secondary	10.4	20.0	24.9	35.8	38.5
Tertiary	20.4	43.6	50.4	46.8	50.3
Total	100.0	100.0	100.0	100.0	100.0

The significant differences among various AEZs in occupation, land and water relations bring out the river basin as a heterogeneous entity not only in its physical characteristics but also in its socio-economic relations. The zone-wise processes of livelihood emergences and resource relations are being explored in detail in the following sections independently in each of the AEZs of the High hills, Foothills, Midlands, Lowlands and the Coastal lands leading towards identification of the prominent interest groups in the major issues of concern that would be vital for basin governance considerations.

### 6.3 Highland Agro-Ecological Zones

The highlands of the Chalakudy river basin located between  $10^{\circ} 15' - 10^{\circ} 35' N$  and  $76^{\circ} 35' - 76^{\circ} 50' E$  were classified into two distinct AEZs: the High hill zone consisting of the Karappara and Sholayar sub-basins located above 1000 m msl and the Highland Plateau zone of the Parambikulam and Kuriyarkutty sub-basins situated around 600 m above msl. The Highland Plateau zone of the Parambikulam plateau was sparsely inhabited and was enclosed within the protected area of Parambikulam Tiger Reserve (PKTR). The high hill zone on the other hand, was reserve forest land with agricultural plantation enclosures. The agricultural plantations of tea, coffee and cardamom were found to be the major user of the land and water resources of the high hill zone sprawled in the Karappara valley of the Nelliampathy hills (also called the Nelliampathies) in the Palakkad district of Kerala and the Valparai plateau of the Anamalai hills in the Coimbatore district of Tamil Nadu. The extremely fragile and threatened ecological status of the Western Ghats has brought these plantations in leased forest lands under close scientific and ecological scrutiny and sociopolitical interest in the recent years (WGEEP, 2011). The high hill zone gives rise to the two major tributaries of Sholayar and Karappara from the Anamalai in the South and

Nellyampathy hills in the North respectively. The highland zones are the regions from where large scale river water diversions are effected under the aegis of the Parambikulam-Aliyar Project (PAP) into the eastern plains of Tamil Nadu. These mountain regions where the river originates, gets dammed and diverted and whose territory is shared by both the states of Kerala and Tamil Nadu is a crucial element of basin based natural resource management of the Chalakudy river basin. Of these two AEZs, the high hill zone was opted for a primary questionnaire survey as part of the present investigation. The Nellyampathy village was chosen as the representative site to ascertain the emerging trends in livelihoods and resource relations in the zone.

### **6.3.1 The setting and multiple boundaries**

The representative village and panchayath of Nellyampathy in the high hill zone of the Chalakudy river basin is a 150 year old plantation settlement and a more recent hill resort destination located in the district of Palakkad, Kerala state. The village nestled within the Nellyampathy RF at an altitude of 1000 m above msl is accessible only from the Palakkad plains through the road that scales the steep northern slopes of the southern escarpment of the Western Ghats, south of the Palakkad gap, serviced only by Kerala State Transport buses that ply few times a day from the small township of Nemmara at the foot of the Ghats. Nellyampathy is bordered by the PKTR and the reserve forests of Vazhachal Forest Division on its western and southern sides. On its northern and eastern inclines it gazes out into the Palakkad Gap and the plains therein from which direction the hills had been historically approached and accessed. The rugged terrain and hillfolds of Nellyampathy contributes drainage to two major river basins of Kerala. While the northern and north eastern slopes forming 32 per cent of the total village area drain into the Bharathapuzha river, the greater 68 per cent extent of southern and south western portions forming the Kuriyarkutty and Karappara valleys contribute drainage into the Chalakudy river (Fig. 6.1).

The region has rich forest loam soils and receives a high average annual rainfall of 2500-4000 mm both from South West and North East monsoons. The panchayath has an area of 264 sq.km of which 206 sq.km is covered by the Nellyampathy RF. The principal agro-ecological and socioeconomic identity of the village is determined by the 30 odd plantations of tea, coffee and cardamom in 53 sq.km of area enclosed

within the forest, majority of them in leased forest land. The population of the village was 8718 persons in the 2001 census which was predominantly constituted of the plantation based population concentrated in the various estates.

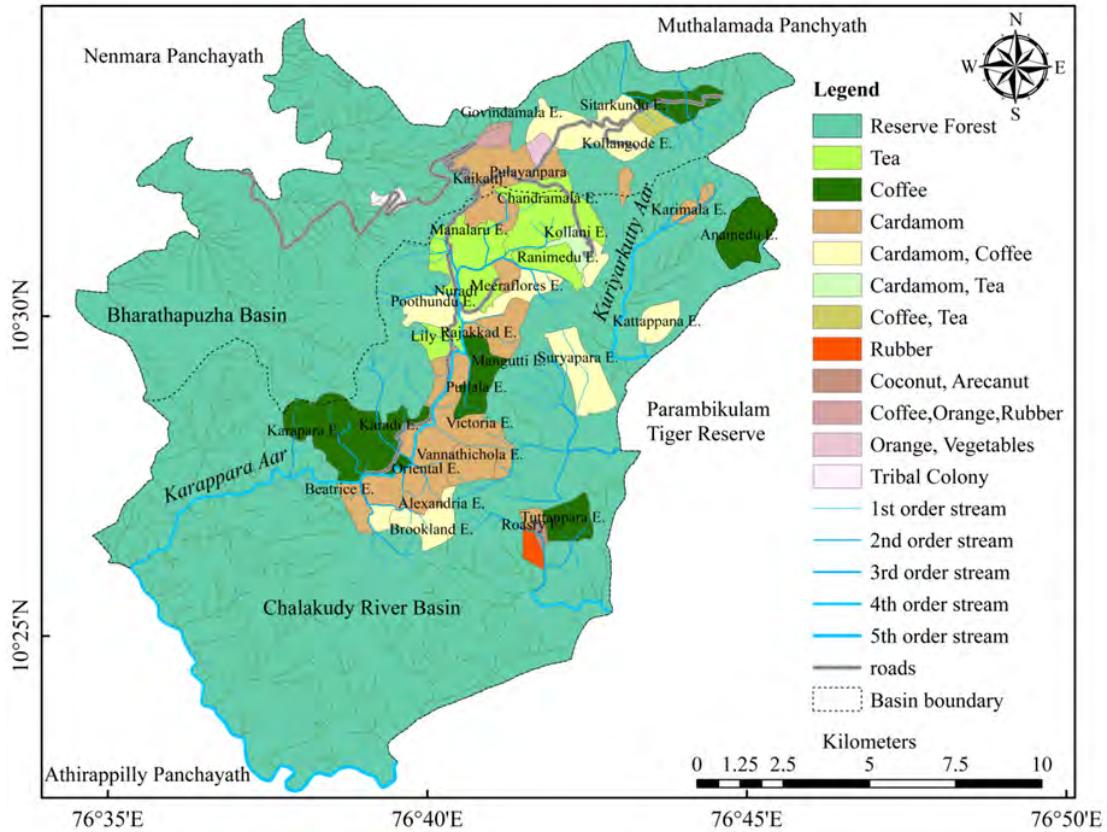
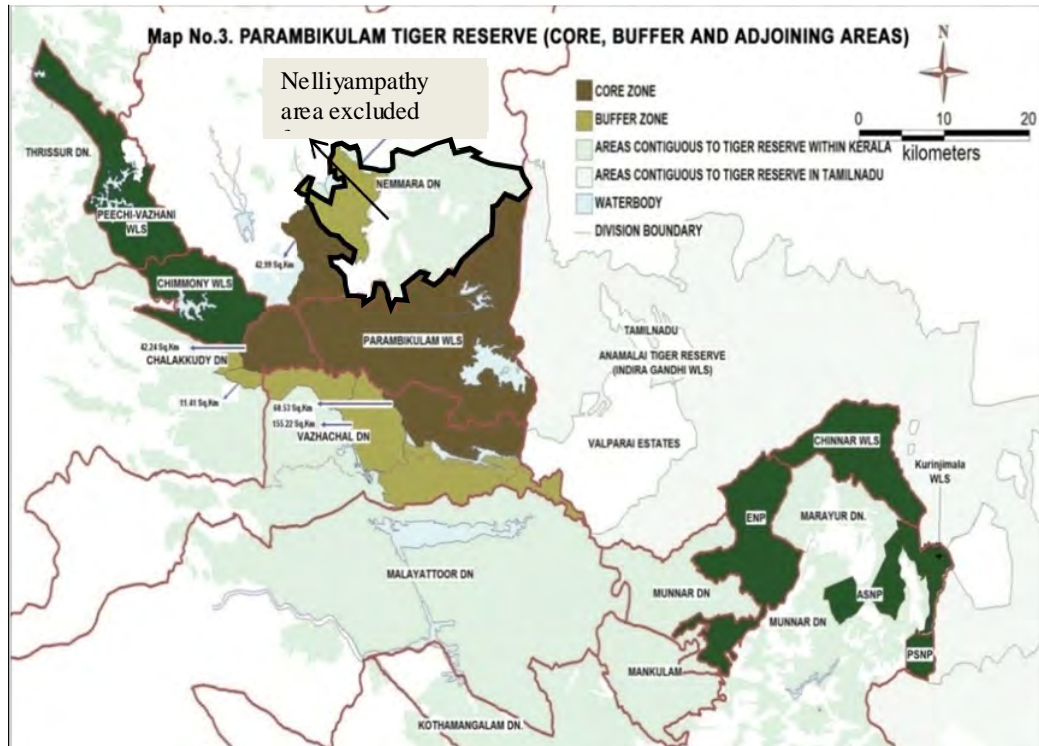


Fig. 6.1 Location and land use of Nelliampathy in the high hill zone

There are a multiple of boundaries that make its presence felt in the Nelliampathy region in the livelihood decisions of the people and the use of its natural resources. All the plantations in the region within the Chalakudy basin are on forest leaseholds owned by the State. Even though the local self-governance body of Nelliampathy panchayath is in charge of local level administration and planning, the greater area of Nelliampathy Forest Range is under the State Forest Department within the jurisdiction of the Nemmara Forest Division. Over and above the Nelliampathy revenue village and panchayath boundaries, the Nelliampathy Forest Range boundary under the jurisdiction of the Nemmara Forest Division is central to the region due to the existence of the plantation village enclosed within the reserve forests. Ecosystem boundaries delineate the area to be a highland AEZ which falls under the highest ecologically sensitive Zone 1 category of WGEEP (2011)

delimitation of the Western Ghats which accords it a very high conservation status. The upgrading of Parambikulam WLS into a Tiger Reserve has initiated fresh boundary concerns in the region.



Source: Official website of PKTR (<http://www.parambikulam.org/map.php>)

Fig. 6.2 Exclusion of Nelliampathy region from the PKTR core and buffer zones

It can be deduced from Fig. 6.2 that some of the regions of Nelliampathy RF fall into the core and buffers areas of PKTR although there is a clear exclusion of the Nelliampathy plantation regions as well as the project site for the proposed Karappara- Kuriyarkutty multipurpose project from the Protected Area network. There are no trans-boundary issues as of now in the Nelliampathy high hills even though the Karappara- Kuriyarkutty project that would link these two tributaries of the Chalakudy basin to the Bharathapuzha basin through a multi-purpose irrigation and power generation project is under consideration of the State government for a considerable time. Since the State is the owner of the entire plantation leaseholds in the Karappara and Kuriyarkutty valleys of Nelliampathy, it emerges as a strong boundary of interest. The reserve forests that form majority of the land cover and the inclusion of certain area within the PKTR also brings in Central government interests

such as that of the Ministry of Environment and Forests within the region that forms yet another boundary concern. Even though the land is under the State government, the laws and regulations that govern the use of these forest land and the activities and interventions undertaken in these protected areas are decreed by the Centre under the purview of the Environment Protection Act of 1986 (GoI, 1986). Institutional boundaries of various Central and State government agencies such as Commodity Boards of tea, coffee and spices and Departments of Agriculture, Water resources and Power also impact the resource use of this plantation village.

### **6.3.2 Occupational and resource use history of the Nelliampathies (1850s - 2000s)**

The Nelliampathy hills and its invaluable forest wealth were deemed the property of the Cochin princely State by the late 18<sup>th</sup> century after various protracted disputes with the local chieftains and rulers and with Malabar and Travancore States. The Nelliampathies was added as the seventh forest division of the Cochin State in the year 1838 when commercial exploitation of these hills with the aid of European capital was broached. Although the early experiments did not bear fruit, the Nelliampathy hills were finally opened for coffee plantations and through these to human settlements by the 1860s and by 1905, the Cochin State documents indicate that there were 18 coffee estates, 17 owned by Europeans and one by a native together employing around 1600 labourers in approximately 8000 acres of forest land (ref). The lease terms prevented any other activity in the land other than agriculture, restricted transfer of ownership through sale and retained state ownership of the land, its trees and water sources. In addition to these plantations on leased land of the Cochin State, a few plantations were also opened on the Malabar owned tract of Nelliampathy under the Kollengode Kingdom. The labourers employed in all these estates were entirely a migrant force, numbering to around a thousand during a working season with a preponderance of casual labourers over permanent ones.

The native population in the hills consisted mostly of the tribes of *Kadars* and the *Malayars* who refused to be drawn into the daily drudgery of the plantation labour, even though they had assisted in the clearing of the sites for plantations and also acted as guides to the European planters in the unfamiliar territory (Congreve, 1942). Reported to be 310 in number in 1911, they were nomadic in their habit and



were mostly engaged in skilled forest operations such as stalking game and the collection of minor forest produce as their livelihood activities (Menon, 1911). They collected and traded in pepper even before it was widely cultivated in the agricultural lands of the State by the 16<sup>th</sup> century (Morrison, 2002). These tribes exchanged the upland produce for lowland products of food grains, textiles and iron through produce contractors and were thus indirectly integrated to the lowland agriculturalists and to the voluminous and legendary spice trade of the Malabar Coast (Morrison, 2002). The plantations established in the erstwhile home of these tribes and the extensive plundering of the forests for their valuable timber that followed, rudely took away their land, home, customary rights over the forest and their means of livelihood by bringing in restrictions on forest access and produce collection. The terms of lease of the Cochin State for the coffee plantations in the Nelliampathies were silent on these original inhabitants, addressing the forests as ‘uninhabited’ and as ‘State property’ (Menon, 1911).

The significant labour requirement in the plantations and the general disinclination of the native tribes to adopt plantation based livelihoods led to outside labour procurement through the *Mestri or Kankani* system of contractual and often coercive labour, then prevalent in all the coffee and tea plantations across the Ghats (Savur, 1973; George and Tharakan, 1986). These early migrant labourers from the backward and oppressed castes in the famine belt of the Eastern Plains of Tamil Nadu, came to the hills despite its inclement weather and tough working conditions due to the even more desperate socio-economic conditions and frequent famines back home. Roads connecting the estates to the foot of the Ghats and the nearest town of Nemmara were constructed by 1870s. By then, tea and cardamom were tried in these hills following a devastating coffee leaf rust disease and low market prices for coffee. The grant of more forest land for plantations after 1894 was decided against as there was a rising concern regarding the effect of the wholesale destruction of the forests on rainfall. Alongside the ecological concerns, there was also the financial calculation that the area earmarked for further extension would be better off retained as forests so as to be tapped for its valuable timber through the Forest Tramway in the neighbouring Parambikulam plateau. Thus, further leasing out of land in the Nelliampathy hills was discontinued by an order dated 11<sup>th</sup> December 1901. Subsequently, by the Cochin Government proclamation of 1909, the entire Nelliampathy hill ranges were declared as State reserve forests with the leased

plantations within it being treated as enclosures within the reserve. But the plantation labour population continued to grow and the Cochin State census reports for the years of 1901 to 1941 recorded an increase in population from around 1600 plantation workers in 1901 to more than 3500 workers by 1941. Thus, by the second half of the 20<sup>th</sup> century, the labourers in the region had more than doubled with a high growth rate of 122 per cent and a very high work participation ratio of 82 per cent (Table 6.3).

Table 6.3 Crop-wise annual labour force in Nelliampathy, 1941

Particulars	Tea	Coffee	Total
As principal means of livelihood	2210	1350	3560
Total dependents	547	256	803
Total population	2757	1606	4363
Work Participation Rate (%)	80	84	82

Source: Rege committee report (Rege, 1946)

Just before independence, during the 1942-1944 time period, various lease titles were transferred from the European leaseholders to Indians. After independence and formation of the Kerala State, the ownership and lessor status of the Nelliampathy estates were transferred to the State of Kerala under the jurisdiction of the State Forest Department. Meanwhile, the Plantation Labour Act became effective from 1951 (GoI, 1951), that organised plantation labour along the lines of industrial labour and with active trade union involvement. The *Kankani* system of contractual labour recruitment thus came to an end during the early 1950s in the Nelliampathy hills. The Nelliampathy panchayath within the Nemmara forest division came into being on 12<sup>th</sup> December 1961, carved out of the Muthalamada and Nemmara panchayaths (GoK, 1961). The new planters continued to work the plantations as lessees of the State for a meager lease amount ranging from 50 paise-Rs.50 per hectare. Records reveal that forest lease rent collected by the Forest department during 1863-1996 from Nelliampathy amounted to only Rs. 6,26,576 for an area of 4190 acres. This was later revised to Rs. 1300 per hectare in 1995 but implemented only by 2009 onwards due to the pressure from the plantation sector (GoK, 2012). There were also fresh leases of previously abandoned estates granted by the Kerala State in its role as lessor. The promulgation of the Forest Conservation Act of 1980 brought in strict regulations for the activities undertaken in reserve forest lands so that the leaseholds in the Nelliampathy hills came under close scrutiny. Consequently,

several of the estates were confiscated by the Forest Department either due to the expiry of the lease period or due to violations of the lease agreement. The enactment of The Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003 through which various tracts of the plantations in Nelliampathy were declared as Ecologically Fragile Land (EFL) (GoK, 2003b) and the upgradation of the neighbouring Parambikulam WLS into PKTR in 2009 also led to greater vigilance against the rampant violations in the leaseholds. Meanwhile the plantation sector itself was facing a dire crisis situation due to the market reforms and related price crashes following globalisation and structural adjustment policies (George and Joseph, 2005). An analysis of the growth trends in population also revealed a trend of declining population of this highland village between the years 1971 and 2001.

The present plantation and labour scenario in these hills, the relations to the natural resources of the river basin in the context of changing livelihood commitments, the natural resource governance related issues of concern in the region and the various interest groups that were identified that have to be accommodated for a meaningful and worthwhile engagement with river basin based management are examined in detail in the sections to follow.

### **6.3.3 Emergent occupations and patterns in the high hills of Nelliampathy**

The present day population of the plantation village of Nelliampathy is composed of the native tribal population, three generations of migrant plantation labourers in the various coffee and tea estates, the estate office and managerial staff and the planters who are by and large absentee leaseholders. The current community of the village was found to have arrived in the hills in four or five main waves. Labourers had continued into the hills through the *Kankani* system even after independence until the enactment of the Plantation Labour Act (PLA) in 1951. Their children, the second and third generation who remain, either work in the plantations as temporary labourers or aspire to different livelihoods away from the hills. During late 1960s and 1970s there was another influx into these plantations, the second generation of those who came then mostly doing higher studies back at the home towns of their grandparents or mother's house, or employed as temporary/ casual plantation labourers. There has only been one fresh labour recruitment after 1990, when several workers were recruited from the Salem- Namakkal dry belt of Tamil Nadu. The first generation of these workers is

now mostly pursuing studies back in the hometown of their parents. In fact, the practice of sending off children to hostels and orphanages or to native villages and home towns to complete their education, especially after lower primary was said to have increased recently with more and more people planning to quit the hills forever. Children go first.

The tribal and *dalit* members together constituted more than half of the population of these hills. The dalit population at 35 per cent was mostly of Tamil origin belonging to the SC groups of *AdiDravida*, *Chakkiliyan*, *Kavara*, *Mannan*, *Pallan*, *Panan*, *Paraiyan* and *Pulayan*. The fact that most of these scheduled castes are particular to the drought prone areas of Tamil Nadu such as Thiruchirappilly (see *Constitution (Scheduled Castes) Order*, 1950, Tamil Nadu) is a keen reminder of the circumstances that had brought these people into these hills initially. The *adivasis* were found to constitute 16 percent of which 6 per cent were native to the hills. Muslims (11%) and other backward caste (OBC) category of Hindus (27%) which included the *Ezhava* and *Vaduka* caste members from the neighbouring Palakkad plains and several other OBC from the arid plains of Tamil Nadu such as *Gaunders*, *Naikars*, *Thevars* and *Pullans* were the other prominent communities.

The population of this highland village has been prominently on the decline for the past three decades along with noticeable shifts in the means of livelihood. Even though the present occupational profile was found to be still dominated by the plantation sector with close to 69 per cent of the workers engaged in it (Table 6.4), it is less than the 93 per cent estimated to be engaged in the sector in 2001 (GoI, 2001). It is also to be noted that even though the other sectors of the manufacturing (8 %), trade and commerce (8 %), transportation (4 %) and other services (9 %) were having a lower proportionate share in the occupational profile, these sectors showed an increased share as opposed to 2001 Census figures according to which secondary and tertiary sectors together had employed barely 6 per cent of the main working population (GoI, 2001).

Of the total persons employed in the plantation sector, 51 per cent were men and 49 per cent were women. But while only around 60 per cent of total working men were employed in the plantation sector, close to 83 per cent working women were employed in the plantations. Of the 40 per cent men employed outside the plantation

sector, 13 per cent were in the manufacturing sector, 11 per cent involved in trade and commerce, and 6 per cent each in transportation and other services. Construction sector employed 4 per cent of men workers. Except for the other services sector where 12 per cent of female workforce was found to be employed, the share of women in the secondary and tertiary activities of manufacturing, construction and transportation were found to be negligible (Table 6.4).

Table 6.4 Distribution of workers in various occupation categories

Main employment	Frequency (n)			Percent (%)		
	Male	Female	Total	Male	Female	Total
Cultivator	0	0	0	0	0	0
Agricultural labour	0	0	0	0	0	0
Plantation, forestry etc.	85	80	165	59.4	82.5	68.8
Mining & Quarrying	0	0	0	0	0	0
Manufacturing	18	1	19	12.6	1.0	7.9
Construction	6	0	6	4.2	0.0	2.5
Trade and commerce	15	4	19	10.5	4.1	7.9
Transportation	10	0	10	7.0	0.0	4.2
Other services	9	12	21	6.3	12.4	8.8
<b>Total (N)</b>	<b>143</b>	<b>97</b>	<b>240</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: Primary survey

Around 31 per cent of the workers were noted to have subsidiary work engagements too. The subsidiary works thus resorted to were mainly in the sectors of plantation and manufacturing. The subsidiary plantation employment was through more opportunities for casual work in the plantations as a result of increased lay off of permanent workers and a return to seasonal employment of workers. The claiming back of the plantations by the State had resulted in laying off of permanent labourers of those estates who had subsequently either left the hills or converted themselves into itinerant casual workers in the several plantations of the area. The temporary and in some cases even the permanent workers were also found to take up subsidiary casual work in other estates, especially during peak work seasons.

Contrary to the subsidiary work in the plantation sector located mainly within the village, subsidiary employment in the manufacturing sector monopolised by the

male workers was located in far off locations strewn all across the country from Tamil Nadu to Kashmir. Termed ‘site work’, this consisted of shut down work in various cement, steel and oil plants for a period of 3-4 months in a year. Site work was found to be popular amongst the young workers who, at other times were mostly engaged as casual workers in the various estates. Eight per cent of male and 21 per cent of female workforce found subsidiary employment through the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS/ NREGS), even though it was confided that permanent workers in the estates were technically not supposed to be engaged in it. Of the non-working population, 7 per cent of males and 8 per cent of female were actively engaged in the NREGS employment so that of the total population, 12 per cent were observed to be actively involved in NREGS activities (Table 6.5).

Table 6.5 Subsidiary employment among main workers– High hills

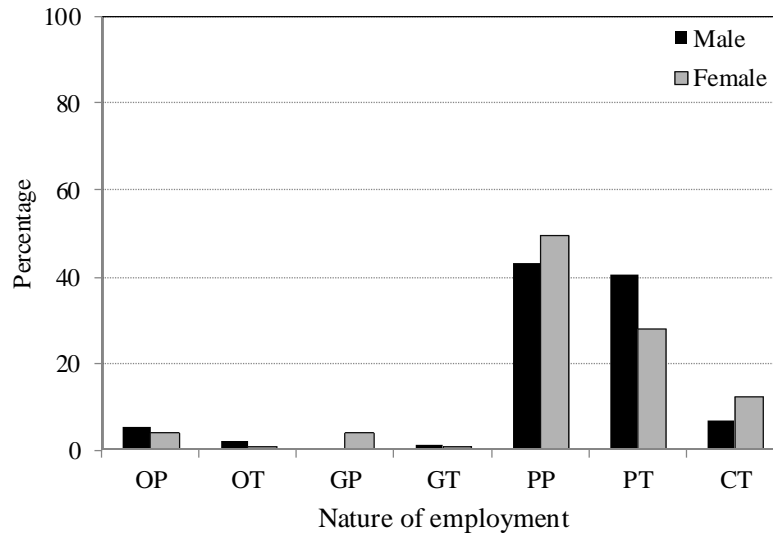
Subsidiary employment	Frequency (n)			Percent (%)		
	Male	Female	Total	Male	Female	Total
Plantation sector	11	5	16	24.5	16.7	21.3
Manufacturing	19	-	19	42.2	-	25.3
MGNREGS	15	25	40	33.3	83.3	53.4
Total (N)	45	30	75	100.0	100.0	100.0

Source: Primary survey

An analysis of the nature of employment brought out that while permanent workforce in the plantations still dominated at 46 per cent, the temporary and casual workers together made up an almost an equal share of 45 per cent. In fact, the high occurrence of a temporary and casual nature of work was found to be true across both men and women workers (Fig. 6.3).

More and more of the population were leaving the hills not just in search of newer livelihood avenues but in a process of transplanting lives altogether. For instance, the Karappara coffee and cardamom estate which had around 60 households employed 20 years back, currently had barely 7 households under permanent employment. The estate now thrived mostly on a casual labour force. In the Pakuthippalam estate, which was leased out to Kerala Forest Development Corporation (KFDC) to relocate Ceylon refugees in the 1970s, the first generation of migrants had reached the end of their employment tenure. Of the 30 families that had originally arrived here with around 75 workers, there remained 6 male and 13 female

workers. The second generation of these first migrants had completely bid farewell to the hills and were employed in other sectors mostly in various industrial townships of the Tamil Nadu plains. Of the 150-200 labourers in the Poothundu estate 5 years back, there were barely 50 labourers on roll. The majority of tribal work force had moved to *Pullukad* as a part of the ongoing struggle for land rights in the hills. Most of the cardamom plantations were highly neglected and on the verge of abandonment. The Victoria cardamom estate of AVT group had been abandoned in 2006 itself laying off around 800 families employed in it. Most of these families had relocated from the hills with only 3 or 4 families remaining who had become casual labourers in other plantations.



Note: OP- Own permanent, OT-Own temporary GP- Government permanent, GT- Government temporary, PP- Private permanent, PT- Private temporary, CT- Casual

Fig. 6.3 Distribution of nature and agency of work - High hills

The relocation of the previously confined and dedicated labour force from the plantations had been observed due to the labour displacement policies or closures of the estates following the crisis in the sector that had directly laid off significant labour force or had fostered utter livelihood insecurities that leave the plantation workers desperate to look out for substitute employment as well as due to preferences for non-plantation work especially among the youth. Such slow demise of earlier labour characterisations of large scale plantations had been well documented in the aftermath of the deep and continuing crisis in the plantation sector post the liberalisation of the world economy. Permanent employment in Central America's coffee sector has fallen

by more than 50 per cent and seasonal employment by 21 per cent accelerating labour migration to urban areas (IADB, 2002). In India, there had been a 20 per cent decrease in the labour force in the coffee sector by early 2000s (Oxfam, 2002). It has been reported that at least 19 plantations in Kerala, 30 in West Bengal and 70 in Assam had to close down since the late 1990's. It is also estimated that more than 60,000 plantation workers have lost their jobs since 2002 and livelihood of another tens of thousands are under threat (Haridas *et al.*, 2012). Mishra *et al.* (2011) had drawn attention to the fact that in Assam, the crisis in the tea industry has created a labour force who although residing in the tea gardens was forced to look for alternate employment opportunities outside, diversifying to non-plantation occupations. This has also meant increasing absenteeism in the plantations. They also note that even though this process is underway, the very limited opportunities that exist outside of the plantation sector in these mostly isolated locations of the plantations have made the transition slow and difficult. Therefore, even those who have left the gardens were employed mainly in the informal sectors. In the High Ranges of Kerala the ex-plantation labourers were found to be largely employed as unskilled labourers in unorganised sectors like construction (Raj, 2010).

The two main avenues of work within the manufacturing sector that had attracted the youth of the hills in the present times of great distress and uncertainties in the plantation sector of the high hill zone of the Chalakudy river basin were the garment industries of Tiruppur in Tamil Nadu situated at a distance of barely 150 km from Nelliampathy and the shutdown work available in cement and other factories in varied locations across the country. The latter work was found to be limited to the young male workers who resorted to it either as main occupation or as subsidiary occupation, taking up casual work in the plantations at other times. The age profile of workers in the manufacturing industry revealed that 94 per cent of them were within the 18-30 age group. The preference of the younger generation in plantation villages for other work avenues had been perceived from the 1980s onwards. Shivalingappa and Mahadev (1992) had recorded the migration of youth into manufacturing and construction sectors in the plantation economies of the highlands of Karnataka in a mobility study of rural workforce. A similar situation where the younger generation seeks better paying off-plantation work had been documented in Kerala in spite of the relatively higher wages and strong trade unionism in the State (Sumitha, 2012). In the



Peerumedu tea estates of Kerala in the High Ranges youth who used to work as temporary workers were reported to have found work in skilled professions like driving, automobile repairing, tailoring, sales in retails market, and home nursing (Raj, 2010).

With such drastic reduction in the workforce, the plantation labour scenario was found to be undergoing various structural changes in these high hills of the basin. The contractual labour system that had given way to permanent labour system following the Plantation Labour Act in 1951, is once again making way to contractual casual employment. In the Nelliampathies, such a system is slowly replacing the permanent labour arrangements especially in the coffee cardamom estates. For the past four to five years peak operations of shade lopping, berry picking, centering, weeding and replanting had been undertaken on contract in most of the coffee estates. In fact, reminiscent of the *Kankani* days, it was a plantation worker himself who had taken up the contract to bring in workers from the arid belt of the eastern Tamil Nadu plains of Thiruvannamalai and Salem. Some of the estates in the Bharathapuzha basin have also started bringing in Bengali and Assamese plantation workers on contract. The Valparai plantation in the Sholayar sub basin of the Chalakudy river basin was importing casual labourers on contract from the north eastern plantation villages who were already employed in the plantations of Idukki district. In the estates that have been claimed back by the Forest Department either due to expiry of lease or due to violation of lease terms, permanent labourers were being laid off gradually. The Thuthampara coffee estate which was under lease to Poabson group was confiscated back by the Forest Department in 2007 after the expiry of its 99-year lease on June 30, 2007, at which time there were 40 labourers employed in the plantation. By 2010 there were only 6 permanent and 7 temporary labourers retained by the department who were also on the verge of relocation. The Thuthampara estate was therefore into big time casual labour involvement especially in the operations of berry picking, weeding and centering operation of the coffee bushes. Labour contractors brought contract labourers from Salem – Thiruvannamalai regions of Tamil Nadu. The Rosary estate which came under the KFDC in 1995 following lease expiry also employed the casual labour force from the Salem Thiruvannamalai regions. Of the 200 and more permanent labourers employed by the estate in its heydays now only 10

remain. Interestingly, the permanent labourers remaining in the estates themselves have turned into contractors, recruiting seasonal labourers from Tamil Nadu.

The permanent and temporary labour force of one plantation itself has become an itinerant workforce undertaking casual labour for nearby plantations. From 2001 onwards the permanent labourers in Miraflores coffee and cardamom estate had work only for half days; the rest of the day they go for casual work in the neighbouring estates of Suryapara, Maria, Pullala and Manalaru earning upto Rs. 900/ week. Several of these workers in Miraflores estate also opted for shut down work in cement factories located in Thiruchirappilly, Chennai, Kadappa, Bellari etc. In the last 2 years, their parent estate work had taken up only barely 6 months of their time. In several of the more inaccessible plantations higher up and deeper into the watershed, the older retired generation past the age of 60 continued as casual labourers not just in their parent estate but neighbouring estates also. Therefore 12 per cent of male and 10 per cent of female plantation workers in Nellyampathy were found to be above the age of 50. The latest recruitment in these plantations had occurred in 1980, and the first generation of these migrants has all left the hills in search of alternate employment. Even in well managed plantations, permanent labourers were limited to the basic minimum with casual labourers used not only for peak season work but daily work also. For example, Suryapara estate had 28 permanent workers but employed 20-50 casual workers per day from the nearby estates. In the space of the past 5 years the contract system of labour has slid so well into place that there were noticed regional preferences for specific operations. For pepper harvest, casual labourers were obtained from Wayanad hills whereas for more generalised peak season work, workers from Kollimala in Salem and Satyamangalam were used. For daily work, local labour filched from neighbouring estates were preferred. Another labour system in place for the past two years was task based work even amongst the permanent labour force of the plantations. These structural redefinitions of labour have been pointed out by the estate managements to affect the nature of operations and their scheduling. Mechanisation is making inroads into the sector which has been traditionally a labour intensive venture. The AVT estate had adopted mechanical pruning in their tea plantations for the past 5 years. Herbicides had also made its appearance replacing manual weeding and clearing in some of the coffee estates.

The distinct change in the labour recruitment pattern signified by displacement of the permanent workers and adoption of sub-contracting has been observed in the South Indian plantations of tea and coffee by Vishwanathan and Shah (2012). Ambinakudige (2009) had remarked that this changed utilisation of labour force in coffee estates preferring temporary over permanent labourers even among small holders is the aftermath of the coffee crisis in the 1990s triggered by the collapse of the International Coffee Agreement in 1989 and the complete deregulation of the national coffee market in 1996. Such a reorientation from permanent labour to casual labour preferences is argued to have replaced the organised labour market with an informal market (Hayami and Damodaran, 2004).

One of the crucial steps taken by the plantations as part of the restructuring of the plantation operations is pointed out to be the employment reduction at the aggregate level and the subsequent increase in the share of women workers (Vishwanathan and Shah, 2012). The presence of women over men in casual work compared to permanent and other better paid work such as supervisors and staff was noticed in the region. This process of increasing feminisation of plantation labour has been observed in the North eastern plantations especially since the 1990s (Sharma and Das, 2009). They further noted that the men workers gave secondary importance to tea garden work devoting themselves more to other forms of employment such as trade and commerce or leaving plantations to engage themselves in other sectors for months together in a year. This had led the management to seize the opportunity to engage more female casual workers who were not to be paid any fringe benefits except the daily wages. The gender differences with regard to the plantation work are also noticed in the attitude towards work. The men labourers in the Nelliampathy plantations pursuing other work or on the lookout for an opportunity to break free were increasingly found to be apathetic towards plantation work, already resigned to the volatility of the sector. Women on the other hand were found to adhere to the work in order to maintain the residence in the labour lines. Konings (1995) had noted a similar tendency among men workers in the plantations of Cameroon as they were no longer interested in keeping their job at any cost having lost hope in the industry's eventual economic recovery.

The evidence of structural change in the plantation labour force was present in the household composition of workforce also. Historically recruiting whole families as plantation labour had been the conscious strategy to obtain labour contingents in the remote and harsh climatological regimes in which plantations were often pioneered. Recruiting households also ensured reproduction of labour since the isolated locations of plantations led to complete pledging of entire household workforce from a very young age to the plantation sector (Bhowmik, 2005). The households in the region were classified into various household groups according to the main occupation of the various working members in the household. It was found that of the total households, only 48 per cent were purely dependent on plantation sector. 47 per cent of the households were mixed households whose members depended on both plantation and non-farm employment as main livelihood means. Almost half of the plantation sector households were therefore seen to have members employed in the non-farm sector also. In keeping with the age group and gender of the people engaged in non-farm employment it can be inferred that the male children in the plantation families were rapidly moving out of plantation based livelihoods.

#### **6.3.4 Livelihood and resource linkages in the high hill zone**

##### 6.3.4.1 The trajectory of land use

There were currently 27 plantation divisions in the Karappara and Kuriyarkutty valley of Nelliampathy, all of which were under varied conditions and time periods of lease from the State government. Table 6.6 gives the details of the present land use of the individual estates and the ownership status. Around 800 ha in the region was under tea (*Camelia sinensis*) being cultivated in 4 estates. Tea was grown as monoculture plantations with no natural shade trees except for the extremely sparse shade provided by the regularly lopped introduced tree species of Australian silver oak (*Grevillea robusta*). The tea plantations in Nelliampathy accounted for 27 per cent of the area under tea in the Chalakudy river basin as greater area under tea was found in the Valparai and Malakkappara regions of the Sholayar sub basin. Coffee was cultivated in approximately 2000 ha of land area in 22 estates most of which were owned by individual planters. Among coffee areas, the shade grown Arabica coffee (*Coffea arabica*) was cultivated in 39 per cent land area whereas the rest of the area was under Robusta coffee (*Coffea canephora*) a species that is grown under less shade. The

Nelliyampathy hills contained almost half the area of Arabica coffee cultivated in the State. Around 40 per cent of the total coffee grown areas in the Chalakudy basin was also to be found in the Nelliyampathies. Small cardamom (*Elettaria cardamomum*), previously a very important and remunerative crop in the region was now taken in barely 1200 ha due to low prices along with poor yield and increased disease and pest infestations and poor management practices. Cultivation in another 670 ha had been completely abandoned for the past 10 years. Small cardamom is a native plant of the Western Ghats requiring denser shade for cultivation and therefore grown amongst native forest trees as intercrop. The area currently under cardamom amounted to only 3 per cent of area under cardamom in the State although majority of the cardamom cultivated area in the Chalakudy basin was concentrated in the Nelliyampathies. The other plantation crops grown in the area were pepper, nutmeg, rubber and orange although in negligible areas. In total the Nelliyampathy region accounted for around 40 per cent of the high hill zone plantation area in the Chalakudy river basin.

Cattle had been a common presence in these plantations since the plantation families had been allowed to maintain cattle that were usually let out into the forests doing unmitigated damage to the forest undergrowth and species diversity. Now on the brink of closure and protracted disputes with the Forest Department, several of the coffee estates have banned cattle rearing. The AVT owned tea estates still allowed cattle though the company charged Rs. 60/month from the labour households for the permit to do so.

Following the widespread crisis in the plantation sector, there had been a visible shift in the interest of the planters from undertaking productive agricultural activities in the plantations to other uses of land which were less risky albeit illegal. Many of the leasehold estates had started homestay facilities trying to tap into the growing reputation of Nelliyampathy as a misty Western Ghats plantation village. Many of these estates had bungalows from the colonial times which were made part of the tourism promotion along with the appeal of hill tourism. These homestays later became the bone of contention between the Forest Department and the leaseholds as these constituted visible violations of the lease agreement which forbade the use of forest land for any other purpose other than agriculture.

Table 6.6 Main plantations in the high hill zone of Nelliampathy

No.	Name	Owner ship	Crop	Area	Labour families	Labourers
				(ha)	(No.)	(No.)
1	Manalaru(AVT)	L	Tea	287.9	464	868
2	Lily (AVT)	L	Tea	77.0	89	
3	Pothupara (AVT)	L	Tea			
4	Karadi (AVT)	L	Co	85.4	18	37
5	Victoria (AVT)	A	Ca	671.8	0	0
6	Karappara A	L vs. F	Co, Ca	219.3	27	31
7	Karappara B	L vs. F	Co, Ca	233.5	27	30
8	Oriental	L	Co, Ca	NA	10	20
9	Beatrice	F 2002	Co, Ca	99.6	5	10
10	Alexandria	L vs. F	Co, Ca	310.0	6	15
11	Brookland	L vs. F	Co, Ca	168.3	6	6
12	Rosary	F 1995	Co, R	50.6	2	10
13	Tuttanpara	F 2006	Co, R	198.7	3	12
14	Pakuthippalam KFDC	F 1972	Co, Ca	105.0	4	19
15	Pothumala KFDC	F 1972	Co, Ca	122.9	18	19
16	Suryapara	L	Co, P	263.0	23	40
17	Miraflores	L vs. F	Co, Ca	197.1	63	80
18	Maria (Mangutti)	L	Co	NA	2	5
19	Pullala	L	Co, Ca	132.3	7	5
20	Rajakkadu (Mangutti)	L vs. F	Co, Ca	116.5	23	35
21	Chaukamattom (Mangutti)	L	Co, Ca	NA	6	15
22	Thottekkad (Gomathy)	L	Co, Ca	NA	6	14
23	Poothundu (Nellikulam)	L	Co, Ca	172.4	55	50
24	Chandramala	L vs. F	Tea	412.9	83	160
25	Minnampara	L	Co, Ca	119.4	7	18
26	Karimala	F 1994	Co, Ca	61.0	0	0
Total				4104.6	954	1499

Source: Primary survey; Note: L- On lease, F- Forest Department and year of acquisition, A – Abandoned, L vs. F – Lease conflicts with Forest Department, O- Own, Co- Coffee, Ca – Cardamom, R- Rubber, P- Pepper, NA- Not Available

Rampant illegal divisions and sales of the leaseholds by the lessees were also afoot especially after the 1990s. The original 13 plantations in the Chalakudy basin area of the Nelliampathy were now 26 due to divisions either through death of the original leaseholder and partitioning of the estate between heirs or through parceling out for sale both of which are prohibited within the terms and conditions of lease. It is

clear from Table 6.6 that of the total estates in the region, 7 of them were in conflict with the Forest Department for having violated lease agreements and the lease of another 4 of the estates had already been revoked following expiry of lease period and discovery of multiple lease violations. Almost all the leaseholders were from outside the basin and were absentee lease lords who managed the estates through managers and other managerial staff except for a few recent small holder plantations that have budded off parent plantations. Many of the owners were difficult to even trace out due to *benami* land dealings and speculation interest in the plantation land.

The use of land as a speculative commodity was evident from the number of lease violations that had surfaced with regard to most of the plantations in the area. Even though transfer of lease is not permitted as per the conditions of lease, most of the estates had a history of at least 3 to 4 lease transactions in the past. Some of the plantations such as Monkswood and Karappara had been parceled out to form smaller plantations. The fragmentation of several of these plantation holdings had also led to identification of several of the lease owners of these smaller divisions as cultivators instead of planters and the workers on these plantations as agricultural labourers which had led to the curious case of the sudden appearance of cultivators and agricultural labourers in the Census NIC data for Nelliampathy village for 2001. In fact the reorganisation of the plantation system from traditional estates to small-holder systems has been a widespread outcome of the crisis period especially in the case of coffee world over and in India (UPASI, 2003; Hayami and Damodaran, 2004). It has been estimated that at present an astounding 85-90 per cent of coffee production from the Indian plantations are from small holder farms (Vishwanathan and Shah, 2012). The starting of such a trend was visible in Nelliampathy also but due to the illegality in the formation of such small holdings from large plantations that were not to be partitioned in the first place, the feasibility of these small holdings are uncertain in these hills. Another evidence of the changing relationship to the land resources is the widespread practice resorted to by the present class of planters of mortgaging the leased forest land in clear violation of the terms of lease. As has been pointed out by Krishnan (2009), the ability of the planters to solicit the best legal expertise and influence the political machinery has ensured that these blatant lease violations continued despite frequent litigations and threat of attachments over the years.

#### 6.3.4.2 Patterns of land ownership and access to land

Coffee and cardamom formed the main plantations in the area covering 68 per cent of the cultivated land although it employed only 34 per cent of the permanent labour force remaining in the hills. 66 per cent of the plantation labour was found to be in the tea plantations that occupied only 17 per cent of the cultivated land area. Even though cardamom was listed as a crop in most of the plantations, price instabilities and increased pest and disease infestations had led to large-scale abandoning of cardamom cultivation in these hills. The ownership patterns of these estates indicated that 7 plantation divisions covering 37 per cent of the land area were under dispute with the Forest Department over expiry of lease period or violation of the terms of lease. The lease agreements of 4 plantations which occupied 9 per cent of the land area had already been revoked so that at present, the Chalakudy basin portion of the Nelliampathy hills had only 12 plantation divisions covering just half the total plantation area with valid lease agreements (Table 6.7).

Table 6.7 Land ownership details of Nelliampathy plantations

Crop	Lease		Lease revoked		KFDC		Lease conflicts		Own		Total	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
Tea	3	365	0	0	0	0	1	413	0	0	4	778
Coffee	3	348	2	249	0	0	0	0	0	0	5	598
Coffee-cardamom	6	424	2	161	2	228	6	1245	1	371	17	2428
Total	12	1137	4	410	2	228	7	1658	1	371	26	3804
(%)		(25.4)		(9.2)		(5.1)		(37.1)		(8.3)		(85.0)

Source: Primary survey

The relationship to the natural resources was quite exceptional in these high hill zone regions due to the differences in ownership pattern. Contrary to other zones of the basin and even to other highland zones of most of the neighbouring basins, the entire cultivated and inhabited region in Nelliampathy was under leasehold from the State government. The ultimate owner of these lands is the State and the present conflicts in the region over resources involved the State directly through the Forest Department. The terms of lease differed from 99 years to 999 years to perpetual lease agreements with strict conditions of lease that prevented all other digressions of land use other than agriculture. The rampant violations of lease deeds and the expiry of



several of the original lease periods have led to annulling of lease, attachment of land and protracted legal conflicts between the planters and the State government.

The coping mechanisms adopted by the plantations to survive the crisis period have deeply affected the use and relations to land in this agro-ecosystem. Most of the estates had stopped collecting rainfall data as scheduling of operations based on rainfall data was no longer feasible in the changed labour and climate scenario. The managers admitted that coaxing maximum harvest in a given year at minimum cost had become the essence of management of these sprawling plantations in the highly fragile ecosystem of the Western Ghats. The dilution in the cultural practices of the plantations such as weeding and fertilizer applications as a consequence of cost cutting and labour displacing measures have been reported widely in most of the literature dealing with plantation crisis. Non-viable plantations have been neglected or abandoned and scientific crop management have been mostly compromised upon which has led to reduced yield in several instances (Oxfam, 2002; Ravi Raman, 2003; George and Joseph, 2005). While on the one hand labour shortages have been pointed out to be the reason for delaying or abandoning of several crop management practices regarded as 'non-essential' such as pruning, pest and disease management practices, on the other hand it has also been put forward that such dilutions in the agronomic care of the crop have led to labour redundancies (Neilson and Pritchard, 2010), bringing to sharp focus the stark viciousness of the cycle that plantation labourers have fallen into.

Interestingly, the reduction in intensive agronomic practices such as use of fertilizers and plant protection chemicals due to high production costs and labour retrenchment has been used as an opportunity for improved produce quality and capturing of niche markets by the use of the geographical identity of the Western Ghats. In the Nelliampathies, the Forest Department in its confiscated estates of Thuthampara and Rosary had made coffee cultivation part of its Landscape Conservation Project so that the coffee produced through minimum of agronomic interventions has been able to enter the organic produce market. Low-intensity organic plantations thus became an alternative to low-intensity conventional plantations (Valkila, 2009). Worldwide there is an expanding consumer demand for sustainably produced coffee that is valued for its geographic location and sustainable, conservation oriented cultivation practices (Rice, 2001; Aerts *et al.*, 2010). The

Rainforest Alliance certification for crops produced through better social, environmental and land-use practices which has been introduced among the plantations of Valparai plateau in the Chalakudy basin also espouses this recent redefinition of land use practices (Mudappa and Raman, 2012).

Due to the reserved forest status of the region, the plantation labourers who formed the majority of the workforce and the population of these hills had absolutely no rights over the land in the Nelliampathies. The analysis of land area possessed revealed that of the total plantation household surveyed, 61 per cent were completely landless whereas 39 per cent possessed land but outside of the hills and the basin. Seventy five per cent of the land owned by 51 per cent of the labourer households was outside the State whereas only 25 per cent was inside the State owned by 49 per cent of households mostly in the Palakkad district in the plains surrounding the Nelliampathy hills. Of the land owned, 72 per cent of households owned homestead land of marginal areas between 5 to 25 cents and another 23 per cent were not aware of their share as it was undivided ancestral property over which they were hopeful to obtain a share. The large proportion of landless households is an indication that most of the families with land assets outside of the hills had already left in search of a more secure livelihood base.

Vishwanathan and Shah (2012) had reported that the prospect of settling down in the labour lines had led the migrant labourers to give up what assets they had in their native villages before setting upon the new phase of life that plantations represented. They contend that an overwhelming majority of the plantation workers were landless and migrant workers who did not have any physical assets or securities to start their life anew once they were out of the employment in plantations which makes them adhere to the sector even when it is poorly paid and highly volatile. Sharma and Das (2009) had affirmed that 82 per cent of the land holdings owned by the plantation labourers in the Darjeeling Himalayas were located outside the plantation districts which indicated the changing frontiers of the plantation industry in the recent times.

#### 6.3.4.3 Changing linkages to water resources

The entire highland village is a web of streams that were being tapped both for domestic water supplies and more recently for irrigation. The most prominent

drinking water source for the plantation quarters were the natural springs whose waters were collected in tanks and supplied through public tap facilities by the estate managements. The region had experienced acute water scarcity in the summer months especially when the plantation workforce had been a strong presence. The emptying of the hill of its workforce had reduced this conflict over water for domestic needs though even now close to 50 per cent of the households reported to face summer scarcities to meet domestic water requirements.

In the irrigation front, the scenario was completely different. The main sources of irrigation in these hills were the stream networks that most often originated in the hills that surround the plantations (Fig. 6.1). The waters from these streams were impounded in check dams which were then used through sprinkler irrigation for tea and coffee and mist irrigation for cardamom. The estate managements reported that the climate and rainfall conditions in the Nelliampathies had been congenial enough around 2 decades back for the crops to be grown without providing artificial irrigation. Tea had been able to thrive in the region as a rainfed crop through conserved soil moisture until the 1990s. Currently sprinkler irrigation was practiced during the months from December to May to counter the extreme drying up of the soils. Coffee, even though a rainfed crop, requires two assured rainfalls during the critical crop stages of flowering and setting for a successful crop. While the Arabica coffee requires the blossom showers during March-April, the Robusta coffee needs it slightly early in February-March. A back up shower during April-May is essential for both species. Many of the experienced managers in the region reported that these showers which had been fairly regular in the Nelliampathy hills, were very erratic and uncertain of late necessitating irrigation. Most of the coffee estates had an irrigation schedule for the entire summer months rotating from one section to the other to meet the irrigation requirement within the critical requirement window. For cardamom, irrigation had become a necessity all throughout December to May to maintain the warm humid microclimate that is essential for a healthy and thriving plantation. Many estates were reporting changes in irrigation scheduling and means due to reduction in water availability that has resulted out of intense irrigation dependence in the recent years. On the other hand, various other estates had stopped irrigation altogether following 'agricultural simplification' whereby only minimal

agronomic measures were being resorted to due to the general lackadaisical attitude to production.

### **6.3.5 The basin boundary extensions through work connections**

The livelihood choices of the people also decided the linkages of the basin to outbasin regions thus expanding the socioeconomic boundaries of the basin. The linkages that are examined here include the place of occupation of the people, the markets from which inputs, capital and labour for basin enterprises are sourced and the output markets for the produce.

An investigation of the place of occupation revealed that nearly three fourth of the workforce was employed in the same village. Here again, trends differed for men and women. Almost 91 per cent of women workforce was working within the village whereas only 64 per cent of men remained working in the village. Of the 35 per cent of men earning their livelihood outside of the village and the basin, an almost equal share (17%) was found both within Kerala and outside of it. Amongst the female workers working outside the village and the basin, more women were employed outside the state, than inside of it. The workers who had sought employment outside the village were found to be almost entirely outside the basin, either within Kerala or in the neighbouring state of Tamil Nadu. Fig. 6.4 captures the various locations to which the working population of the high hills of the Chalakudy basin had spread to for employment.

It is quite evident that those who had left the village to work were rarely limited within the basin boundaries. The nearest towns or industrial locations were often the epicenters of remigration from the hills. Those workers who were in occupations within the state were mostly in the district of Palakkad or the nearby districts of Thrissur or Ernakulum employed mainly in the construction and transportation sectors. Only very few workers had relocated to other plantation townships. The favoured places of work outside Kerala were the industrial townships of Tiruppur and Coimbatore and none were found to have relocated to other plantations outside Kerala. Several persons were also noticed to have found employment in the native villages/ towns of their parents as the start of a process of weaning off from the hills. Whereas previously, the retired permanent workers stayed on in the hills, several of these elderly non-workers had also now returned to their

places of origin. The Middle East as an employment haven had not become a noticeable trend yet. Of the households surveyed, only two had members working outside the country.

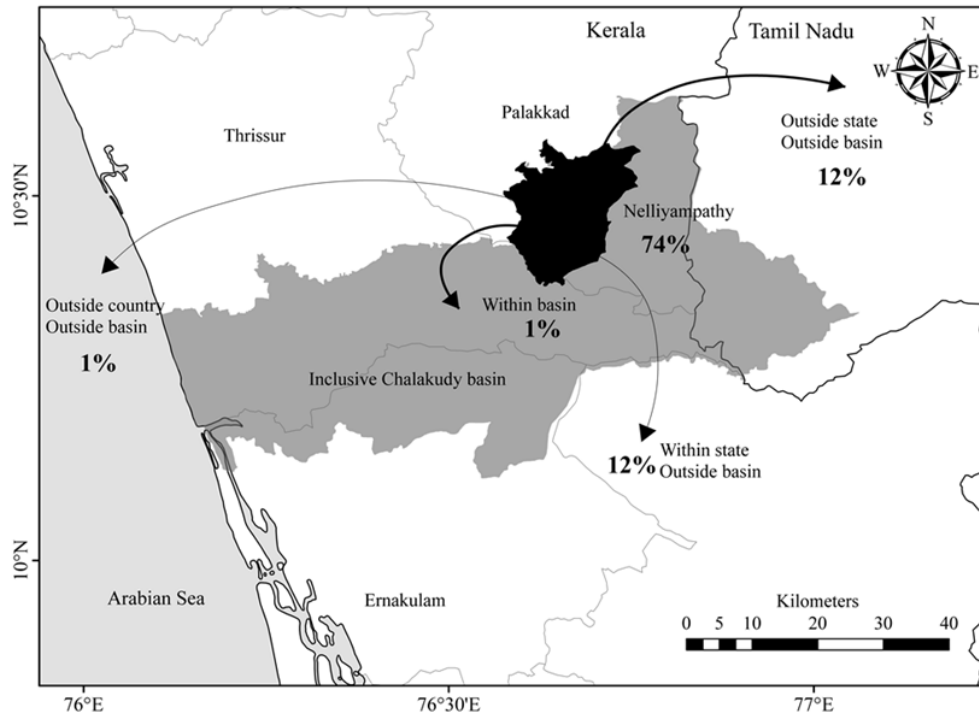


Fig. 6.4 Location of occupation of working population - High hills

In all the plantations in the study region, the lease holders and thereby the capital investment in the plantations came from outside the basin. They were mainly from the High Range plantation regions in the nearby Periyar or Pamba basins though of late lease holders with no background in plantation agriculture have been reported to take up the helm of many of the plantation divisions illegally sold off. Labour linkages in the region had also been historically from outbasin regions. The recent influx of casual labourers from the dry belts of Tamil Nadu also strengthened this bond of primarily outbasin labour linkages in the Western Ghat mountain settlements. Thus both capital and labour made way into these mountains from outside the basin. The crops grown in the plantation sector in these high hills had always been intended for markets outside the basin. It is clear from Table 6.8 that all the produce were intended for distant markets and even the agents that procured these produce came from locations outside the basin. It has been pointed out by Saravanan (2007) that most of the produce grown in a region is intended for markets outside the basin so that there is a virtual trade in resources that leads to a resource crunch within the basin.

Table 6.8 Average yield and markets of the plantation crops in Nelliampathy

Crop	Product	Average yield (kg/ha)		Market
		Nelliampathy	South India	
Tea	CTC	3760.0	1919.7	Cochin, Coimbatore auction houses
Coffee	Dry coffee berry	628.0	918.0	Erattupetta, Wayanad, Kozhikode agents
Cardamom	Dry capsule	9.3	187.5	Palakkad, Coimbatore agents

Source: Personal interviews, Tea, Coffee and Spices Board statistics (2008-09)

### 6.3.6 River basin governance in the high hill zone: The issues of concern and communities of interest

The analysis of emergent livelihoods and resource relations in the high hill zone of the basin has brought out the various interest groups involved in the use of natural resources in the region, their livelihood and ownership connections to these resources, the various issues of concern regarding the use of these natural resources in the context of basin based resource management and the multiple boundaries deciding the power differentials of resource used that need to be scaled for a meaningful participatory governance. It was concluded in Chapter 5 that the multiple boundaries and inclusive basin considerations in a river basin necessitated a governance and stewardship approach which would be concentrated around problemsheds and the communities of interest involved. The various issues of concern and related interest groups identified in the high hill zone of the basin through the analysis of livelihood patterns and relation to resources are discussed below.

#### 6.3.6.1 Degradation of an extremely fragile and invaluable ecosystem and related conflicts

The high conservation status of the Western Ghats which has been declared a global biodiversity hotspot and world heritage site has been alerted to be under significant threat due to the various destructive and fragmentation activities carried out within it which also includes the prominent plantation enclosures within or adjoining its forests. The hills and plateaus of the Western Ghats at present supports 120,000 ha of tea, around 340,000 ha of coffee and over 73, 000 ha of small cardamom plantations cultivated either in leased in forest lands or private lands abutting forests (Mudappa and Raman, 2012). In fact, the plantation districts in Western Ghats in the three states of Kerala, Tamil Nadu and Karnataka is noted to account for 99 per cent of Indian

coffee production , 25 per cent of Indian tea production and almost 60 per cent of Indian tea exports (Coffee Board, 2009; Tea Board, 2009). These plantations have therefore extensively transformed the forested landscapes of the Western Ghats. Kerala can be considered as the 'plantation enclave' of the country and total area under the four crops of tea, coffee, cardamom and rubber accounts for about 34 per cent of the gross cropped area in the state (GoK, 2012).

The leased plantations in the high hill and highland plateau AEZs of the Chalakudy basin in the Nelliampathy, Anamalai, Malakkappara and Parambikulam regions account for around 14 per cent of the total area of the basin (Madhusoodhanan, 2009). The ecological impacts of these plantations include the fragmentation of crucial ecosystems, the deliberate destruction of forests through extensive cutting of forest trees, forest encroachments and use of land for non-agricultural activities (Mudappa and Raman, 2012). It has been cautioned that the unprecedented destruction of tropical habitats result in adverse effects such as the loss of climate regulation and crop pollination thus challenging the very existence of these plantations (Balmford and Bond, 2005). They also admit that within most of the biodiversity hot spots in the tropics, biodiversity, rural livelihoods, customary claims, governance and livelihood crises are closely interlinked. The plantations within Nelliampathy forest are already experiencing these drastic and visible changes in the form of erratic and reduced rainfall, increase in temperature and decrease in relative humidity and soil moisture. The changed climate have in turn resulted in plummeting crop health and yields, increased crop irrigation requirements but reduced stream flows to meet them with, leading to various coping mechanisms within the plantation management that have affected the local livelihoods already reeling under economic crisis related redundancies (Fig. 6.5).

The position of Nelliampathy surrounded by the various wild life sanctuaries and protected areas and containing core and buffer areas of the PKTR, Zone 1 category classification under WGEEP (2011) and several areas categorised as EFL(GoK, 2003b) elevate its conservation status further. These varied developments related to the ecology and conservation status of the region have led to conflicts and collusion between the planter community and the State at various levels, being the two most powerful players in the region. On the one hand, the Forest Department is strictly revoking the lease agreements of all plantations that have exhausted their lease

period and those who are indulging in lease violations. On the other hand, there are concerted efforts from the side of political interests and factions of the State government to delay the process of acquisition as planters represent a powerful interest group whose boundaries span the entire highland zone in the state. In fact, two of the prominent politicians of the ruling party alliance are undergoing vigilance probe for having allegedly abetted the Nelliampathy planters in the illegal pledging of the leaseholds. Hence, even while the lease related litigations are ongoing, the plantations areas in the Nelliampathy hills have been exempted of the core and buffer areas of the PKTR as has been brought out in Section 6.3.1. The power ascendancy of the State boundary can also be detected in the fact that the proposed project areas of the Kuriyarkutty - Karappara multipurpose project have been omitted from the core-buffer boundary delineations of the Parambikulam Tiger Reserve. The ultimate authority of the State in the matters related to natural resource management in the current situation becomes visible in such an interest group based analysis. Any river basin governance efforts which would follow the hierarchy of the State machinery is therefore doomed to failure as far as a truly democratic process of natural resource management is concerned.

#### 6.3.6.2 Plantation based livelihoods and interest groups

The plantation sector as a livelihood option and major land use in these high hills are on the verge of significant transformations. The sector continues to thrive here due to heavily subsidised land and labour relations that include a nominal lease rent rate, low labour wages and unrestrained water extractions. Survival is also sought through numerous illegal activities that include forest encroachments, forest land mortgaging and sale and setting up of tourist resorts and homestays. Labour practices have also radically changed to contract and casual systems of employment. It is evident from the analysis of livelihoods carried out in Section 6.3.3 that there is a strong process of outmigration of the labourers from the hills driven by various factors that include lower wages, changed conditions of employment, plantation sector instabilities and the impossibility of owning any land in the region. Hence, the survival of the sector under the current scenarios is highly uncertain. The opportunities for any alternate employment in these hills are also restricted due to the ecologically fragile status of the region. For instance, the transportation sector, especially private jeep services heavily dependent on tourism which were once thought to be a lucrative



diversification is now facing increasing regulations and restrictions from the Forest Department. While the planter interest groups are vying for continued control over land that would permit diversification of interests through relaxations for tourism, livestock raising etc., environmental interest groups are trying to protect these ecologically sensitive and biodiversity rich regions through various legal measures and public awareness. At the same time, the State has conflicting interests in the area that include protection of the planters' interests, recovery of the leased forest land and development of the multipurpose water infrastructure project. The reservoir of the proposed Karappara- Kuriyarkutty project if implemented would submerge entire plantations in the Karappara valley that would wipe out the plantation sector itself from the region. Therefore power differentials among the various interest groups in the region would influence and decide the governance and stewardship options in these high hills.

#### 6.3.6.3 Land rights issue

The analysis of the emergent livelihoods in the region reveals that the connection of the plantation labourers with the region is extremely tenuous and getting structurally redefined. Their linkages to the natural resources of the place are only work related since ownership of resources is limited in these hills vested with the State. Their voice as an interest group, even though they constitute the largest share in the population of the village is therefore quite subdued. Even then there are demands for ownership rights over land in the area which is highly contested. But the issue acquires prominence in the case of contested *adivasi* land rights.

The tribal population forms 17.2 per cent of the total population in these hills, of which 6 per cent are native tribes of *Kadars* and *Malayars*. While most of the migrant households have a native place to go back to, even after 2-3 generations of plantation life, the native *adivasis* have been truly alienated of all rights to land in their own ancient dwelling places. The *adivasi* land rights movement in Kerala that had acquired a fresh momentum after the *Adivasi – Dalit Samara Samithi* agitation in 2001 had its influence in the Nelliampathy hills also. Following the 2001 agreement with the State government that 5 acres of land per tribal family would be awarded wherever land is available, a permanent strike outpost was set up at a place called *Pullukad* in Nelliampathy where many tribal families have erected shacks

demanding 5 acres of land per family in the hills. A total of 186 families are present at *Pullukad* who have arrived from various estates and hamlets who now eke out a living by doing all manners of casual work in the handful of tourist resorts and other informal service sector enterprises.

It has been well documented that the predominant population and plantation workforce in all plantation belts of the country belong to *adivasi/ dalit* groups (Raj, 2010; Mishra *et al.*, 2011). While the *dalit* population was fully composed of migrants from the plains, the tribals were mostly natives of the forested landscapes that had been transformed into the plantations. In almost all plantation belts of the country, it had been forest lands over which the indigenous communities possessed customary rights that had been encroached upon for plantations either by the State who then bestowed rights to prospective planters or by the planters themselves. Hence, occupation of plantation lands that have been abandoned or nearby lands has been an enduring strategy of the tribes of the State in their demands for land and livelihood rights after the adoption and subsequent inaction of the Kerala Scheduled Tribes (Restriction on Transfer of Lands and Restoration of Alienated Lands) Act of 1975, which sought to restore to the tribals their previously alienated lands and prevent further alienation. For example, an attempt was made in 1984 by *adivasi* and *dalit* plantation workers to occupy and independently cultivate waste lands outside the Ashly estate in the Idukky district in the High Ranges of Kerala which was instantly subverted by the planters with the help of local police. More recently, in 2007, the Kumbazha estate of Harrison Malayalam Limited at Chengara in the hilly terrains of the southern plantation belt of the Pathanamthitta district was occupied by more than 3,000 families of *dalits*, *adivasis* and OBCs under the *Sadhu Jana Vimochana Samara Vedi* demanding five acres of land per family (Manosmita *et al.*, 2012).

The case of Nelliampathy acquires a different intonation compared to the other plantations in the state where the tribal land movements had been pitched due to the continued reserved forest status of these hills. In the historical background of extensive swindling and grabbing of tribal lands by non-tribals and the State in Kerala followed by systematic devastation of landscapes and degradation of the *adivasis*, there is a possibility of using these land rights movements to obtain ownership of the coveted forest lands of the hills by the non-tribals, in yet another phase of tribal

exploitation. Due to the disparate livelihoods including plantation work pursued by these tribals of the Nelliampathies and the absence of a forest dwelling for many, their inclusion within the purview of The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 also become contested. For the time being they remain largely ignored and powerless and in the absence of any steady livelihood opportunities or rights over resources, starvation and malnutrition deaths among the *adivasis* are being reported in these bountiful reserves of nature (Jayaraj, 2013).

#### 6.3.6.4 The downstream impacts of changed water linkages upstream

The Karappara stream that flows through the Nelliampathy high hills is the only undammed tributary of the Chalakudy river. Therefore resource use changes in these uplands have grave implications on water quality and availability downstream. As was seen in the analysis of resource use linkages, one of the responses to decreasing crop yields and changed climatic conditions had been an increase in the irrigation provided to the plantation crops that were once raised as mostly rainfed (Section 6.3.4.3). Heavy lifts directly from the stream or from check dams constructed across it affect the summer flow in the river considerably. The proposed Karappara-Kuriyarkutty inter-basin multi-purpose project which intends to divert water from the head waters of Karappara and Kuriyarkutty tributaries of the Chalakudy river basin to the Bharathapuzha basin is also another potential threat to downstream water dependencies even though ironically the Chalakudy river basin has not even been mentioned in its EIA documents (KSEB,1998). The downstream population dependent on the river for irrigation and drinking water needs form the dominant interest group concerning the issue of such recent and unlimited water abstractions and centralised future projections.

Participatory river basin governance revolving around communities of interest would provide an opportunity to transcend these power gradients of multiple boundary considerations formed around the various interest groups. Any existing system of natural resource management based on the hierarchy of power relations and stakeholders identified within its purview would retain the invisibility and insensitivity towards those interest groups whose relationship to basin resources are not ownership based but based on livelihoods.

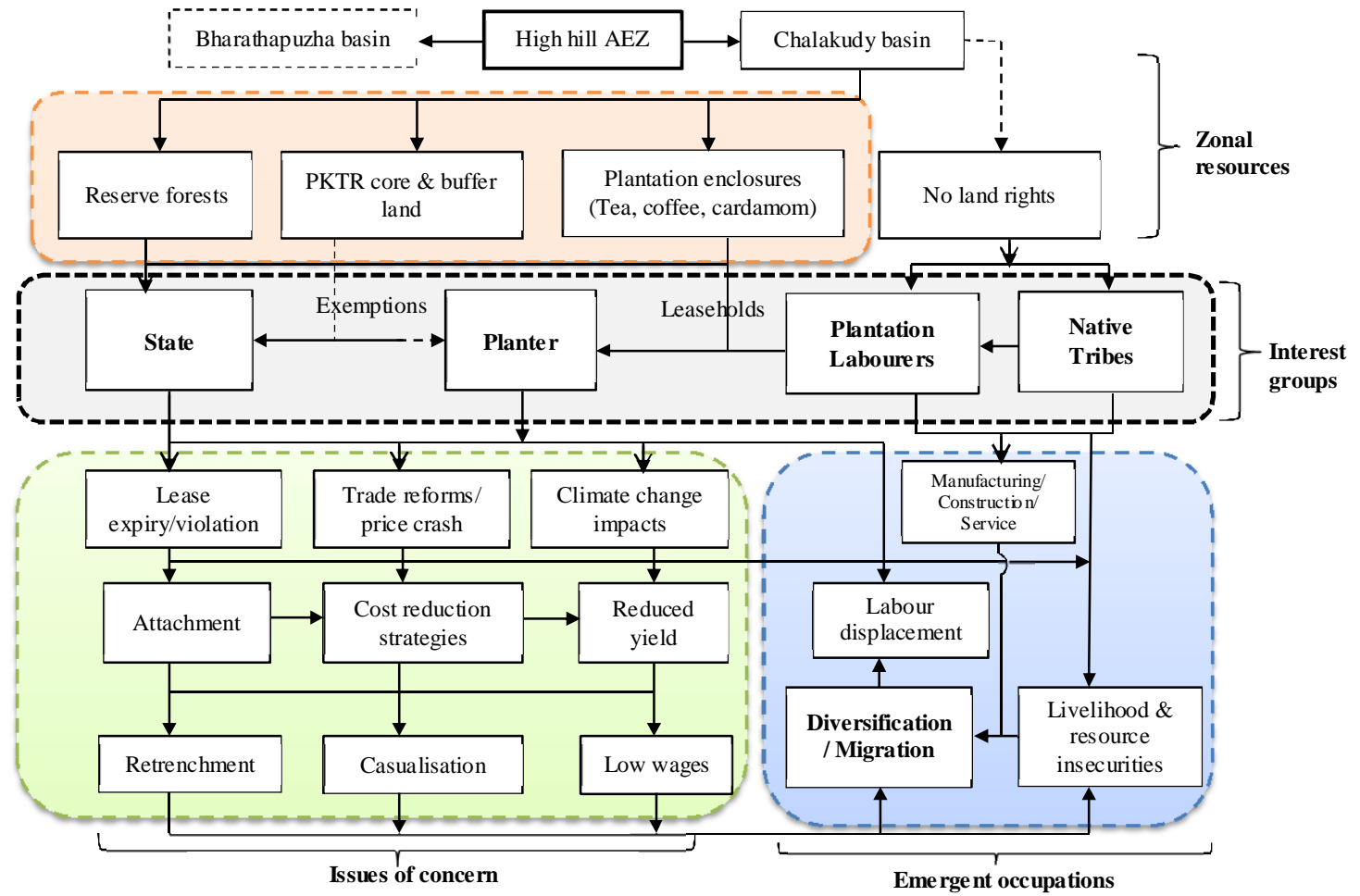


Fig. 6.5 Schematic sketch of interest groups, resource linkages and livelihood emergence – High hills

## **6.4 Foothill Agro-Ecological Zone**

The foothill agro-ecological zone of the Chalakudy river basin is located between  $10^{\circ} 15' - 10^{\circ} 27'$  N and  $76^{\circ} 25' - 76^{\circ} 40'$  E at an elevation range of 60-250 m above msl and is spread out in both forest as well as revenue land constituting around 16 per cent of the area of the basin. The land use is characterised by evergreen and semi-evergreen forests, forest plantations, forests recently converted to agricultural plantations of cashew (*Anacardium occidentale*), rubber (*Hevea brasiliensis*) and oil palm (*Elaeis guineensis*) and a sparse human habitation in mixed cropping homesteads. This zone of the basin is highly undulated with steep slopes and possesses shallow forest loam soils over pre-Cambrian rock formations. The foothill zone forms the transition between the forested upstream hills of the basin and the populated downstream stretches. It is also the region where the river finally flows as a single entity after the union of its major tributaries. The lingering wilderness of the area despite the recent human habitation and interventions, the pristine wild river that cascades over various steep slopes and the entry into the majesty of the Ghats have made the region a favorite tourist destination in central Kerala. At the same time the foothills form one of the most fragile regions in the basin ecosystem due to the increasing human pressures in the form of forest encroachments, monocropped plantation agriculture and tourism related interventions.

The foothill zone of the basin is mainly spread across the lower reaches of Athirappilly panchayath and also has negligible area in the upper reaches of the Kodasserry panchayath in Thrissur district and parts of Ayyampuzha panchayath in Ernakulam district. The major human inhabited region of Athirappilly panchayath downstream of the Athirappilly waterfalls was selected for the primary questionnaire survey for the purpose of understanding the livelihoods and related natural resource linkages in the foothill landscape of a basin.

### **6.4.1 The setting and multiple boundaries**

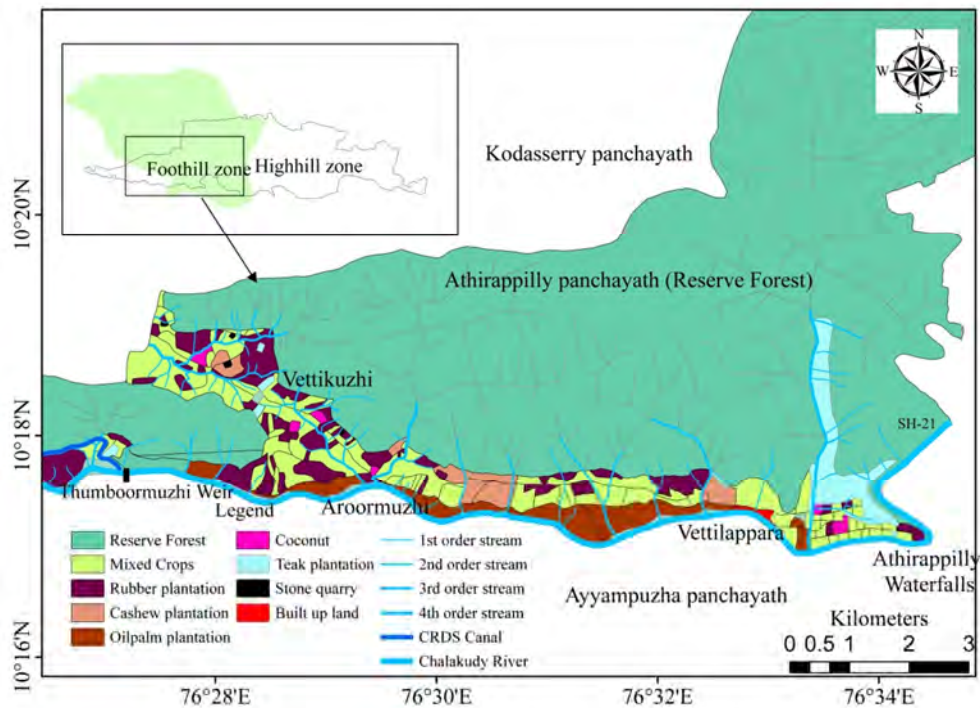
The Athirappilly panchayath carved out of the Pariyaram panchayath in the year 1979 has an area of 489 sq.km of which 410 sq.km towards the north and east are mostly forest plantations of teak and bamboo with scattered patches of dense forests in between. Tea and coffee estates are found in the far eastern region of Malakkappara

which forms a slice of the state boundary with Tamil Nadu. The Sholayar tributary of the Chalakudy river enters the state of Kerala here, gets dammed for the Kerala Sholayar HEP, a constituent of the PAP group of dams, and proceeds to join the other tributaries at Orukombankooty. The northern boundary of the panchayath hugs this confluence point from where onwards the river gains its identity as the Chalakudy river. The river in its wild splendour traverses the length of the panchayath, encumbered once at Poringalkuthu for power generation and later hurtles down the falls of Vazhachal and Athirappilly before assuming a more tranquil flow.

The forested extent of the panchayath with more than a dozen dispersed tribal colonies from Malakkappara to the Athirappilly waterfalls comes under the high hill agro-ecological zone. The remaining area below the Athirappilly waterfalls on the northern banks of the Chalakudy river with a highly undulating topography forms the foothill zone of the Chalakudy basin inhabited by a displaced Malaya tribal community and settlers who had arrived at various periods of time in the past 70 years pursuing assorted dreams of work and land to call their own. It had a total population of 9643 persons of which around 39 per cent belonged to Scheduled Castes and Scheduled Tribes category (GoI, 2001). The population density of the panchayath taking into consideration the whole area in both the AEZs was around 20 persons/sq.km even though bulk of the human habitation was concentrated in the foothills at around 677 persons/ sq.km. The panchayath is bordered in its southeast by the Nelliampathy panchayath, Valparai Municipal Corporation in Tamil Nadu state to its northeast, the Ayyampuzha panchayath in the Ernakulam district to its south and the Kodasserry panchayath to its northwest (Fig. 6.6).

Chalakudy municipality situated at a distance of 30 km east of the village and serviced by both state transport and private buses is the nearest township. The State Highway 21 which connects the Chalakudy town to the state border at *Malakkappara* and from there to the Pollachi town of Tamil Nadu, courses through the panchayath, dividing the foothill region into the southern flank of PCK oil palm plantations bordering the river and northern side of ex-servicemen colony land (Fig. 6.6). *Vettilappara* and *Aroormoozhi* form the major village centre and market place from where the village is also connected to its neighbouring panchayath of Kodasserry through another road that services the northern parts of the panchayath (*Vysserry* –

*Pachakkad*) where the Anamala cooperative farm is situated at *Vettikuzhy*. The Athirappilly waterfall located above *Pillappara* forms the hub of tourist interest in the region which has a cluster of shops, tea-stalls and resorts abutting the waterfall. Of the total land area of 145 sq.km under the foothill zone in the panchayath, 132 sq.km (91%) was under forests and various forest plantations. The rest of the area was found to be under agricultural plantations of oil palm, rubber and cashew and mixed cropping homesteads. The region received an average annual rainfall of 3000 mm mainly from the South West monsoons and had soils that were once a rich forest loam, but had undergone heavy erosion and laterisation over the years (GoK, 2007). There are several small ephemeral streams/ *thodu* such as *Kannankuzhy*, *Pillappara*, *Aroormuzhi*, *Blachi*, *Kaliyankara* and *Appanakuzhi* that horizontally cut across the foothill region, originating in the hill slopes and joining the main river in the valley. Most of the cultivated homestead lands were either rainfed or irrigated through private wells. The Chalakudy River Diversion Scheme (CRDS) weir is situated in the panchayath but had practically no command area within Athirappilly.



Data source : KSLUB (2000a)

Fig. 6.6 Location and land use of Athirappilly foothills zone

The region is institutionally bounded both by the Forest and Revenue Departments and other major institutional stakeholders of Plantation Corporation of Kerala (PCK), Kerala State Electricity Board (KSEB) and the Tourism Department. The forested area is mostly within the jurisdiction of the Pariyaram and Athirappilly Ranges of the Chalakudy and Vazhachal Forest Divisions. The high share of area under forests in the region and the co-existence of human settlements and forests in very close everyday livelihood interactions made the ecosystem boundaries of management important for the region. There were no transboundary extensions in the foothills but there were numerous boundary extensions realised through livelihood linkages.

#### **6.4.2 Occupational and resource use history of the foothills (1900s – 2000s)**

The colonisation of the Athirappilly region has a clear and near history of not more than 70 years. The foothill and high hill zones of the Chalakudy basin in the now Athirappilly panchayath were part of the Kodasserry forest division of the erstwhile Cochin princely state until independence with no other human habitation except for the hunter gatherer tribes of *Kadars* and *Malayars* who had their settlements deep in the forest. The Chalakudy river with its precipitous banks and numerous rapids was not considered navigable in these hilly and mountainous zones especially beyond the Athirappilly waterfall. Ward and Connor (1821) reflects upon the extreme wilderness that surrounded the '*Adrampully Cataract*' in their geographical and statistical memoir of the Cochin survey and pointed out that

*'till within 18 miles of its mouth, the Shalacoodee flows through a wild and mountainous country....'A hill tribe roam thro (sic) the mountainous tracts, which never had other inhabitants..'*

Menon (1911) had recorded in the Cochin State Manual that *Kanjirappilly* (presently in the neighbouring Pariyaram panchayath) was the furthestmost human settlement to the east from Chalakudy town beyond which were the wild un-navigable river and primeval forest tracts uninhabited save for the tribal settlements of the *Malayars* and *Kadars* who were excellent trackers and foragers engaged in the collection of minor forest produce such as pepper, honey, beeswax, lemongrass, *nux vomica* and ginger. Chalakudy had been hailed as one of the six important satellite markets of the Cochin state for pepper during the pre-colonial and early colonial era with abundant trade



relations not only with the Cochin port but also with the Coromandel coast through the Ghat route via Poringalkuthu (Malekandathil, 2010). Therefore by the beginning of the 16<sup>th</sup> century, it is indicated that the occupational mix of these native inhabitants of the high and foothills of the basin consisted of a 'complex mosaic of practices' ranging from swidden subsistence agriculture to forest produce foraging both for trade with lowland groups as well as for subsistence (Morrison, 2002).

With the arrival of the Portuguese in the Cochin port and the start of the colonial era in the sixteenth century, the pressures on these forested foothill tracts were not just for its non-timber treasures but increasingly for its valuable timber also (Menon, 1911). The wanton destruction of the forests that started then was continued throughout the 18<sup>th</sup> and 19<sup>th</sup> centuries along with contract system for firewood and minor forest produce collection. The permit and contract systems that marauded the forest of its trees and bamboos and auctioned off the collection of minor forest produce, rescinded the primary rights of the native forest dwellers over the forest produce. Even the Cochin Forest Act passed in 1905 to prevent the unregulated exploitation of the forest wealth by introducing scientific forest management was only a means to fillip the falling revenues from the forest lands and curtailed the rights of the tribes further. These timber plundering incursions by the government and government approved contractors were the means by which the upland wilderness of the Chalakudy basin was first opened up to heavy outsider influence which was epitomised by the construction of the Cochin Forest Tramway in 1901. Constructed to gain access to the invaluable and as yet inaccessible forest wealth of the Parambikulam plateau, the tramway ran a length of 80 km from Chalakudy town through the foothill forests into the Kuriyarkutty valley. Operational between the years of 1907 and 1928, the tramway led to heavy and organised removal of not only timber but also of other forest produce such as bamboo, canes, medicinal plants and minor forest produce in the entire stretch that it traversed including the foothills (Anon., 1917).

The chain of events that systematically led to the opening up of the entire foothill region of the basin was triggered off when the survey team for the diversion of the tramline chanced upon the Poringalkuthu falls with immense possibilities for a hydro-electric project (Anon., 1917). The initial investigations for the project

commenced as early as in 1917 and the construction finally started in the year 1942. The Anamalai road constructed between Chalakudy and Poringalkuthu (extended upto Malakkappara by 1950 and presently the State Highway 21 connecting Chalakudy town with the state border) primarily for the transport of material and machinery and to provide access to the water power station, was also to serve the '*general purpose of opening up new country and of tapping the forest*' (Rendel and Tritton, 1932). The construction of the dam and the road opened up the country not only to newer avenues of forest exploitation but also to a new crowd of inhabitants to the region as construction labourers and petty traders. Meanwhile, the *taungya* system of raising teak forest plantations, in vogue in this area since 1922, lead to agricultural crops of tapioca and rice being cultivated for the first three years in the clearfelled plots by the *taungya* contractors along with raising of teak seedlings. Many of the early inhabitants of the Athirappilly region had arrived as agricultural labourers or as crop guards for the *taungya* contractors during the time or as casual labourers for clearing the forest areas marked for clear-felling.

During late 1940s and early 1950s when the country was in the throes of the post-World-War II food crisis, large clearances of forests were also made in the guise of the Grow More Food (GMF) campaign for temporary food cultivation resulting in extensive encroachments of forest land. In 1942, the 'Hill paddy' scheme was started by the Forest Department of the Cochin state in the Chalakudy basin foothills. As the Forest Department was not experienced in agriculture and as the main individual colonists who undertook cultivation under the government scheme left the land owing to the ravages of malaria, the venture resulted in great losses (Vallabhan, 1996; Amruth *et al.*, 2007). The region then became the site of a fresh experiment in collective farming by the Anamala co-operative collective farming society (*Anamala Kootukrishi Sangham*) which was formed and managed by the Kissan workers of Pariyaram village. The *Sangham*, after handing over their original land in *Konnakuzhy*, Pariyaram, for the State Cattle Breeding Farm, established their collective farm during 1944-45 on 166 acres of forest land in which the Hill Paddy scheme had been previously attempted without success. Paddy, tapioca, banana and vegetables were cultivated in the initial years under constant evacuation threats from the Forest Department officials who were making a profit by leasing out similar cleared land in the vicinity to tenants and share croppers. The *Sangham* in turn had

invited tenders for leasing out the land to farmers for cultivation, thus pulling in many enterprising farmers into the region. A large portion of these clearfelled forest lands in the *Vettikuzhi* region were later encroached by these and other farmers from the neighbouring midland extents.

In 1952, the entire foothill stretch from *Pillappara* in the east to *Chiklai* in the west was clearfelled after which tapioca was raised once. The acute dearth of agricultural labourers in these previously uninhabited tracts led to abandoning of the venture and 1000 acres of this land was earmarked to be handed over to the Resettlement Division of the Defence Department for the establishment of the Thirukochi Ex-servicemen colony (Anon., 1952). Applications were invited from ex-soldiers of the Travancore-Cochin Force ex-service men who were forcefully dismissed from service during 1950 as a part of amalgamation with the Indian Army and ex-service men of the Indian Army who had served in the Second World War. Plots of area 3.75 to 4.25 acres of land were granted per family to 185 families, most of whom hailed from the midland and coastal villages of Ernakulam and Thrissur districts. The land was issued with a stipulation of '*undertaking cultivation to aid the government and the people*' and staying in the premises was mandatory as per the bye-law of the society registered as the Thrishivaperur District Thiruvitamcoor-Cochin Ex-service Men Co-operative Colony. Rs. 1750/- was issued to each family for house construction and further financial assistance was also provided towards farming expenses. An excess of 200 acres of land and some land pooled from the members was kept as common land by the society which was planted with cashew and later rubber. Over the years, the government acquired portions of the Society land for the establishment of various public facilities of Primary Health Clinic, Ayurveda dispensary, Post office, Krishi Bhavan, Panchayath office, Government School etc. Around 200 acres of clearfelled land in excess of the 1000 acres allotted to the colony was auctioned off by the State at the rate of Rs. 250-300/ acre during the same time in the *Vettikuzhi –Chiklai* region. Several affluent persons from the neighbouring regions of Pariyaram and Melur and from the settler communities of Pala in Kottayam district had thus bought land for which ownership deeds were obtained after 20 years. These official grants were later accrued upon by encroachments into the forest area along the borders by many of the settlers. Apart from the 185 ex-service men families and the settlers who had bought the auctioned off land, agricultural labourers from various

mid and lowland regions of the state were also attracted to these newly denuded foothills in search of fresh livelihood opportunities.

Towards the end of 1950s the construction of the Kerala Sholayar dam as part of the PAP agreement brought in a fresh wave of construction labourers into the region. Several of these workers, many of the agricultural labourers and forest logging workers chose to settle down in the foothill region mostly on *poramboke* lands (later to be resettled in 4-cent colonies). Agricultural work was abundant in the settler farms, the ex-servicemen colony and the newest addition to the rapidly transforming landscape of the region- the PCK rubber plantations. The PCK plantations were established in the early 1960s on leased forest land in the fertile alluvial lands bordering the Chalakudy river after razing off the rich and unique riparian forests and effortlessly displacing the *Malayar* tribal settlement in the region. With the leasing out of the *Vettilappara* river bank to PCK, whole joint families of the *Malayars* were dumped together in a few cents of barren and dry hill slope at *Pillappara* with no water even for drinking. The Poringal and PAP dam constructions and the series of forest plantations in their erstwhile homes had already hurtled the native *Kadar* and *Malayar* families from one site to another as suited the whims and fancies of the latest development agenda of the state (George, 2001). Deprived of their territorial identity and the meager means of livelihood that the severely plundered forests had nonetheless offered, these natives were left to flounder in the permanently temporary ‘new homes’ that the government deemed fit to grant them.

The PCK which was established as a joint stock company in 1962 had several rubber and cashew plantations across the state of which the plantations in the Chalakudy basin named Athirappilly and Kalady group of estates were established on 2195 acres of leased forest lands on the south bank and 705 acres on the north bank of the Chalakudy river respectively. The PCK introduced rubber as a lucrative farming venture into the area and very soon, the absentee landlords in possession of the auctioned off lands in the periphery of the region were also establishing plantations of their own. The Anamala collective farming society also planted rubber in these early days pioneered by the then *Sangham* Secretary. Even the ex-servicemen settler homesteads started their early hesitant experiments with planting rubber. By the late 1960s paddy and tapioca almost entirely disappeared from the homesteads. The PCK

had also attracted a sizable labour force into the area who was housed in the plantation quarters and who after retirement settled down in the region on land bought off the ex-servicemen settlers. The Kalady plantations were later planted with oil palm in various phases starting from 1991-92 onwards after clearfelling of the rubber trees. The 1960s to 1980s also saw a massive drive for establishing forest industrial plantations in the Athirappilly, Vazhachal and Kollathirumedu Ranges which brought in fresh loggers and casual wage workers and denuded the forests further. Several of these casual worker families, later settled down in the 4-cent colonies even though quite a few families still occupy government *poramboke* lands on the side of roads, river/ stream banks and forest fringes.

The next major wave of settlement in the area happened during the 1970s, when the *Kannankuzhy Harijan Colony* was established under the initiative of Shri. P.K.Chathan Master, communist leader and Local Self Government and Harijan Welfare Minister in the first Kerala Legislative Assembly. Blocks were created on either side of the Chalakudy – Malakkappara road each of 1 acre 23.5 cents by clearfelling the remaining forest patch immediately below the Athirappilly waterfalls stretching upto *Kannankuzhy*. Ninety seven families were originally granted land with 12 years temporary *pattayam*, though many of these beneficiaries had to sell their lands as soon as title deeds were obtained, driven out by lack of work, wild animal attacks and other inhospitable conditions. On a different vein, the clearing of this stretch of land inadvertently exposed the majesty of the Athirappilly waterfalls which until then had only been a roaring presence behind the thick canopy of the forest trees that had screened it off. This final act of shaving off the last of the foothill forest cover thus set the stage for the growth of the region into a major tourist destination in the days to come.

The 1980s became a milestone decade in the occupational and landscape change history of the region when the various pathways of settlement of the area merged together through deliberate or fortuitous mutual influences. Athirappilly-Vazhachal falls carved a firm place in the tourism map of the state aided by the various movies that were filmed in the grandeur of the falls, starting from the Tamil blockbuster '*Punnagaimannan*' released in the year 1984. Attracting tourists from either side of the Ghats from both Tamil Nadu and Kerala, tourism related industries

redefined the occupational opportunities of the residents. At the same time, unable to engage in any profitable farming in the land granted to them, the *Kannankuzhy Harijan colony* residents sold off their lands to fledgling tourism entrepreneurs who were on the lookout for prime riverside property. The Ex-servicemen settlers were also granted title deeds for their lands during 1981-85 following the Gazette notification of 14<sup>th</sup> December 1971 and subsequent resurveys. A frenzy of selling followed which redefined the productive uses to which these lands were put to.

The plight of the native tribes in their officially granted colonies continued to be pathetic with increased loss of foraging livelihoods with each fresh incursion into the forest. The Malakkapara Girijan Development co-operative society was started in 1981-82 but failed to bolster the traditional livelihoods of the natives. The Participatory Forest Management introduced by the state government in 1998 and implemented through *Vana Samrakshana Samitis* (VSS) facilitated by the Forest Department became functional in the region by 2001 and absorbed a good number of tribals who had otherwise found employment as casual workers for the Forest Department. The NREGS that became operational by 2008 was another avenue of work but these employment generation schemes were largely marginal activities. According to the Census figures, there was an increase in the share of marginally employed workers in the region from less than 10 per cent in 1971 to close to 20 per cent by 2001. Agriculture as a livelihood activity that had provided for almost half the working population in 1971 supported barely 8 per cent of the workforce by 2001. At the same time, there was an increase in the share of plantation, forestry and orchard workers, from less than one fourth of the working population to around 70 per cent of it in 2001 so that primary sector of employment still dominated the work scenario (GoI, 1971; GoI, 2001). The present occupation patterns in the region in the light of these emergent trends are being explored in the next section.

#### **6.4.3 Emergent occupations and patterns in the foothills of Athirappilly**

The foothill region of Athirappilly, at present, was found to have an occupational mix that had a predominance of casual workforce engaged in an assortment of agriculture, plantation, forestry as well as service sector activities. The gender differences in the livelihood activities pursued were found to be quite sharp in every respect, be it the nature and agency of occupation or the place of work.

Table 6.9 Distribution of workers in various occupation categories- Foothills

Main employment	Frequency (n)			Percent (%)		
	Male	Female	Total	Male	Female	Total
Cultivator	11	0	11	7.6	0.0	5.6
Agricultural labour	28	20	48	19.4	39.2	24.6
Plantation, Forestry etc.	7	5	12	4.9	9.8	6.2
Mining & Quarrying	2	0	2	1.4	0.0	1.0
Manufacturing	18	0	18	12.5	0.0	9.2
Construction	17	2	19	11.8	3.9	9.7
Trade	19	2	21	13.2	3.9	10.8
Transportation	13	0	13	9.0	0.0	6.7
Other services	29	22	51	20.1	43.1	26.2
Total (N)	144	51	195	100.0	100.0	100.0

Source: Primary survey

In keeping with the Census data, the primary sector was seen to have a high representation in the workforce at Athirappilly. 37 per cent of the total working population identified themselves as casual labourers in both agriculture and plantations. Even more strikingly, as high as 49 per cent of women main workers were engaged in primary sector economic activities (Table 6.9). Contrary to the high hill AEZ where the plantation sector workers were engaged in large-scale plantations, the majority of plantation workers in this zone worked in small-scale homestead based plantations of rubber. These workers were also engaged as agricultural labourers in coconut based homesteads and in lease farmed plots of banana (*Musa sp.*). Plantation workers in the strict sense were those who worked for PCK plantations. Here again, the presence of the casual labour force was quite strong due to the recent practice of engaging daily wage labour for most of the peak season operations. The permanent workforce engaged by the PCK had reduced to almost one-third in the recent years due to the practice of engaging casual workers.

Therefore the divide between the plantation and agriculture sector labourers was found to be quite ambiguous in this zone. This ambiguity was furthered due to the forest related livelihood activities that were taken up by this casual labour force either being directly recruited by the Forest Department on daily wages or as a part of the work within the ambit of VSS activities. The VSS formed under the Joint Forest

Management project and NREGS both of which envisage the protection, upkeep and restoration of natural resources of a region through local work participation, were relied upon to augment the dwindling work opportunities in the traditional occupational sectors of agriculture, plantation and forestry. There were a total of 12 VSS operating in the Athirappilly panchayath of which 6 were tribal and the rest were non-tribal forest fringe VSS. It was found that as high as 51 per cent of the women workers and 19 per cent of men workforce were also engaged in VSS and/ or NREGS activities along with 20 per cent and 19 per cent of women and men not engaged in any other economic activities respectively. The activities that were assumed by these primary sector workers under various domains are provided in Table 6.10.

Table 6.10 Work domains of primary sector employment in the foothills

Domain	Man	Woman
Rubber	Taking pits for planting rubber, rubber tapping, processing into sheets, fertilizer application, plant protection measures	Weed clearance, collecting milk, manual transport of fertilizers and manures into plantations
Banana	Planting, Fertilizer/ manure application, opening and closing of basins, tying of ropes to guard against wind	Weed clearance, head load of fertilizers and manures
Oil palm	Harvest, weed clearance, fertilizer application	Head load, weed clearance, fertilizer application
Coconut	Opening and closing of basins, green manure application	Weed clearance, green manure application
Forest	NTFP collection, forest clearing, planting of tree saplings, harvest of cane and reed	
VSS	Forest fire protection activities including fire line creation, lopping of forest undergrowth, raising nurseries and planting of indigenous tree species and medicinal plants in the forest and homesteads, tourist area protection activities including guide service, collection of seeds of forest trees, collection of NTFP and its marketing	
MGNREGS	Weed clearing in public spaces, temporary check dams across streams, pits for planting banana, opening of coconut basins, rainwater harvesting pits and other agronomic activities in homesteads	

Source: Primary survey and interviews



Contrary to the other AEZs in the basin where participation of men in these employment generation activities were limited due to comparatively lower wage rates, men in this zone were also involved in VSS and NREGS work. The employment generated through NREGS was seen to be undertaken by the predominant casual workforce in the zone especially during the monsoons when work in the plantations and farms were limited. Therefore a seasonal shift was witnessed in the domain of work engagement even though the activities undertaken were relatively similar. For instance weed clearance or '*Kaadu veeshal*' was an activity that was commonly undertaken by the women labourers under all the primary sector domains. NREGS activities were also found to be widely taken up by the tribals when they were impeded of non-timber forest produce (NTFP) collection in the forest during heavy rains. Over the years a declining trend was witnessed in NTFP collection due to tribal youth seeking employment opportunities elsewhere and unsustainable collection practices which had led to the destruction of the trees and shrubs that yield the produce. Due to all the above described circumstances and predicaments, the primary sector workforce in the foothills of the basin was found to emerge as a mixed casual workforce engaged in various domains and seasonal works according to availability.

Cultivation or farming as a main livelihood activity was reported by 6 per cent of the working population only. On the other hand, 12 per cent of the main workforce was engaged in farming as a subsidiary economic activity. Even though the average operational land holding size was found to be much greater in this zone, active cultivation of these lands for food crops and subsistence was found to be diminishing with increase in the area under small-scale rubber plantations. In fact, 60 per cent of the main cultivators had reported to have area devoted to rubber cultivation. Commercial banana cultivation was found to be the other major emergent cultivation in the foothill zone. 24 per cent of the cultivators were noted to grow the commercial '*Nendran*' variety of banana on owned as well as leased land. But the highest commercial banana cultivation was undertaken by lessee farmers from outside the basin on leased land as an intercrop in rubber saplings which have been freshly planted or replanted after the earlier plantation had been slaughtered. The lease contract was usually for 2-3 years and the contract usually involves planting and establishment of the rubber seedlings and intercrop of banana or pineapple (*Ananas comosus*) during the time. It is also pertinent that only 6 per cent of the cultivators

reported coconut (*Cocos nucifera*) as a major crop. Nutmeg (*Myristica fragrans*) was seen to be planted by 12 per cent of the cultivators though the paucity of irrigation in the region was a huge deterrent to the successful establishment and spread of the crop. The waning interest in mixed homestead cultivation had resulted in the reduction of year round agricultural work which is another factor that has contributed towards the emergence of the mixed casual workforce discussed above.

Livestock rearing was conveyed to be a fast diminishing enterprise in the region. Of the total surveyed households, only 24 per cent owned cattle. Majority (90%) of households that did own cattle were found to be those dependent on non-farm or mixed activities as main livelihood means whereas only 10 per cent of pure agricultural households owned cattle. The maintenance of a permanent livestock was a rapidly vanishing practice especially with the decrease in serious homestead farming, which required cattle manure as an important input. In fact, several huge cattle sheds were encountered either in utter state of disuse or which had been converted to other uses such as wood stocking sheds or rubber sheet pressing units. The Livestock Census figures for the panchayath indicated that the cattle and poultry population has reduced by more than half between 1996 and 2007 (Fig. 6.7). On the other hand, raising of buffalo as meat stock has gained popularity in the space of the past 5 years. The nearness to the Chalakudy cattle market, availability of open spaces and forest for feeding and the quick returns guaranteed made buffalo rearing for meat a lucrative venture in these foothills.

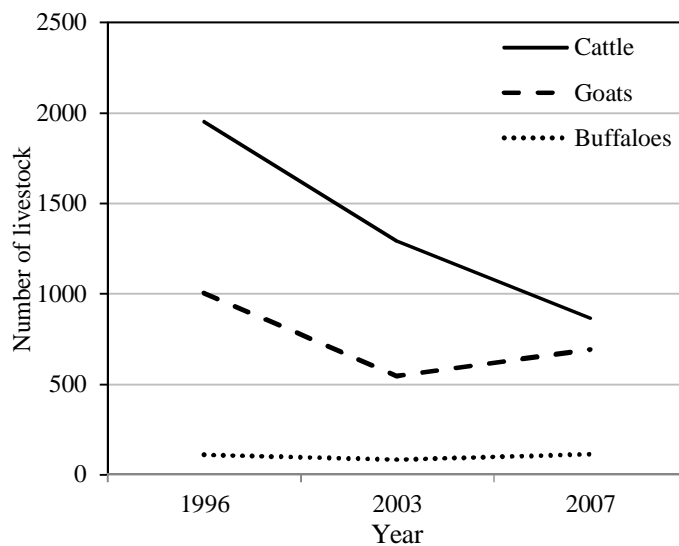
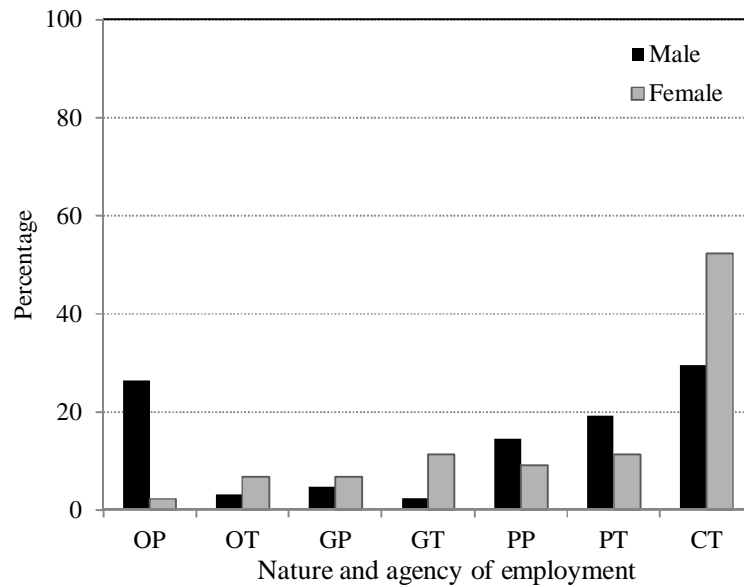


Fig. 6.7 Trends in livestock population 1996-2007- Foothills

Trade and commerce in the form of many small retail shops, hotels, restaurants, etc. abounded in the region due to the tourism activity. There were 8 resorts, 8-10 homestays, 20 restaurants, 22 stationary shops, several soft drink outlets and petty shops and street hawkers and peddlers that thrived in the foothill region of the panchayath, dependent on the heavy tourist influx into the region (Athirappilly panchayath License Register, 2008-2009). It was found that nearly 11 per cent of the working population was engaged in trade related activities, either as owner operators or employed as sales persons in these outlets.

Except for a couple of small scale concrete brick making units and a stone crusher unit, there were no household or other than household industries in the area either in the formal or informal sector. A few young persons employed as workers in carpentry units, aluminum fabrication units etc. were found to be working in the nearby panchayaths of Melur, Pariyaram or Chalakudy town. The construction sector was also not as full-fledged in this zone as observed in the other agro-ecological zones of the basin, employing only 9 per cent of the total workforce. Most of the land in the region was still vested with the Forest Department and therefore developmental activities involving construction was restricted. Many of the workers employed in the sector went outside towards Chalakudy, Ernakulam and Thrissur for their work due to limited amount of opportunities inside the village. Since there was paucity of work in the immediate vicinity, very few women were employed in this sector. There were around 9 per cent of men employed in the transportation sector which was gaining prominence in the recent years due to the presence of the tourism industry and the distance of the area from the nearest medical facilities and other amenities such as wholesale and produce markets, which necessitated reliance on private transportation. This sector was also a subsidiary form of employment for many households. A vehicle was found to be a form of investment for many households after the sale of landed property. The other services sector which included private teaching, tailoring, real estate, head load works, domestic help and various casual works related to tourism and movie production location work, employs another sizable share of the working population. Twenty six per cent of the total workforce and 43 per cent of the women workforce find work in the sector, the major share of which was temporary or casual work in the private sector, thus adding to the casual work pool in the village.

Thus it was seen that 52 per cent of the women main workers and 30 per cent of male workers undertook casual and temporary work in the foothill zone (Fig. 6.8).



Note: OP- Own permanent, OT-Own temporary GP- Government permanent, GT- Government temporary, PP- Private permanent, PT- Private temporary, CT- Casual

Fig. 6.8 Distribution of nature and agency of work - Foothills

The caste composition of the population and workforce provided a glimpse into the cross-section of society who had first settled down and prevailed in these foothills despite the adverse and often uninhabitable conditions. Due to the specific nature of settlement of the region based on a variety of land grant schemes and the much better accessibility of the foothills compared to the high hills of the basin, the population was a combination of pioneer homesteaders and the most marginalised and poor. The *dalits* belonging to the scheduled castes of *Pulaya*, *Paraya*, *Panan*, *Velan*, *Kavara*, *Kanakkan/ Padanna* and *Vettuva* had arrived in these hillslopes either as casual wage workers during the various phases of forest clearfelling and dam constructions upstream or as labourers in the farms and plantations. The *Kavara* families had migrated to the region around 35 years back from the Bharathapuzha basin due to the availability of bamboo for their traditional occupation of basket weaving. Except for the few *dalit* families who still remained in the lands granted to them through the Harijan land grant scheme at Kannankuzhi, all the others resided in various four-cent or SC colonies in the region or on *poramboke* land. The *adivasis*

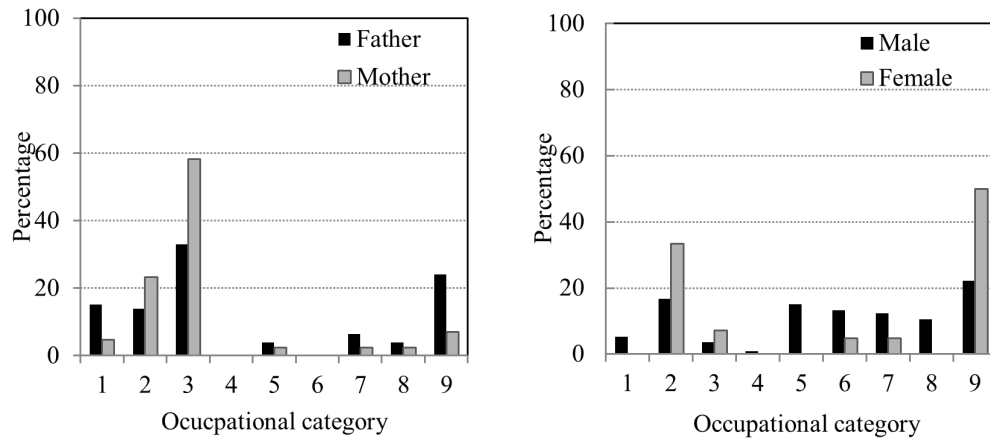
belonging to the *Malaya* and *Kadar* tribes, native to the forests of the Ghats resided in tribal hamlets which had been several times relocated by the State to make space for one developmental project after another in the highlands of the basin.

The present occupational pattern of the predominance of casual workforce in primary and service sectors had strong caste overtones also. The present working population was composed of 35 per cent Christians, 38 per cent other backward castes of which 34 per cent were *Ezhavas*, 18 per cent *dalits* and 9 per cent *adivasis*. 59 per cent of the total tribal and 34 per cent of the total *dalit* working population were found to be engaged as casual workers in plantations, forestry and agriculture. More importantly, 100 per cent of the *adivasi* and 43 per cent of *dalit* women workers were active in these operations. The rest of the *dalit* women workers were occupied in the other service sector either as Asha or Anganwadi workers or as casual workers in domestic service. In contrast, nearly 80 per cent *dalit* and 46 per cent of *adivasi* men workers were employed in construction, petty trade and transportation sectors, again as temporary or casual workers in the private sector.

The age and education of this emergent workforce also merit attention. While majority of the women workers in the age range of 30-50 were employed in the primary sector, women workers below 30 years of age were all employed in the other services activities. Men workers were more spread out in the secondary and tertiary sectors in the 30-50 age group whereas those below 30 were found to prefer construction and manufacturing sectors. It can be seen that the 40 per cent of the men workers were educated upto the secondary level which has considerably influenced their livelihood decisions, while most of the men workers with only primary education were employed in the primary sectors. Of the 25 per cent of women workers with secondary education 70 per cent were occupied in the other services activities and 30 per cent were found to be in the primary sector.

The emergence of the secondary and tertiary occupations of manufacturing, construction, trade and transportation and the preference of the male workforce for these occupational choices could be witnessed in a comparison between the work categories of the parental and present generations (Fig. 6.9). It also brought out the disappearance of plantation sector as a stable source of employment, the reduction in cultivators as a main livelihood category and the increasing identification as

agricultural labourers especially among women due to the mix of casual work in small-scale plantations, homesteads, forest and public spaces. The emergence of the other services activities as an important work category for women is also evident from the intergenerational comparisons.



Note: 1- Cultivators, 2- Agricultural labourers, 3- Plantation, Forestry etc., 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6.9 Occupational profile of parental and present generation- Foothills

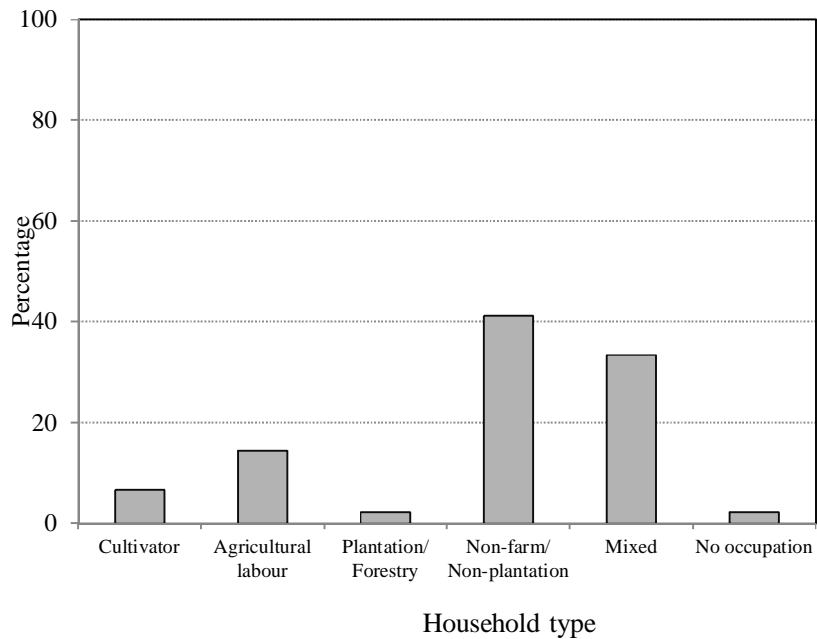


Fig. 6.10 Household livelihood groups composition- Foothills

A mix of livelihood strategies was seen to be adopted not just at the individual level, but at the level of households also. As can be gathered from Fig. 6.10, 33 per cent of the households resorted to a mix of both primary and other sector activities and around 40 per cent of them were purely non-farm occupations based, which consisted of a mix of non-farm occupations in the secondary and tertiary sectors. 80 per cent of the *adivasi* families were found to be mixed occupation households whereas 56 per cent and 47 per cent of the *dalit* and *Ezhava* families respectively were found to pursue purely non-farm occupations as main livelihood strategy.

It has been reported from foothill regions across the developing world that most of the households have been engaging in multi-livelihood strategies integrating the various subsistence and income-earning activities of agriculture, horticulture, hunting and gathering, animal husbandry, and forestry to survive in an era of fluctuating environmental and economic conditions (UNDP, 2001; Alexander *et al.*, 2006). A similar tendency was noticed in one of the high range villages in the Western Ghats by Nair and Ramkumar (2007) ignited by agrarian distress conditions. On the other hand, decreasing interest in animal husbandry, collection of NTFP and increased migration of people to urban areas were witnessed in a foothill agro-ecological situation in central Kerala in an examination of the changing labour scenarios (ATMA, 2008). The next section looks into the resource linkages of these emergent trends and multi-strategy households that would define the natural resource governance related problems and interest groups in the region.

#### **6.4.4 Livelihoods and resource linkages in the foothill zone**

The steeply sloping lands of the foothills of Chalakudy river basin have a settlement and agriculture history of barely 70 years, as has been elaborated in Section 6.4.2 and presented a clear study of immediate, visible and traceable changes in the livelihood relationship to resources. The steep slope of the land made it difficult to lift water for irrigation and the nature of the groundwater table do not permit heavy abstraction for irrigation. Therefore much of the cultivation that had evolved in these lands was rainfed. The absence of water during the non-monsoon months, rather than the abundance of it, had always influenced the cropping pattern in the foothills, despite the river that borders it and the numerous streams that gurgle down the slopes to meet

the river, most of them seasonal in nature. The forests that border this fringe human settlement have also been crucial in the resource schema of the region.

#### 6.4.4.1 Patterns of land ownership and access to land

The land in the foothills of Athirappilly can be broadly classified as forest lands and privately owned revenue lands. Majority of the forest area in the region had been leased out to the PCK for agricultural plantations way back in the 1960s thus introducing the plantation crop of rubber into these foothills. The rest of the foothill forests were vested with the Forest Department and were highly degraded forest plantations of teak, bamboo and other miscellaneous tree crops. The revenue lands were variously owned by the settlers who had arrived in these hills at various points of time, out-basin absentee landlords including religious institutions, farmers' cooperatives, speculators and tourism entrepreneurs. Marginal areas were also owned by *adivasi* and *dalit* households as tribal and 4-cent colonies. The classification of the land types represented in Fig. 6.11 reveals that the entire privately owned land in the foothills of the basin was characterised as upland garden lands. Around 20 ha of wetland paddy fields in the region had also been converted into mixed cropping garden lands long back.

A livelihood based analysis of the ownership of land holdings brought to the attention that 52 per cent of the homestead garden lands were currently owned by households whose primary occupational avenues were non-farm based. This was followed by pluri-active households who owned 31 per cent of the land area. Even then, highest average area per household was found to rest with purely agricultural households. The purely agricultural labour and other NR based households owned the least area. 25 per cent of the households owned holdings other than homestead land also dominated by non-farm and mixed strategy households (Table 6.11). Even though landless households were recorded as nil, there were some households which had taken up residence in *poramboke* lands on the side of roads, river and stream banks and forest fringes.



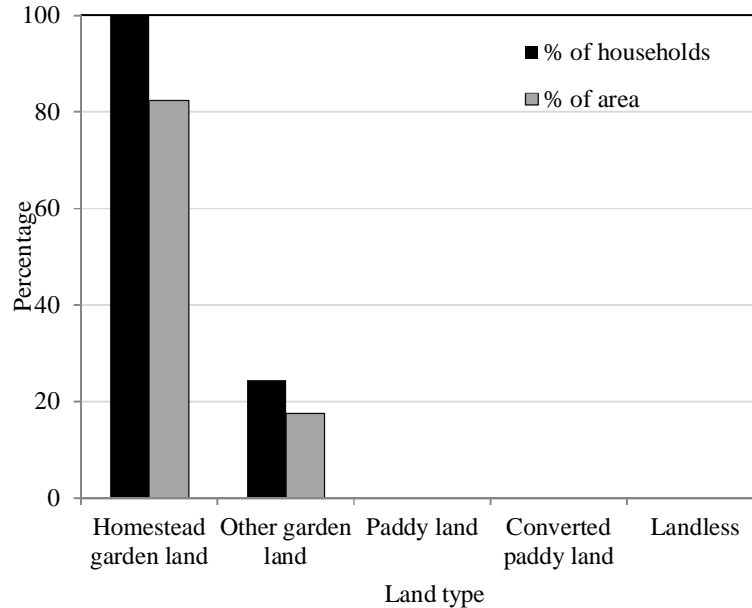


Fig.6.11 Distribution of land types in the foothills

The nature of inhabitation and settlement in the area through land grant schemes had meant that initially the average land area per household in these foothills was much higher than the basin or state average. But over the years, due to sale and inheritance related fragmentations and the concentration of the *dalits* in 4 cent colonies and *adivasi* households in displaced hamlets, the holdings had become increasingly marginal in size (Table 6.12). According to the Panchayath Peoples Plan Report 2009-10, there were 14 *adivasi* and three 4-cent SC colonies in the Athirappilly panchayath. At present, more than half of the households (53%) owned highly marginal holdings of less than 25 cents which constituted just 8 per cent of the total homestead area owned, indicating high inequality of distribution. The private land holdings were dominantly owned by Christian and *Ezhava* households. Despite the land grants of 1.23 acres each to the dalits, only 12 households had original lands still in their possession. The proximity of most of these land parcels to the river had led to heavy tourism related real estate investment in the region that had ousted the original owners out of their land. The SC, ST and other economically backward OBC families were therefore mostly found in 4- cent and *adivasi* colonies in the most inaccessible and barren regions with worst resource access crises.

Table 6.11 Distribution of land types among livelihood groups- Foothills

Household type	Homestead land			Other land holding			Total (including landless)		
	Area owned (acres)	House holds (No.)	Average area owned (acres)	Garden land			Area owned (acres)	House holds (No.)	Average area owned (acres)
				Area owned (acres)	House holds (No.)	Average area owned (acres)			
Cultivator	7.2	6	1.2	3.9	2	2.0	11.1	6	1.9
Agricultural labourers	2.7	13	0.2	0.6	1	0.6	3.3	13	0.3
Plantation/ Forestry	0.2	2	0.1	0.0	0	0.0	0.2	2	0.1
Non-farm	30.2	37	0.8	5.4	9	0.6	35.6	37	1.0
Mixed	18.1	30	0.6	2.5	9	0.3	20.6	30	0.7
No occupation	0.3	2	0.2	0.1	1	0.1	0.4	2	0.2
Total	58.6	90	0.7	12.6	22	0.6	71.2	90	0.8

Source: Primary survey

Table 6.12 Distribution of land types according to holding size- Foothills

Land type	Marginal land										Small		Medium		Large		Total	
	< 5 cents		5-25 cents		25-50 cents		0.5-1 acres		1-2.5 acres		2.5-5 acres		5-10 acres		>10acres		No.	Area
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area		
Homestead land	11	0.4	37	4.4	9	3	15	18.3	12	17.1	6	15.3	0	0.0	0	0.0	90	58.6
	(12.2)	(0.8)	(41.1)	(7.4)	(10.0)	(5.5)	(16.7)	(31.1)	(13.3)	(29.2)	(6.6)	(26.0)	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Other garden land	1	0.0	6	0.7	5	1.3	5	3.0	5	7.5	0	0.0	0	0.0	0	0.0	22	12.6
	(4.5)	(0.3)	(27.3)	(5.7)	(22.7)	(10.4)	(22.7)	(24.0)	(22.7)	(59.6)	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)

Source: Primary survey

Note: Figures in parentheses indicate percent share of total number of holdings and land area

#### 6.4.4.2 The trajectory of land use

Land use in these foothills had always been oriented towards perennial long term crops which were rainfed, save for a short phase in the first half of the 20<sup>th</sup> century during the initial clear felling and settlement years when tapioca (*Manihot esculenta*) and paddy (*Oryza sativa*) were raised in a rotation sequence. Upland rice varieties of *modan* and *kayama* were undertaken in the settler homesteads during this time whereas tapioca and paddy was cultivated by the *taungya* cultivators in the forest lands clear for industrial plantations. The present cropping pattern was dominated by perennial tree crop based agriculture undertaken by various categories of cultivators (Table 6.13).

Table 6.13 Details of land use and land ownership in the foothills

Cultivator category	Crop	Land ownership	Irrigation
Plantation Corporation of Kerala	Oil palm, rubber	Lease from Forest Department	No
Church and other absentee landlords	Rubber	Own	No
Ex-servicemen cooperative society	Rubber, cashew	Own	No
Anamala cooperative society	Rubber, cashew, arecanut, coconut, banana	Own	Lift from stream, well
Lease farmers	Banana, pineapple, tapioca	Lease from individual land owners	Well
Homestead farmers	Rubber, banana, arecanut, coconut, nutmeg	Own	Well

Source: Primary survey and interviews

The entire cultivated area was either under large commercial plantations of rubber, cashew or oil palm of PCK, Ex-servicemen society and Anamala cooperative society and other private individuals or under coconut based mixed homesteads which were also gradually shifting to small-scale rubber plantations. Large-scale rubber estates were also owned by absentee landlords including those owned by the Church (the Irinjalakuda diocese) and other religious institutions.

Originally intended as a farming collective, the ex-servicemen colony had diverged a long way from its original intents and purposes. Right now, very few

people made their living out of farming in the land granted them. Even though upland and hill paddy varieties were cultivated in these lands at the time when these lands were initially occupied by the ex-service men families, the cultivation was soon discontinued in favor of coconut and arecanut based mixed homestead systems. In the past few years, with the decline of coconut as a remunerative crop, extensive areas were being planted with rubber, which also promoted leased cultivation of banana as an intercrop for the initial years of establishment of the rubber saplings. The records at the *Krishhi Bhavan* show that close to 1500 coconuts were cut in the year 2008-09 availing subsidy and that very few of these had been replanted. The area under rubber in the region was of three basic categories: *i*) rubber planted for the first time and yielding, *ii*) rubber just planted for the first time and not yet yielding and *iii*) rubber planted for the second time after slaughter of the first batch and not yet yielding. Of these the second category of rubber planted for the first time and onto its second or third year was prevalent revealing the very recent and extensive conversion of homesteads to rubber. These newly planted areas were given for lease for a period of three years to banana planters mostly from outside the basin. Hence, banana as a leased crop was also widespread. Seasonal cropping of tapioca and paddy had almost disappeared from these foothills. Most of the original settler families had sold off their lands and were now left with only that much which they can ‘handle’ with the reduced labour power of the family that had shifted to non-farm based occupations. In fact, nearly 79 per cent of the households and 68 per cent of the cultivated land owned by the surveyed households were found to be growing rubber (Table 6.14).

Table 6. 14 Main crops and their distribution- Foothills

Crop	No. of households	Area (acres)	Average holding size	Percentage share (%)	
				Households	Area
Rubber	37	42.2	1.1	78.7	68.2
Coconut	26	10.1	0.4	55.3	16.3
Banana	11	5.8	0.5	23.4	9.3
Nutmeg	6	2.2	0.4	12.8	3.6
Arecanut	6	1.6	0.3	12.8	2.6
<b>Total</b>	<b>47</b>	<b>61.9</b>	<b>1.3</b>	<b>100.0</b>	<b>100.0</b>

Source: Primary survey; Note: Cultivation on own land only

In addition to the homesteaders, the Ex-servicemen society and *Anamala Kootukrishi Sangham* had also started leasing out large areas to commercial banana cultivation, especially with the long term interest of spreading the area under rubber plantations. In limited areas where there was assured irrigation, the perennial tree spice of nutmeg was also being experimented as a lucrative commercial crop. These extensive changes in the cropping pattern to the plantation crop of rubber had also influenced the occupational matrix of the women workers in the primary sector as has been detailed in Section 6.4.3.

Though lease farming was prevalent in the area of late, it was being undertaken mostly by lessee cultivators from outside the basin. Most of these lease contracts were for the establishment of rubber plantations along with a three year lease to raise banana or pineapple as intercrops. The commercial ‘*Nendran*’ variety of banana was the preferred variety in leased in lands both by local cultivators and outsiders. Table 6.15 (a) brings out that even though seasonal cultivation was undertaken by an equal number of own and lease cultivators, the area cultivated by own land cultivators was negligible (6%) compared to the area cultivated on lease (94%). The agricultural assistance for banana cultivation disbursed through the *Krishi Bhavan* under the State Horticulture Mission for the year 2008-09 also shows that a significant proportion of 31 per cent of the beneficiaries were lease cultivators.

Table 6.15 (a) Land – Livelihood linkages: Seasonal crops in the foothills

Seasonal crops	Households (No.)	Garden land	
		Area (acres)	Average area/ household (acres)
Cultivation on own land	7	0.8	0.1
Main	6	0.6	0.1
Subsidiary	1	0.3	0.3
Cultivation on lease land	7	12.8	1.8
Main	7	12.8	1.8
Subsidiary	0	0	0
Total cultivation	14	13.6	1.0
Share of own cultivation (%)	50	5.9	
Share of lease cultivation (%)	50	94.1	
Share of main cultivation (%)	92.9	98.2	
Share of subsidiary cultivation (%)	7.1	1.8	

Source: Primary survey Note: Includes leased in land area also

In a study of the agrarian distress and transition in the high range village of Upputhara in Idukki district of Kerala, Nair and Ramkumar (2007) had remarked on the growing presence of lease farming in the foothill villages of Kerala especially on marginal land holdings. They had recorded that about nine per cent of households leased in land for cultivation and that the extent of leasing-in land has been increasing in the recent years. This trend was corroborated in the foothills of the Chalakudy basin also, even though it was noticed that average area on which lease cultivation was undertaken was significantly greater than average area cultivated by own land cultivators.

It is also important to note that although 98 per cent of the seasonal cultivation was undertaken as a main livelihood activity both by own as well as lease cultivators, it took up only 20 per cent of the total cultivated area including leased in area. On the other hand, perennial cultivation of tree crops is found to be undertaken on close to 80 per cent of land, both as a main and subsidiary activity in an almost equal proportion of land area although a higher average area was owned by those households who undertook cultivation as a subsidiary activity (Table 6.15 b).

Table 6.15(b) Land – Livelihood linkages: Perennial crops in the foothills

Perennial tree crops	Garden land		
	Households (No.)	Area (acres)	Average area (acres)
Cultivation on own land	46	56.2	1.2
Main	26	28.5	1.1
Subsidiary	20	27.7	1.4
Share of main cultivation (%)	56.5	50.8	
Share of subsidiary cultivation (%)	43.5	49.2	

Source: Primary survey

Close to 86 per cent of the land area owned was thus put to agriculture largely perennial in nature. Even those lands which were put to seasonal cultivation were largely lands on which rubber saplings were being raised. The cultivating households, which consisted of those undertaking both main and subsidiary cultivation, made up only half the total households whereas the uncultivated 14 per cent of area was owned by the other half of the population. Agriculture as a main livelihood activity was thus

found to be getting redefined even in these relatively sparsely populated foothills with larger-sized homesteads and several plantations and farms under private, co-operative and government managements.

Along with increasing crop shifts, land as an investment commodity is also an emergent phenomenon in the region. River side lands owned by SC families near *Kannankuzhy* were especially priced for their river frontage and nearness to the falls. Of the original families of the Harijan colony, only a handful remained by the turn of the millennium with the entire river frontage land being taken up by various homestay and resort ventures. Spurred by the meteoric growth in tourism, the Athirappilly Development Committee was formed by resident entrepreneurs and a collaborative venture of Silverstorm Water Theme park was launched in 2000. Even the PCK took advantage of the rising opportunities in tourism in the region and set up the ambitious 'Plantation Valley' farm tourism project. The ex-servicemen-society had also geared up to the tourist trade by setting up a Herbal Garden, restaurant and lodging facilities.

#### 6.4.4.3 Changing linkages to water resources

The village is defined by the Chalakudy River that flows through its entire length forming its Southern boundary. But, ironically, the whole area was water short during summer months due to lack of groundwater and poor quality of the river water. A large number of streams and springs that becomes active during the rainy season petered out by the time the summer set in especially due to the changed land use scenario. Only 30 per cent of the wells in the area were found to be perennial. The beneficiary group managed Japan aided Rural Water Supply and Sanitation project '*Jalanidhi*' started during 2001 catered to the domestic water needs of the whole panchayath. But, the source of this water supply either being wells which were dependent on groundwater or being the river with no purification process at all, scarcity and poor quality riddled the domestic water supply in the region. Drinking water was identified as a major issue of concern for all livelihood groups, even while the lack of irrigation water was not lamented by many. Instances of water sharing among families were also a common phenomenon. It can be confirmed from Table 6.16 that 51 per cent of the households were dependent on the '*Jalanidhi*' waters across land holding sizes, even though dependence of the marginal land owners on it was even higher. The marginal land owners were also highly dependent on neighbouring wells especially for potable water.

Wells were the main private source of water whose distribution increased as the land holding size increased (Table 6.16). In the marginally land holdings of less than 5 cents which were constituted by the tribal and *dalit* colonies, as high as 44 persons were dependent on a single well. Whole colonies were found to be at times reliant on a single well, that too not dependable during summer months.

Table 6.16 Domestic water source in the foothills

Land holding size	<i>Jalanidhi</i>		Own Well		Neighbour's well	
	(No.)	(%)	(No.)	(%)	(No.)	(%)
< 5 cents	9	64.3	1	7.1	4	28.6
5-25 cents	27	57.4	15	31.9	5	10.6
25-50 cents	2	22.2	7	77.8	0	0.0
0.5-1 acres	12	52.2	10	43.5	1	4.3
1-2.5 acres	8	50.0	8	50.0	0	0.0
2.5 - 5 acres	1	20.0	4	80.0	0	0.0
5-10 acres	0	0.0	1.0	100.0	0	0.0
<b>Total</b>	<b>59</b>	<b>51.3</b>	<b>46</b>	<b>40.0</b>	<b>10</b>	<b>8.7</b>

Note: Multiple dependences on sources, Source: Primary survey

Irrigated agriculture was virtually non-existent as a result of the predominance of cash crops in the cropping pattern as well as due to the difficulty in lifting water from the river to the holdings which are located on the steeply sloping hill sides. Well irrigation was also not popular due to shortage of groundwater. The survey results yielded that close to 93 per cent of the land area as unirrigated (Table 6.17). Although there were two public operated lift irrigation schemes in the panchayath, these had limited beneficiaries.

Table 6.17 Distribution of operational holdings based on irrigation- Foothills

Particulars	Operational holdings			
	No.	Area	Average area	Cultivated area share
	(No.)	(acres)	(acres)	(%)
<b>Un-irrigated</b>	44	57.4	1.3	<b>92.7</b>
<b>Irrigated</b>	11	4.5	0.4	<b>7.3</b>
Well	7	2.5	0.4	4.0
Private LI from river	3	1.3	0.4	2.1
Public LI	1	0.8	0.8	1.2
<b>Total area under cultivation</b>	<b>47</b>	<b>61.9</b>	<b>1.3</b>	<b>100.0</b>

Source: Primary survey



#### 6.4.5 The basin boundary extensions through work connections

The main outbasin links forged in this foothill village dominated by the twin waterfalls of Athirappilly-Vazhachal was through the tourism interest it generated. The land in the river banks had been bought by tourism entrepreneurs for the entire stretch from *Pillappara* to *Kannankuzhy* where private ownership was possible. It can be seen from Fig.6.12 that 70 per cent of the working population found employment within the zone. An equal proportion of the workforce is found to find work outside the country in Middle East counties as well as within the state. Work locations within the state were mostly for the construction and service sector workers in Thrissur and Ernakulam towns who either temporarily migrated or commuted daily for work.

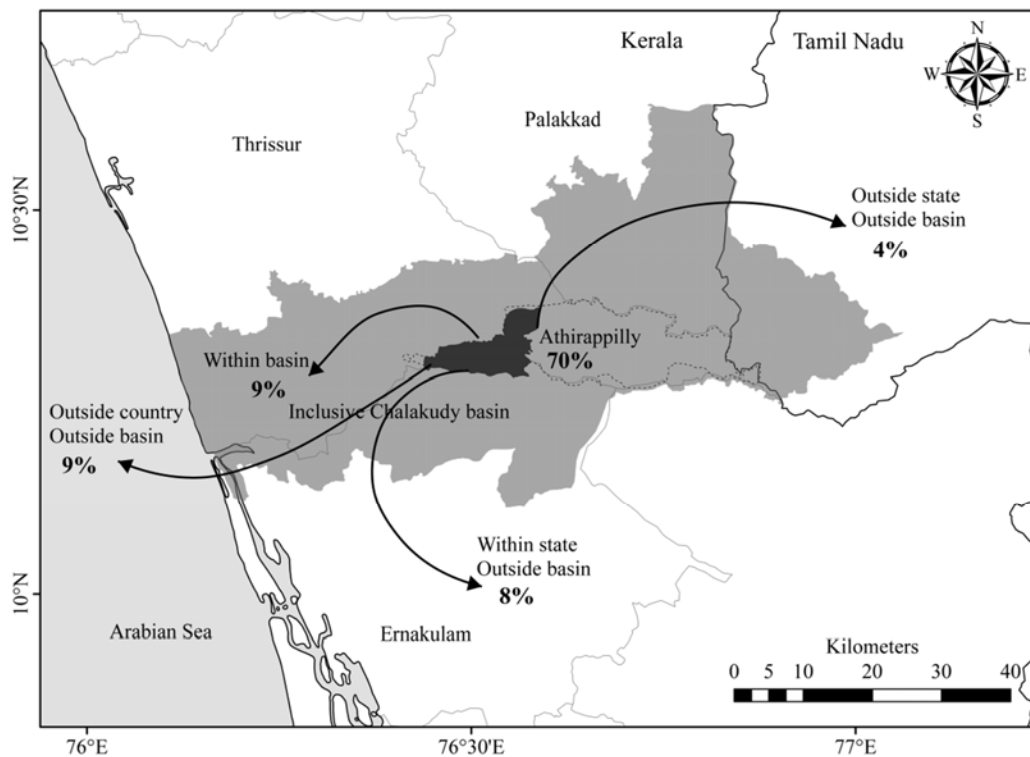


Fig. 6.12 Basin – outbasin work migrations in the foothills

The main land use of agriculture was found to have strong outbasin connections as all the major inputs were procured from outside. The planting material of the seasonal crop of banana was invariably procured from Tamil Nadu. Poultry manure was slowly replacing cattle manure due to reduction in local cattle population as well as due to the difficulty in handling of cow dung. The main source of poultry manure was the hatcheries located at Meloor panchayath within the basin and the

hatcheries in the Salem-Namakkal region of Tamil Nadu supplied through agents. The main produce from the land be it rubber as milk or dried sheets, oil palm kernels, banana or coconut, was found to be largely destined for outside markets.

#### **6.4.6 River basin governance in the foothill zone: The issues of concern and communities of interest**

Resource governance in the foothill region proves to be a tougher proposition than in the high hills because of the wider network of actors and interest groups in this AEZ (Fig. 6.13). The presence of human habitation in close conjunction with the forested areas leads to diverse conflicts of interest. The foothills in fact would form one of the most difficult regions to enforce regulations due to the nature of land ownership and the identity of the forest land fringes that has not completely transformed into an agricultural landscape.

##### **6.4.6.1 Monocultures on fragile hill slopes and stewardship concerns**

The main issue of concern in these fragile hill slopes of the Western Ghats was identified as the unrestricted cultivation practices, cropping patterns and forest encroachments that have jeopardised not only the productive capacity of the land, but also the groundwater availability and stability of the land. The monsoon floods and landslide in 2013 that had devastated the Athirappilly region were an indication of the extreme fragility of the land. All over the foothills and highlands of the Western Ghats, incidences of landslides following heavy monsoon showers have become common due to the extreme interventions in the form of conversion of forested hillslopes into plantation monocultures (Kuriakose *et al.*, 2009). It is clear from the analysis from the previous sections that major interest groups in these foothills of the Chalakudy basin who had a stake in such monocultures were the Forest Department, the government agency of PCK, absentee landlords from outside the basin, assorted homesteads whose main occupation was no longer agriculture and farmers' cooperative societies that still existed as legacies of a time when these regions were cleared for food crop cultivation to ward off famine. The dominance of non-farm occupations at the individual and household level had also influenced the shift into perennial plantations that were increasingly undertaken as a subsidiary livelihood activity. These shifts and increasing fragmentation of holdings had affected agricultural labour opportunities in the region especially among the women workers.

At the same time, these plantations had also heralded the emergent occupational group of outbasin lease farmers into the region during the establishment and replanting phases.

It has been reported that Kerala had witnessed a geographically concentrated increase in small holder rubber plantations in its foothills and midlands over the past 4-5 decades that tends to be predominantly monocultures (Vishwanathan and Shivakoti, 2008). Therefore, even though WGEEP (2011) had identified these regions as Sensitive I category lands, regulation of human activities in the region would involve these diverse interest groups at multiple scales. But the power differentials that had led to the sanctioning of prime river side alluvial land for rubber and later oil palm cultivation and allocation of extensive area to industrial forest plantations would not be easy to negotiate. The multilayered interest of small homestead owners who have shifted their cropping patterns and who are at the same time affected by the land use changes also plays a crucial role in influencing the composition of the interest groups and the stewardship options that would involve a major change in the cropping patterns and practices in these foothills.

#### 6.4.6.2 Tourism based livelihoods, resource relations and interest groups

Athirappilly at present is a village by the forest fringes dominated by a couple of waterfalls. The tourism industry that has taken firm roots in the area surrounding and focusing on the "*largest waterfall in the state*" has influenced directly or indirectly every aspect of life in these foothills including their livelihoods and resource consumptions. Despite the prominence of the sector, tourism in the region has been under the constant and prolonged threat of being wiped out by the proposed Athirappilly Hydro Electric Project (AHEP) by the KSEB that would annihilate the Athirappilly and Vazhachal waterfalls. The AHEP has become a major issue of concern in the Chalakudy river basin that has resulted in the emergence of multiscalar interest groups across the basin against the project. Within the foothills, the emergent tourism related livelihood groups that are the immediately affected interest groups had played a crucial role in the sustained protests against the proposed project. In the future, there is also a potential that these interest group pressures may influence water allocations from the various upstream diversion projects for sustenance of the waterfalls.

The tourism in this zone is completely under the control of the Forest Department since the waterfalls are situated within the forest lands. The region caters to about 1.5 million tourists per year that brings in revenue of Rs. 2 crore per annum as entry fee alone to the Forest Department. Despite the undisputed stamp that Athirappilly Vazhachal twin falls have made on the tourist map of the State, the tourism activities in the zone is highly unregulated that is affecting the river water quality which used to be the drinking water source of the immediate downstream stretches where the inhabitants of Athirappilly reside. The two water amusement parks that started recently to tap the tourist vein are also freely using the river as a source for water and sink for their waste. As of now, there are scant regulations regarding the tourism industry or its growth which has led to unchecked land grabbing in the region or use of the river as a convenient channel for waste dumping without any form of waste water treatment despite various protests from the people at several instances. The various powerful interests groups in the region have made the best of the situation by opening resorts, hotels and homestays including the PCK, Ex. Servicemen Society and enterprising homestead households. But the drinking water needs of the region that is chronically water short have been compromised and the people who are worst hit as always are those who do not have the luxury of water security linked to land ownership; those who have to depend on the common property resource of river water. Even water pumped from a well on the banks of the river is not being used for domestic purposes due to high contamination. The river water contamination in the upstream is a grave concern for drinking water dependent interest groups along the entire downstream stretch of the basin. At present, these weaker and unorganised interest groups are unable to address the pollution issues effectively. A river basin governance framework based on multi-scalar interest groups could provide a platform to address such issues and act as pressure groups.

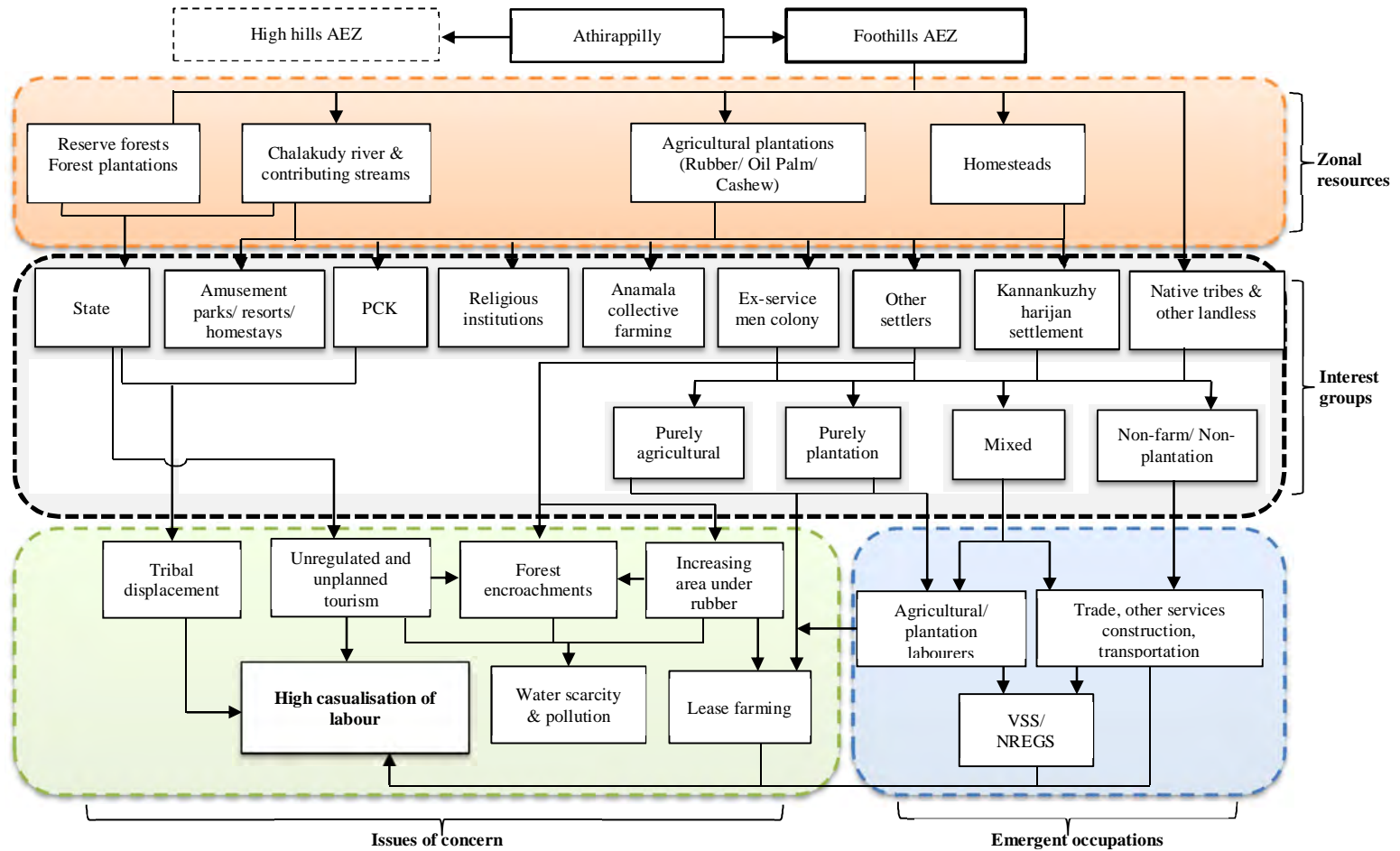


Fig. 6.13 Schematic sketch of interest groups, resource linkages and livelihood emergence - Foothills

### **6.5 Midland Agro-Ecological Zone**

This midland zone of the river basin situated between  $10^{\circ} 10'$  and  $10^{\circ} 25'$  N and  $76^{\circ} 20'$  and  $76^{\circ} 32'$  E constitutes 10 per cent of the total inclusive basin extent with majority of area lying at an elevation range of 20-50 m above msl. A few patches of the reserve forests of the Western Ghats exist in the eastern inclines of the midland landscape although the major features are the lateritic garden lands and terraced upland paddy fields that descend into clayey loam wetlands and alluvial river and stream banks. The igneous rock faces of the Western Ghat extensions are sites of intense granite quarrying activities all along the midland stretch of Kerala (GoK, 2009). The Chalakudy river after the CRDS diversions, the CRDS main and branch canals, various streams that either join the main river or receive discharge waters of the CRDS are the main water sources of the zone. The major land use in this zone was identified to be plantation crops of rubber, commercial cultivation of banana, tapioca and nutmeg/coconut based mixed homesteads on privately owned garden lands and converted paddy lands. The cultivated area is almost completely irrigated by the CRDS canals or numerous LI schemes that mostly operate out of the river.

The midland zone of the basin consists not only of parts of panchayaths falling within the hydrological boundaries but also those panchayaths being served by the CRDS left and right bank canals in the adjoining basins of Karuvannur and Periyar respectively (Fig. 6.14). The hydrographic basin is limited to Pariyaram panchayath in Thrissur district and parts of Ayyampuzha, Melur and Karukutty panchayaths in Ernakulam district. But it was found that the inclusive basin extent sketched by the CRDS canal command included parts of the panchayaths of Kodasserry and Mattathur in Thrissur district in the Right Bank Canal (RBC) head reaches and Mookannur and Manjapra panchayaths in Ernakulam district in the Left Bank Canal (LBC) head reaches. The mid and lowland extents are currently the most commercially exploited zones in the basin for resource extraction. These include laterite and granite quarries and mines for building material and manufactured sand production (M-Sand), laterite soil mines and hill excavations for land filling in the lowlands and coastal regions, clay mining from the wetlands, sand mining from the river beds and flood plains, river water abstraction and non-point and point pollution through agriculture and various industries respectively. Numerous drinking water schemes (DWS) also operate out of

the river in the zone increasing the dependencies on the river and widening the inclusive basin extent. The emergent livelihoods and livelihood dependencies in these densely populated reaches of the river basin therefore becomes very important from the basin governance point of view. The Pariyaram panchayath in the Thrissur district was selected as a representative site to study the midland livelihood emergences and resource linkages.

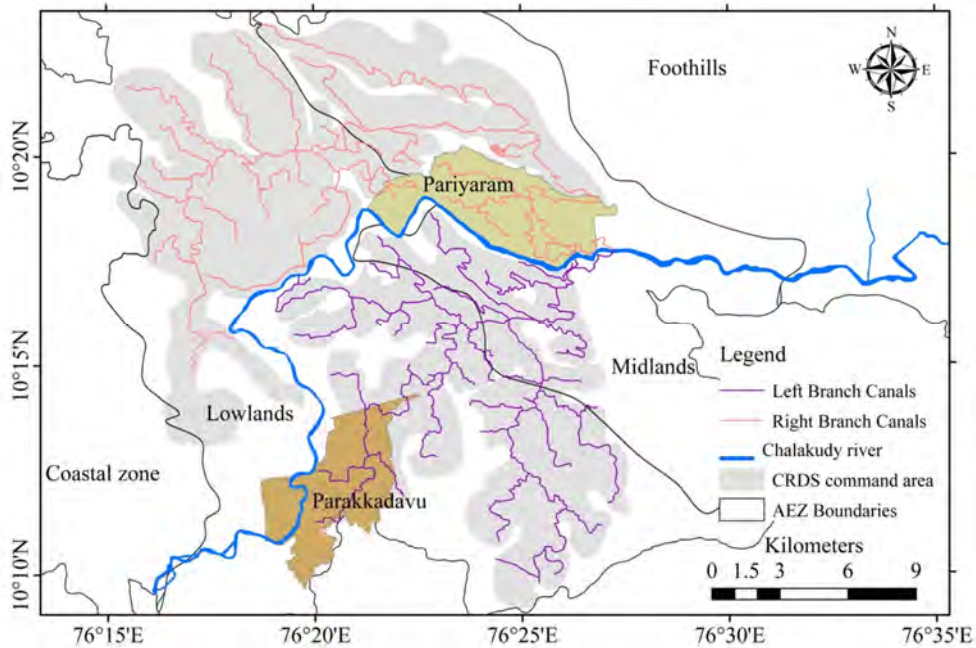


Fig. 6.14 Boundary extension in the mid and lowlands through CRDS

### 6.5.1 The setting and multiple boundaries of concern

Pariyaram panchayath with a geographical area of 27.19 sq.km and a total population of 21,972 persons had a population density of 808 persons/ sq.km (GoI, 2001). The self-governance unit of Pariyaram panchayath is constituted of the villages of Pariyaram to the west and southwest and Kuttichira to the north and northeast. The Chalakudy river and the Melur panchayath across it in the Ernakulam district forms the southern boundary of the panchayath while the *Kappa thodu*, a stream that originates from the foothill slopes, borders the north across which is the Kodasserry panchayath of Thrissur district. The Kumbidan peak at 448 m elevation guards the eastern boundary of Pariyaram beyond which lies the Athirappilly panchayath. Towards the west is the Chalakudy municipality and the town and market of Chalakudy at barely 3 km distance. The panchayath is on the busy tourist route to

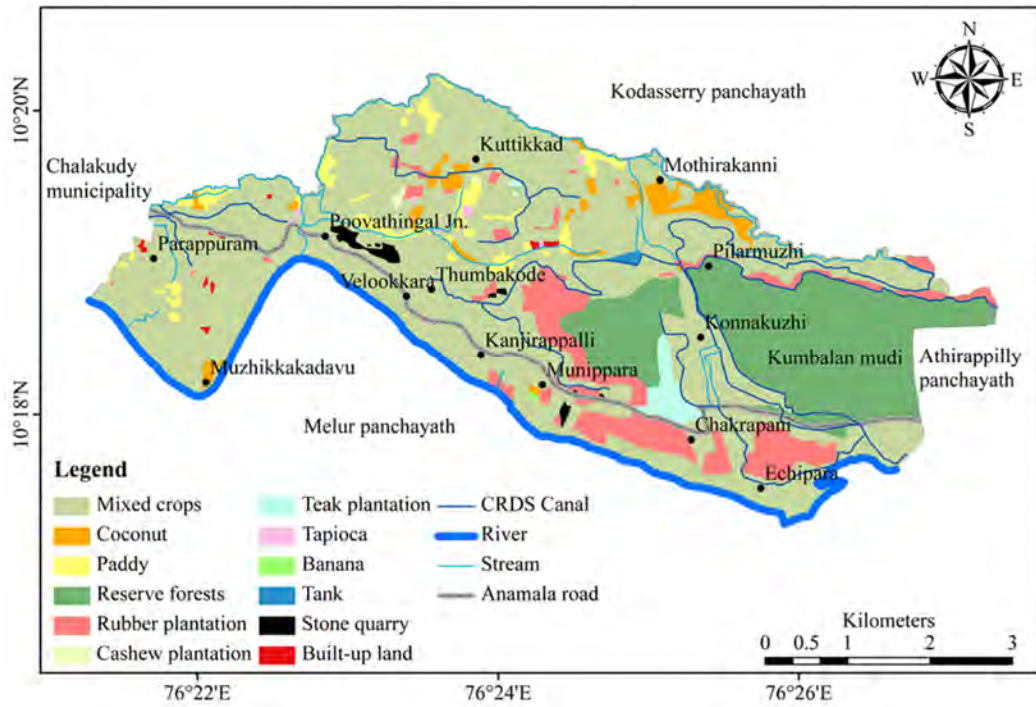
Athirappilly from Chalakudy and hence is amply serviced by both private and state buses along the Chalakudy-Malakkappara state highway (Fig. 6.15).

Pariyaram is having an elevation range of 20-448 m above msl with its eastern and north eastern extremities in the regions of *Chattukallu*, *Echipara*, *Chakravani* and *Pilarmuzhi* forming continuation of the foothill tracts. Considerable area in these regions is under forest plantations of teak and other miscellaneous trees coming under the Pariyaram Range of Chalakudy Forest Division. Private rubber plantations and stone quarries also dot these west facing lower slopes of the Western Ghat spur hills. Stone quarries abound further westward in the *Munippara*, *Vellokkara*, *Orappana* regions. Towards the northwest regions, the panchayath is composed of moderate slopes and terraces on which rubber and mixed perennial crops such as coconut and nutmeg and seasonal crops of banana and tapioca are raised. Low lying paddy lands in the valleys and river banks on the southern and central portions of the panchayath have been mostly converted into mixed homestead lands.

The soils of this midland village are found to be predominantly lateritic with loamy and riverine alluvium towards the valleys and river stream floodplains. The panchayath receives an average annual rainfall of 3000 mm from the SW and NE monsoons. Pariyaram is almost completely irrigated by the CRDS right bank main canals that traverse its northern parts and through well irrigation that are indirectly fed through the CRDS canal recharges. Numerous LI scheme distributaries both private and public irrigate the south and south western regions.

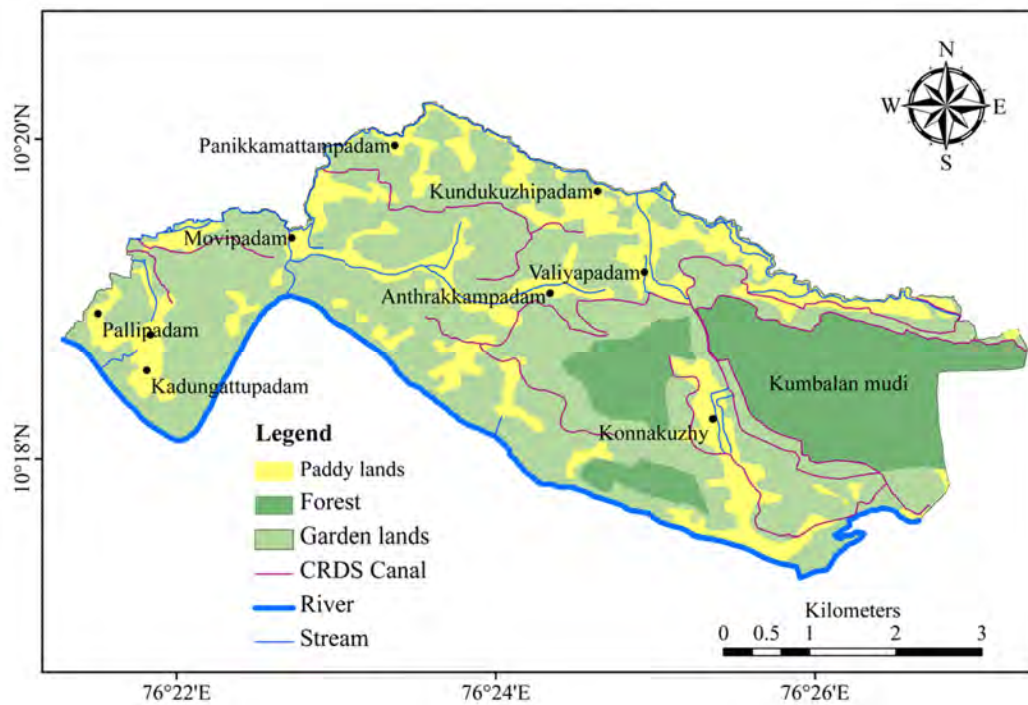
The inclusive basin limits in the midland zone span the transboundaries created by the CRDS in its head reaches (Fig. 6.14). The political boundaries of the constituent panchayaths and districts are recognised as being influential along with the institutional boundaries of the Irrigation Department, Revenue and Forest department. The Mining and Geology department and the Pollution Control Board are the other institutions of importance in these midland stretches due to the profusion of granite stone quarries in the region stimulated by the easy access that these regions have to the west facing escarpments of the Western Ghats and the availability of revenue land that could be either bought or leased in.





Data source: KSLUB, 2001a

Fig. 6.15 Location and land use of Pariyaram in the midlands zone



Data source: GoI, 1976

Fig. 6.16 Paddy land area in Pariyaram in 1966-67

### 6.5.2 Occupational and resource use history in the midlands (1900s -2000s)

The mid land zones of the Chalakudy basin marks the beginning of agriculturally important and populated regions of the erstwhile kingdom and princely state of Cochin (Ward and Conner 1821; Menon, 1911). The history of resource use and livelihoods in these tracts is therefore intimately connected to the history and trajectory of agriculture development. The summer palace of the Maharaja of Cochin was situated in the village and majority of the lands in this zone had originally belonged to the *Thripunithura Kovilakam*, several high officials in the Cochin government, local chieftains and Namboothiri families. Extensive wetland areas were cultivated on lease by Christian and *Ezhava* tenant farmers mostly as tenants-at-will or as sharecroppers. Early rubber and cashew plantations were established in the area in the beginning of the twentieth century by British officers who owned extensive areas in the eastern side of the panchayath (Amruth *et al.*, 2007). For instance, the first rubber plantation in the basin was planted by Mr. J.C. Kohlhoff who was the Chief Conservator of Forests of the Cochin Princely State during 1880 -1899. The agricultural lands in the area thus consisted of both paddy land (*nilam*) and gardenland (*purayidam* or homestead) and cash crop plantations in the hill slopes. The paddy lands were mostly single cropped rainfed lands as lift irrigation from the Chalakudy river was rarely practiced (except in a few instances of tank or ‘*chira*’ irrigation) owing to the steep banked nature of the river which did not permit easy lifts of water from it (Ward and Connor, 1821; GoK, 1958).

The narrative of intensive irrigated agriculture in these midlands begins from the time when widespread food crisis was experienced in the state following the economic depression of the 1930s which worsened after the Second World War and interception of cheap rice imports from Burma. As measures to overcome the crisis, forceful cultivation through royal proclamations of the Cochin state was resorted to that insisted on ‘*all lands fit for raising food crops to be brought under cultivation of paddy*’ (Proclamation XIX of 1118, 1943) and that these ‘*shall not be left uncultivated and shall not be used for any other purpose which would in any way reduce the normal yield of paddy*’ (Proclamation III of 1123, 1947) along with strict restrictions on movement of labour outside of the Cochin state (Proclamation XVIII of 1120, 1945). Landless cultivators were encouraged by the state to initiate cultivation in the foothill and midland tracts of the basin including the eastern portions of Pariyaram

during the time through the hill paddy scheme of the Cochin state. Many of the tenant cultivators of the Pariyaram village and settlers from the adjoining Christian settlements in the Melur village had thus pioneered cultivation in the forested eastern tracts who were subsequently awarded *pattayam*.

Irrigation schemes that would utilise the plentiful waters of the Chalakudy were envisaged to further raise agricultural production and productivity. The lift irrigation (LI) schemes in the Chalakudy river that became functional during the time in the mid and lowland reaches of the basin are among the first of their kind in the whole of Kerala (Menon, 1961). A major irrigation scheme of Chalakudy River Diversion Scheme (CRDS) proposed in 1947 without any storage structures depending on the perennial Chalakudy river, to irrigate around 14,000 ha of paddy lands in the mid and low land villages of Chalakudy and its adjoining basins was also a legacy of those times of frantic food self-sufficiency drive. By the end of 1957, there were 14 major LI schemes operating in this river (GoK, 1958). Irrigation development in these tracts entered a new phase after the formation of Kerala state in 1956 and the thrust to agricultural development that was the hallmark of its initial five year plans (1956-1961). Irrigation and agriculture (especially paddy) had constituted 31 per cent of the total plan expenditure and CRDS was one among the 8 major irrigation schemes included in it. The 1<sup>st</sup> stage of the scheme was partially commissioned in 1952 and completed in 1957 supplying assured and plentiful water for second crop paddy stabilisation and for taking an additional third crop thereby altering the midland agricultural landscape considerably. Pariyaram panchayath was in the head reach of the CRDS and therefore abundantly supplied with the canal water. Paddy cultivation was undertaken not only in the wetlands but also in the gardenlands with upland rice varieties of *Modan*, *Chenkayama*, *Cheera* etc. The area under paddy in the Pariyaram village during the 1960s during which time the CRDS had been functional in its full and unimpeded glory was found to be 6145 ha which was 23 per cent of its total land area (Fig. 6.16). Moreover, the Pariyaram wetlands situated strategically in the head reaches of the right bank canals (RBC) of CRDS became reputed to be highly fertile three crop lands. According to the 1961 Census figures, half the population of total main workers in the Pariyaram panchayath was engaged in agriculture (GoI, 1961). The high share of cultivators and agricultural labourers is a testimony to the labour intensive paddy based agricultural landscape of

these midlands during the time. A cattle breeding farm was also established in the village under the state government in 1954. The farmers in the area had also spearheaded several organised farmer movements and strikes in the state and had founded the Anamala cooperative farming society that had taken up collective farming in the forests of Athirappilly foothills during these times between 1940s and 70s when agriculture was the livelihood lynchpin of the majority of the midland population. The abolition of tenancy and ceiling on land holding size through the Kerala Land Reforms Act of 1963 and the subsequent redistribution of land led to the majority of the tenant Christian families in the area to become the new land owning class in the village.

The sharing of the waters of the Chalakudy river with Tamil Nadu through the multi-basin interstate Parambikulam Aliyar Project (PAP) became operational in the 1960s which drastically reduced water availability in the river and the CRDS ayacut thus heralding another phase of landscape change in these midlands. Downstream pressure on the river increased when the farmers in desperation tried supplementing the CRDS water with direct lifts from the river. LI schemes thus increased but most of them were for stabilising the CRDS ayacut rather than for irrigating fresh ayacuts (Madhusoodhanan, 2009). The implementation of land reform measures in the state and the opportunities for labour migration into the Middle East during the 1970s led to ownership and subsequent fragmentation of holdings on the one hand and shortage of labour on the other. As a result of these varied developments which limited the availability of water, land and labour, but at the same time permitted individual decision making in cropping patterns, the widespread cultivation of paddy was slowly abandoned and paddy lands were converted to coconut arecanut mixed holdings. Later, nutmeg, a less labour intensive perennial tree crop, requiring irrigation, but not the crucial critical period demand as of paddy became a favorite in the midlands of the basin. At the same time, the agro-climatic conduciveness of these midland villages for rubber led to gradual shift of homesteads into rubber. The Kerala Horticulture Development Programme – KHDP (presently the Vegetable and Fruit Promotion Council of Kerala - VFPCCK) became functional in the village since 1997 which had promoted extensive banana cultivation in the region through production loans and formation of self-help marketing groups.

Along the hilly slopes and above the canal, encroached settlements sprouted up and stone and laterite quarries also became functional on these slopes as early as the late 1960s (GoI, 1976). By 1980s the construction sector in Kerala had become active that led to a proliferation of granite quarries in the mid and foothill stretches of the state, which received a further fillip through the decision of the Kerala government to dump granite boulders into the sea for a length of 480 km along Kerala's 560 km coastline after a 1989 assessment of coastal erosion vulnerability by the Directorate of Central Water Commission and Coastal Erosion Studies of the Kerala State (Lakshmi *et al.*, 2012). The older stone quarries in Pariyaram started heavy production during the time, providing casual employment not only in the quarry sector but also in the complimentary transportation sector. On the other hand, the banning of sand mining from the Chalakudy river from time to time and the Panchayath permit system that was initiated to control the activity had made employment in this sector illegal and therefore clandestine operated both by highly organised 'sand mafia' as well as informally by casual labourers residing on the river banks. The 1980s also saw the initiation of drinking water schemes (DWS) including the panchayath DWS at Thrippappilly that lifts water from the river and pump it to the beneficiaries with scant purification measures. An industrial unit manufacturing packaging cardboards that was established in 1995 on the river banks and an amusement park set up in 2000 both functioning upstream of the DWS have further deteriorated the quality of the water supplied. The Kerala Rural Water Supply and Environmental Sanitation Project (*Jalanidhi*) was initiated in Pariyaram during 2000, to tide over the water quality and scarcity problems in this midland village.

Even though the primary sector of employment continued to be prominent in the region, there was a marked reduction in the proportion of main workers devoted to the primary sector from 77 per cent in 1971 to 43 per cent by 2001 (GoI, 1971; GoI, 2001). The secondary sectors of non-household industries and construction had an increased proportion of workers in them from 5 per cent in 1971 to 21 per cent in 2001 due to the construction boom that had hit the state of Kerala post 1980s. The tertiary sector has also grown during the time period from 14 per cent to 32 per cent of the main workforce. The broad indications in emergence provided by the census analysis were further followed up using the primary data results which are being presented in the following section.

### 6.5.3 Emergent occupations and patterns in the midlands

The midlands have continued to be an agriculturally important tract which is also reflected in the share of workers still employed in agriculture. Main cultivators surveyed constituted 9 per cent of the total workers and agricultural labourers were also a prominent work category at 13 per cent. The presence of women workers as agricultural labourers (22%) was more compared to share of men as within the men workers increased diversification to non-farm employment could be witnessed (Table 6.18).

Table 6.18 Distribution of workers in various occupation categories- Midlands

Main employment	Frequency (n)			Percent (%)		
	Male	Female	Total	Male	Female	Total
Cultivator	28	4	32	10.4	4.2	8.8
Agricultural labour	28	21	49	10.4	22.1	13.4
Plantation, livestock etc.	3	6	9	1.1	6.3	2.5
Mining & Quarrying	20	5	25	7.4	5.3	6.8
Manufacturing	31	3	34	11.5	3.2	9.3
Construction	32	0	32	11.9	0.0	8.8
Trade	35	15	50	13.0	15.8	13.7
Transportation	36	0	36	13.3	0.0	9.9
Other services	57	41	98	21.1	43.2	26.8
<b>Total</b>	<b>270</b>	<b>95</b>	<b>365</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: Primary survey

Among the workers whose main occupation was as cultivators, 28 per cent had nutmeg as the principle crop, 22 per cent grew rubber and banana was grown by 16 per cent. Mixed homesteads and coconut was the principle crop of 10 per cent each of the cultivator class. It is also to be noted that paddy cultivation was not taken up by any of those involved in agriculture as the main livelihood option. Ninety four per cent of the cultivators were Christians in this midland village whereas the agricultural labourers were found to be almost equally drawn from Christians (35%), *dalits* predominantly of the *Pulaya* caste (31%) and *Ezhavas* (29%). The age range of the cultivators showed that as high as 86 per cent of the male cultivators were above 50 years of age since with most of the male cultivators, agriculture was a retirement option. Even within the agricultural labourers, 57 per cent of male agricultural

labourers were older than 50 years in age whereas 57 per cent of female agricultural labourers were younger at 30- 50 years of age. More than half the share of cultivators and agricultural labourers had received only primary education, especially among men. Women agricultural labourers were better educated with 38 per cent having studied upto upper primary.

According to the survey results, only 41 households (21%) of the 191 surveyed raised livestock. The reduction in the cattle population of the village was evident from the Livestock census figures (Fig. 6.17) which shows that although rearing of milch cattle has come down, goats have recorded an increase in population. In Pariyaram also the trend of raising buffaloes for the beef market was found to be a recent trend, which is yet to be captured in the livestock census figures.

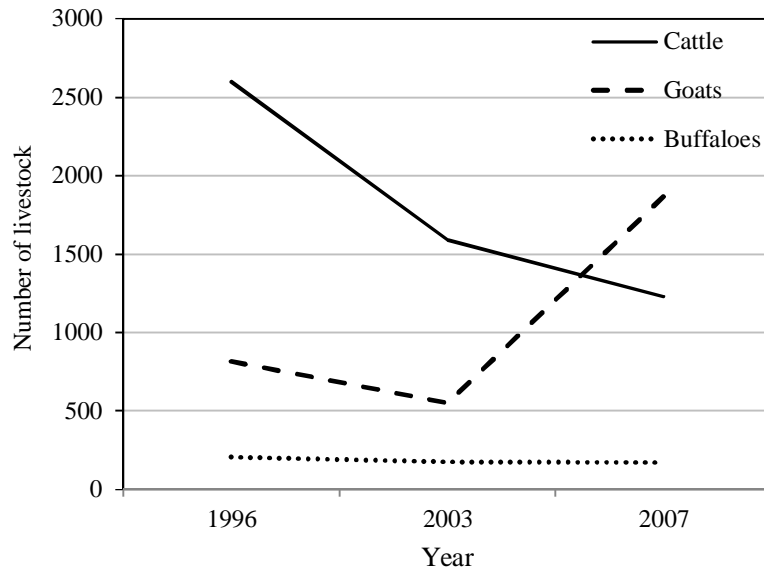


Fig. 6.17 Trends in livestock population 1996-2007- Midlands

Mining and quarrying activities in the panchayath were found to employ only 7 per cent of men and 5 per cent of women workers and was a major livelihood option especially in the eastern and central regions of *Echippara*, *Munippara*, *Velookkara* and *Konnakuzhy*. The mining and quarrying activities of granite building stone that had commenced in the village in the early 1970s was slowly reaching saturation. Most of the quarries in the eastern fringes had already become dysfunctional. The erstwhile quarry workers in these regions were struggling to reorient their lives and livelihoods. The women searched out casual service sector works based at Chalakudy or turn to

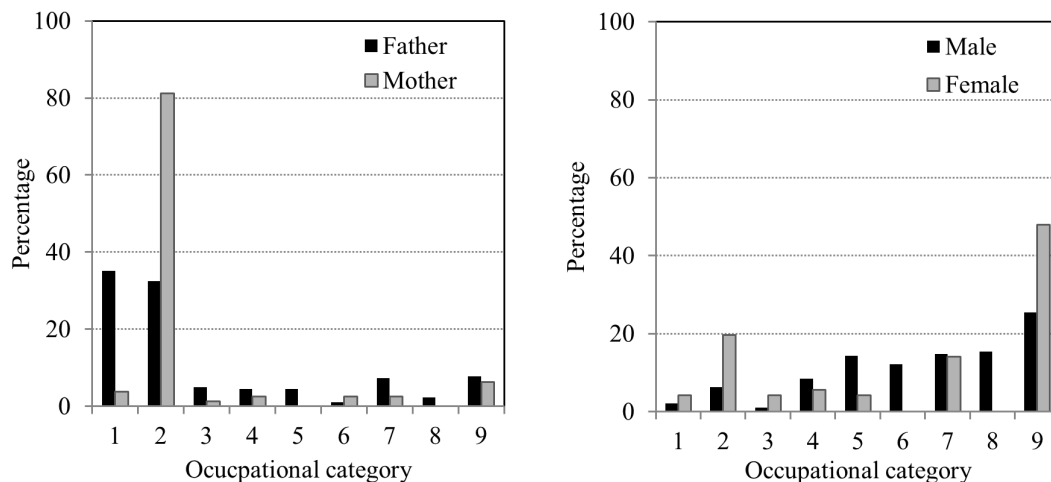
MGNREGS whereas men were increasingly seen to move into the other extractive work of sand mining. Unlike the quarry workers in the lowland village of Parakkadavu, the quarry workers here were from within the village itself. Seventy per cent of the quarry workers were in the age group of 30-50 and almost half of them were only educated upto the primary level. The presence of numerous granite quarries in the midland villages which lie skirting the foothill zone provide an explanation for this relatively larger share of quarry workers compared to the other zones. Large scale quarrying in the foothill zone of the basin is deterred due to majority of land being under Forest Department even though illegal quarries do operate at a smaller scale. Therefore as soon as the forest boundaries are crossed, a narrow North-South belt of such quarrying villages comprising much of the upland and midland villages can be seen in all the Western Ghat basins of Kerala (GoK, 2009). The large share of itinerant migrant workers that work in these quarries in majority of the sites could be the reason why the proportion of workers in the sector does not entirely reflect the extent of this activity in this zone. The transportation sector employment has grown alongside the quarrying and mining operations with 13 per cent of men workers in the Pariyaram panchayath employed as drivers of vehicles that transport the granite boulders.

Construction sector was reported to be the livelihood means of 12 per cent of men workers though no women were found to be working in the sector. Most of the construction work opportunities were based outside the village. Manufacturing and processing was another sector that offered emergent livelihood opportunities employing around 9 per cent of the main workers. The presence of the river both as a source of water and as a sink for effluents had attracted many manufacturing and processing industries into the midland stretch of the basin. Pariyaram panchayath had a couple of packaged water bottling plants, ayurvedic medicine manufacturing firm, a paper mill and a few other informal industrial units. The paper mill employed migrant workers along with local labour. Service sector including trade related activities was found to have absorbed a large share of workers especially among women (59%). These assorted activities such as sales persons, domestic servants and other 'helper' jobs were locally called '*Chalakyady pani*' (Work at Chalakyady) since most often the location of work was the nearby town and market of Chalakyady. Younger workers in the age group of 18-30 (40%) and 30-50 (44%) dominated the other services and



transportation activities with higher education levels. Forty five per cent of men and women workers in the ‘other services’ activities were educated upto the secondary/ senior secondary level.

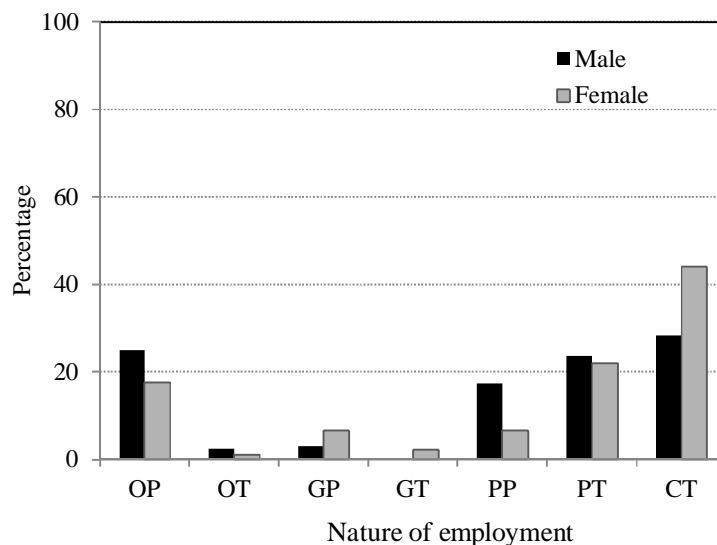
Comparison of parental occupation of the household heads with the occupation of the household head and children brought out the clear shift that had happened in the work scenario. The men in the parental generation were found to be mainly occupied as cultivators and agricultural labourers whereas women workers were or had been almost solely engaged as agricultural labourers. As opposed to this, the men workers in the present working population were observed to be concentrated in the secondary and tertiary sectors while women workers had shifted towards service sector works although still retaining a fair share of workers as agricultural labourers (Fig. 6.18).



Note: 1- Cultivators, 2- Agricultural labourers, 3- Plantation, livestock etc., 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6. 18 Occupational profile of parental and present generation- Midlands

The nature and agency of present work opportunities revealed that majority of workers in mining and quarrying, construction and agriculture labour class were casually and temporarily employed whereas cultivators were self-employed and mostly permanent in their livelihood choice. Casual employment was also found to be significantly higher among the female workforce (Fig. 6.19).

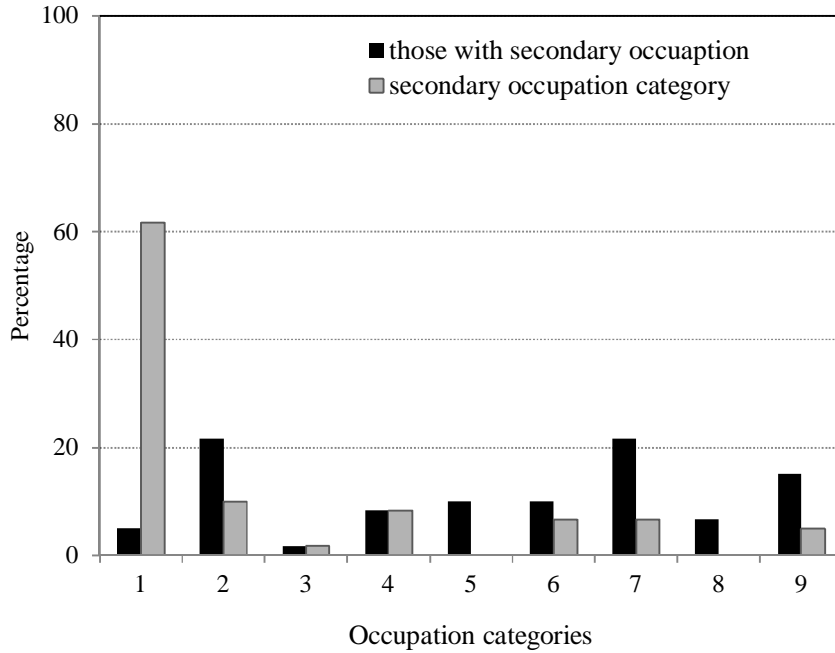


Note: OP- Own permanent, OT-Own temporary GP- Government permanent, GT- Government temporary, PP- Private permanent, PT- Private temporary, CT- Casual

Fig. 6. 19 Distribution of nature and agency of work - Midlands

Secondary occupation was resorted to by 16 per cent of the total workforce in which agricultural labourers (26%) and trade sector workers (26%) were found to dominate. Nearly 20 per cent of mining and quarrying, construction and manufacturing sector workers also undertook secondary occupation. More than 60 per cent of the secondary occupations undertaken were in the agricultural sector as cultivators either on own land or on leased in land (Fig. 6.20). Seven per cent of the working women and 5 per cent of non-working women were engaged in NREGS works also. No men were actively involved in NREGS due to the very obvious difference in the wage rate. The prevailing wage rate as agricultural labourers was Rs. 350/ day at the time of the survey whereas NREGS wage rate was only Rs. 125/ day. The opportunities for labour that existed even outside of the village in agricultural and other casual work deterred heavy dependence on NREGS in the midlands as opposed to the foothills.

The grouping of households based on the main occupation of the members in this midland village brought out that close to 60 per cent families were non-farm dependent (Fig. 6.21). Purely agriculture dependent families constituted 11per cent of the total surveyed households whereas mixed strategies were found in 29 per cent of the households.



Note: 1- Cultivators, 2- Agricultural labourers, 3- Plantation, livestock etc., 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6. 20 Distribution of subsidiary occupation- Midlands

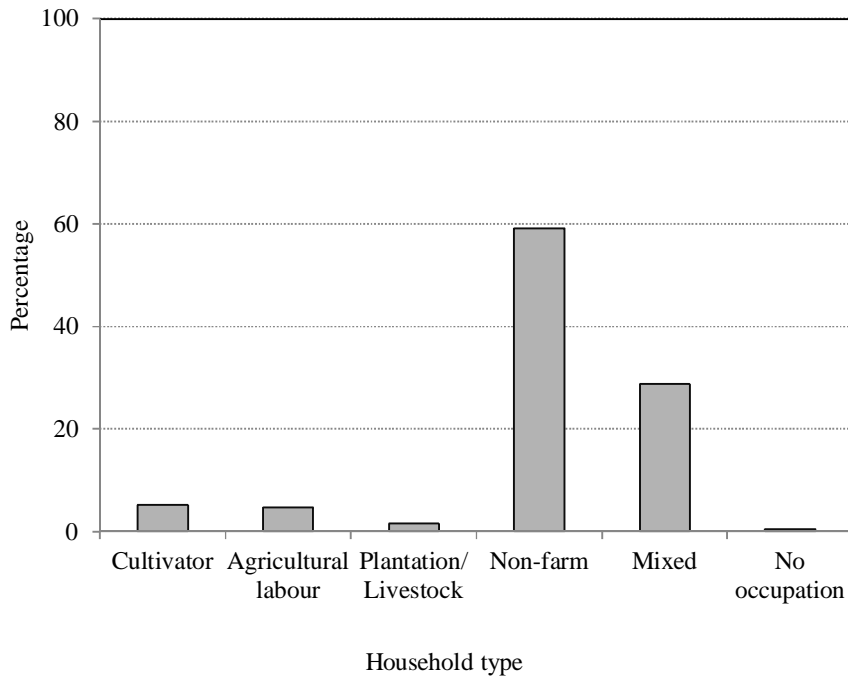


Fig. 6. 21 Distribution of household groups based on livelihood- Midlands

#### 6.5.4 Livelihoods and resource linkages in the midland zone

The midlands represent the region where the basin smoothens out into a landscape with moderate slopes and laterite soils with occasional rock outcrops that are extensions of the Western Ghats as spur hills. There is a diversity of water resources ranging from the river after all the upstream diversions, the streams that join the river either from the foothill slopes in the east or from the valley wetlands, the CRDS and LI irrigation canals that interweave the territory to a motley mix of private wells, tanks and abandoned quarry ponds. Over the years, various combinations of these water resources have served to irrigate the midlands and to ensure drinking water security during the summer months. The nuances of the livelihood linkages to these resources are being explored in the following sections.

##### 6.5.4.1 Patterns of land ownership and access to land

The majority of the land area (74%) in the midland zone was privately owned, the land ownership having been transferred a large extent from the landowning upper caste households to the tenant cultivator families during the 1970s. In the eastern parts of the village, some land (26%) was under the Forest Department comprising of forest plantations of teak, bamboo and miscellaneous trees. The privately owned land consisted mostly of elevated, well-drained garden lands and paddy lands in the valleys and river banks which had been almost completely converted to garden lands (Fig. 6.22).

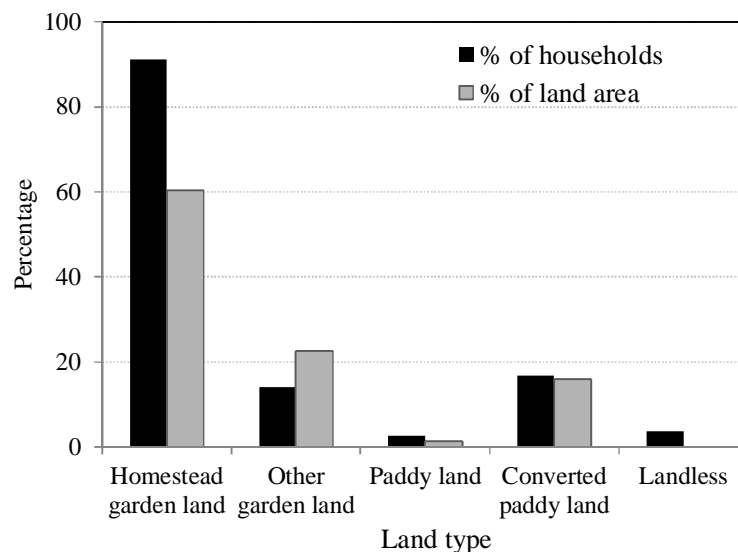


Fig. 6.22 Distribution of land types in the midlands

As was elaborated in Section 6.5.2, the conversions of paddy lands into garden lands were effected after the 1980s when a mix of factors had made seasonal and labour intensive paddy cultivation non-lucrative in these midlands. It is evident from the Fig. 6.22 that these conversions had claimed almost three-fourths of the paddy area in the zone. The midlands represent a clear transition phase from agriculture as a major livelihood option that is reflected in the ownership pattern of land among the various livelihood group households (Table 6.19). The mixed/ pluri-active households were found to possess more than half the land area (52%) and the purely cultivator families were also in possession of 11 per cent of total land area. The average land holding size among these household groups were also found to be high at 1.7 and 2 acres respectively. The non-farm based households owned 35 per cent of the total land area and the average land holding size was only 0.4 acres. The homestead garden lands were the main and only land holding for majority of households. Paddy lands were owned by barely 3 per cent of the households and that too were in the possession of non-farming households mostly. Other garden land and converted paddy lands were possessed by 14 and 17 per cent of the households respectively and were mostly concentrated with mixed and non-farm households even though the average area of other land holdings owned were much higher with the mixed strategy households. The purely agricultural labour and other natural resource based activities dependent households were observed to possess the least land area and the lowest average land holding size. They also did not own any other land other than the homestead holdings (Table 6.19). The extreme inequality of distribution is evident when it is noted that 61 per cent of the households possessed only marginal homestead lands that constituted only 10 per cent of the total homestead garden land area (Table 6.20). It is also evident that the remaining paddy lands in the region were also highly marginal in size, with 80 per cent of the holdings less than 1 acre in size.

Eighty five per cent of the land in the village was owned by Christian households who constituted only 67 per cent of the households in the village. They also possessed the highest average land holding size at 1.3 acres. The next significant land holders were the *Ezhava* households although average land possessed was much lower at 0.5 acres. The agricultural labour families of the *Pulayas* still had very little ownership over land resources. These households were found to be concentrated in SC colonies and less endowed regions of the village.

Table 6.19 Distribution of land types among livelihood groups- Midlands

Household type	Homestead land			Other land holding									Total (including landless)		
	Area owned	Hous e holds	Average area owned	Paddy land			Garden land			Converted paddy land			Area owned	House holds	Average area owned
				Area owned	House holds	Average area owned	Area owned	House holds	Average area owned	Area owned	House holds	Average area owned			
(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	
Cultivator	12.6	10	1.3	1.0	1	1.0	3.5	3	1.2	3.0	1	3.0	20.1	10	2.0
Agr. Labourers	0.6	7	0.1	-	-	-	-	-	-	0.6	1	0.6	1.3	9	0.1
Plantation/ Livestock	0.4	2	0.2	-	-	-	-	-	-	-	-	-	0.4	3	0.1
Non-farm	40.2	103	0.4	1.2	3	0.4	11.9	16	0.7	10.4	18	0.6	63.7	113	0.6
Mixed	55.4	51	1.1	0.2	1	0.2	25.6	8	3.2	14.8	12	1.2	96.0	55	1.7
No occupation	0.3	1	0.3	-	-	-	-	-	-	-	-	-	0.3	1	0.3
Total	109.5	174	0.6	2.4	5	0.5	41.0	27	1.5	28.8	32	0.9	181.7	191	1.0

Source: Primary survey

Table 6.20 Distribution of land types according to holding size- Midlands

Land type	Marginal land						Small		Medium		Large		Total					
	< 5 cents		5-25 cents		25-50 cents		0.5-1 acres		1-2.5 acres		2.5-5 acres		5-10 acres		>10acres			
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area		
Homestead land	18	0.6	89	10.7	29	10	17	10.6	13	18.0	7	20.0	0	0.0	1	40.0	174	109.5
	(10.3)	(0.5)	(51.1)	(9.7)	(16.7)	(8.9)	(9.8)	(9.7)	(7.5)	(16.4)	(4.0)	(18.3)	0.0	0.0	(0.6)	(36.5)	(100.0)	(100.0)
Other garden land	4	0.1	2	0.2	4	1.6	6	4.2	8	12.3	2	6.7	0	0.0	1	16.0	27	41.0
	(14.8)	(0.3)	(7.4)	(0.4)	(14.8)	(3.8)	(22.2)	(10.2)	(29.6)	(29.9)	(7.4)	(16.4)	0.0	0.0	(3.7)	(39.1)	(100.0)	(100.0)
Paddy land	0	0.0	1	0.2	2	0.7	1	0.5	1	1.0	0	0.0	0	0.0	0	0.0	5	2.4
	0.0	0.0	(20.0)	(8.3)	(40.0)	(29.2)	(20.0)	(20.8)	(20.0)	(41.7)	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Converted paddy land	0	0.0	9	1.7	8	2.7	7	8.9	4	6.0	3	9.5	1	0.0	0	0.0	32	28.8
	0.0	0.0	(28.1)	(5.8)	(25.0)	(9.4)	(21.9)	(30.9)	(12.5)	(20.9)	(9.4)	(33.0)	(3.1)	0.0	0.0	0.0	(100.0)	(100.0)

Source: Primary survey

There were 19 such colonies in Pariyaram almost all of which were located in the most inaccessible and resource poor regions of these midlands such as around abandoned quarries, rocky outcrops and steep hillsides. Sixty per cent of the households did not have access to drinking water and 17 out of the 19 were not serviced by roads or electricity.

Speculative interest in land was found to be lesser in the midlands compared to the lowlands and the foothills, even though many of the larger rubber plantations were owned by absentee landlords who were not natives of the village or the basin. Quarrying was the other prominent activity on land. According to the Mining and Geology department statistics for the year 2008-09 (Consolidated Royalty Payment Register, 2008-09), there were 31 quarries that were functioning with license in the Pariyaram and Kuttichira villages of which 8 were operating on leased lands. The total area being quarried was around 14 acres although very deep extractions even exceeding 20 feet were being practiced since there were ambiguities regarding the maximum permissible depth to which quarrying can be undertaken (HC, 2010).

#### 6.5.4.2 The trajectory of land use

The land use map of the panchayath presented in Fig. 6.15 indicates that the land use in the region was homestead agriculture dominated by perennial tree crops of coconut or nutmeg. The midlands were also found to possess a major share of land under rubber plantations (Table 6.21). A comparison between the 1966-67 land use as derived from the toposheets (Fig. 6.16) revealed that paddy lands had decreased from 23 per cent of the total land area to barely 3 per cent of the land area by 2001. The irrigated tree spice crop of nutmeg was at present found to be the main crop in these converted midland paddy lands. Coconut which had been the earlier signature crop of conversion had fallen to disfavor due to a series of pest and disease infestations and abysmally low market prices for over a decade. Even in the paddy lands that had escaped conversion, the crops cultivated were found to be dominated by banana, tapioca and vegetables rather than paddy. Interestingly, the paddy land stretches (*padashekharams*) in the panchayath still retained their names and skeletal *padashekhara samithis* though paddy cultivation had been discontinued in most of them indicating the not so distant history of conversion.

Table 6.21 Main crops and their distribution- Midlands

Crop	No. of holdings	Area (acres)	Average holding size (acres)	Share (%)	
				Holdings	Area
Paddy	3	1.5	0.5	1.1	0.8
Banana	29	34.35	1.2	10.3	17.6
Tapioca	11	6.35	0.6	3.9	3.2
Coconut	84.0	27.3	0.3	29.9	14.0
Nutmeg	104.0	51.9	0.5	37.0	26.5
Arecanut	21.0	4.4	0.2	7.5	2.3
Rubber	29.0	69.7	2.4	10.3	35.7
<b>Total</b>	<b>281</b>	<b>195.4</b>	<b>0.7</b>	<b>100.0</b>	<b>100.0</b>

Source: Primary survey

According to the Pariyaram panchayath People's Planning Report 2008-09, of the less than 20 per cent of the population depended on agriculture as a livelihood activity and that too predominantly as subsidiary dependence, 93 per cent farmed on marginal land of less than 1 ha. It is clear from Table 6.22 (a) and (b) that there are certain very important distinctions in this group of cultivators according to the crops cultivated and the nature of access to land. The cultivation of seasonal crops of banana, tapioca and vegetables were found to be undertaken on 22 per cent of the cultivated land by both main and subsidiary cultivators on own as well as leased land holdings. On the other hand, garden land cultivation of commercial perennial crops in the larger segment of cultivated area was mainly undertaken as a subsidiary activity. At the same time, almost half the land owing households were observed to be non-cultivating although the area left uncultivated by them constituted barely 5 per cent revealing that these were extremely marginal holdings.



Table 6.22(a) Land – Livelihood linkages: Seasonal crops in the midlands

Seasonal crops	Garden land			Paddy land			Total land		
	House holds	Area (acres)	Average area (acres)	House holds	Area (acres)	Average area/ household (acres)	House holds	Area (acres)	Average area/ household (acres)
<b>Cultivation on own land</b>	9	14.6	1.6	17	14.7	0.9	24	29.3	1.2
Main	4	1.3	0.3	5	2.6	0.5	8	3.9	0.5
Subsidiary	5	13.3	2.7	12	12.1	1.0	16	25.4	1.6
<b>Cultivation on lease land</b>	9	8.7	1.0	4	4.5	1.1	10	13.2	1.3
Main	7	8.55	1.2	2	2.5	1.3	5	11.1	2.2
Subsidiary	2	0.15	0.1	2	2.0	1.0	5	2.2	0.4
<b>Total cultivation</b>	18	23.3		21	19.2		34	42.5	
Share of own cultivation (%)	50.0	62.7		81	76.6		70.6	68.9	
Share of lease cultivation (%)	50.0	37.3		19	23.4		29.4	31.1	
Share of main cultivation (%)	61.1	42.3		33	26.6		38.2	35.2	
Share of subsidiary cultivation (%)	38.9	57.7		66	73.4		61.8	64.8	

Table 6.22 (b) Land – Livelihood linkages: Perennial crops in the midlands

Perennial tree crops	Garden land			Converted paddy land			Total land		
	House holds	Area (acres)	Average area (acres)	House holds	Area (acres)	Average area/ household (acres)	House holds	Area (acres)	Average area/ household (acres)
<b>Cultivation on own land</b>	89	126.1	1.4	28	21.1	0.8	98	147.2	1.5
Main	31	31.4	1.0	11	6.6	0.6	36	38.0	1.1
Subsidiary	58	94.7	1.6	17	14.6	0.9	62	109.2	1.8
Share of main cultivation (%)	34.8	24.9		39.3	31.0		36.7	25.8	
Share of subsidiary cultivation (%)	65.2	75.1		60.7	69.0		63.3	74.2	

#### 6.5.4.3 Changing linkages to water resources

The midland of the basin even though blessed with a proliferation of water resources was a predominantly rainfed agricultural region until the first half of 20<sup>th</sup> century (Section 6.5.2). But a structural transformation of its agricultural landscapes was wrought by the initiation of the CRDS in the 1950s and the later fluctuations in water supply following other upstream diversions. CRDS and a couple of LI schemes from the river that were born along with it, were intended to encourage and expand net cropped area under paddy cultivation in the region. Even though paddy cultivation has almost completely disappeared from these midland tracts, the legacy of irrigated agriculture is continued so that 97 per cent of the region was found to be irrigated at present through diverse sources that ranged from wells to seepage irrigation from the canals (Table 6.23). Even regions above the canal contour were seen to avail the benefits from the canal waters through lifts of water from the canal using private (illegal) motors.

Table 6.23 Distribution of operational holdings based on irrigation

Particulars	Operational holdings			Share of total cultivated area (%)
	(No.)	Area (acres)	Average area irrigated (acres)	
<b>Un-irrigated</b>	8	2.3		<b>3.1</b>
<b>Irrigated</b>	154	71.0	0.5	<b>96.9</b>
Well	29	11.3	0.4	15.8
CRDS	62	20.5	0.3	28.9
Private LI from river	8	6.4	0.8	9.0
Public LI	10	6.6	0.7	9.2
Seepage irrigation (CRDS)	37	24.0	0.7	33.8
<b>Total area under cultivation</b>	<b>162</b>	<b>73.3</b>		

Source: Primary survey

In a changed scenario where homestead garden land agriculture by subsidiary farmers has taken precedence over full time cultivators, the role of irrigation has also been considerably redefined. The canal waters now primarily benefit the converted paddy lands, where the economic crop of interest is nutmeg. Several other public and

private LI schemes had cropped up after the 1980s *i*) to irrigate lands which are not served by CRDS waters especially in the southern portions of the panchayath, *ii*) to irrigate garden lands which are above the CRDS canal contours and *iii*) to stabilise the ayacut of the CRDS due to changed water supply in the canals post PAP. Along with irrigation, the regular inundation of the lands through these irrigation canals also served the more important purpose of recharging the groundwater reserves that ensured drinking water security in the midlands throughout the summer. The residents of the midlands have pointed out the ironic situation wherein water scarcity is experienced not during summers when there is water supply through the canals, but during monsoons when there is no steady recharge of the groundwater especially if the rains are scanty.

Table 6.24 Domestic water source in the midlands

Land holding size	Pipe (Panchayath/ <i>Jalanidhi</i> )		Own Well		Neighbour's well	
	No.	(%)	No.	(%)	No.	(%)
< 5 cents	10	55.6	4	22.2	4	22.2
5-25 cents	47	52.8	42	47.2	28	31.5
25-50 cents	2	6.9	25	86.2	2	6.9
0.5-1 acres	3	17.6	15	88.2	0	0.0
1-2.5 acres	0	0.0	12	92.3	0	0.0
2.5 - 5 acres	0	0.0	7	100.0	0	0.0
<b>Total</b>	<b>62</b>	<b>32.5</b>	<b>105</b>	<b>55.0</b>	<b>34</b>	<b>17.8</b>

Note: Multiple dependences on sources, Source: Primary survey

Wells were seen to constitute the main source of domestic water supply among those households who have larger sized land holdings (Table 6.24). The most marginal households were found to depend on multiple sources ranging from Panchayath DWS, *Jalanidhi* and own or neighbouring wells in the locality. Therefore, in the case of the marginal holdings which were not served by irrigation canals, drinking water continued to be an issue of grave concern. The panchayath DWS at Thrippappilly is situated downstream of the Paper mill industry and therefore none of the surveyed households with access to it were using the water for drinking. Many of the marginal land holdings were also seen to be on converted paddy lands that had

been previously irrigated but are now out of the reach of the canal waters due to disrupted distributaries.

### 6.5.5 The basin boundary extensions through work connections

The midland region consisted of a major share of (62%) of workers in the village itself in the various occupations of agriculture, plantations, mining and quarrying and related transportation sector. The proximity of the Chalakudy town had also resulted in a significant group of daily commuters in the workforce in the service and construction sectors. Even the agricultural labourers were found to find employment outside the village in the mid and lowland reaches. The midlands also had around 11 per cent of the working population in the Middle East countries (Fig. 6.23).

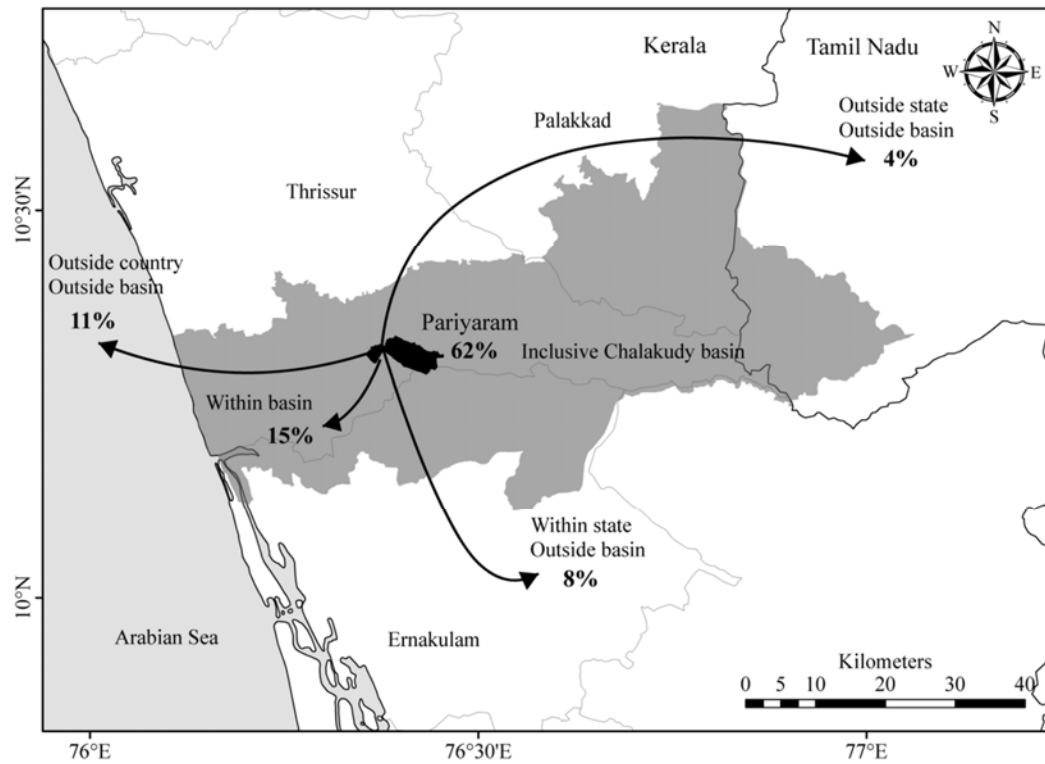


Fig. 6.23 Basin – outbasin work migrations in the midlands

Besides the share of workforce that were employed outside the zone and the basin as brought out in Fig. 6.23, the occupational and resource linkages in the midland zone to the outbasin regions was decided by the resource utilisation in agriculture and quarrying and mining activities. The main agricultural inputs of

banana planting material, props, poultry manure and fertilizers were all sourced from outside the basin. The chief agricultural produce of nutmeg, coconut, banana and tapioca were also market oriented. Nutmeg was marketed both in the Chalakudy and Aluva markets either directly or through agents whereas the banana was either marketed through the VFPCK at the village itself or directly at the Chalakudy market. Tapioca was procured directly from the field by agents from outside the basin based at Ernakulam, Alapuzha and Tamil Nadu. Rubber as sheets was marketed either through the co-operative societies or through the private agents. This zone was found to significantly cater to the stone and sand raw material requirement of the construction industry in the state with 1.6 lakh tonnes/ year of sand abstractions from the river bed and 16 lakh tonnes of granite boulders from the quarries within the panchayath of Pariyaram itself.

#### **6.5.6 River basin governance in the midland zone: The issues of concern and communities of interest**

The midlands were found to have multi-scalar interest groups that have linkages with the upstream and downstream AEZs as well as livelihood based interest groups within the zone. In the following sections, an analysis of these various issues of concern and the governance possibilities within an interest group based basin management framework are examined. The livelihoods, interest groups and concerns are provided schematically in Fig. 6.24.

##### **6.5.6.1 Transforming agricultural livelihoods and interest groups**

The mid and lowlands of the Chalakudy river basin had constituted one of the important agriculturally developed regions in the state for paddy cultivation which had been provided irrigation as early as the 1950s. These regions had considerably shifted in livelihoods and land use in the past three decades reorienting the resources into commercial agriculture which has implications for the food security concerns that challenge the state today. The conversion of wetlands to non-agricultural uses, mineral extractions and cultivation of garden land crops is being stiffly opposed in the state both at the level of public movements and government policies in the background of the food security and larger environmental concerns (GoK, 2008b). Within the Chalakudy river basin itself, the large-scale conversion of mid and lowland

wetlands has been noted to have adversely affected the land and water resource base (George, 2001; Padmalal *et al.*, 2004; Chathopadhyaya, 2005). Within a river basin management framework therefore these would be a prominent issue of concern that would require the identification of the interest groups involved. The interest groups that were identified in this respect within the present configuration of agricultural livelihoods and resource relations in the midlands of the basin were *i*) the subsidiary land owning perennial tree crop cultivators and *ii*) the main cultivators of seasonal food crops on own and leased land. These interest groups function in highly unorganised and often illegal spaces due to the illegality of conversions and lease farming in the state. Therefore policy interventions for land and water use regulations will have to be a part of basin governance mechanisms.

#### 6.5.6.2 Industrial and tourism related river water pollution

The river flowing through the midlands is considerably depleted after all the upstream diversions and transfers. The pollution of these waters through enterprises such as the paper mill and amusement park in the village itself and tourism related pollution further upstream in the foothill and non-point pollution from the highland plantations form a main issue of concern in the downstream stretches of the river including the midlands. The river forms one of the main water sources in this zone especially for those who cannot ensure water security through possession of lands served by irrigation canals. Pollution of rivers had been one of the earliest concerns that had led to consideration of basin as a unit of management world over (Molle, 2008b). It was noticed that in the Chalakudy river basin also, pollution of the river through various activities in the AEZs gives rise to multi scalar interests groups, the most affected and the most powerless being the ones who depend on it as a common property resource. A coming together of such downstream interest groups was witnessed in the basin in the case of the uprisings against the Sri Shakthi Paper mills at Pariyaram and the Nita Gelatin Plant in the midland village of Karukutty which had been polluting the river through the dumping of toxic and untreated waste into it. These interest group based uprisings had been brutally put down by the more influential company managements using the State mechanism which then had necessitated legal measures and/ or prolonged strikes. Bringing such issue based concerns within the purview of river

basin governance would give legitimacy and strength to the voice of these interest groups and stakeholders who at present are regarded as mere “protesters and affected”.

#### 6.5.6.3 Mines and quarries and the associated ecological and livelihood issues

The minor mineral quarries of granite building stones and laterites in the state are mostly situated in the mid land areas (GoK, 2009). It is estimated that there are at present 18,000 quarry units in the state with only 8,000 of them licensed. It has also been accepted that the adverse consequences of these quarries manifest in diverse ways like deforestation, soil erosion, air and water pollution, landscape and bio-habitat disturbance and changes in quality of life of local people especially in a densely populated state like Kerala (GoK, 2009). But the adverse effects of such heavy extractive activities on the environment and the lives of the people have yet not been comprehensively addressed or redressed due to the powerful interests wielded by the sector as a supporting sector of the flourishing construction industry in the state. The role of the LSGs as a decision making agency for granting of license to these local resource extraction units has also been contested (HC, 2013).

The midland residents have been dealing with the adverse effects of extensive quarrying and mining activities for more than two decades that range from physical damages to buildings to receding water tables to accelerated erosions (George, 2001). This had led to numerous disparate individual and collective attempts at legal redressal which had time and again resulted in temporary bans and stays on mining and quarrying activities. A river basin governance framework would help to streamline these efforts by giving visibility to the affected interest groups spread across the foothills, mid and lowland rock outcrops of the basin and strengthening the role of the democratic machinery in decision making regarding natural resources.

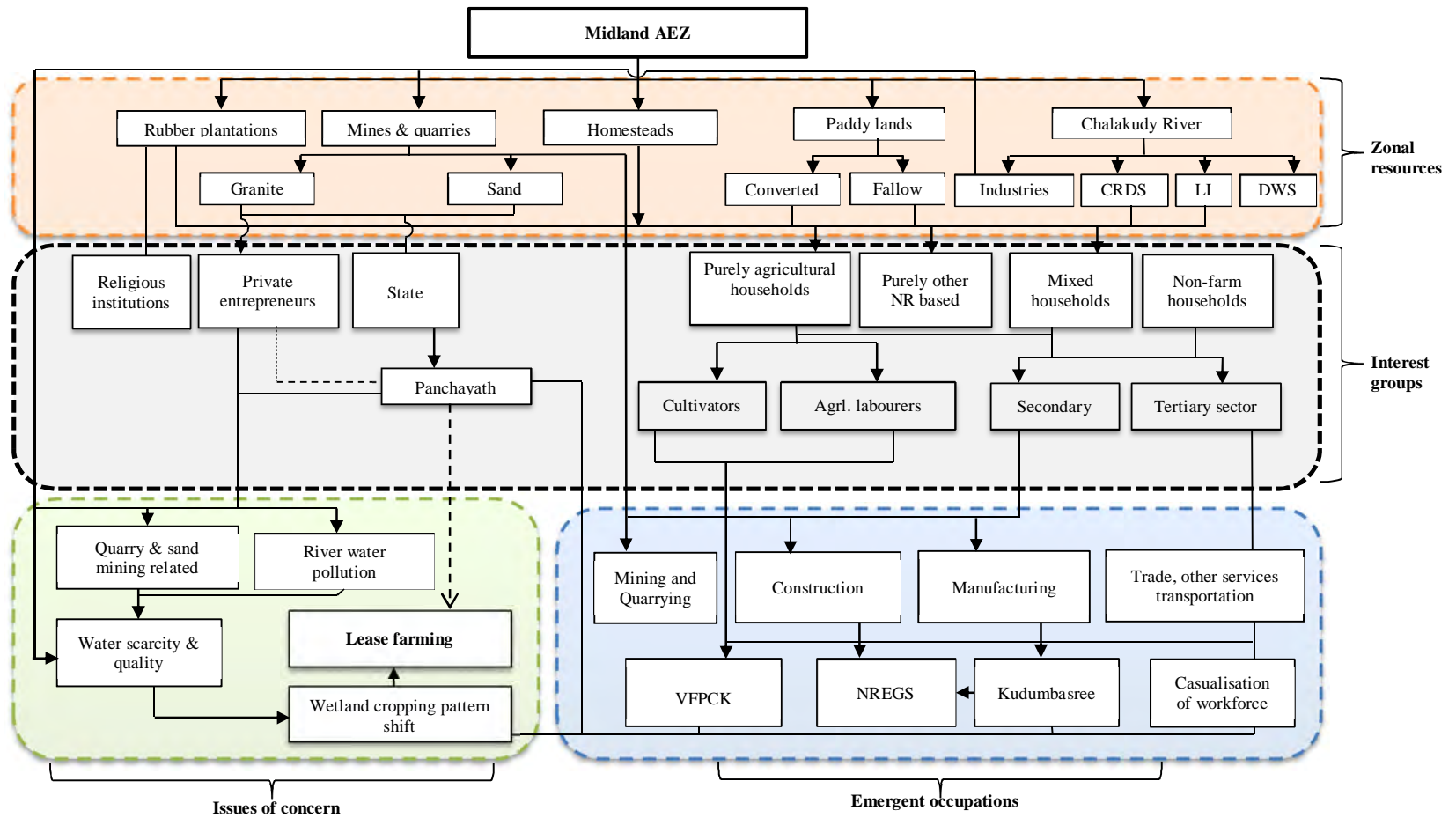


Fig.6.24 Schematic sketch of interest groups, resource linkages and livelihood emergence- Midlands



## 6.6 Lowland Agro-Ecological Zone

The lowland zone is located between  $10^{\circ} 5'$  and  $10^{\circ} 25'$  N and  $76^{\circ} 15'$  and  $76^{\circ} 30'$  E at an average elevation range of 8-20 m above msl with occasional rocky outcrops and hillocks of above 50 m above msl. The land is characterised by low-lying paddy lands interweaving a mosaic of hills and slopes. The lowland AEZ is served by the mid and tail reaches of the Chalakudy river diversion scheme (CRDS) left and right bank canals (see Fig.6.14 in Section 6.5). This region also has several public and private river lift irrigation schemes that irrigate both paddy and garden lands. The lowland zone with a land area of 415 sq.km comprises 18 per cent of the total area of the inclusive Chalakudy basin. Around 55 per cent of this area is under crops such as coconut, arecanut and nutmeg raised in mixed homestead gardens while 21 per cent of the land area is classified as paddy lands. Fifty six per cent of the cultivated area is under irrigation, either through Chalakudy diversion canals, public and private river lift irrigation schemes or through private wells.

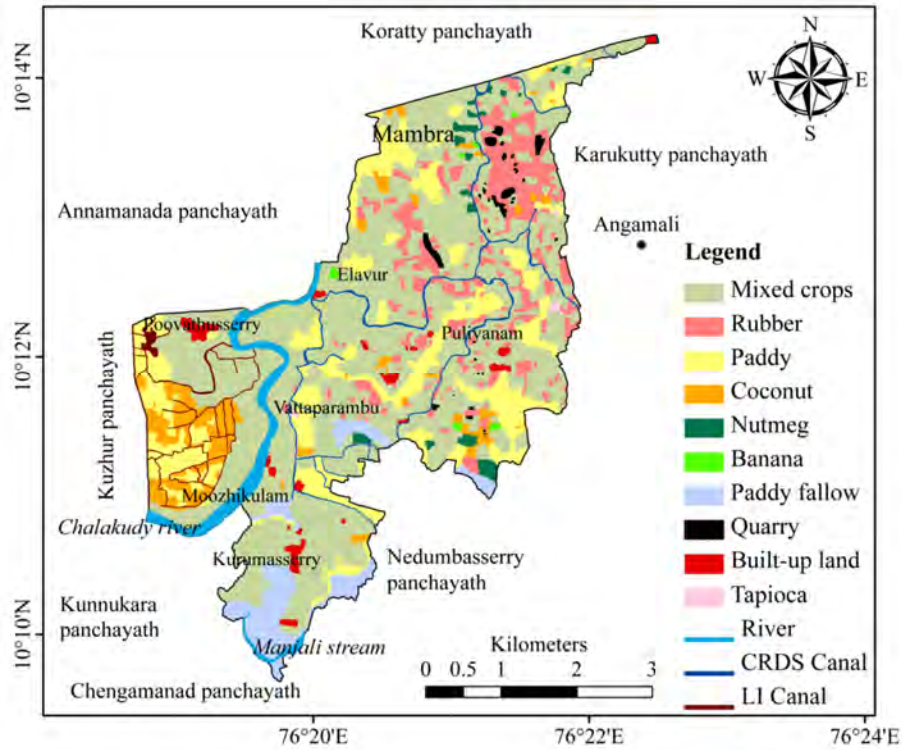
The lowland AEZ of the basin comprises of the panchayaths of Koratty, Kadukutty, Annamanada, Kuzhur, Mala, Alur and Chalakudy municipality in Thrissur district and the panchayaths of Kunnukara and Parakkadavu in Ernakulam district within its hydrographic boundaries and parts of the panchayaths of Kodakara and Muriyad in Thrissur district and Thuravoor and Kalady panchayaths and Angamali municipality in Ernakulam district within the extended CRDS beneficiary boundaries. The lowlands of the inclusive Chalakudy basin had once supported extensive single or double crop paddy farming along with vegetable or pulse cultivation in the summer. These lands were the major users of all basin resources, supporting a largely agrarian population which had thrived on the rich soil and abundant waters of the river basin in its most bestowing stretch. Rapid and unrelenting paddy land conversions, cropping pattern shifts and various non-agrarian activities using the fertile land and water base such as clay and sand mining for the large-scale and numerous construction and construction related manufacturing enterprises since the 1990s had drastically altered the landscape and livelihood structure of these lowlands. An understanding of the changes and the present livelihood and resource linkages is essential to comprehend the governance challenges presented by the lowlands of the Chalakudy basin. The

village of Parakkadavu, served by the tail reaches of the CRDS Left Bank Canals (LBC) was selected as a representative site for the purpose.

### **6.6.1 The setting and multiple boundaries of concern**

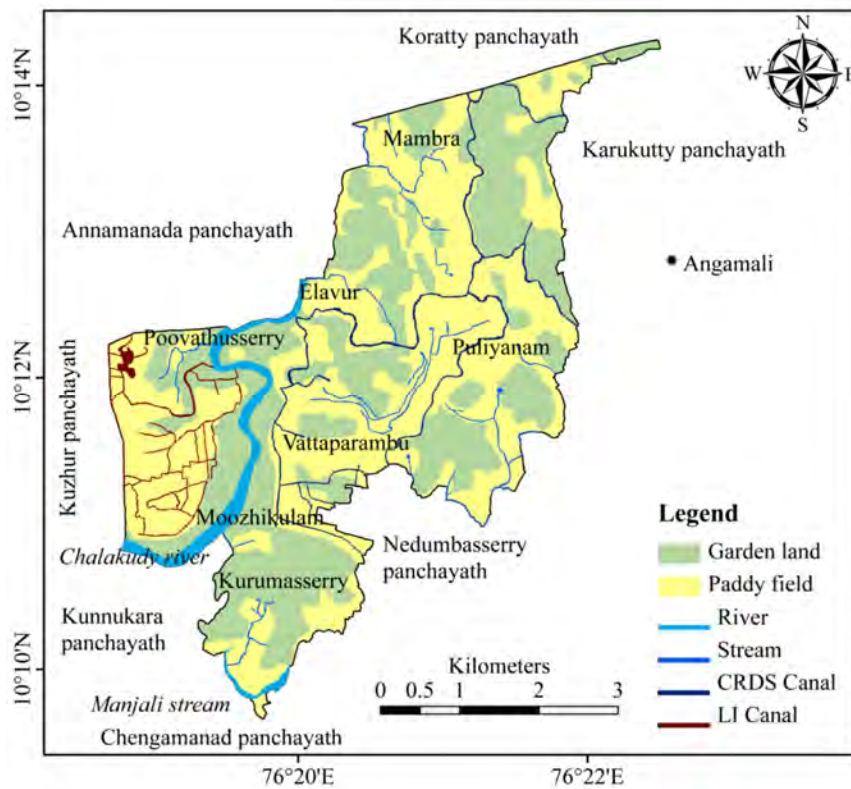
The lowland zone village of Parakkadavu is situated at an elevation range of 8-60 m above msl. The Chalakudy River flows through the village for about 8 km. The village is also bounded by the *Manjali* stream in its southern extremity. Parakkadavu village has an area of 24.7 sq.km and a population of 29,997 people with a population density of 1216 persons per sq.km (GoI, 2001). Parakkadavu receives an average annual rainfall of 2500-3000 mm from both the South West and North East monsoons. Low-lying paddy lands, in various stages of conversion were found to be bounded by garden lands of lateritic or rich river bank alluvium soils devoted to highly fragmented homestead cultivation and hillslopes of rubber plantations and granite quarries. Of the total land area, around 50 per cent was under perennial crops such as coconut, arecanut and nutmeg raised in mixed homestead gardens and 17 per cent of the land area was classified as paddy land. Around 47 per cent of the cultivated area was under irrigation, either through CRDS LBC, public or private lift irrigation schemes from the river or through private wells.

The hydrological extent of the basin covered only the south eastern portion of the Parakkadavu village. The northern part of Parakkadavu drained into the *Manjali thodu* whose drainage patterns and the nature of the floodplains that surround it made it difficult to be classified into any particular basin. The officially acknowledged Chalakudy basin boundary cuts through the watershed boundary of the *Manjali* stream which has been designated to be part of Periyar river. On the other hand, the inclusive Chalakudy river basin included the entire Parakkadavu panchayath as the area is served by the CRDS left bank canals. The Parakkadavu panchayath is the local self-governance body and the land comes under the revenue jurisdiction of the Parakkadavu village. The panchayath is located in the Parakkadavu block, Aluva taluk in the Ernakulam district of Kerala state. The village is surrounded by the lowland village panchayaths of Kuzhur, Annamanada and Koratty of Thrissur district and Karukutty, Nedumbasserry and Chengamanad panchayaths and the Angamali municipality of Ernakulam district (Fig. 6.25).



Data source: KSLUB (2001a)

Fig. 6.25 Location and land use of Parakkadavu in the lowlands zone



Data source: GoI (1976)

Fig. 6.26 Paddy land area in Parakkadavu based in 1966-67

The towns of Angamali and Aluva are situated close by at 6 and 9 km respectively from where there are regular private and state transport buses plying through the village. Parakkadavu is also barely 8 km away from the National Highway No. 47 and the Kochi International Airport in the neighbouring Periyar basin. These proximities to major trade centres and routes have also influenced the resource use patterns and livelihoods in the village.

### **6.6.2 Occupational and resource use history in the lowlands**

The lowland stretches of Kerala with its fertile soil and bounteous and diverse water resources had been the earliest centres of inhabitation and settlement. Of the 32 ancient Vedic Brahmin settlements (*gramam*) of Kerala which are claimed to be the origin of village structure and economy in this south western strip of the peninsula, 12 are located between the rivers Karuvannur and Periyar in what is now the inclusive basin stretches of the Chalakudy river. The location of one of the most important of these settlements called *Moozhikulam* is in the village of Parakkadavu. *Moozhikulam* was revered as one of the four centres of Vedic learning during A.D. 800 at the time when the Chera rule was reestablished in the state. Centred around the authority of the temple and controlled by the politically powerful and landed castes of *Namboothiris* and *Nairs*, these villages were organised as dispersed settlements of specific castes spread over comparatively elevated, dry land (*parambu*) bordering the inundated lowlands (*padam*) where paddy was grown (Tarabout,2006). The agrestic slave castes of the *dalits* were settled as separate hamlets near the paddy fields of the specific families to which they were attached to.

The process of land tenancy and therefore a differential relationship to land had followed a well etched and multi-layered caste, power and wealth gradient (Miller, 1954; Mencher, 1966). The ultimate ownership of the land, especially paddy land, rested with the temple (*devaswam*) and these were leased out for cultivation by the feudal *Namboothiri* or *Nair* houses on which the control of the land was vested/ endowed with. The long-term mortgages (*kanam* rights) were awarded to prominent *Nair* and wealthy Christian families in the area who then sublet it for temporary lease agreements (*verum pattom*) to the cultivator families of less affluent *Nairs*, *Ezhavas* or Christians. The agricultural labourers who worked these paddy lands were the still 'lower' *dalit* castes of *Pulayars* and *Parayars*. The garden land labourers were mostly

sourced from the *Ezhava* and *Kudumbi* castes. Even the castes specialised in non-agricultural labour such as the carpenters, blacksmiths, washers, barbers, astrologers etc. undertook cultivation under tenancy (Census of India, 1901). By the 18<sup>th</sup> century, these lowlands became established as the main production and distribution centres of Central Kerala, mostly under the rule of the princely states of Cochin and Travancore. Paddy cultivation was the foundation of the economy both in terms of land use and livelihoods. The cultivation and trade in spices especially pepper that flourished during these times was also controlled from the lowland by the Muslim and Christian families (Menon, 1911).

The land and tenancy rights were revamped considerably over time both in the Travancore and Cochin states so that by the middle of the 19<sup>th</sup> century, direct control of the state over majority of the land holdings became established that also permitted transaction and sale of landed property (Kumar, 1982). These changes brought in increased social and economic mobility so that Christians and the lower caste of *Ezhavas* became property owners. Even then and notwithstanding the periodic changes initiated in tenancy and ownership rules both by the princely states and the successor Kerala state, the essential structure of land use in the lowlands was retained. Development of irrigation works to combat the post-World War II food crisis was the first major turning point in the land use of these lowland tracts. Lift irrigation (LI) schemes were first initiated in the Periyar and Chalakudy rivers followed by the first major irrigation scheme in the state in the Chalakudy river in 1947. Generous concessions and incentives were also given by the Kerala state to encourage cultivator groups and societies to adopt LI (GoK, 1958). The Parakkadavu No. 1 LI scheme was commissioned in the Parakkadavu village during the 1950s which was an era of active irrigation ayacut expansion in the state to increase food production. Later, the CRDS LBC waters also reached the village through the canals which were laid in 1961. Chalakudy river at that time was free flowing with only one hydroelectric dam upstream at Poringalkuthu with negligible storage. The CRDS canals diverted the abundant waters to the mid and lowland ayacuts which until then were single or double cropped rainfed paddy lands. In the garden land clearings upland rice was being taken as a rainfed crop and various other small millets were also cultivated. Coconut as a lucrative garden land crop was just beginning to establish itself and arecanut was cultivated in lower slopes with well or tank irrigation. Rubber was not

prevalent except in a limited area on the hill tops whereas drier lands high upon the slopes had cashew growing on them. The canal water which arrived in the 1960's drastically changed this landscape largely attuned to rainfed cropping. Wherever canal water reached and below the contour traversed by the canal, double crop and sometimes even three crop paddy was cultivated. There was widespread cultivation of upland paddy and garden lands were deepened wherever possible to facilitate entry of canal water. The wetlands at that point of time constituted around 40 per cent of the land area and in total paddy were taken in about 52 per cent of the land area including the upland rice (Fig. 6.26).

By early 1970's Kerala Land Reforms Act 1963 was implemented in the state leading to major reconfigurations of ownership rights over the land resources that were being so intensively cultivated. The large-scale migration to the Middle East also started off during the 1970's, leading to alterations in labour and resource availability. Balakrishanan (2001) had argued that labour migration out of the state and the combined loss of land and labour in the agricultural sector had acted as a pincer movement on Kerala's agriculture, starving it of its resources. To clinch matters, it was during this time period that the interstate interbasin Parambikulam Aliyar Project (PAP) treaty became operational in the upstream of the Chalakudy river, diverting huge quantities of water to the neighbouring state of Tamil Nadu. The resultant severe reduction in downstream flow in the Chalakudy river led to reduced water availability in the already existing CRDS canal command. In a decade's time, the changes brought about in labour, capital and the resources of land and water employed in agriculture heralded both a shift in the cropping pattern as well as the emergence of a strong non-agrarian sector in these lowlands. Construction sector began to establish itself, giving opportunities of unskilled and semi-skilled labour to the workforce moving out of agricultural labour work. Various non-agricultural resource uses associated with the growth of the construction industry were also witnessed in these lowlands during the time. Clay brick and tile manufacturing industries in the locality using the fertile clay base of the paddy fields came up during this phase during the 1980s. Mining of river sand from the Chalakudy River to unprecedented extents and depths commenced and laterite and stone quarries were also established in the village during this time period.

Meanwhile water resource utilisation in the village was following a different trajectory. The CRDS canal waters had seen its last days of abundance and glory by the 1980s, when PAP diversions became functional so that water which flowed three days of every week during the summers reduced to twice in every two weeks. On the one hand, attempts were made to atone for the deficit in water supply and on the other cropping pattern shifts were resorted to. To cater to the declining water availability, numerous new LI schemes became operational not only from the river, but from the flooded wetlands and also from the *Manjali* stream. Private well irrigation was also taken up extensively. At the same time, there were extensive conversions of paddy lands following unviability of labour intensive paddy cultivation. Perennial tree crops of nutmeg and coconut replaced upland paddy altogether. Even wetland paddy fields were planted with coconut and nutmeg and slowly converted to garden lands. Rubber began to be cultivated as a homestead crop and slowly the area under rubber spread even to areas below the canal contours to the valleys and paddy fields also.

Various non-farm sectors have since then emerged in the village as a major livelihood means, only less than 20 per cent of the working population were engaged in agriculture as the main livelihood activity as opposed to 68 per cent in 1971. The tertiary (39%) and secondary sector (35%) were the largest sector of occupation in this lowland village by 2001 whereas these had occupied only 15 and 17 per cent of the working population respectively in 1971 (GoI, 1971; GoI, 2001). It is also to be noted that the share of marginal workers in total workforce was steadily increasing over the years, especially among women so that by 2001 as high as 41 per cent of the women workers were marginally employed. These emergent livelihood options and patterns have in turn brought in their own patterns of labour and resource use in the basin over time, linking up the basin with the non-basin areas and redefining linkages to the resources of land and water within the basin.

### **6.6.3 Emergent occupations and patterns in the lowlands of Parakkadavu**

The results of the primary survey were examined to understand the composition and nature of emergence of the occupations in Parakkadavu. It was brought out that agriculture and allied activities as main livelihood activities in these lowlands had receded considerably so that the share of cultivators and agricultural labourers was only around 8 per cent at the time of the survey (Table 6.25). It was further observed

that the cultivators and labourers were no longer water tight compartments. Agricultural labourers in most cases doubled up as cultivators by cultivating leased-in land. Within the cultivator class with ownership of land, those who undertook farming were mainly those who engaged in it as a post retirement option. The age composition of the working population revealed that 80 per cent of the male cultivators were above 50 years in age. Among the agricultural labourers, 62 per cent were above the age of 50.

Table 6.25 Distribution of workers in various occupation categories- Lowlands

Primary occupation	Frequency (n)			Percentage (%)		
	Male	Female	Total	Male	Female	Total
Cultivators	59	14	73	9.4	6.0	8.4
Agricultural labourers	47	21	68	7.4	9.0	7.9
Livestock and fisheries	5	5	10	0.8	2.1	1.2
Mining and quarrying	35	6	41	5.5	2.6	4.7
Manufacturing	106	63	169	16.8	27.0	19.6
Construction	87	12	99	13.8	5.2	11.5
Trade and commerce	96	15	111	15.2	6.4	12.8
Transportation	62	0	62	9.8	0.0	7.2
Other services	134	97	231	21.2	41.6	26.7
Total (N)	631	233	864	100.0	100.0	100.0

Source: Primary survey

Livestock rearing had been a strong presence in the village during the time when paddy farming was a predominant occupation. At the time of the survey, cattle were owned only by 27 per cent of the households. The change in the sector is marked in that instead of milch and draught animals, presently animals for meat are reared such as pig, broiler poultry and premium buffalos, for a short period ranging from 6 months to a year after which they are sold off and a new batch raised. This shift is also of a recent nature and has occurred in the past 5 years' time frame. The Livestock Census data for the past 15 years revealed a drastically declining trend in the number of cattle in the village although the buffalos did show a slight increase in the period between 2003 and 2007 (Fig. 6.27). The increase in the in the number of goats and buffalos in the last 5-6 years can be ascribed to the vast areas of paddy fields lying fallow in the village where the goats and buffalos can be left to graze



untrammled. In fact, these fallow fields, however transient in their ownership, have become the new commons in the village.

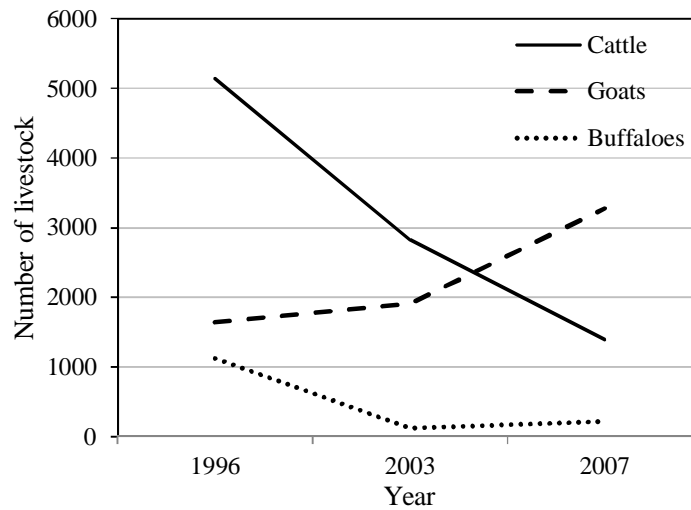
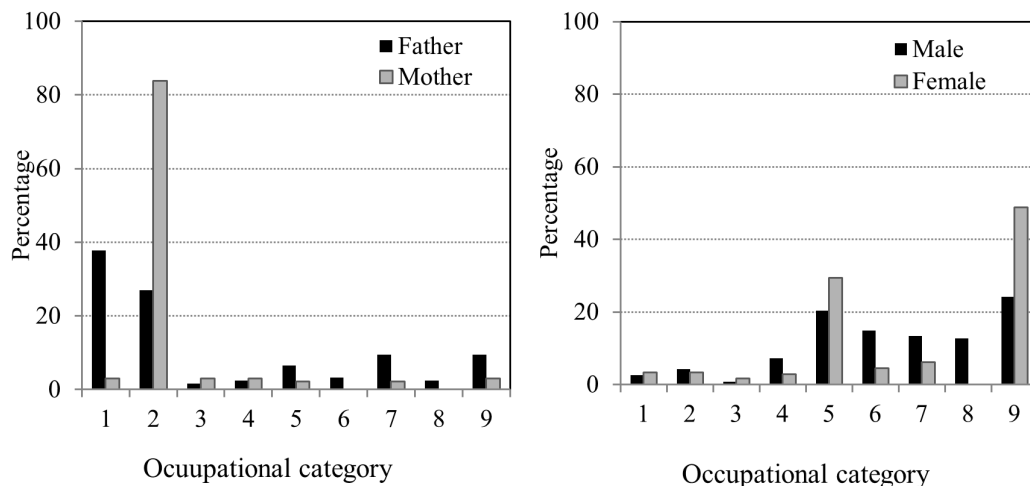


Fig. 6.27 Trends in livestock population 1996-2007 - Lowlands

A brief look at the occupational pattern of the parental generation of the household head revealed that agriculture was the dominant sector of employment which has now shifted to manufacturing and services sector for women and distributed in the various secondary and tertiary activities for men workers in the present generation (Fig. 6.28).



Note: 1- Cultivators, 2- Agricultural labourers, 3- Livestock and Fisheries, 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6.28 Occupational profile of parental and present generation- Lowlands

At the same time, some of the caste rigidities in the primary sector of employment were found to be still prevalent. Christians were found to be the dominant religion in the village who made up 43 per cent of the total workforce followed by the *Ezhava* caste contributing 24 per cent of the total workforce. While the Christian cultivators were observed to dominate at 60 per cent, the major share of agricultural labourers (35%) were still people belonging to the *dalit* castes of *Pulayars* and *Parayars*. On the other hand, the emergent sectors of manufacturing and construction were found to offer new work opportunities to the *dalit* and *Ezhava* workers so that a major share of workers in these castes were now found employed in these occupations.

The secondary and tertiary sectors employed the highest proportion of main workers (Table 6.25). Construction sector has been around as a major non-agrarian livelihood means in the village ever since the initial construction boom started in the 1980s along with the arrival of remittance capital from the Middle East. With the shift from agricultural production that had occurred around that time, one of the sectors that had absorbed the labour was the construction sector. Many women labourers, relocated from agriculture, had found employment as unskilled workers in the sector back then even though the sector mainly attracted men labourers both as skilled and unskilled workers. The sector had continued to be a major livelihood provider and the emergent behaviour of the sector was noticed in the increase in the skilled nature of jobs such as painting, tile, concrete beautification and fancy wood works generally catering to private house constructions. There were two construction firms in the village which had started in the space of the last 5 years employing around 100 people each as skilled labourers (masons, carpenters, electricians, plumbers, tile workers, painters) on a contract basis in addition to the unskilled labourers called 'helpers' (such as for mixing and transporting concrete). This was in addition to the skilled construction workers working independently or for private contractors. The women 'helpers' in construction was found to have been replaced by labour from Tamil Nadu and in the recent years by men workers from North and North East India so that only 5 per cent of women were employed in construction related activities.

The occupational opportunities in the manufacturing and processing sector were distributed across the village, with numerous small scale and household units

employing from 5 to 50 people in various sub-sectors. The sector was found to employ 20 per cent of the total main workforce and as high as 27 per cent of the women workers. There were many (17 in number) small scale industrial units manufacturing packaged food articles, in which mostly young women of the locality find employment. The women employed in the sector hailed from families which were ancestrally farm labourers attached to specific cultivator families and whose parents were now mostly employed in the construction sector. Traditional food processing units of rice and oil within the village were slowly on the decline. The solitary rice mill was on the verge of closure employing fully outside state seasonal migrant labourers. Oil mills were putting up a valiant fight by trying out retail trade in super market chains. Ayurvedic medicine manufacture, manufacture of paper cartons, plastic sheets, bottle and bags, aluminum vessels etc. were the other small scale units which employed largely women labour. Another opportunity for women labour was learned to be the Industrial Estate located at Chempannur, in the Angamali municipality, within the extended basin.

Construction related manufacture within the village was yet another emergent sector which has flourished especially due to the rich resources that the region had been blessed with. Diverse enterprises from informal units manufacturing cement bricks, cement tiles, sand, crush metal, fibre doors, aluminum fabrication works and metal truss works to the older formal units of clay tile factories and unorganised informal units of brick kilns thrived in the area. The carpentry units, though a traditional manufacturing sector were seen to be undergoing change in caste composition due to shortage of labour to meet the rise in demand. Earlier practiced only by the members of a particular caste, carpentry now employed workers of all communities in the village as well as migrant workers. Another work connected to construction which had come up in the recent years, was well digging and associated water quality enhancement works on wells. In an area where poor quality and quantity of drinking water was a fairly recent phenomenon, new well digging and well renovation was a thriving sector with well over 100 people working in it.

There were around 40 stone quarries in Parakkadavu in the hills of Mambra and Puliyanam which had become operational during the late 1960s. Early methods of stone breaking centered on the use hand tools had limited the scope of the activity to an average of 10 loads of stone/ day employing only 4-5 persons per quarry. With the

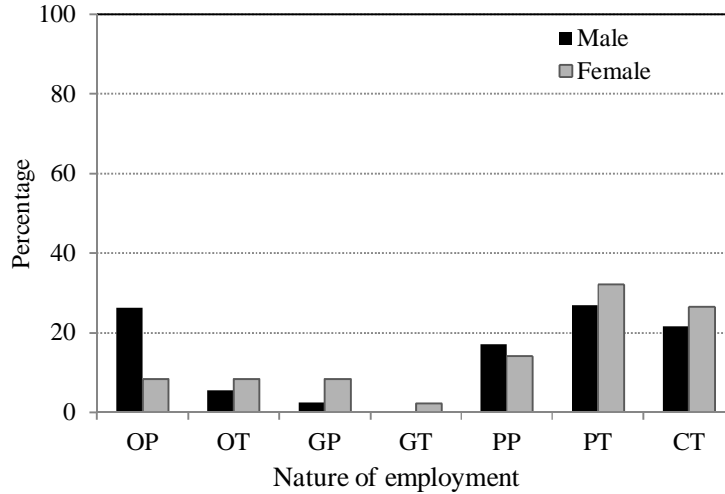
arrival of mechanised form of drilling in the early 1990s through diesel powered hydraulic hammers and a sharp rise in the demand, the yield from quarries increased 10 fold to around 100 loads of stone /day from each quarry. With such dramatic increase in the stone yield and demand, the emergent practice was noticed to be the employment of a huge migrant labour force in these quarries to meet the high labour requirement. At the same time, the local workforce slowly started receding from quarry work due to the changed nature of work oriented more towards the intense physical works of loading and stone breaking. Meanwhile, the trend of replacing quarry sand for river sand in construction activities had again led to further expansion of the quarrying activities. Transportation sector which employed 10 per cent of the male workers was found to be the emergent sector of employment for the local population living near quarries in the Mambra –Puliyannam region. With around 100 loads of stone / day/ quarry, transporting stone to the main market destinations was the main emergent livelihood means employing around 400 men among the local population as truck drivers. Brick, soil, sand and M-sand freight transport were the other allied opportunities in the sector.

With the rise in construction activities in the state since the late 1990s (Prakash, 1998) there has been an increase in demand for the raw materials of construction such as sand, stone and clay that were chiefly sourced from the resource rich mid and lowlands of the river basins of Kerala (Padmalal *et al.*, 2004). These regions therefore came to be extensively mined and quarried to satisfy the burgeoning demands for building materials from both inside and outside the basins. Most of these basins are now facing closure conditions with regard to availability of river sand along with the adverse impacts of intensive sand mining (Sreebha, 2008). This has resulted in the replacement of clay bricks and river sand by cement bricks and quarry sand which has led to a large increase in the number of small scale quarries and rock crushing units in these very same midlands and lowlands of the state (GoK, 2009). The annual production of granite building stone quarried from the state as a whole was 2.9 million tonnes per annum in 2006-07 (GoK, 2010b). Ironically, only less than 1 per cent of the working population in Kerala was engaged in mining and quarrying activities. The workforce in this sector was dominated by a large in-migrant labour force which is largely missing in the Census enumerations and National Sample Survey (NSS) estimates because of their floating character (Bremner, 2007). Other

studies conducted in Kerala and other parts of the country also confirm that migrant labour now is the most preferred labour for operations that does not require sophisticated skills especially in the construction sector (Deshingkar and Akter, 2009; Surabhi and Kumar, 2007).

Trade and commerce activities were seen to engage a sizable share of the workers (13%), especially among men (15%). Retail trade in agricultural produce of nutmeg and mace, arecanut and coconut was a prominent activity handled by local agents who collected the produce for sale to exporting agents or processing units whereas retail trade in agricultural inputs were mostly handled by the two co-operative societies. There were around 23 wholesale stockists and traders in food and other items and 50 retail outlets of various stationary, medicine, clothes, jewelry and food items including hotels and restaurants. Other services category of labour accounted for 27 per cent of the employment divided between various sub-sectors such as teaching, health services, government services, and engineering and a range of personal services such as hair dressers, house workers, tailors etc. The results of the primary survey indicated that the highest share of total working population was involved in the tertiary sector especially in the other service activities. In the case of the women workers, as high as 42 per cent were engaged in these occupations which ranged widely from hospital staff to school teachers to domestic helps. It is also pertinent to note that 61 per cent of the young women in the age group of 18-30 were engaged in these service sector occupations.

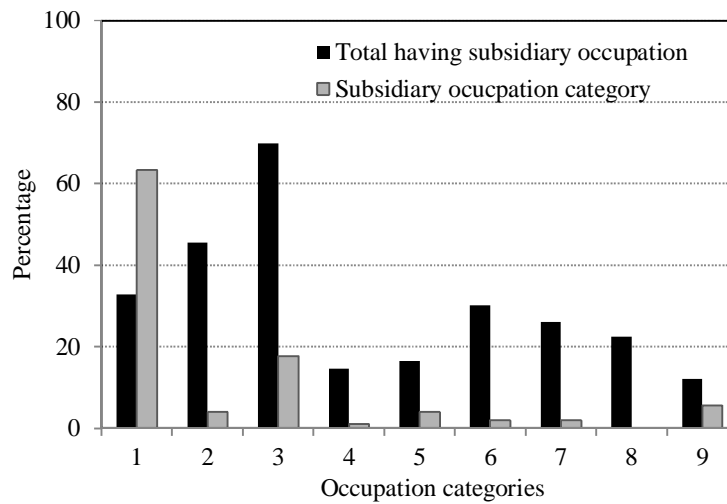
The prevalence of main livelihood activities in the tertiary as well as construction and informal manufacturing sectors has led to a large proportion of casual and temporary workforce in the village especially among women (Fig. 6.29). This casual and temporary workforce employed mostly in the private sector was therefore found to engage in a host of other economic activities such as NREGS by women and farming in leased land by men workers as subsidiary occupations. Ten per cent of the working women as well as 7 per cent of non-working women were actively involved with the NREGS work undertaken in the village while barely 1 per cent of men were active in NREGS work. On the other hand, of the 14 per cent of the main workforce having subsidiary occupations other than NREGS, 79 per cent were observed to be men.



Note: OP- Own permanent, TP- Own temporary GP- Government permanent, GT- Government temporary, PP- Private permanent, PT-Private temporary, CT- Casual

Fig. 6.29 Distribution of nature and agency of work- Lowlands

The subsidiary occupations engaged in were largely in the agricultural sector. It is evident from Fig. 6.30 that more than 60 per cent of those who engaged in subsidiary occupation resorted to farming or own cultivation and another 18 per cent undertook livestock rearing, especially buffalo. It is also to be noted that while the cultivators mainly took up animal husbandry as a secondary occupation, all the other work categories endeavoured into farming as a subsidiary activity.



Note: 1- Cultivators, 2- Agricultural labourers, 3- Livestock and Fisheries, 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6.30 Distribution of subsidiary occupation- Lowlands

Classification of the households based on the main occupation of the working members affirmed that majority of the households (67%) depended on non-farm activities as main livelihood means, followed by mixed strategies households (25%). It is clear from Fig. 6.31 that households that depended solely on agricultural activities were only a handful in this lowland village.

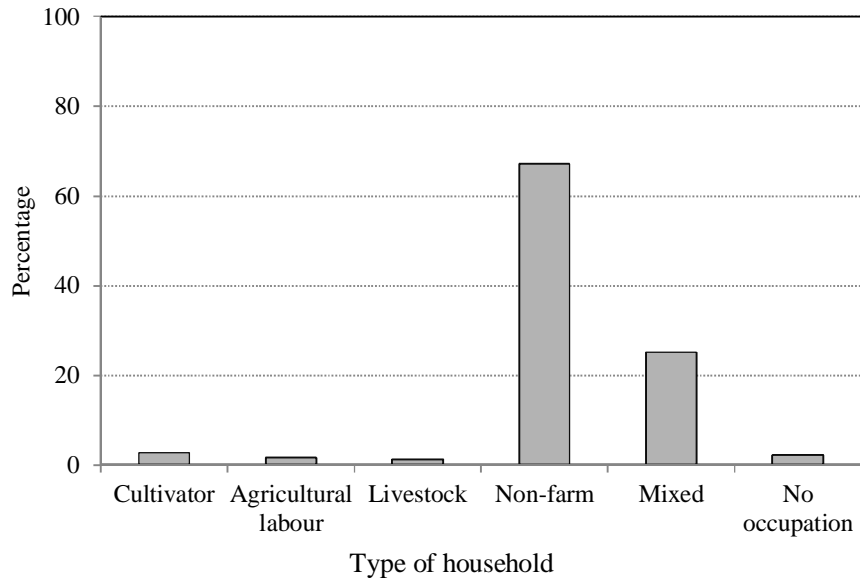


Fig. 6.31 Distribution of household groups based on livelihood- Lowlands

#### 6.6.4 Livelihoods and resource linkages in the lowland zone

The resources of land and water in these lowland landscapes were very closely interwoven. The land area was a mosaic of fast diminishing wetlands and upland garden lands. The wetland topography that dominated the landscape, the Chalakudy river that flows through the northern regions of the village, the *Manjali* stream in the western extremity and the numerous streams originating from the wetlands along with the CRDS and LI canals that also replenishes the groundwater reserves make the village rich in a variety of water resources. But severe resource scarcities were experienced in the region despite the apparent resource affluence. The various linkages of the households to their land and water resources are being examined in the following sections to understand the present configurations of livelihoods and resource relations in the lowland tracts of the basin.

#### 6.6.4.1 Patterns of land ownership and access to land

The ownership over the land resource in the village classified as garden lands, paddy lands and converted paddy lands by the different household types based on the main occupation of their members was analysed. It was evident that homesteads were primarily located on garden lands and these formed the major and in most instances the only land area possessed by majority of the villagers. Even then it was found that garden lands as homesteads and other land holdings made up only 51 per cent of the total land area of the village. Ninety three per cent of the households possessed homestead land whereas garden land other than homestead was owned by only 9 per cent households. The rest of the land area was present as paddy lands and converted paddy lands in the possession of fewer households. While the paddy lands constituted 29 per cent of the land area owned by 32 per cent of the households, 20 per cent of land area was identified to be converted paddy lands in the possession of 23 per cent households (Fig. 6.32). It is evident from the figure that roughly two-thirds of the paddy lands in the village have been converted into garden lands.

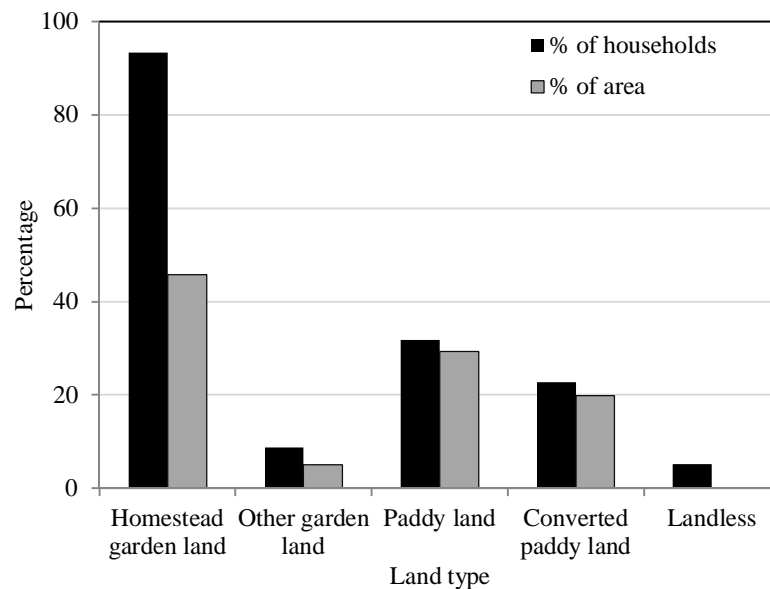


Fig. 6.32 Distribution of land types in the lowlands

The ownership pattern of these lands amongst the various livelihood groups revealed that major share of the area rested with the non-farm households (Table 6.26). More than half the area under garden land homesteads (58%) and paddy lands (56%) and as high as 73 per cent of converted paddy lands were vested with the nonfarm households whereas the households with mixed livelihood strategies owned



25 per cent of garden land homesteads, 30 per cent of paddy lands and 11 per cent of converted paddy lands. Purely cultivation oriented households had in their possession only 9 per cent of the garden land homesteads, 5 per cent of paddy lands and 10 per cent of converted paddy land area. The purely agricultural labour households possessed only 1 per cent of the total land area of the village. This clearly brought out that the land area in the village was primarily under the possession of those households whose primary occupation was no longer agriculture. The land area was also found to be highly fragmented with majority of the holdings being marginal in size, be it garden land, paddy land or converted paddy land (Table 6.27).

A caste-wise analysis of land ownership brought out that the land area in all the four categories was concentrated with the Christian families who had the highest share in the total land as well as the highest land area per household. The *Ezhava* households were found to be the second largest presence in land ownership although the per household land ownership was found to be low. The SC and ST households owned the least area and least land area per household being mostly confined to colonies in the most resource poor regions of the panchayath.

The wetland paddy fields were present as extensive stretches called '*padashekharams*' consisting of a collection of small and large sized paddy lands under various owners and generally under the management of a single *Padashekhara Samithi*. These *padashekharams* which had been provided irrigation from a diversity of sources and had been the focus of agriculture in the lowlands in the past were the emergent sites of real estate and speculator interest in land due to the extensive areas available in a single stretch. The speculative and investment interests in these lowland stretches close to the National Highway, Airport and the township of Ernakulam were noted to be very high. The boom in land prices by mid 2000s had stimulated large-scale sale of paddy lands by small and large holders alike who had stopped cultivation in these lands by the late 1990's.

A significant share of the paddy land ownership in the village was reported to be with anonymous buyers from the nearby townships of Aluva and Ernakulam who had acquired these lands as investments. The registered organisations of *Padashekhara Samithis* who had previously coordinated the farming in these extensive stretches of paddy lands were found to be under the strong influence of land speculators with the

Table 6.26 Distribution of land types among livelihood groups- Lowlands

Household type	Homestead land			Other land holding									Total (including landless)		
	Area owned	House holds	Average area owned	Paddy land			Garden land			Converted paddy land			Area owned	Hous e holds	Averag e area owned
				Area owned	House holds	Average area owned	Area owned	House holds	Average area owned	Area owned	Hous e holds	Averag e area owned			
(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	
Cultivator	15.0	10	1.50	4.2	7	0.60	0.0	0	0.00	7.0	4	1.74	26.2	11	2.38
Agr. Labourers	0.6	6	0.10	0.6	2	0.30	0.0	0	0.00	0.0	0	0.00	1.2	7	0.17
Livestock etc.	3.2	5	0.63	1.2	2	0.61	0.7	2	0.36	1.8	1	1.78	6.9	5	1.38
Non-farm	95.2	254	0.37	58.3	73	0.80	10.2	22	0.46	51.9	66	0.79	215.7	275	0.78
Mixed	41.6	100	0.42	37.6	40	0.94	6.9	11	0.62	8.0	20	0.40	94.0	103	0.91
No occupation	7.6	8	0.96	2.7	6	0.44	0.2	1	0.15	2.1	2	1.05	12.5	9	1.39
Total	163.3	383	0.43	104.6	130	0.80	17.9	36	0.50	70.7	93	0.76	356.5	410	0.87

Source: Primary survey

Table 6.27 Distribution of land types according to holding size - Lowlands

Land type	Marginal land										Small		Medium		Large		Total	
	< 5 cents		5-25 cents		25-50 cents		0.5-1 acres		1-2.5 acres		2.5-5 acres		5-10 acres		>10acres		No.	Area
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area		
Homestead land	33	1.3	201	24.5	62	21	43	46.7	33	42.8	8	27.4	3	0.0	0	0.0	383	163.3
	(8.6)	(0.8)	(52.5)	(15.0)	(16.2)	(12.6)	(11.2)	(28.6)	(8.6)	(26.2)	(2.1)	(16.8)	(0.8)	0.0	0.0	0.0	(100.0)	(100.0)
Other garden land	3	0.1	18	2.1	5	1.8	3	1.9	6	9.0	1	3.0	0	0.0	0	0.0	36	17.9
	(8.3)	(0.6)	(50.0)	(11.6)	(13.9)	(10.0)	(8.3)	(10.8)	(16.7)	(50.3)	(2.8)	(16.8)	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Paddy land	0	0.0	22	3.9	32	11.5	35	30.3	35	45.4	5	13.5	1	0.0	0	0.0	130	104.6
	0.0	0.0	(16.9)	(3.8)	(24.6)	(11.0)	(26.9)	(28.9)	(26.9)	(43.4)	(3.8)	(12.9)	(0.8)	0.0	0.0	0.0	(100.0)	(100.0)
Converted paddy land	1	0.0	22	3.2	17	6.0	28	31.3	23	30.1	0	0.0	2	0.0	0	0.0	93	70.7
	(1.1)	(0.1)	(23.7)	(4.5)	(18.3)	(8.6)	(30.1)	(44.2)	(24.7)	(42.6)	0.0	0.0	(2.2)	0.0	0.0	0.0	(100.0)	(100.0)

Source: Primary survey

*Samithi* secretary himself in one instance turning into the real estate broker for mediating the sale of the paddy lands. Known to the locals as ‘*Aluvakkaar*’/ *Ernakulamkaar*’ – the ones from Aluva/ Ernakulam – they had in their name vast extents of the *Puncha* paddy lands of the *Manjali* floodplains called as *Kodusserry puncha*. They were also found to have stakes in the extensive *Poovathusserry padashekham*. Interestingly, some of these lands have been leased back for cultivation from the owners based on informal agreements and in a couple of cases without explicit knowledge or consent of the absentee landlord. In fact, as a part of the Food Security drive and the Kerala Conservation of Paddy Land and Wetland Act, 2008 (GoK, 2008b), the Krishi Bhavan and panchayath were found to urge the cultivation of these ‘orphan’ lands by whoever interested in undertaking paddy farming. Even when cultivation was with the consent of the owner, the terms of lease were found to be flexible in that the urgency was in having the field under some form of cultivation than in the remuneration as lease amount. The occupational linkages to the land use need to be explained in this backdrop.

#### 6.6.4.2 The trajectory of land use

The lowlands which were the traditional agricultural domain of the Chalakudy basin had had a diversity of crops being raised intensively in various land types such as irrigated and rainfed wetland paddy fields and garden lands, irrigated upland paddy fields and hill slopes attuned to specific cropping seasons and calendars. Paddy farming had ruled the landscape and agriculture or ‘*krishi*’ had been synonymous to paddy cultivation. With the changes in the land configurations, the use to which these lands were put to and the nature and agency of these land uses had also undergone considerable redefinitions.

A major share of the land area in the form of homestead garden lands and converted paddy lands were under nutmeg and coconut based mixed farming where the principle crops of nutmeg and coconut were raised along with arecanut, banana, vegetables and tuber crops such as colocasia and elephant yam. It was also observed that banana, vegetables and other seasonal crops were diminishing in importance as upland crops and these were increasingly being taken in paddy fields or converted paddy fields. Paddy farming was found to be undertaken on 25 per cent of the total cultivated area even though banana and tapioca, both of which emerged in the past

decade as lucrative crops to replace paddy farming were also noticed to be cultivated in an almost equal extent of land (Table 6.28). The use of paddy land for raising of other commercial crops is evident from the fact that 41 per cent of the main cultivators raised banana, tapioca and vegetables in the paddy fields. On the other hand, garden land agriculture of nutmeg, coconut and arecanut was undertaken only by 26 per cent of main cultivators and rubber was grown by 5 per cent of the main cultivators.

Table 6.28 Main crops and their distribution- Lowlands

Crop	No. of holdings	Area (acres)	Average holding size (acres)	Percentage share (%)	
				Holdings	Area
Paddy	117	111.6	1.0	11.8	25.3
Banana	167	82.7	0.5	16.9	18.7
Tapioca	35	35.6	1.0	3.5	8.1
Vegetables	27	18.0	0.7	2.7	4.1
Coconut	278	80.5	0.3	28.1	18.2
Nutmeg	219	73.1	0.3	22.1	16.6
Arecanut	125	14.3	0.1	12.6	3.2
Rubber	22	25.5	1.2	2.2	5.8
<b>Total</b>	<b>990</b>	<b>441.5</b>	<b>0.4</b>	<b>100.0</b>	<b>100.0</b>

Note: Includes leased land cultivation also

Source: Primary survey

The recently converted paddy lands were different from the proper garden lands in many of their attributes such as the poor fertility of the soil, the presence of a very high water table that makes irrigation redundant for garden land crops and the poor quality of water available from wells. Some of these lands which were not raised above the level of the canal still received irrigation water intended to irrigate paddy. The legal status of these converted lands was also dubious. If proved to be a designated 'paddy land' in the land records, these lands could not be used for undertaking any form of non-agricultural activity. Some of these paddy lands which were converted very early during the first phase of conversions during the late 1970s using coconut as the pioneering crop were difficult to be distinguished from a proper upland holding. Therefore one of the emergent procedures related to use of land in these lowlands was observed to be the process of establishing the credentials of a plot

of land as garden land using photographs of the land, its lay and crops grown so that building of houses may be permitted in it. The converted paddy lands had also become a favorite form of investment in land since they commanded a price less than that of proper garden lands.

Paddy lands had thus shrunk to mere pockets which were either left fallow or where only a single crop of either the first season *Virippu* or second season *Mundakan* was cultivated. Two and three crop paddy cultivation which was the prevalent practice until the 1990s was discontinued mainly due to shortage of labour for harvest. Land owning households of paddy lands especially of the upper caste Hindus were found to be reluctant to farm on their own due to a lack of the necessary social capital to undertake direct paddy farming such as lack of active involvement in *Padashekhara Samitis*, inability to bargain with agricultural labourers to undertake agronomic operations on time etc. It was therefore found that 60 per cent of the seasonal cultivation on paddy lands was undertaken on lease although the lease farming households made up only 36 per cent of the share of total cultivators of paddy lands. It is also to be noted that the per capita land cultivated by the lease farming households were greater than that of households cultivating on own land. Another important trend noticed was that lease farming was undertaken both as a subsidiary activity as well as the main livelihood means although larger area was cultivated by those undertaking it as a main activity. Lease farming was also found to be a widespread practice in the cultivation of garden lands with seasonal crops of tapioca, banana and vegetables (Table 6.29 (a)).

Various alternative arrangements existed such as farming on lease, share cropping and farming through agricultural labourers for a fixed amount. The owners were facing various difficulties in directly involving in paddy farming. For one, obtaining labourers in time had become an immense hassle. The owners in such instances looked out for a reliable labourer who would take off the burden of farming off his shoulders either for a share of one third or one fourth of the crop or for a lease amount. There were also instances where the non-farm occupation based households could not find the time or inclination to farm on their own. Leasing land to maintain the land under cultivation as '*Nottaparambu*' was also found to be a prevalent practice, especially in the case absentee-landlordism. In various instances, such lease

farming ventures into the fallow paddy lands were endorsed by the Panchayath also. For example there were 75 Kudumbasree units that undertook paddy farming in the panchayath on informally leased land under subsidy from the *Krishi Bhavan*. Paddy land farming was thus found to be increasingly practiced by workers from other professions on leased in land with the aid of state subsidies though tenancy and tenant farming is illegal according to the Kerala Land Reforms Act, 1963.

Farming on owned lands was mostly undertaken as a subsidiary activity limited to homestead land and perennial crops of nutmeg, coconut and arecanut which were less labour intensive in its agronomic operations. It is evident from Table 6.29(b) that 67 per cent of the households undertaking perennial crop cultivation considered it as a subsidiary activity. Other uses of land were found to be in mining and quarrying of sand, soil and stone from the river bed, paddy fields and the stone outcrops respectively as resource providers for the construction sector. There was around 200 acres of land in the panchayath under active and defunct quarries.

According to a study conducted in 2003 in Muriyad village in Thrissur district lying in the lowland AEZ of the adjoining Karuvannur basin and having inclusive regions within Chalakudy basin irrigated by the CRDS, only 19 per cent of the households were found to be taking agriculture as their major occupation and the majority of these were marginal farmers with less than 50 cents of land. Agricultural practices showed a declining trend with 40 per cent of household leaving their land fallow. A large chunk of the households (44%) in this village was also reported to sustain their life through any odd jobs that were available to them (Thomas *et al.*, 2003). In such changed occupational circumstances, Nair and Menon (2006) had noted the simultaneous increase in two categories of people in the state of Kerala post land reforms: ‘those who have land but unable to cultivate’ and ‘those who have the labour and skills, but no lands or not enough lands of their own to cultivate’.

#### 6.6.4.3 Changing linkages to water resources

The Chalakudy river coursed through Parakkadavu not only as the main river but also in the form of numerous canals and as groundwater recharges and thus formed the lifeline of the region. There were around ten LI and drinking water schemes in the region, some under the minor irrigation department and others functional under

Table 6.29 (a) Land – Livelihood linkages: Seasonal crops in the lowlands

Seasonal crops	Garden land			Paddy land			Total land		
	House holds	Area (acres)	Average area/ household (acres)	House holds	Area (acres)	Average area/ household (acres)	House holds	Area (acres)	Average area/ household (acres)
<b>Cultivation on own land</b>	67	11.0	0.2	114	83.2	0.7	129	94.2	0.7
Main	29	6.3	0.2	46	36.5	0.8	46	42.8	0.9
Subsidiary	38	4.8	0.1	68	46.6	0.7	83	51.4	0.6
<b>Cultivation on lease land</b>	28	31.4	1.1	64	122.5	1.9	78	153.9	2.0
Main	10	17.8	1.8	35	79.9	2.3	40	97.7	2.4
Subsidiary	18	13.5	0.8	29	42.6	1.5	38	56.1	1.5
<b>Total cultivation</b>	95	42.4	0.4	178	205.7	1.2	207.0	248.1	1.2
Share of own cultivation (%)	70.5	26.0	-	64.0	40.4	-	62.3	38.0	-
Share of lease cultivation (%)	29.5	74.0	-	36.0	59.6	-	37.7	62.0	-
Share of main cultivation (%)	41.1	56.9	-	45.5	56.6	-	41.5	56.7	-
Share of subsidiary cultivation (%)	58.9	43.1	-	54.5	43.4	-	58.5	43.3	-

Table 6.29 (b) Land – Livelihood linkages: Perennial crops in the lowlands

Perennial tree crops	Garden land			Converted paddy land			Total land		
	House holds	Area (acres)	Average area	House holds	Area (acres)	Average area/ household (acres)	House holds	Area (acres)	Average area/ household (acres)
<b>Cultivation on own land</b>	207	136.0	0.7	96	57.44	0.6	210	193.5	0.9
Main	69	60.5	0.9	26	15.68	0.6	70	76.2	1.1
Subsidiary	138	75.5	0.5	70	41.76	0.6	140	117.3	0.8
Share of main cultivation (%)	33.3	44.5	-	27.1	27.3	-	33.3	39.4	-
Share of subsidiary cultivation (%)	66.7	55.5	-	72.9	72.7	-	66.7	60.6	-

various panchayath schemes. Parakkadavu was also part of the tail end command of the CRDS left bank canals. Numerous streams joined the main river from the floodplains which also received the residual flow from the canals. There were relifts from the canals and streams for irrigating garden land crops of nutmeg, banana and tapioca. The canals had therefore become vital for recharging the wells of the command area and served the more important purpose of meeting the drinking water needs through recharge of groundwater aquifers. The conversion of paddy lands which were the original beneficiary regions of the CRDS and earlier LI schemes in the region had also increased the value placed on irrigation water as a means of ensuring water security in the converted lands. The recent LIS for irrigating garden land area were valued for their ability to recharge wells so that it was reported that in all regions where LIS had been implemented, the domestic water scarcity had been adequately redressed. The area and source of irrigation is provided in Table 6.30.

Table 6.30 Area and sources of irrigation in the lowlands

Source of irrigation	Area (ha)	Share (%)
<b>Un-irrigated</b>	1299.5	<b>52.7</b>
<b>Irrigated</b>	1166.6	<b>47.3</b>
Well	232.9	9.4
CRDS	787.0	31.9
River lift	146.7	5.9

Thus wells formed the major drinking water source in the panchayath. It is to be noted that 35 per cent of the households who were landless or marginal land owners could not afford the water security linked to land ownership but were still dependent on groundwater for domestic needs obtained from either neighbours' wells or through public wells. Table 6.31 shows that as high as 51 per cent of the marginal land owners were dependent on neighbouring wells whereas only 15 per cent were benefitted from public water supply. The irrigation and therefore land oriented domestic water security assurance in the panchayath was seen to jeopardise the domestic water needs of the landless and marginal landowners who were predominantly residing in the SC and 4-cent colonies and who experienced water scarcity and quality problems throughout the year.



Table 6.31 Domestic water sources in the lowlands

Land holding size	Pipe (KWA/ Panchayath)		Own Well		Neighbours' well	
	(No.)	(%)	(No.)	(%)	(No.)	(%)
< 5 cents	5	15.2	11	33.3	17	51.5
5 - 25 cents	16	7.5	159	75.0	37	17.5
25-50 cents	3	4.8	59	95.2	0	0.0
0.5-1 acres	1	2.3	42	97.7	0	0.0
1-2.5 acres	0	0.0	33	100.0	0	0.0
2.5-5 acres	0	0.0	9	100.0	0	0.0
5-10 acres	3	100.0	0.0	0.0	0	0.0
<b>Total</b>	<b>28</b>	<b>7.1</b>	<b>313</b>	<b>79.2</b>	<b>54</b>	<b>13.7</b>

Note: Multiple dependences on sources, Source: Primary survey

### 6.6.5 The basin boundary extensions through work connections

The outbasin connections in the lowland village of Parakkadavu were forged mainly by the basin population pursuing livelihoods outside the basin extents, resource use connections such as the procurement of agricultural inputs and the markets for agricultural and non-agricultural produce and thirdly through the large population of in-migrants within the basin. Parakkadavu was found to have only 60 per cent of the working population working with the village with as high as 12 per cent of the work force employed outside the country. It was also noticed that increasing occupations in the construction and service sectors had increased daily commuting to work locations outside the village and the basin that employed 13 per cent of the work force in this lowland AEZ (Fig. 6.33).

The main inputs of sand and clay for the non-agrarian sectors of construction and construction related manufacturing units were sourced until recently from the basin itself. These were now obtained from outside the basin. The basin now provided the physical space for the units to be located in, hopes for future input acquisitions, a ready migrant labour force available from outside the state stationed in the various range of activities, a ready market for the output in the basin and surrounding regions and close at hand opportunity for illegal mining of the inputs. A range of outputs was provided by the construction and its related manufacturing sectors which were consumed outside the basin to a large extent. Majority of the capital and labour in the

quarrying sector was from outside the basin. The main destinations for the boulder from the quarries were Ernakulam, Aluva and Paravur, all lying outside of the basin.

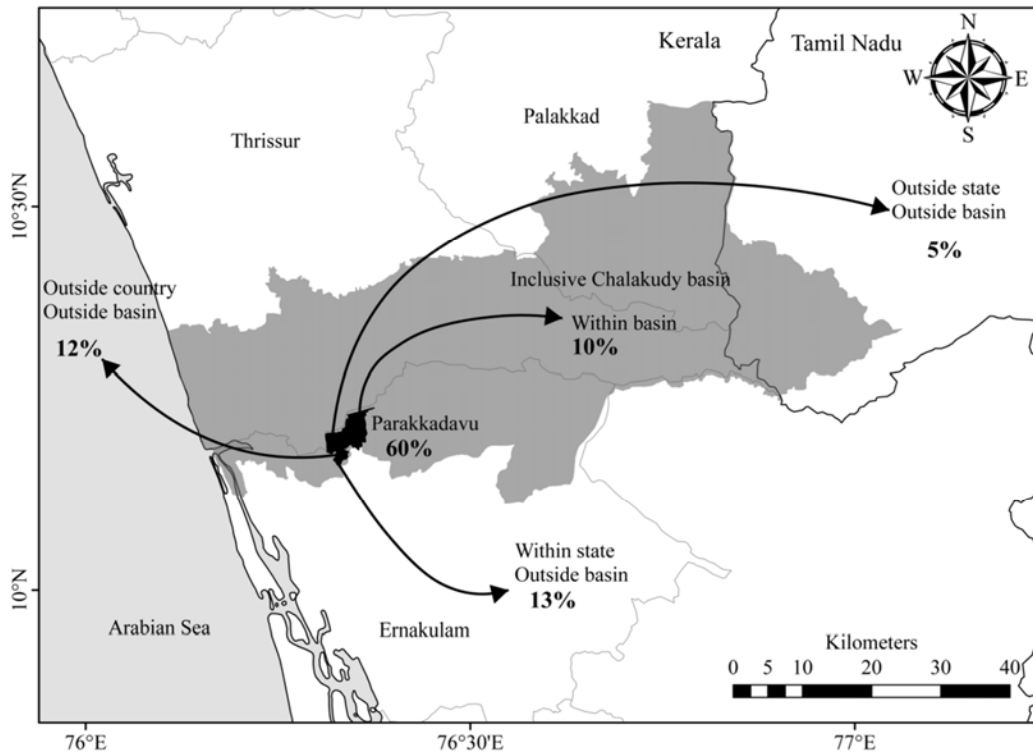


Fig. 6.33 Basin – outbasin work migrations in the lowlands

The outputs of food related manufacturing sectors and agricultural sector found its way outside of the basin. While capital and labour in these sectors were sourced within the village itself, the inputs were acquired from outside the basin, and the outputs and produce were marketed outside the basin. Most of the farm outputs made their way outside the basin through commission agents and wholesale dealers in the case of banana and tapioca, through rubber co-operatives in the case of rubber and retail traders in the case of nutmeg. Both capital and labour for livestock sector were found within the basin though the entire stock of buffalos and chicks were acquired from Tamil Nadu.

At the time of the study there were around 3000 migrant labourers within the village of Parakkadavu itself, a large majority of whom were unskilled or semi-skilled workers engaged in private house construction works, public road works, canal works etc. Almost all non-agrarian sectors of occupation employed men labour from outside states, except for trade and commerce activities, transportation and skilled

construction activities. While the tile factories employed Oriya and Assamese labourers, the brick making units employed seasonal migrants from Tamil Nadu. The carpentry units, though a traditional manufacturing sector has also started bringing in outside state labourers. Workers from Tamil Nadu who had initially made up for the increased need for workforce have been completely replaced by workers from Orissa and other economically backward states of North-Eastern India in the space of the last 5 years. As high as 800 quarry workers were from Orissa. Recently some of the cultivators had also started employing outside state labourers for farm work.

Remittances was found to determine the capital to a certain extent and at the same time influenced a similar deployment of in-basin capital also, the main source of which was borrowing. For instance, the capital for private construction works came both from outside the basin as remittances and influenced a similar deployment of in-basin capital making house construction on loan a prevalent social phenomenon. It was found that one of the local co-operative societies State capital also found its way into the basin, again put into construction sector and also into encouraging paddy farming, through increased incentives.

#### **6.6.6 River basin governance in the lowland zone: The issues of concern and communities of interest**

The rapid changes to livelihood and resource relations in the mid and lowlands in the past four decades has given rise to a plethora of issues related to resource extraction and utilisation that would be of extreme relevance in river basin management. The emergent uses to which wetland paddy fields and rivers were put to that ranged from illegal extraction of minerals to land conversions to lease cultivation and the increased quarrying activities in the rock outcrops had resulted in diverse livelihood concerns on the one hand and resource stewardship necessities on the other. In all these sectors, in-migrant labour force was found to play a pivotal role in resource extraction. The major stewardship concerns and governance challenges that the lowlands represent in such a resource use and livelihood scenario are being examined below and presented schematically in Fig.6.34.

##### **6.6.6.1 Wetlands as contested spaces of resource extraction**

The decline in agricultural activities and simultaneous rise in building construction consequent to the Gulf boom that hit the State in the early seventies has been stated to

be some of the causative factors for the extensive transformations of the mid and lowland plains of Kerala (Padmalal *et al.*, 2004). While rice farming became non-lucrative on the one hand, the clay and sand reserves in these paddy lands became essential raw materials in the construction industry on the other hand. There were about 350 tile factories and 5000 brick kilns concentrated around the mid and low land stretches of the Chalakudy, Karuvannur, and Periyar river basins in Central Kerala. The annual clay mining in these basins was reported to be half a million tonnes per annum in 2006-07 (GoK, 2010b). Paddy lands were also extensively reclaimed into garden lands for agricultural and non-agricultural purposes.

The depletion of the natural resource base of the lowland zone due to these indiscriminate land conversions and extraction of sand and clay from fertile paddy fields had resulted in manifold repercussions both social and environmental. The impact of these heavy extractions on water availability and quality had triggered strong public resistances within the zone whereas the environmental impacts of wetland conversions and the destruction of the food security reserve of the state had lead to larger environmental and social mobilisations across the state. Such resource depletions and related public protests across river basins in the state had precipitated the formulation of stringent regulations such as the ‘Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001’ and the ‘Kerala conservation of Paddy Land and Wetland Act, 2008’. These physical and social closure conditions for the resources of clay and sand in turn had set off the proliferation of various activities in the basin to meet the growing demand for these resources which included illegal mining of sand from river, sand and clay from paddy fields and illegal manufacture of sand from mining hills. These wetlands have therefore transformed into intensely contested spaces with diverse interest groups such as the state, the construction and allied sectors, the agriculturists and other local residents. The river basin governance at the level of multiple interest groups would provide a space where such violations of stringent policy measures could be examined within its nuances and conflicting interest groups.

#### 6.6.6.2 Lease farmers as intermediary land stewards

The remaining stretches of the vast wetland landscape of the lowlands were found to be cultivated on lease by landless labourers, marginal landowners and often subsidiary

cultivators with their main occupation in diverse non-farm avenues. The major share of garden land and converted garden land cultivation of seasonal crops of banana, vegetables and tapioca is also undertaken by a large section of such lease cultivators. Women cultivators, who conspicuously owned very little land, were found to court leased land cultivation through Self Help Groups (SHGs) such as *Kudumbasree* units. In fact, the cultivation of these market oriented food crops in the lowlands is now largely in the domain of a group of people who have very few rights over the resources they use since within the purview of the Kerala Land Reforms Act, 1963 the tenant cultivation of wetlands and garden lands has been rendered invalid making these lease farmers unauthorised and illegal. Interestingly, these lease cultivators are being relied on by the state machinery itself to promote food crop cultivation as part of the food security campaign in the state using the provisions of the Kerala Conservation of Paddy Land and Wetland Act of 2008. Absentee landlords also use the services of lease cultivators to maintain the land under proper care and to escape the provisions of the above bill that would allow for the land to be forcefully cultivated if left fallow for a continuous period of more than 5 years. Thus these lease cultivators have turned into 'intermediary caretakers of land' even in instances where the land speculators have taken possession of vast tracts of wetlands. The river basin unit of governance based on interest groups will have to take cognizance of these land stewards who are normally missed out in an ownership based stakeholder determination process. In fact, it has been pointed out by Mollinga (2007) that such stakeholder definitions in a river basin clearly exclude marginalised sections without recognised rights over resources.

#### 6.6.6.3 Migrant labourers in resource extraction activities

The predominance of migrant labour for the exploitation of natural resources can be observed in the lowlands of the Chalakudy basin and the adjoining basins of Periyar and Karuvannur also. There were around 3000 migrant labourers in the lowlands of Chalakudy basin, a large majority of whom were engaged in quarry work. In the midland zone of Periyar River Basin, centred around the Perumbavoor village in the foot of the Ghats, there are numerous wood-based industries employing more than 6000 migrant labourers. The brick kilns and tile factories dependent on the fertile clay base of the lowland zone of Karuvannur River Basin also utilise migrant labour force. In-migration in all these areas is circular, transient, and made up of single men in the

age group of 17-28. The extraction and conversion of natural resources of a river basin therefore was found to be predominantly mediated by a migrant labour force. The existing laws in the state do not have any provisions to consider these migrant labourers who arrive on their own through social networks and not through registered contractors. Even the stipulation that labour contractors recruiting migrants require a license is rarely enforced. Therefore, neither the state government nor the Local Self Governance body has any reliable records as to the number of in-migrants in a locality.

On the other hand, there is widespread popular protest against the unregulated exploitation of natural resources which is changing the local landscape and ecological features irrevocably in various regions of the state. The environmental impacts of these activities are now much more evident and recognised by the public leading to confrontations with the migrant labour force as they are the ones directly involved in the process. The invisible people in the government records become the only visible target in such confrontations. Already such situations are manifesting in various parts of the state. For example, in the Erayamkudy paddy fields of Annamanada village in the Chalakudy River Basin, migrant labourers were the first to face the brunt of a public protest against brick kilns in the area. This necessitates the inclusion of these in-migrant working population, in river basin planning approaches since at present this workforce is directly involved in the mobilisation of the natural resources of a river basin. It is estimated that there are around 100 million circular migrants in India today (Deshingkar and Akter, 2009). These workers have played a huge role in sustaining and building India's economy, but their contribution remains unrecognised because of their lack of stake in the resources of the region that they work in. Moreover there is a dearth of data regarding these in-migrants. Migrants remain on the periphery of society, with few citizen rights and no political voice in shaping decisions that impact their lives. Exclusion of these important actors can in future lead to manifold issues with increased pressure over the basin resources related to demand, utilisation and conservation. In the context of prevalent migrant transient labour force in the mobilisation of natural resources, the ways in which the migrant labour interest groups can be incorporated in a basin resource management framework through implementation of fair work practices and ensuring of fundamental and human rights requires serious attention.

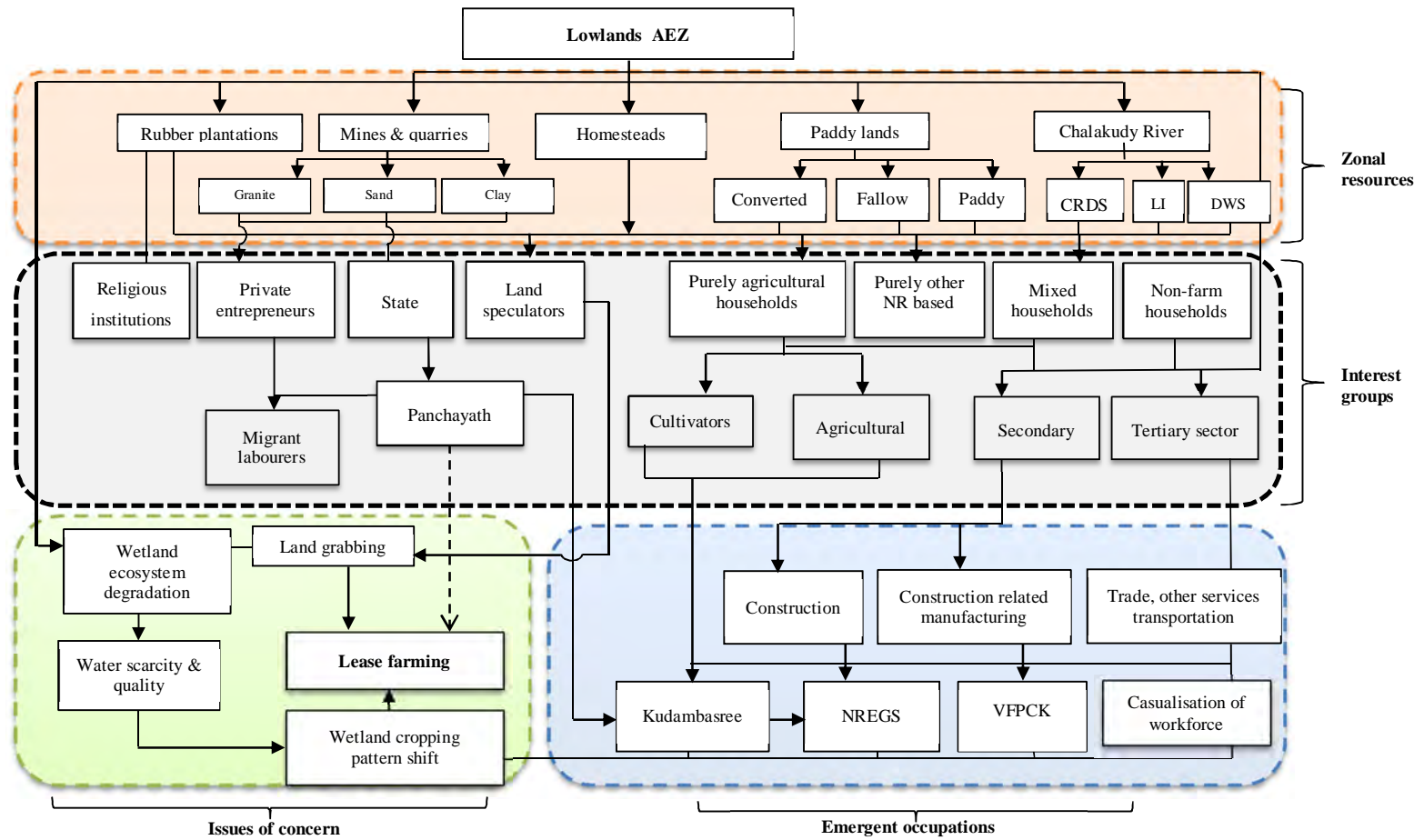


Fig.6.34 Schematic sketch of interest groups, resource linkages and livelihood emergence- Lowlands

## 6.7 Coastal Agro-Ecological Zone

The coastal zone identified as that of the Chalakudy river basin includes those panchayaths lying below the confluence of the Chalakudy river with the northern distributary of *Periyar* river. The zone is drained by an interconnected system of backwaters that finally void into the Arabian sea through the *Kodungallur- Azhikode* estuary. The delineation of this area into any particular river basin was particularly difficult given the peculiarities of coastal drainage that tends to either join the sea directly making small independent micro-catchments along the coast, or make its way into the main river through a network of streams and estuaries that have been artificially linked for navigation purposes. At the same time, these coastal regions were crucially dependent on the river for drinking water needs. The Kodungallur Domestic Water Supply Scheme pumping 6.2 million liters of water per day from the Chalakudy river at Vynthala KWA pumping station situated in the lowlands of the basin provide drinking water to several villages and town in this coastal stretch. The boundary assignments in this coastal region have therefore been highly arbitrary which has left the coastal tracts and communities virtually excluded from any basin identity. Multiple boundary deliberations were therefore found necessary that would include the contributing river basins, independent watersheds boundaries of the streams that joined the *Kodungallur-Azhikode* estuary through the *Pullut* backwater system, river water dependencies and the administrative boundaries of the concerned LSGs. Therefore in the present context, the coastal agro-ecological zone was delineated as the LSGs drained by the *Pullut* backwaters and other streams that flow into the Kodungallur estuary (Fig. 6.35) and are dependent on the Chalakudy river for its drinking water needs.

This coastal zone is situated between  $10^{\circ} 10'$  to  $10^{\circ} 20'$  E and  $76^{\circ} 10'$  to  $76^{\circ} 20'$  N in the Thrissur and Ernakulam districts of Central Kerala and has its western fringe abutting the Arabian Sea. The LSGs that constitute these sandy coastal lands have a marine western boundary and are bounded on the east by a transition wetland zone which consists of a system of interconnected wetlands and estuaries that finally drain into the joint river (Fig. 6.35). The LSGs of this transition zone have also been regarded as part of the coastal zone in choosing a representative site. The zone therefore comprises of the village panchayaths of Poyya, Methala, Edavilangu,



Eriyad, Sreenarayanapuram, Mathilakam, Kaipamangalam and Perinjanam and the municipality of Kodungallur in the Kodungallur taluk of Thrissur district and of Pallippuram and Puthenvelikkara in the Aluva taluk of Ernakulam district. Of the total land area of 288 sq.km, 51 per cent was found to be under coconut, paddy fields occupied less than 10 per cent of the area and 21 per cent was found to be under mixed crop homesteads dominated by coconut. The land was fully irrigated through privately lifted groundwater. The highly checkered land area in these coastal villages are found to be interspersed within a network of streams, channels and tanks/ ponds that play a crucial role in the provision of potable drinking water to the villagers and aid in the maintenance of a delicate water balance with the sea both in terms of quality as well as quantity. But even then, most of these villages are under a constant threat of water shortage, monsoonal water logging and declining water quality. Edavilangu panchayath in the Kodungallur taluk of Thrissur district was selected as a representative site for primary questionnaire survey and case study.

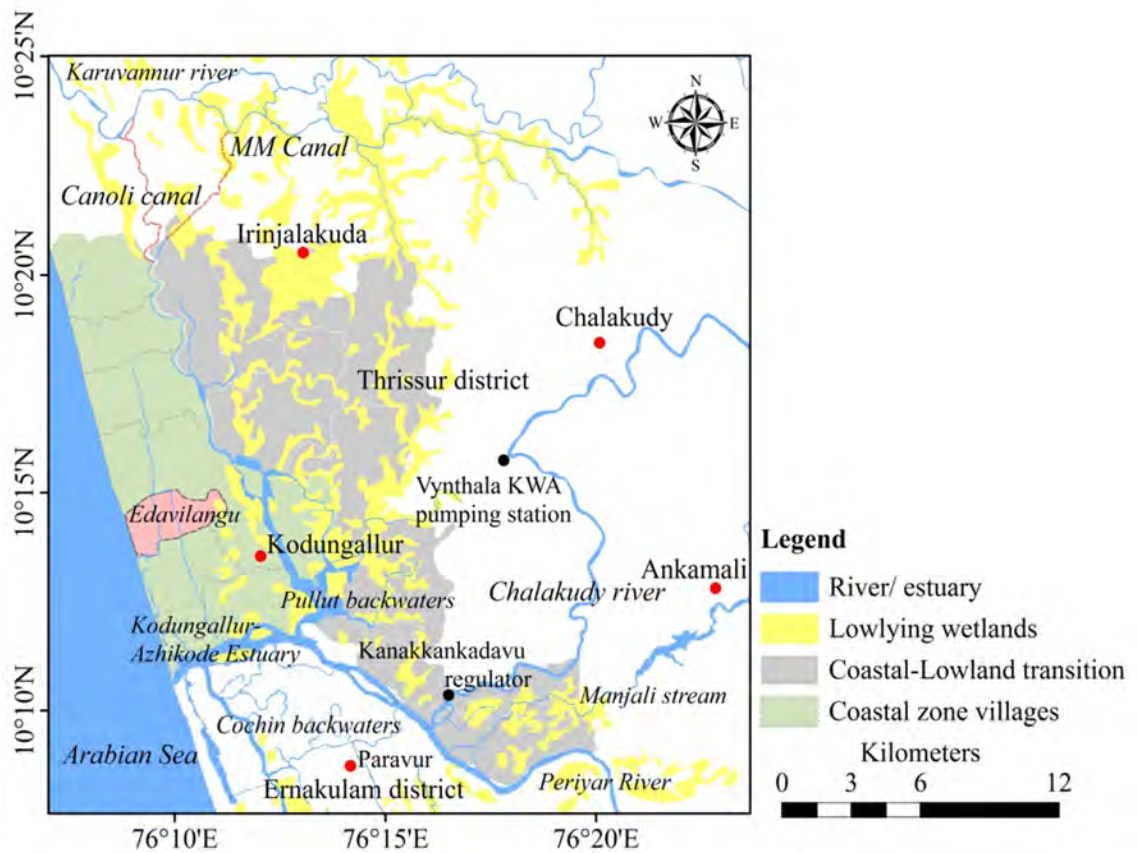
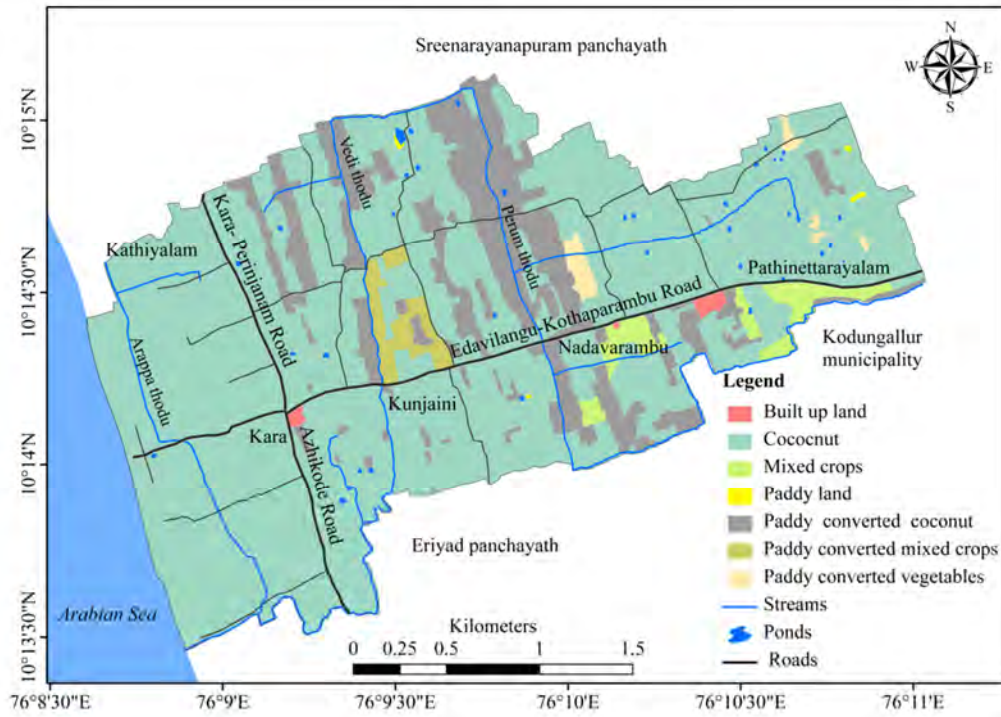


Fig. 6.35 Inclusive extent in the coastal reaches

### 6.7.1 The setting and multiple boundaries of concern

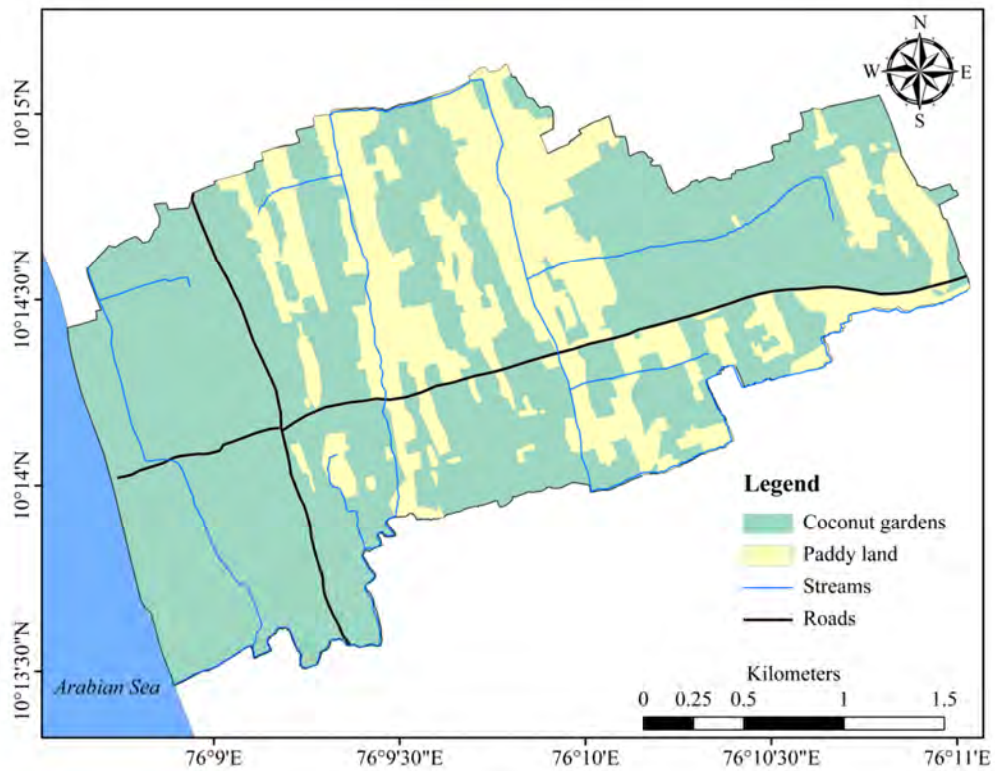
Edavilangu, selected as a representative site of the Coastal agro-ecological zone has an area of 7.6 sq.km, a total population of 19,537 people and a very high population density of 2571 persons / sq.km (GoI, 2001). The Edavilangu grama panchayath is the local governance body in charge of local administration and resource planning. The network of streams and channels that interweave the village drain either into the joint river of Chalakudy and Periyar or flow directly into the Arabian Sea that bound the panchayath to its west. A narrow strip of sandy shore abuts the sea which is succeeded on the landward side by sandy-clay soils in the low lying areas and sandy soils further upland. The panchayath has an average elevation of 10 m above msl and has a high average annual rainfall of around 4000 mm from both the SW and NE monsoons.

The village shares its southeastern boundary with the municipality and ancient port town of Kodungallur. The main approach from Kodungallur is through a road that runs the entire length of the village to further proceed northward to the other coastal panchayaths of the zone. Edavilangu is bounded on its south by the Eriyad and to the north and northeast by the Sreenarayanapuram (SN Puram) panchayaths. The *Azhikode* harbour is situated to its south at a distance of nearly 3 km. The panchayath can be divided into the main regions of *Kara Kathiyalam*, *Kunjaini*, *Nadavarambu* and *Pathinettarayalam* (Fig. 6.36). The *Kara-Kathiyalam* region adjacent to the sea houses most of the fisher households of the village. Geographically this tract is composed of several drainage channels that crisscross the sandy soils joining up with the main drainage channel of *Arappa* that opens both into the sea and the Chalakudy river below its confluence with the Periyar river. There are three beaches in the locality viz. *Arappa*, *Vaakadappuram* and *Tattinkadavu*, while the rest of the coastline has been confined by a seawall. The opening of *Arappa* into the sea remains sealed to prevent saline intrusion into this low lying region except during the peak of South West monsoons when the temporary bund is broken to drain off the excess water inundating the area. Further east, away from the sea, surrounding the nodal points of *Kunjaini*, *Nadavarambu* and *Pathinettarayalam* the land is characterised by coconut groves on sandy rises and low-lying areas which were once paddy cultivated wetlands where the panchayath office, the local market and the screwpine mat market are situated.



Data source: KSLUB (2001a)

Fig. 6.36 Location and land use of Edavilangu in the coastal zone



Data source: GoI (1976)

Fig. 6.37 The extent of paddy lands in Edavilangu in 1966-67

### 6.7.2 Occupational and resource use history

The region that has been delineated as the coastal zone of the Chalakudy basin had always been subject to diverse influences and equivocal basin boundaries due to a long history of international maritime trade and the presence of a contiguous water route for trade and communication formed by a network of rivers and estuaries running parallel to the coast, navigable right from Kozhikode in the north to Thiruvananthapuram in the south. This coastal zone of the basin in the present day Kodungallur taluk of Kerala, had been a heavily populated trade nerve centre during the ancient period distinguished by the seat of the Chera dynasty and the legendary port of Muziris. The flourishing spice and other commodities trade from the Muziris port until the 12<sup>th</sup> century AD with Rome, Africa, China and the Middle East had determined the occupational and resource use history of the coastal stretch between the rivers of Periyar and Chalakudy (Bostock and Riley, 1855). The trade route from the mountains to the coast that the twin rivers of the Chalakudy and the Periyar offered, had determined the upstream downstream interlinkages of the basin from time immemorial (Morrison, 2002). Even after the decline of the Muziris port since the 12<sup>th</sup> century, the region became an important hinterland of the Cochin port during the colonial times and the lagoon network between the rivers continued to serve as a highway for the spice carriers (Malekandathil, 1998). Despite these hectic intra and international connections of the zone, the coastal region had always maintained a distinct identity and existence of its own, separate from those of the mainstream land based societies of the basin, due mainly to the peculiarities and compulsions of the maritime occupations (Kurien, 1994).

The sea and its fish resources have always been the most noted facet of the coastal occupational scenario. The fishing community belonging to predominantly to the *Araya* caste group was engaged in traditional artisanal fishing in these coastal stretches governed autonomously by community level institutions of ownership and management right through the colonial times (Thurston and Rangachari, 1909; Kurien, 1994). The internal sale of fish was mainly by women who took it as head load to local markets or on door to door sale. Facilities to dry fish and extract oil existed in the coastal villages owned by the local affluent families of the non-fishermen castes or Muslims, in which the women from the fishermen communities found subsidiary employment (Thurston and Rangachari, 1909). The drive to

modernise the fisheries sector after independence triggered by a rising international market for high value prawn/ shrimp species led to radical structural changes in this traditional sector through heavy infusion of capital and transformation of the property regimes from 'community heritage' to 'open access' realms (Kurien, 1994). Individual entrepreneurs entered the scene, paving way for a fast development of trawl fishery in the coastal waters and later for subsidised large scale motorisation of country crafts (Jacob *et al.*, 1987; Balan *et al.*, 1989). Ancillary facilities for the export trade in shrimps such as shrimp hatcheries and ice plants began to dot the landscape of the coast during the time (Salagrama and Koriya, 2008). The mid 1970s and 1980s is also noted to be a time rife with physical and socio-ecological conflicts between the artisanal fishermen using traditional harvesting techniques and large mechanised craft operators finally leading to trade union based organisation of the artisanal fishermen as 'fish workers' (Kurien, 1992). By the 1990s, the intense marine fishing activities had resulted in decreased fish catches causing a post-modernisation crisis phase (Salagrama, 2009). The changes in the ownership and occupational patterns had socio-economically changed the coastal fishing communities by then and led to a deep rooted deprivation among them. The 1980s also witnessed the construction of seawalls all along the coast to contain coastal erosion which had in effect robbed the coastal communities of beach spaces crucial for their occupation. In the village of Edavilangu such local landing sites have reduced in number and extent to just three small beaches. The village which had had around a dozen fish drying yards through the length of the coast has none since the 1990s. In 1988, a ban on trawling during the south west monsoons was declared by the state government (Kurien and Achari, 1988) but by then most of the fishers at Edavilangu had adapted themselves as crew in large mechanised boats that operate from the nearby *Azhikode* harbour. While the sea was being subjected to increased pressures and conflicts through a transformation in the mode of ownership, operation and livelihood choices, the agricultural resources and livelihoods of these sandy tracts were also fast changing.

The coastal lands of the basin were under the ownership of *Thiruvanchikulam dewaswam* which were given under permanent lease (*Kanam*) to prominent Brahmin/ Nair families in the area who had then sub-leased (*Pattom*) it out to the members of *Ezhava* caste and Muslim families who then either cultivated it or rented it out again

to other *Ezhava*/ Muslim households. Following a string of land reforms introduced after the 19<sup>th</sup> century to ensure the rights of the tenants over the land enacted first by the state of Cochin and then by the state of Kerala after independence, land ownership in the region came to rest mostly with the erstwhile tenant families of the *Ezhavas* and the Muslims. Agro-ecologically, the sandy tract between the lagoons, the river and the sea were a mosaic of coconut groves and low-lying paddy fields. The paddy cultivation in the coastal zone of the Chalakudy basin was undertaken using the method known as '*Kootumundakan*' in which a mixture of a photo-insensitive genotype suitable for *Virippu* (first crop season) and a photosensitive *Mundakan* (second crop season) genotype were sown together prior to the South West monsoons in May. Tall traditional rice varieties of *Kodiyam*, *Onavattan* etc. were widely used for the first crop. There were also some fields where only the second season crop of *Mundakan* paddy was cultivated after the waters of the monsoon had receded from the fields. Even here, traditional varieties suitable for saline deep water ecosystems such as *Anakodan* were preferred. During the summer season, these fields were invariably planted either with sesame (*Sesame indica*) or with summer vegetables such as cucumbers, pumpkins and other gourds (*Cucumis melo*, *Momordica dioica* etc.). These paddy fields were bordered luxuriantly by the *Kaitha* (Screwpine) plant (*Pandanus utilis*) which served as excellent soil binders. The women agricultural labourers had found employment in the seasonal and steady work accorded by paddy cultivation such as transplantation, mid-term harvest of the *Kootumundakan*, and the final harvest.

The coconut palm (*Cocos nucifera*), was valued not only for its nuts but also for the wide variety of by-products that had fed the cottage industries and export networks emanating from the area such as toddy tapping, jaggery making, arrack distilling, oil pressing, coir making etc. (Barbosa, 1516; Kumar, 1982). The agricultural labourers of the *Ezhava* and *Kanakkan* castes specialised in the cultivation practices of the coconut palm. Pot irrigation in the coconut groves was an avenue for occupation for women agricultural labourers who also engaged in a variety of manufacturing activities primarily based on the by-products of the coconut palm and the abundantly available screwpine leaves. The cultivation of the coconut palm in the coastal tracts was markedly different from its cultivation practices in the mid and lowland reaches. The palm was raised mostly as a monopoly crop with virtually no

other strata of crops below. Nearer to the sea where the tendencies for waterlogging and the network of drains and streams were both huge, the palms were planted on raised bunds with the drainage channels in between. These water channels were used for the retting of the coconut husk and fronds for coir making and mat weaving respectively. The coconut grew in its importance as a plantation crop through the early years of the 20<sup>th</sup> century leading to the earliest conversions of paddy lands to coconut. Following the land reform act and its implementation in the 1970s, the cultivation of coconut gained further prominence. The fragmentation of holdings making them unfit for paddy cultivation, the less intense labour requirements of the perennial crop at a time when agricultural labourers began to be both scarce and expensive and the high market value for the produce led to major shift in the cropping pattern of these coastal villages. The topographic sheets for the coastal tract of the basin surveyed during 1966-67, present a glimpse of the unique geography of the region that has vanished forever following these rapid and relentless conversions since the 1970s (Fig. 6.37).

The abundant and diverse water resources in the zone have a history of use and reclamation inescapably linked to the fate of the land resources. From the Arabian Sea to the *Pullut* backwaters to the numerous drainage channels, streams and ponds and the ubiquitous groundwater, these water resources are a defining feature of both the land and the peoples' livelihood. The numerous small fresh water ponds that speckled the land surface of the stretch of coastal villages were interconnected through channels that finally led to a main channel that joined the main river or the sea. Ward and Conner (1821) had remarked on the good quality and easy procurability of the water found in these small reservoirs. These ponds and channels served to regulate the water level and maintain a delicate balance with seawater in these tracts which are only a few meters above mean sea level. The ponds also served as reservoirs of fresh water for meeting drinking water, domestic and even irrigation requirements. With the advent of wells as sources of drinking water and the pressure of land conversions, these ponds slowly started disappearing by the 1970s. The supply of piped water through public taps by the Kerala Water Authority since 1986, the second phase of land conversion into housing plots and the advent of filter point tube wells towards late 1990s, have drastically altered the waterscape of the village. The ponds were slowly abandoned either by filling them in or by using these as waste

dumping pits. The main channels that connected these drainage paths to the main river were once navigable across the cross section of the village and were the main inland trade routes. With the end of inland navigation and beginning of large-scale conversions which redefined the extremely fragile wet and dry land equilibrium of these coastal tracts, the main water channels fell to disuse and disregard and the dependent traditional occupations have also ceased to be major livelihood options.

### **6.7.3 Emergent occupations and patterns in the coastal lands of Edavilangu**

The inevitability of alternate livelihoods in the coastal zone have been an intense topic of debate especially since the 1990s when the downside of the rapid modernisation phase of the marine fisheries sector started manifesting itself in the form of livelihood saturation in the fisheries sector, especially for the poor (Salagrama and Koriya, 2008). The exhaustion of the marine fish stock following exploitative fishing during the modernisation phase coupled with the exclusion of small and artisanal fishers from their customary rights over the resources has led to a situation where livelihood diversification had become a necessity among the fisher households. The parallel changes to the coastal landscape resulted in paucity of raw materials for most of the traditional manufacturing activities on which both the fisher as well as non-fisher women had depended. It has been noted that fishing is often just one element within a multitude of activities that constitute the livelihood strategy of most of the coastal households (Allison and Ellis, 2001). Even then, the equally radical changes to the land based livelihoods in the coastal zone have been largely bypassed in all mainstream discussions on coastal livelihood insecurities but are significant in arriving at the scope, boundaries, issues and interest groups in river basin based governance in the coastal zone.

In Edavilangu, the emergence of non-fisher and non-agrarian livelihoods was found to be a complex outcome of both distress induced diversification due to economic and ecological push factors as well as due to upward mobility aspirations of the workforce especially among the youth. The present occupational profile of the village showed that currently only 6 per cent of the working population was engaged in the fisheries sector even though the Census analysis had pointed at a much larger share in 2001. The greatest share of workers was to be found in the service related livelihoods of trade, transportation and other services (Table 6.32). Within trade



related livelihoods, 34 per cent persons were engaged in wholesale trade of agricultural commodities, the most prominent of which was coconut, the main land use, agricultural product and commodity of trade in the village. There were 89 shops in the village ranging from small stationary shops, vegetable outlets, medical shops, tailoring units, textile shops, studios, jewelry, mobile sale and repairs, tea shops and restaurants to wholesale stockists of varied commodities such as cement, iron bars, carpet, timber, furniture, tiles, batteries, electrical goods to biscuits and sweets, thus accounting for 63 per cent of the people employed in the trading sector either as owners or as sales person. The transportation sector employed 11 per cent of male workforce, the majority of who were drivers. The women workers were to be found concentrated in the sectors of other services (44%) and manufacturing (45%) where the presence of men were noted to be much lower at 20 per cent and 10 per cent respectively (Table 6.32). Within other services, 40 per cent workers were self-employed as tuition teachers, tailors, real estate agents and electrician/ plumbers and another 35 per cent were casually employed as household servants or in other private jobs. Close to 20 per cent persons were found to be in government jobs, a fair share of it (10%) as school teachers.

Table 6.32 Distribution of workers in various occupation categories- Coastal lands

Main employment	Frequency (n)			Percent (%)		
	Male	Female	Total	Male	Female	Total
Cultivator	4	0	4	1.0	0.0	0.7
Agricultural labour	22	0	22	5.5	0.0	4.1
Fisheries	33	2	35	8.3	1.4	6.4
Mining & Quarrying	0	0	0	0.0	0.0	0.0
Manufacturing	40	64	104	10.0	44.8	19.2
Construction	104	1	105	26.0	0.7	19.3
Trade	72	12	84	18.0	8.4	15.5
Transportation	46	1	47	11.5	0.7	8.7
Other services	79	63	142	19.8	44.1	26.2
Total (N)	400	143	543	100.0	100.0	100.0

Source: Primary survey

Within the manufacturing sector, which employed 19 per cent of the total village work force, 59 per cent, were found to be engaged in the traditional manufacturing activities such as screwpine mat weaving and coconut frond weaving,

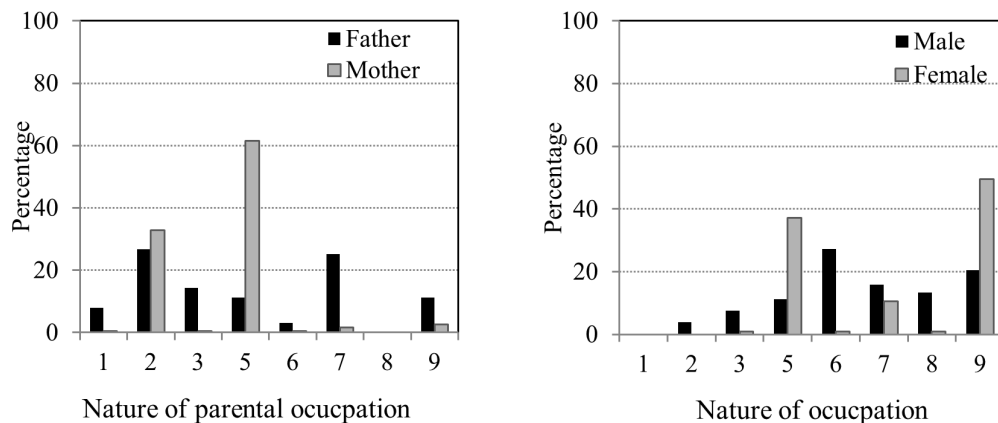
majority of who were women. The cooperative initiative of *Thazhapaya Vikasana Samiti* (Screwpine mat development society) at Edavilangu has nearly 1000 women as members in it. The village also had a flock of small furniture manufacturing units which had come up in the space of the last 4-5 years, as a late entrant in the construction boom catering to the growing demand for door frames, windows and furniture in the house construction sector. These units employed close to 18 per cent of those engaged in the manufacturing sector in the village. There were around 20 such small units in the Kara- Perinjanam stretch that covers the coastal extent of the basin. Even the two older saw mills in the area had vertically diversified into their own furniture design workshops. Fourteen per cent of the manufacturing activities were concentrated in welding workshops, gold ornaments manufacture and aluminum manufacture units. There were 7 welding and automobile workshops and 4 other cottage scale manufacturing units in the village all of which were unorganised informal units (Panchayath License fees Demand Register, 2008-09, 2009-10). Three prawn hatcheries and one ice factory were the only two organised manufacturing units in the village.

Construction currently engaged 26 per cent of the male workforce in the region. Within construction, mason work and concreting work were found to be the dominant activities taken up by 72 per cent of the workers in the sector. There were around 10 construction contractors and one construction company in the village who had several teams of construction workers under them. These workers found employment both within and outside the village.

In these coastal lands, agriculture as a main means of livelihood was seen to have declined considerably. Only 11 per cent of the total workforce were engaged in primary activities, opposed to the almost 24 per cent recorded in the Census 2001. Women engaged in primary sector activities were found to be a mere 1 per cent whereas close to 15 per cent men were found employed in the sector of which 8 per cent were in the fisheries based activities and 5 per cent were agricultural labourers. Contrary to the other zones of the basin, close to 40 per cent of the men engaged as agricultural labourers were specialised and skilled as coconut palm climbers. In fact, many of them were also employed in the upstream stretches of the basin due to paucity of coconut climbers in other parts of the basin. The presence of NREGS in the

village since 2008 has been pointed out to have reduced the livelihood opportunities and security in the agricultural sector. Majority of the NREGS members in the village were women. 20 per cent of the main working women and 10 per cent of the non-working women were found to be engaged in NREGS activities.

The significant shift in occupations from primary sector activities of agriculture and fisheries to secondary and tertiary sector activities was clear from a comparative analysis of the present occupational choices of the household head and their children with the parental occupations of the household head (Fig. 6.38). The emergence of construction and transportation as important main occupations especially among men can be clearly perceived from the two figures. Among women workforce, employment in the tertiary sectors of trade and other services had recorded a sharp increase in the present generation compared to the parental generation. It is also clearly visible that agriculture which had previously employed more than 20 per cent of women workforce had virtually no women working in it in the present generations. The share of women engaged in the traditional manufacturing sector of screw pine mat weaving was also observed to have decreased in the present generations compared to the parental generation.



Note: 1- Cultivators, 2- Agricultural labourers, 3- Fisheries, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6.38 Occupational profile of parental and present generation- Coastal lands

Another evidence of emergence was observed in the age of the workers in each of the work categories. It was seen that as high as 77 per cent of women workers in the 18-30 age category were engaged in the other services occupations. On the other hand, 83 per cent and 76 per cent of women in the age group of 51-60 and

above 60 respectively were engaged in the manufacturing sector. In the case of male workers, in the 18-30 age group, the dominant occupations were construction and other services. On the other hand, the fisheries sector employed only 6 per cent of men in the 18-30 age group. Majority of men employed in the fisheries sector were in the 31-50 age group. The other primary sector of agriculture had 75 per cent of men cultivators above 60 years old and the rest 25 per cent were found to be between 51-60 years of age.

Education and the social capital acquired through it have been commented to be another pull that has catapulted the workforce out of the traditional sectors. In Edavilangu, it was often remarked that the young 'just waited to be out of school to go for work'. Construction industry and the multitude of supplementary and complementary activities such as construction related manufacturing and transportation readily attracted this section just out of secondary school. A sector-wise analysis revealed that the primary occupations of fisheries and agriculture had around three quarters of male workers with only primary education whereas the emergent occupations of construction, transportation and other services had more workers educated upto 10<sup>th</sup>. Among women, the manufacturing sector had 67 per cent of women who were educated only upto the primary level. On the other hand, the emergent sectors of trade and other services had a major share of women who were educated upto 10<sup>th</sup>.

The coastal lands of Chalakudy basin had had a flourishing manufacturing sector located both within the household and outside of it which was closely knit to the landscape and water resources in the area. The sea, apart from providing primary occupations, also fostered secondary activities such as dry fish making and other fish processing related livelihoods. Coconut along the canal and ditch waterscape provided for a variety of secondary employment opportunities both for men and women which ranged from rope making from the coconut husk to making of plaited coconut leaf fronds generally used as a roof thatching material. Both of these activities required retting of the raw material in water prior to processing. The palm was as much valued for its by-products of husk and leaf as it was for its main produce. The screwpine plant that luxuriantly grew bordering the paddy lands and water channels were used for mat making which was a major household employment for the women. Therefore maintenance of the water channels was strongly linked to the occupations of the

people. With the change in land and waterscapes, these occupations have also ceased to be major livelihood options as is reflected in the share of the people engaged in the sector. Similar declining trends in screwpine mat making due to destruction of the plant from the banks of streams, canals and rivers and ponds in fragmented holdings were reported from in the coastal zone of the neighbouring basin of Karuvannur. The coir soaking pits which were present along the coasts and estuarine belt of the Karuvannur basin were gradually converted into garden lands owing to increasing demand for land and pollution problems related to the enterprise. Consequently there has been an occupational shift in the labour force from this industry which is noted to be the case all along the coastal belt of Central Kerala (ATMA, 2008). In another study in Central Kerala Madhusoodanan (2003) had observed that traditional labour practices of the coastal areas such as manufacture of coir and its products were greatly diminishing and that the agricultural fields were either being converted to human settlements or being left unused. Campbell *et al.* (2006) had remarked that since opportunities based on the use of natural resources in general are becoming increasingly limited in the coasts in all fronts be it water or land, the coastal population were forced to either adapt or face increased marginalisation and displacement. At the same time it has also been clarified by many studies, especially along the Kerala coast that younger people with better educational levels were moving out of traditional sectors into other occupations such as construction (George and Domi, 2002; Divakarannair, 2005).

The influence of caste on diversification of occupations is historically mediated as well as dynamically situated in these coastal stretches. The strong differentiation of the working population along caste lines that had been a feature of these lands during the ancient and colonial times was seen to have its influence even with the diffusion into various non-agrarian occupations in the recent period. This has led to a dynamic situation where the traditional primary sector livelihood activities are still very much caste based, with rapid diffusion by the *dalit* and other backward castes (OBC) into the emergent non-agrarian occupations mostly as unskilled and casual workforce. While entry into most of the traditional sectors were rigidly caste and skill oriented, the casual work oriented emergent sectors such as construction and related activities and the multitude of service sector occupations requiring very few skills took in people from diverse caste backgrounds.

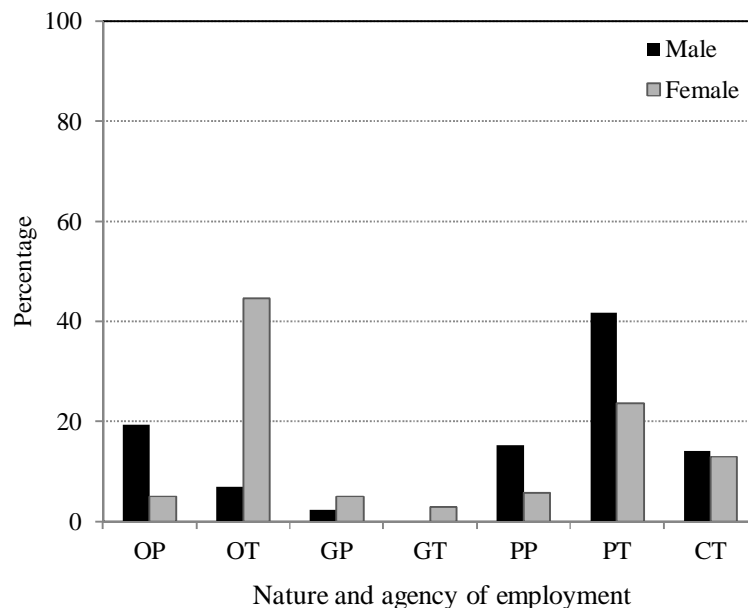
It can be seen that in Edavilangu, fisheries were still dominated by the *Araya* caste and a small share of Muslims with only a sparse share of *Ezhavas*. The fishing communities in this coastal stretch were concentrated in the *Kara-Kathiyalam* stretch of the panchayath facing the sea. It was seen that 44 per cent of the *Araya* men were still largely dependent on fisheries as the main means of livelihood due to the strong ties to the sea, the skill and knowledge that has been passed down through generations and amassed through years of hard experience and the incomparable way of life that no other profession could substitute. Diversification was seen here in the nature of employment. From being independent fishermen with their own boats and rights over the waters, they had become crew members of large boats that operate out of the *Munambam-Azhikode* harbour. The rest of the *Araya* workforce had migrated to other occupations of construction and other service activities.

The Christians and *Vishwakarma* were two religion/ caste divisions who had also managed to diversify within their traditional livelihood activities. While the *Vishwakarma* had moved on from traditional manufacturing to welding and furniture workshops, the Christians of the panchayath who had very early on diversified into skilled construction workers as masons now rode the construction boom. Muslims of the village had either been affluent, landed and influential or poor, landless and marginalised. While the former moved on from principal agriculture and trade dependent livelihoods, acquiring education and further moving on to professional and skilled jobs abroad, the latter became more and more marginalised, diversifying into casual labour in service based activities, most notably transportation. It was observed that nearly 78 per cent of the Muslim working population in the village was engaged in service sector activities. The *Ezhava* caste constituted the largest group among the population as well as the working population whose occupational history as agricultural labourers and tenant cultivators was seen to still linger as half the proportion of cultivators and half the share of agricultural labourers were still *Ezhavas*. On the other hand, within the *Ezhavas*, 24 per cent and 23 per cent were respectively engaged in the manufacturing and construction activities.

A similar situation exists in the case of *dalit* and OBC workforce also. The *dalit* workers in the area were either *Vettuvans* or *Pulayans*. Even now, 36 per cent of the agricultural labourers were found to be constituted of these *dalit* caste members.

In instances where diversification has occurred, they have migrated into the low skilled casual activities in construction and other services in which 26 per cent and 30 per cent of *dalit* workers were employed respectively. Tribal presence in the village was limited to a few *Ulladan* families who were traditionally engaged in diverse occupations ranging from inland fisheries to boat making to every kind of agricultural work from ploughing, sowing, transplanting and reaping to cattle grazing. The workers in this caste now were mostly engaged as casual unskilled workers in other service activities.

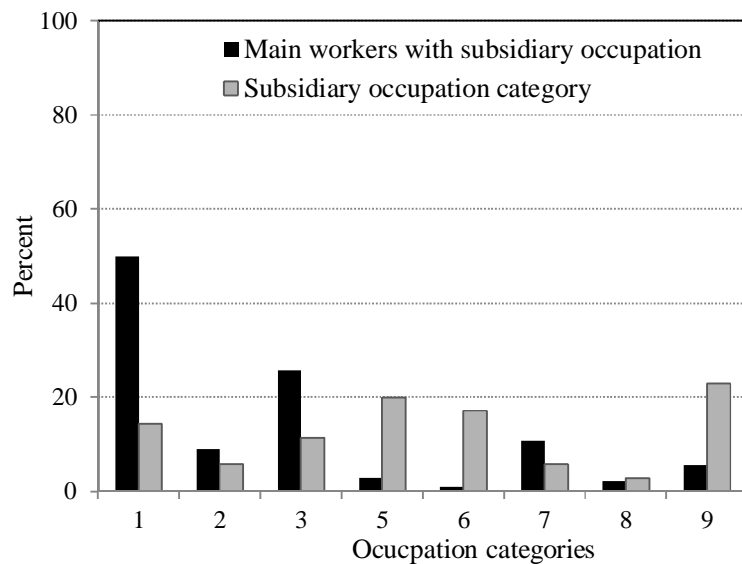
It is obvious from Fig. 6.39 that among the male workforce temporary nature of employment in the private sector was more pervasive with more than 40 per cent of men workers therein. This result reflected the fact that the high male work force engaged in the sectors of fisheries, construction, other services and transportation were employed in the private sector on a temporary basis. In fact, 64 per cent of men workers in construction, 49 per cent in fisheries and 43 per cent in transportation jobs were temporarily employed in the private sector. It is also to be noted that majority of the men workers who were engaged in fishing undertook it as a temporary activity. On the other hand, self-employed workers who were temporarily engaged in the screwpine mat weaving activity were more prevalent (45%) among the women.



Note: OP- Own permanent, TP- Own temporary GP- Government permanent, GT-Government temporary, PP- Private permanent, PT- Private temporary, CT- Casual

Fig. 6.39 Distribution of nature and agency of work- Coastal lands

It was observed that only 6 per cent of main workers were engaged in subsidiary livelihood activities (Fig. 6.40). It is also significant to note that the primary sector had a greater share of main workers with secondary work engagements. For instance, half of cultivators were found to have trade related secondary work while 25 per cent of workers in the fisheries sector took up other work as an ancillary occupation mostly in the construction and manufacturing sectors. Therefore even while engaged in natural resource based activities, other work dependences were found to be indispensable.



Note: 1- Cultivators, 2- Agricultural labourers, 3- Livestock and Fisheries, 4- Mining and Quarrying, 5- Manufacturing, 6- Construction, 7- Trade, 8- Transportation, 9- Other services

Fig. 6.40 Distribution of subsidiary occupation- Coastal lands

Gender aspects of livelihoods and diversification were quite distinct and significant in these coastal landscapes. Women in the fisher communities of *Arayas* were traditionally fish vendors and also employed themselves in scores of manufacturing activities ranging from fish drying to screwpine mat weaving to coconut frond weaving to coir retting and rope making to seasonal agricultural activities (Thurston and Rangachari, 1909). The shift in fish landing bases from the village to centralised locations and harbours from where the fish is usually directly auctioned off to wholesale bidders, has considerably restricted the fisher women in their traditional livelihood activity and the drastic changes to landscape relations have made the other subsidiary activities also phase out. In the post -modernisation phase,



the *Araya* and Muslim fisher women were found to have a severe dearth of gainful employment. Some of them were found to work in the tile factories located quite far off in the lowlands of the basin in Mala and Ashtamichira.

The women of the other more land based castes of the *Ezhavas*, *Vettuavas*, and *Kudumbis* were also seen to face a similar conundrum. Screwpine mat weaving was no longer a lucrative option due to a variety of reasons which included failing health of the middle and old aged who widely reported backache problems due to being continually hunched up over the mats, the increasing unavailability of screwpine leaves in the village and the high cost of the dried leaf bundles. The slowly dying market for the mats replaced rapidly by plastic substitutes had also dampened the spirits of the women who remained in the sector. The efficiency of weaving itself was pointed out to have dwindled. Whereas previously a family used to turn out 20 mats/ week, at present it had come down to 4-5 mats/ family per week. The unavailability of steady work and income had led to mushrooming of commercial microcredit agencies in the region in addition to the 161 *Kudumbasree* units that also undertook lending activities.

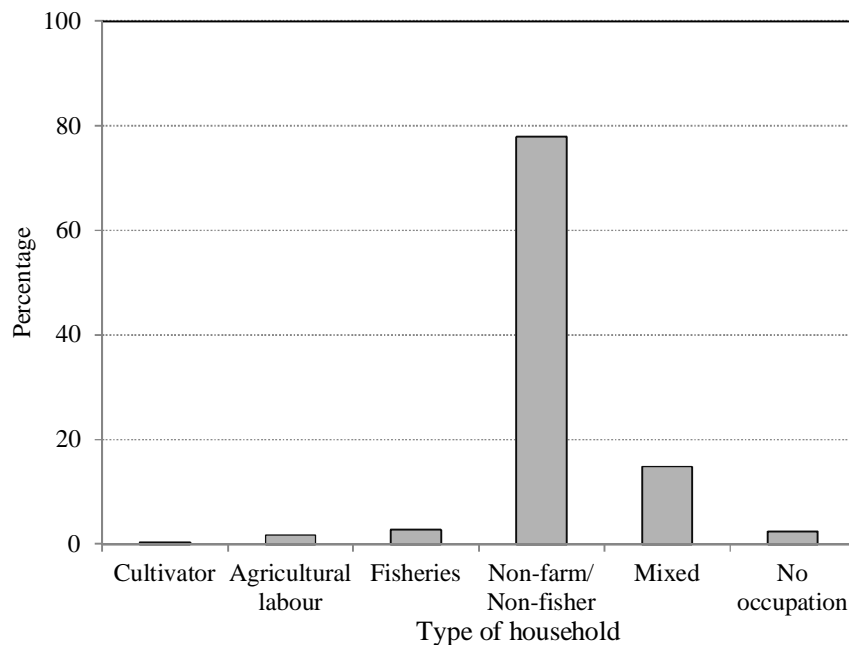


Fig. 6.41 Household classification into livelihood groups- Coastal lands

The linkages to natural resources in the context of these changed livelihoods were examined at the level of the households since ownership and access to land and

through it to water were determined at the level of the household. It was observed that more than three-quarters of the households were purely non-farm/ non-fisher households with only 3 per cent of households which depended solely on fishing and related activities for a livelihood (Fig. 6.41). Forty per cent of the *Araya* households had completely shifted out of fisheries sector whereas 37 per cent pursued mixed livelihood strategies. Only one single Muslim family and a couple of *Ezhava* and *Vettuva* families were purely cultivator and agricultural labour based respectively.

The livelihood diversification that is evident from the above analysis that had occurred into a multitude of seasonal and long-term non-fishing and non-farm activities both at the individual as well as the household level has redefined all resource relations in these coastal lands. The next section explores in detail the resource linkages in the context of such livelihood reconfigurations.

#### **6.7.4 Livelihoods and resource linkages in the coastal zone**

The coastal land topography itself is markedly different from that of other parts of the basin. While other basin zones are dominated by sloping lands that lead down to valleys and wetlands at the base where water follows well defined pathways and directions, the coastal stretch presents a more level land surface at about 0-15 m above mean sea level where water flowpaths are more ambiguous but ubiquitous. In fact, land and every expression of it are intimately connected to the water resources in the coastal stretches. Within the coastal zone itself, based on the proximity to the sea, there are gradations to the land type and characteristics. In its westernmost extremity, the coastal zone is a more or less level land consisting of beaches, sandy coastal plains, sandy raises and dunes and ridges and runnels within the sandy plain. These ridges and runnels and shallow water tables account for the omnipresence of water in the coastal landscapes. Further eastward, the sandy plains are slightly more elevated and dotted with small freshwater ponds and drained by numerous streams and channels that make way directly to the sea or join the estuarine complex further downstream.

These topographic and hydrographic differences are also reflected in the varied land relations such as settlement patterns, land uses, livelihood influences and landscape changes of the coastal regions. The dominant presence of the ocean in the coastal livelihoodscapes had always overshadowed other resource relations in this

zone. In the discussions and policy documents on Coastal Regulation Zone (CRZ), coastal resource management and sustainable coastal livelihoods, the extent of area that receives attention most often gets limited to the littoral fringe facing the sea, the marine and estuarine fish resources and fisher folk livelihoods. But as Sharma (2010) had observed, the coastal region is not merely the fringe facing the sea but involves much inland with common climatological, topographical, vegetational and socioeconomic circumstances that supported a diversity of livelihoods and socio-vocational groups from fisher folk to agriculturists to manufacturers and traders. These regions also acted as interface between the inland and the sea and therefore between the maritime and land-based societies. Therefore, from a river basin management perspective, the exploration of these relations to natural resources and their livelihood linkages is of paramount importance to trace the emergent interest groups and power regimes that need to be negotiated for successful participatory governance. The diverse relations to the resources of land and water are elaborated in the following sections.

#### 6.7.4.1 Patterns of land ownership and access to land

Coastal livelihoods traditionally depended on a multitude of common property resources the greatest of them being the ocean. The land closest to the sea, sandy and riddled with numerous creeks and channel networks were occupied mainly by the fishing community households. Traditionally the coastal settlements developed on the sand dunes leaving the interdunal areas free for cultivation and other livelihood activities. Unlike other regions of the basin where land holdings were individual and homestead based, the settlements of the fisher folk were mostly hamlets huddled on the shore leaving open spaces for activities related to fishing such as fish drying, repair and maintenance of nets, hauling up and berthing of boats etc. The ownership of land by individual fisher households was therefore minimal. The ownership rights over these lands were either customary or granted through the tenancy act. All of the households engaged in fishing as the main livelihood activity were found to inhabit this narrow belt of land facing the sea and all of them had marginal land area below 25 cents as their only land possession. On the other hand, the remaining 50 per cent of homestead land in this littoral fringe was owned by 13 per cent of households who were mainly Christian and Muslim families engaged in nonfarm activities in the service sector and trade. The real estate purchases of land that had gripped the other

zones had a presence in the coastal zone also. Most of the larger holdings in the coastal belt were owned by unknown owners/ real estate speculators from outside whose interests varied from eco-tourism to real estate development.

The land area in the coastal village of Edavilangu was found to be currently dominated by homestead garden lands constituting 77 per cent of the total land area owned by 98 per cent of the households (Fig.6.42). The ownership pattern of land among the different household groups based on livelihood also brought out that land was concentrated in those households whose main occupational mix was composed of non-farm activities (Table 6.33). Within the homestead garden land holdings, 79 per cent of the households possessed land less than 25 cents in extent that made up only 38 per cent of the total homestead land area. In fact, as high as 84 per cent of the households owned only homestead land and the average land holding size was as low as 0.2 acres/ household (Table 6.34).

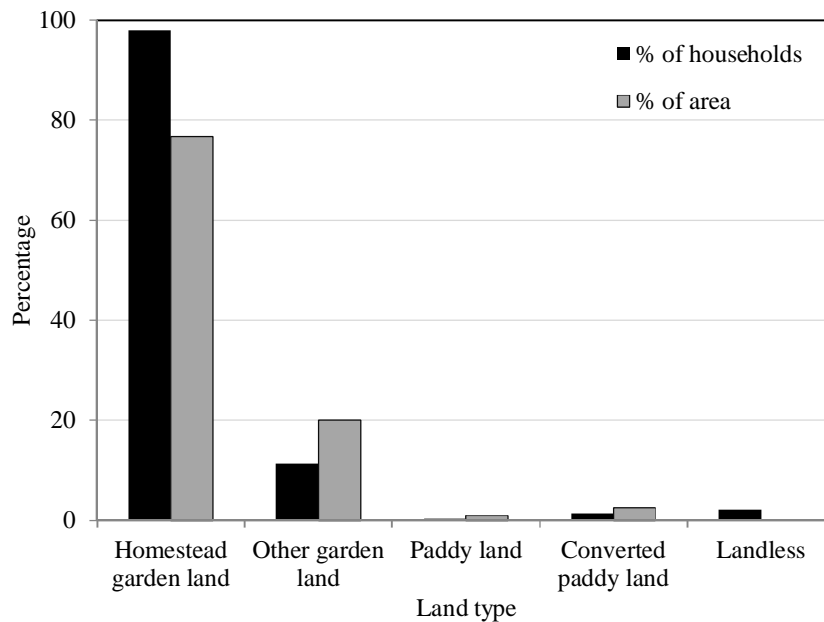


Fig. 6.42 Distribution of land types in the coastal lands

The extent of marginalisation of the fishing community from land resources was evident in that the purely fisheries dependent households which made up 3 per cent of the total households owned only 1 per cent of the total area. This land was also entirely marginal with an average holding size of just 8.7 cents/ family.

Table 6.33 Distribution of land types among the livelihood groups- Coastal lands

Household type	Homestead land			Other land holding									Total (including landless)		
				Paddy land			Garden land			Converted paddy land					
	Area owned	House holds	Average area	Area owned	House holds	Average area	Area owned	House holds	Average area	Area owned	House holds	Average area	Area owned	House holds	Average area
	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)	(acres)	(No.)	(acres)
Cultivator	0.2	1	0.18	-	-	-	0.8	1	0.84	-	-	-	1.0	1	1.02
Agr. Labourers	0.4	5	0.07	-	-	-	-	-	-	-	-	-	0.4	5	0.07
Fisheries	0.7	8	0.08	-	-	-	0.2	1	0.15	-	-	-	0.8	8	0.10
Non-farm	46.7	221	0.21	-	-	-	11.5	31	0.37	2.0	5	0.39	60.2	226	0.27
Mixed	6.6	42	0.16	0.6	1	0.64	4.4	5	0.87	-	-	-	11.6	43	0.27
No occupation	2.9	7	0.42	-	-	-	-	-	-	-	-	-	2.9	7	0.42
Total	57.4	284	0.20	0.6	1	0.64	16.9	38.0	0.44	2.0	5	0.39	76.9	290	0.27

Source: Primary survey

Table 6.34 Distribution of land types according to holding size- Coastal lands

Land type	Marginal land										Small		Medium		Large		Total	
	< 5 cents		5-25 cents		25-50 cents		0.5-1 acres		1-2.5 acres		2.5-5 acres		5-10 acres		>10acres			
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
Homestead land	40	1.5	185	20.6	33	11	16	10.6	10	13.7	0	0.0	0	0.0	0	0.0	284	57.4
	(14.1)	(2.5)	(65.1)	(35.9)	(11.6)	(19.2)	(5.6)	(18.5)	(3.5)	(23.8)	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Other garden land	4	0.1	13	1.8	12	5.0	7	6.0	1	1.0	1	3.0	0	0.0	0	0.0	38	16.9
	(10.5)	(0.6)	(34.2)	(10.6)	(31.6)	(29.5)	(18.4)	(35.4)	(2.6)	(6.2)	(2.6)	(17.8)	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Paddy land	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6
	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)
Converted paddy land	0	0.0	1	0.1	2	0.7	0	0.0	1	1.1	0	0.0	0	0.0	0	0.0	4	1.8
	0.0	0.0	(25.0)	(3.8)	(50.0)	(37.4)	0.0	0.0	(25.0)	(58.8)	0.0	0.0	0.0	0.0	0.0	0.0	(100.0)	(100.0)

Source: Primary survey

The rights of the fishing community over their land were also highly contested. Living in close knit settlements with barely demarcated boundaries, most of the people owned customary rights to the sea coast that lack any *patta* deeds. Even though the CRZ notification of 1991 recognised the customary right of these fishermen over the coast, the subsequent amendments of the rule, fell silent on this crucial aspect (Rodriguez, 2010). As the coastal lands became prime tourist possibilities by the close of the 1990s, the value of the coastal lands have acquired a demand and meaning that was previously absent.

In the village of Edavilangu, there has been a recent spurt in the sale of the coastal fringe of land to outside investors that has been variously ascribed to tourism interests, a North South coastal highway and the general decrease in the availability of house construction sites in the thickly populated coastal stretch that made even the risky fringe lands worthy of investment. Meanwhile the notion of land ownership among the fishermen community were also changing. Along with a slow shift in the main livelihood activities that did not require the proximity of the sea, fishing community of the *Arayas* were slowly moving away from the coastal fringe belt into the more elevated portions of the village. The appreciation of the quality of land as dictated by the indicators of fresh and assured water, absence of water logging and avoidance of the risk of a truculent monsoonal sea were well evident in the new acquisitions of property of the *Arayas* who had moved further inland.

The situation of the purely agricultural labour households which made up 2 per cent of the total households was also found to be equally abject. They were in possession of merely 0.5 per cent of the total land owned with an average holding size of 8 cents/ family. Therefore it is evident that households that depended solely and directly on natural resources had drastically dwindled in the zone and their share of the land resources of the region was even lesser. The almost complete disappearance of paddy lands in the area was reflected in the fact that of the entire households surveyed only one was found to be in possession of paddy lands.

The high population density in the coastal zone and reclamation of all the former wetlands and paddy fields led to highly fragmented homesteads which cannot undertake any agricultural activity except for maintaining a few coconut palms. While the coconut groves retained the sandy soil of the coastal ecosystem, the converted

paddy fields had been replaced by lateritic soils. The defining feature of the landscape in these regions was the presence of numerous small fresh water tanks/ ponds both perennial and seasonal. These tanks now command the price of the space that they occupy rather than their functional value as freshwater reservoirs. While in the other regions of the village, paddy land reclamation had occurred at least a quarter century before, in the easternmost regions, the process of transformation was still going on. While the initial bout of reclamation of the paddy lands was intended towards agricultural development through a shift to the more remunerative coconut crop, the present day conversions of either these already reclaimed coconut groves or the paddy lands were for non-agricultural purposes.

The changing relations to the land were also evident in the way in which several households had started buying up land for private approaches to their houses. Edavilangu being a coastal village with a population density of around 3000 persons/sq.km, most of the houses did not have approach to public roads and the most frequently used approaches were through the compounds of other houses. Therefore permanent boundary walls and individual approaches to houses were not normally resorted to. The division of individual properties used to be by means of fences made of dried and matted coconut fronds and of late using plastic sheets. These were parted generously wherever a house existed on the other side. Such thoroughfare was not without its quota of boundary fights and tiffs with neighbours but the situation was drastically changing with many households buying land from frontage houses for approach roads. Pukka boundary walls of brick and concrete – a common phenomenon in the other zones, was also catching up in the area, replacing the old fences. These live fences were once one of the chief sources of screwpine leaves for the mat weaving activity of majority of the women in the village. Fences were often taken on yearly lease by the women who were engaged in mat weaving. With the replacement of fences by brick/ concrete walls, another abundant source of screwpine leaves was fast disappearing.

#### 6.7.4.2 The trajectory of land use

The land use in the village followed a common pattern of coconut groves along the western boundary and mixed plantations of coconut and arecanut further up east enclosed within which the last remnants of the wetland paddy ecosystem could be

seen. Most of these low-lying lands had been converted into garden lands which had drastically altered the agro-ecological composition of these stretches. Not only had the cropping pattern of these erstwhile paddy lands shifted to a mixed and stratified homestead model, the soils used for conversion were increasingly lateritic soils that were sourced from the mid and lowlands. The compactness of the lateritic soil as opposed to the natural sandy soil of the region had played havoc with the natural drainage and flow paths, deteriorating the water quality further.

The main crop that connected the people to the land in these coastal stretches was coconut as is evident from Table 6.35 which shows that 96 per cent of the households surveyed grew coconut that constituted 90 per cent of the land area owned. But extensive coconut groves that had once characterised the coastal landscape and land use have now disappeared so that the average size of land holding was found to be marginal at 0.2 acres. The livelihood linkage of these extremely fragmented landholdings can be witnessed in Table 6.36(b). As high as 85 per cent of the garden and converted paddy land area were being cultivated as a subsidiary activity by households that were dependent on non-farm based activities as the main livelihood means. The land holdings not subjected to any form of cultivation was also found to be high at 32 per cent in these coastal tracts.

Table 6.35 Main crops and their distribution- Coastal lands

Crop	No. of holdings	Area (acres)	Average holding size (acres)	Percentage share (%)	
				Holdings	Area
Coconut	194	45.7	0.24	96.0	90.1
Banana	14	3.2	0.23	6.9	6.3
Nutmeg	6	1.0	0.16	3.0	1.9
Arecanut	11	0.9	0.08	5.4	1.7
Total	202	50.7	0.25	100.0	100.0

Source: Primary survey

In the recent years, the fall in price of coconut and the related fall in care of the palms along with disease and pest infestations had spelled the doom of this remaining tenuous connection to the land as a productive resource. Decreased yield from the palms, non-availability of labour for coconut climbing and the high wage rate of agricultural labourers had increased the apathy of the people towards the palm and care for palms was now increasingly limited to irrigation during summer months. The land, on the other hand was now highly valued as a commodity rather than for



productive reasons. Hence recent trends in land improvement gravitated towards activities which would raise its commercial value such as filling in the land with laterite soil of poor quality to raise its level, filling in of freshwater ponds, acquiring of walkway paths leading to the plots and cutting of coconut palms. In an examination of the trends in growth of existing enterprises in the coastal sandy agro-ecological situation in Thrissur district, it was found that coconut area decreased due to fragmentation of holdings, pest and diseases, lack of interest due to unavailability of labour for climbing and increasing land preparation costs (ATMA, 2008).

Over the years, paddy land area has come down drastically from nearly 43 ha in 1990 to less than 1 ha at present (Fig. 6.42). The paddy lands have been increasingly converted during the space of the past 20 years to coconut groves, built-up land and mixed cropping plots where coconut, arecanut, banana, pepper, and various fruit trees such as mango and jack fruit were taken together in a single plot. The nature of the soil prevented conversion to any other crop though nutmeg and banana were being recently experimented upon in plots where paddy land conversions had been achieved through filling with lateritic soils. Nutmeg was found to gain popularity in areas having ample irrigation and adequate drainage conditions.

Paddy cultivation was undertaken by a limited few and that too basically intended as a fodder crop than for grain purpose. The remaining pockets of paddy land were facing threats of imminent conversion due to fragmentation and isolation by which the drainage connections of these lands were disrupted beyond repair. The only economically viable use of these paddy lands was in using them for summer vegetable cultivation, especially the gourd *Cucumis melo* var. *momordica* called 'pottuvellari' locally. The cultivation of these summer vegetables was mainly undertaken by agricultural labourer households on leased lands. Banana had recently entered the ambit of leased cultivation in the paddy lands and garden lands, though its crop period of 10 months made it unviable for most of the lands which were water logged for close to 6 months in a year. Table 6.36 (a) provides the details of the cultivation of seasonal crops in the zone which confirms the dominant presence of lease cultivation in raising the seasonal food crops of banana and vegetables. Eighty five per cent of the land area seasonally cultivated was on lease. But it can be made out that this area constituted just 7 per cent of the total cultivated area.

Table 6.36 (a) Land – Livelihood linkages: Seasonal crops in the coastal lands

Seasonal crops	Garden land			Paddy land			Total land		
	House holds (No.)	Area (acres)	Average area/ household (acres)	House holds (No.)	Area (acres)	Average area/ household (acres)	House holds (No.)	Area (acres)	Average area/ household (acres)
<b>Cultivation on own land</b>	6	0.5	0.08	1	0.6	0.6	6	1.1	0.2
Main	1	0.1	0.06	1	0.6	0.6	1	0.7	0.7
Subsidiary	5	0.4	0.09	0	0	0	5	0.4	0.09
<b>Cultivation on lease land</b>	8	2.7	0.3	0	0	0	8	2.7	0.3
Main	5	0.2	0.05	0	0	0	5	0.2	0.05
Subsidiary	3	2.5	0.8	0	0	0	3	2.5	0.8
<b>Total cultivation</b>	14	3.2	0.2	1	0.6	0.6	14	3.9	0.3
Share of own cultivation (%)	42.9	15.2		100.0	100.0		42.9	29.3	
Share of lease cultivation (%)	57.1	84.8		0.0	0.0		57.1	70.7	
Share of main cultivation (%)	42.9	9.0		100.0	100.0		42.9	24.1	
Share of subsidiary cultivation (%)	57.1	91.0		0.0	0.0		57.1	75.9	

Source: Primary survey

Table 6.36 (b) Land – Livelihood linkages: Perennial crops in the coastal lands

Perennial tree crops	Garden land			Converted paddy land			Total land		
	House holds (No.)	Area (acres)	Average area (acres)	House holds (No.)	Area (acres)	Average area (acres)	House holds (No.)	Area (acres)	Average area (acres)
<b>Cultivation on own land</b>	194	47.5	0.2	1	0.8	0.8	194	48.3	0.3
Main	35	7.1	0.2	0	0	0.0	35	7.1	0.2
Subsidiary	159	40.4	0.3	1	0.8	0.8	160	41.2	0.3
Share of main cultivation (%)	18.0	14.9		0.0	0.0		18.0	14.7	
Share of subsidiary cultivation (%)	82.0	85.1		100.0	100.0		82.5	85.4	

Source: Primary survey

The agricultural subsidies provided from the *Krishi Bhavan* for the year 2008-09 for banana and vegetables were also found to reflect the significance of lease cultivation in seasonal food crop cultivation. Forty six women SHGs were given assistance for cultivation of vegetables most of whom undertook cultivation on leased lands. Twenty five per cent of *pottuvellari* and 20 per cent of banana cultivated areas availing subsidy were on lease. It was also noted that the average area cultivated on lease was higher than that of own cultivated area.

#### 6.7.4.3 Changing linkages to water resources

The panchayath area was spread in the two micro-watersheds (MWS) of Eriyad-Blangachal MWS and Kara MWS and was abundant in surface water resources of tanks/ponds and streams/ channels and groundwater sources of open wells and filter point wells. But the domestic water dependences on these diverse sources were found to be minimal (Table 6.37). Even though multiple dependences were discovered, these were mostly on groundwater resources in multiple forms such as piped supply, open wells and filter point wells. Close to three quarters of the households were found to depend on filter point wells for domestic water, which was higher in the case of households with marginal area of less than 25 cents.

Table 6.37 Domestic water source in the coastal lands

Land holding size	Pipe (KWA/ Panchayath)		Open Well		Filter point well	
	(No.)	(%)	(No.)	(%)	(No.)	(%)
< 5 cents	8	20.0	17	42.5	34	85.0
5 - 25 cents	49	26.5	58	31.4	136	73.5
25-50 cents	8	24.2	10	30.3	23	69.7
0.5-1 acres	4	25.0	10	62.5	4	25.0
1-2.5 acres	4	40.0	4	40.0	5	50.0
<b>Total</b>	<b>73</b>	<b>25.7</b>	<b>99</b>	<b>34.9</b>	<b>202</b>	<b>71.1</b>

Source: Primary survey

Note: Multiple dependences on sources

The groundwater occurs in this zone in pheratic, semi confined and confined conditions (CGWB, 2007). The groundwater exploitation in this coastal zone was mainly from the pheratic system by construction of open wells, filter point wells and

ponds. The deep sedimentary formation in this region did not yield potable water and were mainly brackish in nature. Water level fluctuation in the phreatic system varied from 3 to 7 meters in the area (CGWB, 2007). Due to extensive exploitation of groundwater in the zone that exceeded 100 per cent, there has been a significant drop in the pre-monsoon and post-monsoon water level trends. As per the latest Groundwater Estimation norms, if the groundwater development was greater than 100 per cent and if there was significant drop in the pre-monsoon and post monsoon water levels, the area was to be treated under 'overexploited' category. Therefore the entire coastal zone of the Chalakudy basin falling within the Kodungallur block had been notified by the government of Kerala as 'overexploited', vide the Kerala Groundwater (Control and Regulation) Act 2002 (CWGB,2007). The overexploitation of groundwater was also aggravating the saline water intrusion in the area. But ironically it was observed that close to 94 per cent of the land holdings of the surveyed households were irrigated even if the plot held only a sole coconut tree or sapling (Table 6.38).

Table 6.38 Distribution of operational holdings based on irrigation- Coastal lands

Particulars	Operational holdings			
	No.	Area	Average area irrigated	Share of total cultivated area
	(No.)	(acres)	(acres)	(%)
<b>Un-irrigated</b>	<b>24</b>	<b>3.2</b>		<b>6.2</b>
<b>Irrigated</b>	<b>199</b>	<b>47.7</b>		<b>93.8</b>
Well	7	0.7	0.10	1.4
Filter point well	135	17.8	0.13	35.0
Pond/ Tank	57	29.2	0.51	57.4
<b>Total area under cultivation</b>	<b>202</b>	<b>50.9</b>		

Source: Primary survey

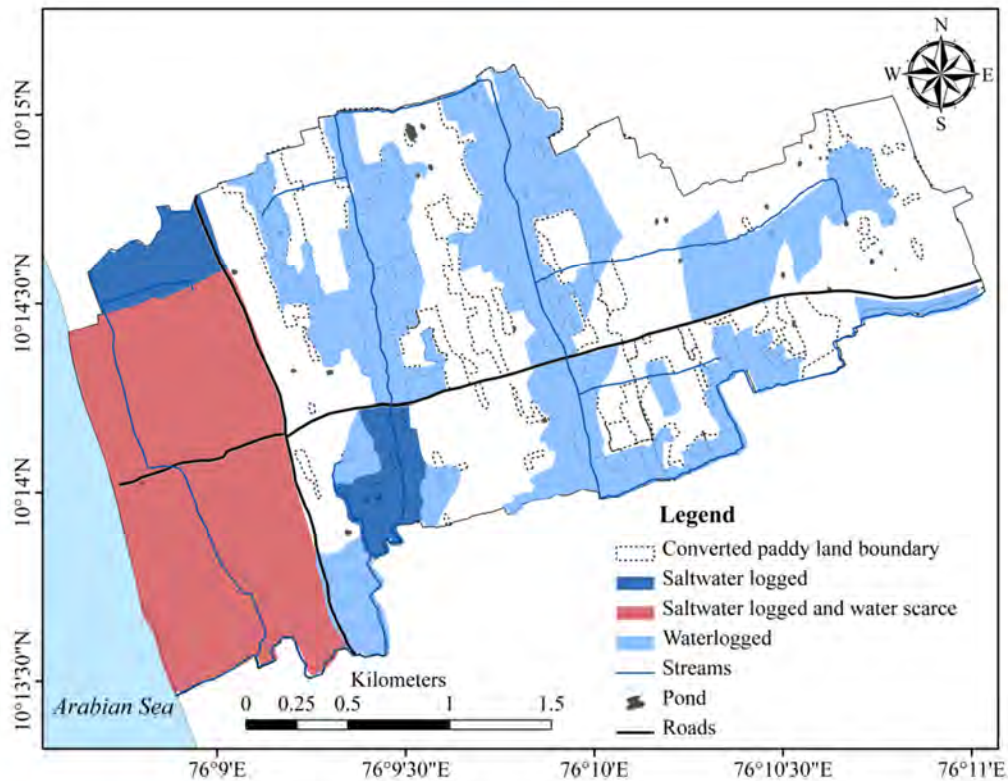
The tanks were used for all domestic purposes which included drinking washing, bathing etc. and most homesteads had two tanks one serving drinking water needs and the other used for other domestic activities and irrigation. At present number of wells far outweighed the number of tanks even though irrigation dependence on tanks was still high at 57 per cent. Several of these tanks have been reclaimed following the increasing pressure on land resources. Disappearance of most of these household tanks had resulted in increased groundwater withdrawal of water

through filter point tube wells for domestic requirements and irrigation. With the increase in the price of land and related pressure over land as a resource, each square inch of land had become valuable. The ponds were therefore now valued for the land area that they would command after filling in. The division of ancestral landed property among the heirs also led to reclamation of ponds in them as very often, the ponds were given joint ownership that invariably led to altercations and feuds between the owners. The acute scarcity of labour to clean the ponds was noted to have accelerated the disappearance of these once abundant freshwater sources in a land of chronic water woes. Moreover, the use of several of these tanks as waste dump pits had also affected the quality of water in the nearby ponds. The large-scale conversion of the paddy lands had also disrupted the connections of these ponds with the main water channels and interrupted the flowpaths of water in the soil that had affected both the quantity and quality of water in these reservoirs speeding up their abandonment.

It has been pointed out that a coastal drainage network is made up of a hierarchy of channels typically with a series of subsidiary channels feeding into shorter length of arterial or main channels (Wade, 1990). There are 10 main streams/channels that flow through the panchayath. Of these, three main channels of *Perumthodu, Arappathodu and Vedithodu* flow parallel and join the sea directly. The rest of the channels join the main *Perumthodu* at various locations. Temporary sand bunds were created across the *Arappa* channel where it joins the sea, to prevent saline intrusion during summer. There has been a gradual decrease in the length of subsidiary channels due to heavy conversions of land into homestead plots. The main channels and the subsidiary channels that remained were in a state of acute neglect and disuse. These channels which were earlier routes of busy inland navigation, sources of irrigation during summer and which harboured luxuriant clumps of screwpine plants along its banks were now choked full of aquatic weeds, losing depth and width of flow due to heavy breaching and encroachment of the banks from either side. These channels had also become the sink of solid wastes which accumulated at narrow stretches preventing water flow.

The changed land and water linkages described above had led to increased water logging, saline intrusions and poor quality of drinking water in the region.

Close to 60 per cent of the land area was reported to be water logged especially during the monsoons (KSLUB, 2001a and b). It is clear from Fig. 6.43 that the regions that were water logged corresponded to those areas where paddy lands had been widely converted. The littoral western extent of Edavilangu, constituting 31 per cent of the area was buffeted by salt water intrusion and water scarcity during summers and acute waterlogging during monsoons.



Source: KSLUB (2001a)

Fig. 6.43 Water related problems in the coastal lands

### 6.7.5 The basin boundary extensions through work connections

The coastal AEZ had been the pivotal international and internal trading centre and market place since the ancient times and as such has a rich history of diverse livelihood connections both intra and out-basin (Fig. 6.44). It was found that only 44 per cent of the village working population in Edavilangu was engaged in within village occupations which were mainly dominated by women workers in the traditional mat weaving manufacturing sector, agricultural labourers and the workers

in the emergent manufacturing firms. On the other hand, the other emergent sectors of construction and transportation engaged workers in other zones of the basin.

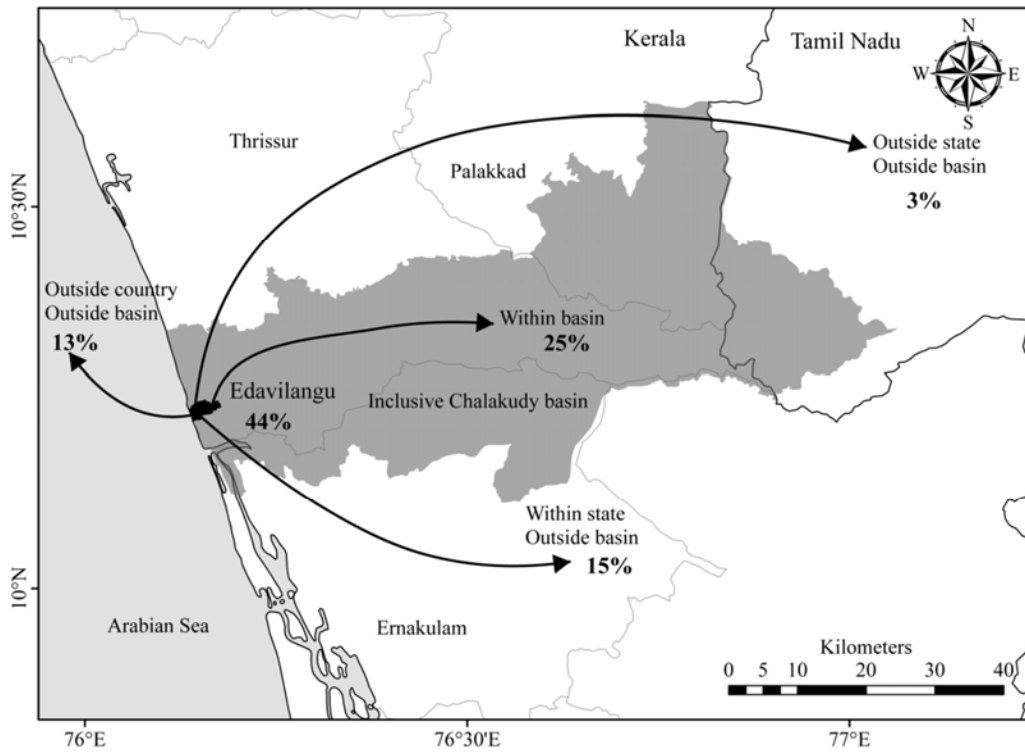


Fig. 6.44 Basin – outbasin work migrations in the coastal zone

These sectors employed people in the Thrissur- Ernakulum stretch at a radius of about 50 km that involved the neighbouring basins of Periyar and Karuvannur. The coastal zone was identified as a major supplier of skilled construction workforce to other parts of the basin as well as to regions outside the basin. Even the coconut climbers from the coastal regions have now diversified spatially taking advantage of the opportunity created by the paucity of coconut climbing labourers in the low and midland stretches. In the case of the fishers in the village, lateral work migration within the zone was seen to the *Munambam-Azhikode* harbour situated in the neighbouring Eriyad panchayath with the closure of local beaches and unviability of artisanal fishing. There was also lateral movement along the coast to various other neighbouring landings according to the availability of the fish catch. Thus the livelihood boundaries were being stretched further even by traditional livelihood activities which were once highly location specific. These short-distance work migrations accounted for 25 per

cent of the work population within the basin and 15 per cent outside the basin especially within the districts of Ernakulam and Thrissur. Salagrama and Koriya (2008) had mentioned such lateral spatial migrations as one of the most important diversification strategies among the Indian fishing community especially in the recent post-modernisation phase of the fisheries sector.

While it is the male workers that were inclined to migrate to other parts of the basin for work in the construction and traditional sectors of agriculture and fisheries, the women workers were found to migrate for work to the lowland stretches of the basin in clay tile factories and other such manufacturing firms even though the proportion of such women workers was quite low. Outside the country migrations especially to the Middle East as a geographical diversification strategy was also seen to be a time-tested method of ensuring livelihood security in the coastal zone. Thirteen per cent of the coastal zone workforce was found to be working outside the country especially in the sectors of construction, manufacturing and services.

The Edavilangu village market was renown in the past for its daily transactions in a variety of agricultural commodities, the chief of which was the screwpine leaf mats, copra, retted coconut husk etc. The mat market was fully functional until the 1980s at which time around 10,000-15,000 mats had been traded daily. Over the years the importance of the Edavilangu market has come down and at present the mat market functions only as half day market and the number of mats has decreased to around 200 mats/ day. The village had two main coconut drying yards which acquired coconut from the northern districts of Kozhikode, Malappuram and Palakkad in addition to local produce. Close to 50,000 nuts were being processed in both these yards in a month to yield close to 70 quintals of copra which was then sold to large oil mills situated out of the basin at Irinjalakuda.

#### **6.7.6 River basin governance in the coastal zone: The issues of concern and communities of interest**

It had been pointed out that there are three basin components for governance in the coastal regions of the world: coastal units, coastal activities and coastal stakeholders (Areizaga *et al.*, 2012). In the foregoing sections, the coastal unit, activities and stakeholders and the livelihood context of the coastal ecosystem in the Chalakudy river basin was traced in order to arrive at an interest group centered approach to



basin governance in the coastal AEZ. The schematic sketch of these linkages is provided in Fig. 6.45. The substantial shift of the coastal working population from natural resource oriented activities as main occupational choices was markedly reflected in their interlinkages to the basin resources also. These changed relationships will have to be factored in, in any analysis of stewardship and governance of the river basin in its coastal stretches. The lack of a place based approach to river basin planning was evident from the watershed management section of the People's Planning report of the Edavilangu panchayath which started off by stating that the main livelihood means of the people was agriculture, even while the people engaged in agriculture was less than 1 per cent of the working population. The official version of watershed planning activities in this coastal village was therefore treated to be concomitant to agricultural development oblivious to the sea changes that had occurred in the livelihood-resource linkages that necessitated fresh approaches to resource governance.

#### 6.7.6.1 Coastal areas as 'tail end' ecosystems of river basins

The 560 km long coastal stretch of the state of Kerala is characterised by estuarine complexes formed by the west flowing rivers originating from the Western Ghat mountains and numerous other small independent streams that eventually join the Arabian Sea. The 41 west flowing rivers of Kerala form 30 major interconnected estuarine systems in the coastal zone forming the crux of the coastal drainage but also making strict delineation of river basins in the coastal stretch a difficult task. In fact, a chain of waterbodies of lagoons, estuaries and brackish water lakes exist parallel to the coast along the entire length of Kerala from North to South that defines the drainage patterns and natural resource consumption of the coastal zone. Historically, these interconnected coastal drainage systems had dominated the inland trade network of the Malabar Coast and numerous artificial connecting channels and inland navigation arteries had been dredged in the course of time to further interlace the drainage patterns. The low lying wetlands and floodplains surrounding these estuarine networks have also been interconnected through irrigation and drainage channels that further complicate the coastal drainage networks. These coastal landscapes with the extensive estuarine and wetland interconnections that weave through them therefore

have never been explicitly acknowledged as integral parts of their contributing river basins due to this very same complexity.

Despite these connections cutting across drainage boundaries that obfuscate strict basin delineations, incorporating the coastal stretch as an integral and inclusive part of the basin becomes necessary due to the multitude of reciprocal relationships that exists between the coast and the upstream reaches of the river basins. These resource interlinkages between the upstream of the river and coastal regions are also manifested in the ways in which uses, meaning making and conflicts over these resources pan out. The construction of dams in the Western Ghat mountains during the 1950s and 60s in the catchments of the rivers Periyar, Chalakudy and Karuvannur that severely curtailed the inflow of freshwater into the sea is perceived by the fishermen of the central coast to have profoundly affected the very nature and character of the sea and the livelihoods dependent on it (Hoeppe, 2007). The perception of this vital upstream-coastal linkage that enrich the coastal and marine ecosystems is seen to have influenced the intense unrest in the coastal zone against the recent proposal for yet another dam on the Chalakudy river in the Western Ghats. On the other hand, a proposed cement factory and clinker unit near *Azhikode* harbour was strongly opposed not only by the coastal communities and LSGs but also by the people and LSGs further upstream in the Chalakudy river. It is also important to note that the schism between the basin and its coastal region in river basin planning had led to complete omission of the coastal tracts from all development projections of these basins. This is amply reflected in the fact that the Environmental Impact Assessment reports of the proposed upstream projects on the Chalakudy river such as the Athirappilly hydroelectric project and the Kuriyarkutty- Karappara multipurpose project do not consider the coastal impacts of flow regime modifications due to these proposed projects. The recognition of the coastal tract boundaries of the basins is thus currently limited to the boundaries that are invoked in the wake of specific problems in the coastal regions due to resource engagements and interventions upstream.

It has been recognised globally that the delimitation of the coastal tracts is a high priority activity in any integrated management activity that often requires a multi-scalar approach (Lamacchia *et al.*, 2002; NOAA, 2004). It has been further pointed out that boundary assignments in the coastal regions are a mixture of

sociopolitical, ecological and judicial considerations (Balaguer *et al.*, 2008). This element of political choice in boundary delineation as opposed to mere hydrological demarcation of the technical unit of the basin is observed to strengthen the democratic process of basin governance and validate the basin as a social space of resource relations (Warner *et al.*, 2008). The delineation of the coastal basin boundaries based on multiple considerations rather than delimitation based exclusively on technical criterion that in itself is arbitrary or the area of influence of a particular problem therefore acquires significance in the light of two very important aspects of inclusion and informed decision making in the basin planning process and governance., The inclusion of these areas in the basin planning process is vital for ensuring its share in basin resource allocations, for recognising these regions to be implicated by the upstream interventions and for ascertaining that the impact assessments and restoration efforts are extended to these regions also. Secondly, for adherence to the principle of subsidiarity vital to community participation in the governance of basin resources and multisectoral decision making, the interest groups as well as democratic machinery in the coastal tracts would require the possession of this knowledge of inclusion for efficient interventions both locally and in upstream resource planning and decision processes that influence the coastal regions. Integrated river basin management therefore can never be complete without the inclusion of this very important 'tail end' ecosystem in the territorial and governance considerations of river basins.

#### 6.7.6.2 Landscape- livelihood redefinitions and increasing water woes

As a result of the structural transformations to the land and waterscapes in the coastal AEZ, the main problems identified were waterlogging and flooding during monsoons, saline intrusion during summer and the scarcity of drinking water at all times. Even while the notable feature of this region is the network of channels and ponds, their state of neglect and phasing out leads to heavy flooding and waterlogging during monsoons. Extensive filling of paddy lands, reclamation of tanks and ponds, permanent boundary walls and discontinuance of *thodu- chira* system of coconut cultivation has also exacerbated water logging problem in this tract. Piped water supply is the only means of domestic water in the coastal belt where there are no other sources of fresh water supply. In the other regions also, acute drinking water

scarcity is now a major concern. At present the water for public supply is sourced from various sources including an open well within the panchayath, which provides 45,000 litres/ day, wells and tanks in the neighbouring panchayaths and partially from the Chalakudy river KWA pumping station at Vynthala. The zone as a whole is now expecting to quench its thirst through extension of the Vynthala drinking water scheme that would bring more water from the Chalakudy river into its coastal zone villages. Such projected future dependences of the coastal region on the river make the inclusion of coastal regions in the basin governance framework vital.

#### 6.7.6.3 The crisis in the fisheries sector and implications for basin governance

Integrated management of coastal resources has been noted to require a simultaneous awareness of the multisectoral and transnational linkages that define the fisheries sector of today. While on the one hand, interlinkages of the coast with the upstream basin such as heavy deforestation induced siltation, reduced river flows, effluents and other non-point pollution of the river influences resource availability, on the other hand, the international export linkages decides the quantum and nature of coastal fishing (Kurien, 1994). It is also important to factor in that the 'fishing community' of today has undergone considerable socio-economic metamorphosis as a result of incorporation into larger national and international economic and ecological processes which has affected its relationships both within and without the basin. As brought out in the analysis of the emergent livelihood options, the survival strategies of this highly skilled community with a vast knowledge base of the sea and its vagaries included joining of the crew of the mechanised crafts, migration to Middle Eastern countries and casual unskilled employment in other sectors such as construction and related manufacturing. Kurien (2005) therefore speaks of the need to identify a 'core' group among these changed coastal fishermen communities that can act as stewards of the coastal waters as a common resource. The inclusion of such coastal interest groups within the river basin framework becomes essential for a stewardship effort that could legitimately intervene in upstream processes that jeopardise the coastal ecosystem and livelihoods.

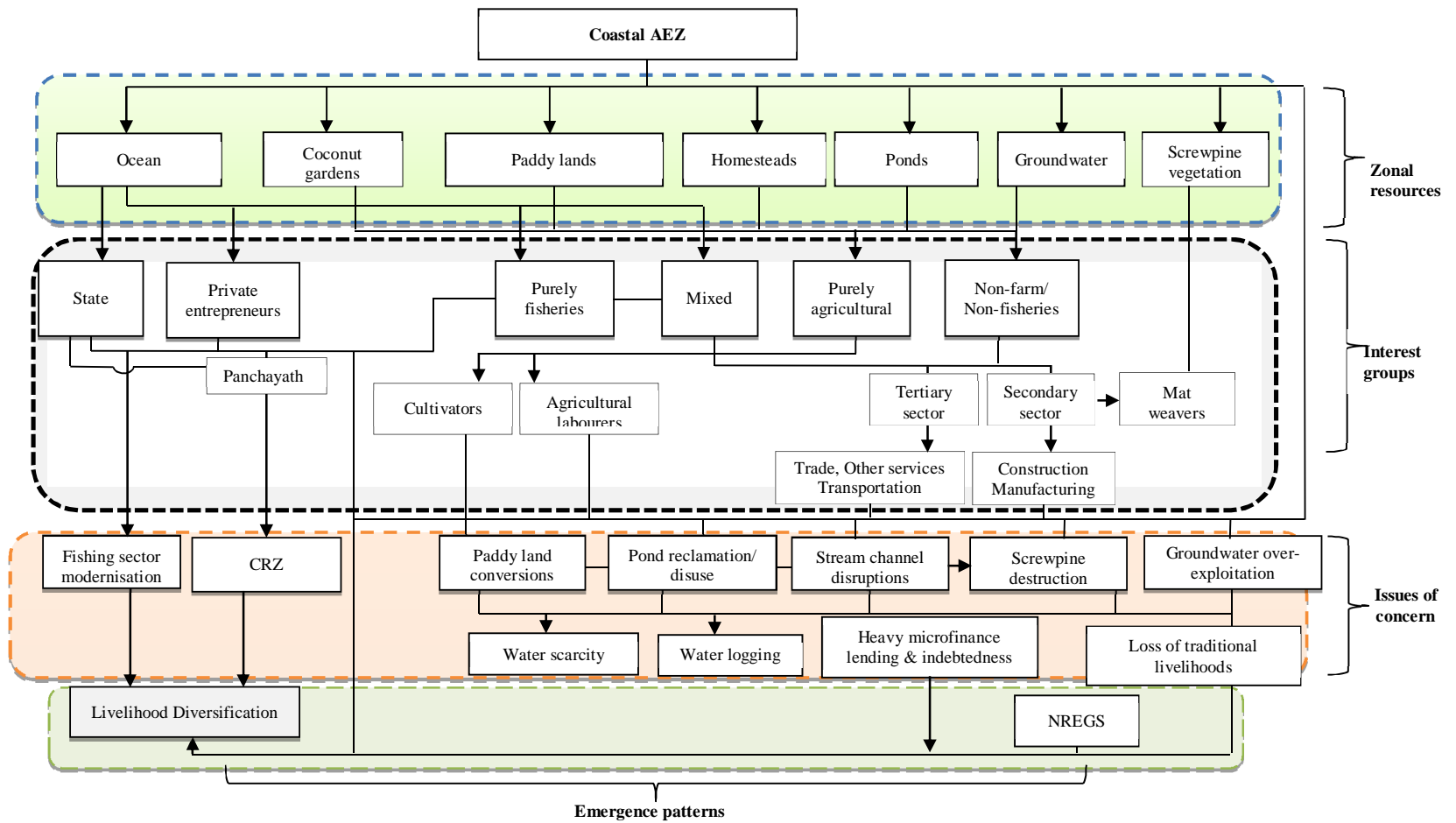


Fig. 6.45 Schematic sketch of interest groups, resource linkages and livelihood emergence- Coastal lands

## **6.8 Emergent livelihoods, resource relations and interest groups across AEZs: Arriving at the socio-ecological identity of Chalakudy river basin**

Chalakudy river basin spread across various AEZs in the west coast of peninsular India was therefore found to have patterns of livelihood emergence and resource relations that varied considerably in its various zones. A mosaic of these distinct trajectories and processes was arrived at to sketch the basin as a multi-scalar socio-ecological entity.

The high hill zone of the basin was found to have dominant livelihood activities in the plantation sector with emergent tendencies of casualisation, feminisation and diversification of labour within a plantation economy in leased plantations on forest land where resource relations were also veering towards tourism, illegal encroachments and mortgages. The foothills on the other hand had tourism related casual service sector workers and agriculture labourers who engaged in a mix of activities ranging from small-scale plantation and agricultural labour work in home gardens, forestry related casual work and NREGS and VSS work as main livelihood categories in a landscape that was rapidly converting from coconut based homesteads to small holder rainfed rubber plantations taken up as a subsidiary livelihood activity. Tourism related non-agricultural investments in land and pollution of surface water sources were the other emergent relations. The midlands had major livelihoods as various non-farm activities in the tertiary service sector even though irrigated farming of fragmented garden lands with perennial tree crops and seasonal food crops were taken up as subsidiary occupation either on own or leased in land. The lowlands had construction, construction related manufacturing and service sector as the major livelihood avenues with subsidiary cultivation of owned marginal land holdings. Non-agricultural uses of wetlands for mining, infrastructure development and as investments leading to largescale conversions and wetland fallows was countered to some extent by leased cultivation of these as main or subsidiary household activity. In the coastal tracts, construction and casual service sector work and both traditional and emergent manufacturing activities were the major livelihoods with highly fragmented and converted lands on which irrigated and token cultivation of coconut was being undertaken.

Leased in cultivation of land was found to be a reality in all the AEZs of the basin in diverse forms. In the high hills, despite extensive lease violations and expiry of lease terms, the leaseholders of forest lands raising plantation crops of tea, coffee, cardamom and rubber were found to be a strong and powerful presence on the basis of historical rights enjoyed over the land and the politically and economically powerful interest group of the 'planters' that they form part of. The foothills presented another class of powerful lease holders in the form of PCK who also enjoyed uncontested rights over the forest lands on which commercial tree plantations of rubber and oil palm were being raised. The exclusion of plantation crops from the purview of the Kerala Land Reforms Act, 1963, makes these lease holdings legally binding and makes the leaseholders a force to be reckoned with as basin stakeholders. On the other hand, in the mid and lowlands, the leaseholders were mainly landless labourers, marginal landowners and often subsidiary cultivators with their main occupation in diverse non-farm avenues. The major share of wetland and garden land cultivation of seasonal crops of banana, paddy, vegetables and tapioca was undertaken by a large section of such lease cultivators. Women cultivators, who conspicuously owned very little land, were found to take up leased land cultivation through Self Help Groups (SHGs) such as *Kudumbasree* units. In fact, the cultivation of market oriented food crops in the basin was found to be largely in the domain of a group of people who had very few rights over the resources they used since tenant cultivation had been rendered invalid in the state making the lease farmers unauthorised and illegal. Interestingly, the lease cultivators were being relied on by the state machinery itself to promote food crop cultivation as part of the food security campaign in the state using the provisions of the Kerala Conservation of Paddy Land and Wetland Act of 2008. Absentee landlords also used the services of lease cultivators to maintain the land. Thus these lease cultivators had turned into 'intermediary caretakers of land' even in instances where the land speculators had taken possession of vast tracts of wetlands in the lowland zone.

A burgeoning migrant labour force absolutely invisible in the existing planning perspectives was found to be an important characteristic of the basin in its various AEZs. From the plantation sector in the high hills, the mining and quarrying operations in the midlands and foothills, manufacturing and construction sectors in the mid and lowlands and the fisheries sector in the coastal lands, these migrant

workforce has now become an undeniable presence directly involved in various natural resource extraction activities within a basin but with no rights over those resources. Along with extending the livelihood boundaries of the basin, these migrant workers were becoming a serious interest group within the basin even when they were largely ignored in the current resource relations and were severely underrepresented within all the existing institutional arrangements.

There were considerable gender differences in occupational emergence in all the AEZs of the basin. In the high hill zone, the plantation sector which had been a historically feminised work category was seen to have undergone greater feminisation process mainly due to the tendency among the men to look for alternate employment away from the hills. Diversification into non-farm work was opted only by a small share of unmarried young women while majority of the women workers were employed within plantations with an increasing tendency towards casualisation. In the foothills of the basin, the women workers were found to be pursuing a mix of casual employment as agricultural and plantation labourers, forest related works and non-farm occupations in the service sector. The midlands and lowlands possessed a greater share of women as agricultural labourers even though this share was found to be declining in the lowlands. In the lowlands, women agricultural labourers and other workers had taken up lease farming of seasonal food crops of paddy and vegetables as *Kudumbasree* units although this venture was not very prevalent in the midlands. In the coastal reaches women workers were found to be slowly migrating from the traditional manufacturing sector of screwpine mat weaving into various casual and temporary works in the service sector.

The agricultural labourers in the various AEZs continued to be dominated by the SC and OBC caste members thus continuing the rigid and impermeable caste boundaries of agriculture. On the contrary, it was also noticed that a larger share of the SC, ST and *Ezhava* caste workers were now employed in non-farm activities in the service or construction sector as their main livelihood activity. Many of these workers undertook farming as a subsidiary activity on leased land holdings especially in the low land AEZ which had historically been the tracts where labor intensive cultivation patterns had evolved in the wetlands. It was evident that the SC (whose caste composition varied from zone to zone) and economically backward OBC



(majority of them *Ezhava* across the zones) workers preferred to farm on their own using family labour since labour was the most expensive input in the seasonal cultivation of food crops especially paddy. Lease cultivation also was devoid of the traditional caste based oppressions and coercions as in many instances the cultivation of the land in order not to leave it fallow was more necessary to the land owner than farming as an income source to the lease cultivator.

Through the basin, in every AEZ it was noticed that the dwellings of the *dalits*, *adivasis* and the most economically backwards households of the *Ezhavas* were in extremely inaccessible and hostile locations, where the land-water relations that decide the quality of the land was at its lowest ebb. Even in areas where the *dalits* and *adivasi* families have been awarded land, these have been systematically taken away from them either through coercion or the lure of economic incentives. Both the government and private individuals were found to be upto this game of displacement of the powerless to gain access to those land areas that capture their imagination at a point of time, either as ideal locations for a hydro-electric project, as the perfect contour for a road, as the prime location for a resort or as the best opportunity for a timely investment. They were found to finally drift into the SC / 4-cent colonies which were invariably located in rocky terrains with no provision for safe or perennial drinking water sources, on converted paddy lands prone to water logging or in the littoral stretches prone to coastal erosion according to the AEZ in question. Such forced confinements of the most marginalised and disadvantaged communities had led to silent, continuous and mostly unsuccessful conflicts over the resources of the basin in all its AEZs.

The livelihood boundaries of basin out-basin linkages for the various AEZs were observed to be laid through labour, capital and output market connections. The high hills had been linked to the outbasin regions historically through labour and capital connections and more recently by the outmigration of the labourers from the hills in search of work opportunities in the plains. The outbasin linkages of the foothills of the basin were originally through the settlers of the land from the lowlands and coasts of the state and through the recent transformation of the region into a popular tourist destination. The outbasin linkages of the midlands and the lowlands were through non-farm work connections as well as through input and output markets

of the agricultural produce. The rising demand of the booming construction sector of the state for sand, stone and clay resources of the mid and lowlands have also forged strong outbasin resource and migrant labour linkages. The coastal lands, historically linked to the outbasin regions through trade and commerce activities have recent outbasin connections through work migrations and diversifications and export oriented modernisation of the fisheries sector.

The water linkages in the basin were both irrigation and domestic water related and often interwoven. Irrigation during the summer months through CRDS and LI canals in the mid and lowland AEZs were being valued for its groundwater recharge function that has firmly linked water security to possession and ownership of land area served or influenced by the canals. Land ownership was therefore found to be a necessary prerequisite for water security rather than for food security. Consequently, marginal land holdings above canal contours beyond the reach of canal waters and occupied by the marginalised sections of the basin population were perennially water scarce depending on the common property resources such as piped water supply, public wells and more recently the Japan aided community drinking water scheme of '*Jalanidhi*'. Dependence on the river directly for drinking water was found to be minimal in the mid and lowland AEZs except in the highlands due to severe pollution problems ranging from uncontrolled tourism activities in the foothills to industrial pollution in the mid and lowland reaches.

While the high hills and the coasts were distinct in every aspect of these emergent tendencies, the foothill-midland-lowland stretch was found to have some unifying aspects especially in relation to the deployment of land resources. The high hills with continuing predominance of plantation sector employment and leasehold estates within reserved forests had distinct livelihood and resource relations that gave rise to distinct livelihood interest groups of plantation labourers and planters. Multiscalar linkages of these interest groups with the other AEZs were not considerable except for the *adivasis* for whom the issue of concern spread out into the foothills also. Even though the emergent main occupations were found to be statistically different in the foothill – midland – lowland stretch, the diversification through secondary occupations and pluri-activity of livelihoods both at the individual and household level traced similar patterns here. Even with a major share of working

population pursuing non-farm occupations, the predominant land use of the basin is still agriculture in its mid, lowland and coastal stretches. The extensive conversion of paddy lands in the mid, low and coastal AEZs had created a new hybrid category of land type called 'converted paddy lands'. Another emergent practice that had gained momentum in the mid and lowland AEZs as a direct result of availability of fallow paddy lands was their use as a common property resource for various subsidiary enterprises. The use of irrigation water to ensure drinking water security through groundwater recharge was also a common tendency in the midland-lowland stretch even though source of the irrigation tended to vary. Therefore importance given to irrigation over safe drinking water provisions had jeopardised the water security of the most marginalised and disadvantaged communities in the stretch who were found to depend on the common property resources such as piped water supply, public wells and the much polluted river.

The interest groups that were traced in the foothill-midland-lowland stretch therefore had multi-scalar linkages according to the nature of the issue. For instance, the pollution of the river waters by industries has garnered the cooperation of various interest groups in the mid and lowland zones. Yet another instance of multiscalar interest groups is found in the protest against large-scale quarrying and mining in the basin mid and low lands. A multi-layered planning of river basins in its divergent agro-ecological and socioeconomic settings would require an understanding of these interest groups and their multiscalar connections. These multiple interest groups identified in the zones based on these emergent livelihood and resource relations form novel spaces for basin governance and stewardship. These interest groups also accommodate the relatively powerless and non-ownership based relations to basin resources.

The natural resource management unit of the Chalakudy river basin was therefore found to have a hybrid socio-ecological identity that takes into account the inclusive boundary considerations, the heterogeneity of livelihoods and resource relations in the various AEZs and the emergent livelihood and resource use patterns and related interest groups. These livelihood activities, resource relations and interest groups transformed the basin into a 'space of engagement' (Ferreyra *et al.*, 2008; Venot *et al.*, 2011) thus crafting a socio-ecological identity for the basin as a

management unit. Such a conceptualisation prevents viewing the basin as exclusive, homogenous or statically agrarian and breaks the predominant notion of basin management still rooted in resource development. It also shifts the focus of management from centralised bureaucratic control to polycentric options that revolve around interest groups. Interest group formation has also been pointed out to be the mechanism by which cross scale interactions are triggered in resource management systems (Adger *et al.*, 2006). A range of these linked and emerging forces has been posited to provide the changing context of basin management (Franks *et al.*, 2011). A firm understanding of these emergent aspects and constructs of the basin has been deemed an important prerequisite for arriving at diverse management and conflict resolution mechanisms within a river basin (Moench *et al.*, 2003).

## **6.9 Closure**

The livelihood patterns and processes in the various zones of Chalakudy river basin were observed to be shifting out of agriculture which was reflected in the relations to the resources of land and water. It was observed that the transformation of livelihoods followed varied patterns in each of the AEZs. There were also clear caste and gender differentials in ownership and access. The non-prominence of agriculture as a livelihood option and the changed resource relations in these zones had led to formation of various interest groups outside of agriculture which has significant influence on river basin governance envisaged through communities of interests. The river basin therefore gains an identity beyond the conventional farmer-irrigator complex and exclusion of these influential factors and emergent interest groups may lead to a river basin governance framework that would be redundant and non-practical. It was also clear that river basin governance in emergent non-agrarian basins will have to focus on the land, water and livelihood securities of less privileged interest groups. A mosaic of these AEZs and the multiscale connections between the various interest groups lead to a socio-ecological conceptualisation of the river basin as a management unit.

## **Chapter 7**

### **Summary, Policy Implications and Conclusions**

#### **7.1 Introduction**

The present study revealed the river basin unit of natural resource management as an inclusive, heterogeneous entity within which livelihoods were getting redefined, transforming the relations to the basin resources. Such a reappraisal of the river basin as a socio-ecological entity becomes relevant at a time when the planning and management of the natural resources of the country are being streamlined along the lines of IRBM. An understanding of these redefinitions is crucial in devising ways of local governance practices and informing related central and state policy regimes. This chapter summarises the relevant findings of the present study, contextualises the work from the perspective of policy contributions and then proceeds towards concluding remarks and suggested directions of future research.

#### **7.2 Summary of work**

1. A case study of the interstate interlinked Chalakudy river basin in the Western Ghats of peninsular India was taken up to study the prevalent assumptions of the river basin as an exclusive, homogenous and agrarian space in the various agro-ecological zones of the river basin. The study explored the river basin as a natural resource governance unit that can move beyond centralisation tendencies in resource governance.

2. Multiple boundaries were discerned in the Chalakudy river basin within and beyond the hydrological boundary that encompasses an inclusive region of resource engagement coined as 'inclusive basin' which embeds in it various communities of interests. The inclusive basin was found to better represent the hybrid socio-ecological identity of a river basin from a management perspective. The inclusive basin consequently necessitates the need for a polycentric approach to governance within given political and historical settings primarily mediated by the communities engaged with it at various scales. A mosaic of such communities of interest and issue based networks is posited as the way forward to a politically conscious basin management that incorporates the realities of resource use established along permeable and dynamic boundaries.
3. The dominant livelihoods and natural resource linkages of the inclusive Chalakudy river basin in its five AEZs of High hills, Foothills, Midlands, Lowlands and Coastal plains was found to have undergone transformations that varied significantly in its composition, nature and processes from zone to zone, thus establishing the basin as a heterogeneous entity in its biophysical attributes and socio-economic relations. The multiple boundaries of concern that include the political, institutional, ecological and transboundaries of resource transfer were also found to vary in their extent and influence according to the AEZs.
4. The emergent occupational patterns in the high hills zone of the basin included contractual casual plantation employment which was slowly replacing the permanent labour system and increasing feminisation of plantation labour due to diversification of men and youth into manufacturing and service sector occupations. The lease ownership of land under agricultural plantations in the high hills had led to a number of conflicts regarding natural resource use such as forest encroachments and non-agricultural and speculative use of forest land by the lessee planters. The leaseholders and the lessor state government were recognised as the stronger interest groups in the zone. The lack of ownership over resources and the increasingly casual livelihood relations has made plantation labourers a weaker interest group even though they constituted the largest share of the population of these hills. The native *adivasi* population was observed to be

severely marginalised and constituted the weakest of interest groups thriving on the fringes of livelihoods as well as resources.

5. In the foothills of the basin, the emergent and dominant characteristic of occupation was noted to be the mix of casual employment activities in tourism, agriculture and other NR based activities sector. Both revenue and forest lands and owned and leased lands were present in the zone. Average operational land holding size was found to be much greater in this zone although homestead cultivation was increasingly becoming a subsidiary activity of raising commercial tree crops. Commercial banana cultivation was found to be the other major emergent cultivation in the foothill zone by lessee farmers from outside the basin on leased land as an intercrop in rubber saplings. Non-agrarian relations to land were by the tourism entrepreneurs who had bought up all river side land for prospective resorts and as investments. The region was chronically water short due to shallow water tables, steeply sloping lands that discouraged LI from the river and heavily polluted river through unregulated tourism activities. The Forest Department, PCK, absentee landlords, subsidiary small-scale cultivators, workers in the tourism sector and the *adivasis* and *dalits* who were forced to depend on the polluted public water source were the main interest groups identified in the region.
  
6. The midland zone was characterised by largest share of main workforce in service sector activities mostly as casual or temporary workers in the private sector. It was also noted that self-employed permanent cultivators and purely agriculture dependent households were a much larger presence than in other zones of the basin. Cultivation as a subsidiary activity was undertaken either on own land or on leased in land. The main use of the land in the midlands, though still agricultural, was revealed to have undergone acute transformations over the years. Wetland paddy fields had been heavily converted into garden lands so that paddy lands were a marginal presence in the midlands. Lease cultivation of banana was resorted to mostly in the garden lands and converted paddy lands and that of tapioca in the remaining wetlands by main and subsidiary lease cultivators. Another emerging trend in these midlands was the increasing area under homestead rubber and ownership of larger plantations by absentee-landlords from outside the basin. Granite quarries abounded in the midland zone spurred by the easier access to the

midlands and the availability of revenue land on lease. Irrigation originally intended for paddy cultivation was mostly benefitting converted and fragmented homesteads and formed the basis of land ownership based water security. Landless and marginal landowners were confined to the most resource poor locations dependent on polluted and unreliable public water supplies. Subsidiary cultivators, lease farmers, quarry owners and workers and the local populace affected by the emergent land and water relations were the main interest groups.

7. In the lowlands, service sector was the main work provider along with the informal manufacturing units and construction. Agriculture as a main livelihood activity on own land was mainly a retirement option, while construction, manufacture and service sector as the preferred main work choices occupied 78 per cent of the workforce. A large migrant labour force was also present in all physically intensive activities including quarrying and construction works. Majority of land were owned by non-farm households. Large extents of paddy fields and garden lands were under lease cultivation both as subsidiary and main livelihood activity. The lowlands still had close to a quarter of the total area remaining under paddy fields, which were the new sites of development and contestations due to availability of vast stretches of land that have been left fallow for various non-agricultural resource extractions, large-scale speculation and investments and for infrastructure development projects. The lease farmers constituted temporary caretakers of these wetlands through a plethora of informal arrangements. Irrigation meant for paddy cultivation and several other newer LI schemes were depended upon for groundwater recharge and water security. The livelihood and resource linkages based interest groups in major issues of concern identified were the lease farmers, the investors in the wetlands, the marginal landowners and the migrant workers.
8. In the coastal lands major livelihood activities were in the service sector casual works, construction sector and traditional and emergent manufacturing activities. Fisheries sector was observed to have greatly diversified both in terms of location and composition of occupation. Major share of land was with non-farm households. The link between the land and water was even more immediate due to the high water tables and the delicate saline balance maintained between the land



and the sea. Interventions with the land were immediately translated into water availability and quality problems. The interest groups here include the river and groundwater dependent marginal landowners, fish workers affected by upstream basin interventions and women workers in the traditional manufacturing sectors who were still a considerable presence in the zone.

9. While the high hills and the coast were significantly different in all resource relations, the foothill-midland-lowland stretch was identified to have certain similarities in subsidiary occupations pursued by the working population, land utilisation, ownership and access. The social boundaries of livelihoods and resource use were also found to be comparable along this stretch.
10. The non- ownership based linkages and interest groups that include the vulnerable sections of a river basin population such as the women, *tribals*, *dalits*, lease farmers, migrant labourers and a large casual labour force in the informal non-farm sectors having varied and nebulous relationship with the basin resources will have to be seriously considered in order to visualise a river basin governance true to the principles of equity and subsidiarity.
11. A mosaic of these diverse and significantly different AEZs and interest groups that forge multiscale connections according to the issues of concern forms the hybrid socio-ecological identity of an inclusive river basin and is posited to be the way forward in integrated inclusive river basin management.

### **7.3 Policy implications**

It has been argued that environmental policies need to be an integral part of regional development and agricultural policies in order to factor in the structural transformations in agriculture that have serious implications on the environment (Knickel, 1990). At the same time, Rigg *et al.* (2012) cautions that regional policy interventions need to acknowledge the diversity of activities and the mixed nature of livelihoods which would include multiple livelihoods, hybrid identities and increased occupational mobility. It is evident from the present study that Integrated River Basin based Management as a governance system have to take cognizance of these interconnections between the policy regimes of environment, agriculture and non-

agrarian spaces to truly achieve an integration of management efforts. The policy implications of the present work with respect to river basin as a multi-scalar socio-ecological space of engagement are being elaborated below.

1. The conceptualisation of the natural resource management unit of the river basin as an inclusive, heterogeneous and emergent non-agrarian entity is highly relevant and necessary at a time when the National and State Water Policies of the country are getting rapidly realigned along the lines of IWRM/IRBM. It is also clear that the resource use policies of the country will have to take cognizance of the emergence of non-agrarian livelihoods and its manifold influences on natural resource governance.
2. The study also brought out the necessity of integrating institutional mechanisms within shared boundaries of nascent systems of environmental governance that revolve around participatory co-management such as river basins, ecosystem units and coastal regulation zones to avoid redundant and/ or conflicting management efforts.
3. The study points at the need for close working of IRBM with other existing institutional and policy regimes so as to integrate land and water use planning within a river basin that would take cognizance of the burgeoning non-ownership based resource relations and ownership based non-agricultural relations to these resources. For instance, legitimisation of lease farming with clear terms and stipulations would be necessary for successful interest group based basin land use planning in its mid and lowland zones. The lease farming activities and terms are currently informal and discretionary, heavily resource exploitative with no provisions to reward the lease cropper for sustainable improvements made on the land, for the environmental services rendered by keeping the farms cultivated and ensuring food security. Another instance of such policy meshing would be in taking account of the migrant labourers in various resource extraction activities within the basin who are currently neither considered within the policy ambit of the state of their origin nor of their work. Even the local self-governance bodies are yet to acknowledge the emergent issues of governance that such a huge presence of migrant workforce engenders. An interest group based river basin

governance will have to contend with the rapidly increasing migrant workforce in river basins especially with regard to provision of minimum and basic rights such as clean and safe drinking water, hygienic living conditions and safe work practices in resource extraction.

4. The issues and challenges identified in the present study over delimitation of boundaries and the management of resources at river basin scales can become more complex and daunting in the context of the National River Linking Project (NRLP) in which large scale river water diversions/transfers are planned by stringing together river basins across the country. Moreover there is a clear policy contradiction between the river basin approach which essentially aims at decentralised control over the natural resources of a basin mediated by the 'principle of subsidiarity' and the NRLP which aims at centralised control over the water resources of the country by linking the apparently 'surplus' and 'deficit' basins.

#### **7.4 Conclusions and future research direction**

The river basin as a management and governance unit requires the conceptualisation of the basin as an inclusive heterogeneous entity with emergent livelihoods and resource relations that influence the interest groups and stewardship concerns. Long term management of basin resources can only be envisaged in local spaces created by these interest group domains that would capture and creatively respond to the emerging social realities of resource use established along permeable and dynamic boundaries of multiple livelihood and resource use networks. These emergent livelihood options have brought in their own patterns of local and migrant labour deployment and redefined linkages to the resources of land and water within the basin. The inclusive basin as a mosaic of its multi-scalar interest groups formed around issues of concern in the various AEZs within a democratic framework is posited as a way forward towards a contextually meaningful and socially and politically relevant integrated river basin management. Future research will have to look into the mechanisms by which river basin management through multi-scalar interest groups is effected and the democratic framework that will bring together these polycentric efforts within an inclusive river basin.

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## Appendix - 1



Questionnaire No: .....

Ward name: .....

Panchayath:.....

**I. GENERAL**

1	Name		2	Address Ph. No.	
3	Ward No.		4	Religion /caste	<input type="checkbox"/> H <input type="checkbox"/> C <input type="checkbox"/> M <input type="checkbox"/> O..... <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> SC <input type="checkbox"/> O.....
5	Age		6	Education	<input type="checkbox"/> I <input type="checkbox"/> PE <input type="checkbox"/> HE <input type="checkbox"/> PUC <input type="checkbox"/> G <input type="checkbox"/> PG <input type="checkbox"/> ITI
7	Occupation		8	APL/ BPL	<input type="checkbox"/> APL <input type="checkbox"/> BPL

**II. FAMILY DETAILS**

No.	Relation	Occupation	Place of Residence
1			
2			
3			
4			
5			
6			
7	Father <input type="checkbox"/> L <input type="checkbox"/> D	<input type="checkbox"/> W ..... <input type="checkbox"/> NW	<input type="checkbox"/> WR <input type="checkbox"/> O
8	Mother <input type="checkbox"/> L <input type="checkbox"/> D	<input type="checkbox"/> W ..... <input type="checkbox"/> NW	<input type="checkbox"/> WR <input type="checkbox"/> O

**III. RESIDENCE DETAILS**

- Period of stay here?  < 1 year  1-5 years  5 - 10 years  10-20 years  > 20 years
- Ownership of house  Own  Rental  Others .....
- Where did you live before?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Where does your father live ?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Where is your ancestral home?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Why did you move here?  Work related  Family related  Marriage  
 Affordable land prices  Other reasons .....  
 Not moved



**IV. OCCUPATION DETAILS**

**a. List of occupations and time spent**

No.	Occupation	Time Spent		
		Hours/day	Days/month	Months/year

**b. Main Occupation**

1. Place of work?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
2. Mode of transport:  Walk  Cycle  Two wheeler  4-wheeler  Bus  Train
3. Travel time to reach work place?  < 30 mts  30mts to 1 hr  1-2 hrs  > 2 hrs
4. Employment details:  Govt.  Private  Own  Other specify .....
5. Months employed in a year?  < 3 months  3-6 months  Full year

**c. Subsidiary occupation:**

1. Place of work?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
2. Mode of transport:  Walk  Cycle  Two wheeler  4-wheeler  Bus  Train
3. Travel time to reach work place?  < 30 mts  30mts to 1 hr  1-2 hrs  > 2 hrs
4. Employment details:  Govt.  Private  Own  Other specify .....
5. Months employed in a year?  < 3 months  3-6 months  Full year

**d. Other job/jobs in the past 30 years**

No	Job	Time period	Reasons for shift

**V. LAND LINKAGES**

1. Owned land details

	Homestead	Paddy land	Gardenland other than homestead	Converted paddy land
Area (cents)				
Place	<input type="checkbox"/> I <input type="checkbox"/> O	<input type="checkbox"/> I <input type="checkbox"/> O	<input type="checkbox"/> I <input type="checkbox"/> O	<input type="checkbox"/> I <input type="checkbox"/> O
Year of purchase				
Reason for purchase	<input type="checkbox"/> AP <input type="checkbox"/> H <input type="checkbox"/> I <input type="checkbox"/> A	<input type="checkbox"/> AP <input type="checkbox"/> H <input type="checkbox"/> I <input type="checkbox"/> A	<input type="checkbox"/> AP <input type="checkbox"/> H <input type="checkbox"/> I <input type="checkbox"/> A	<input type="checkbox"/> AP <input type="checkbox"/> H <input type="checkbox"/> I <input type="checkbox"/> A
Present use	<input type="checkbox"/> H <input type="checkbox"/> A <input type="checkbox"/> O	<input type="checkbox"/> H <input type="checkbox"/> A <input type="checkbox"/> O	<input type="checkbox"/> H <input type="checkbox"/> A <input type="checkbox"/> O	<input type="checkbox"/> H <input type="checkbox"/> A <input type="checkbox"/> O

2. Have you sold any landed property?  Yes  No

If yes,

Land type	Area	Year of purchase & sale	Reason for sale
Garden Land			
Paddy land			
Converted paddy land			

3. Have you leased in land in the past year?  Yes  No

If yes,

Land type	Crop	Area	Rate	Owner's occupation	Reason
Garden land					
Paddy land					

4. Have you leased out land in the past year?  Yes  No

If yes,

Land type	Crop	Area	Rate	Lessee's occupation	Reason
Garden land					
Paddy land					

5. Source of finance for buying land  Own savings  Remittance from abroad  
 Family/ Friends  Bank Loan  Other specify .....

6. Do you have any debt  Yes :  CB  NB  PF  LML  TN  MF  O  No

7. Membership in any society /association  Padashekhara samithi  VFPCCK  
 NREGS  Kudumbasree  Merchants Association  Any other .....

8. Do you own cattle?  Yes  No if yes, Specify kind and number.....  
 If sold, then when?

9. Whether any scarcity for labour?  Yes  No

10. Prevailing wage rate (Rs/day) a. Men ..... b. Women .....

### Field Survey Questionnaire

#### 11. Details of cultivation

No	Land type	Area	Crop	No.	Fertilizer/ Pesticides/ Manure	Total Cost	Yield	Own use	Market	Irrigation source	Labour	
											Source	No.
										<input type="checkbox"/> None <input type="checkbox"/> Well <input type="checkbox"/> Tube well <input type="checkbox"/> Private LI <input type="checkbox"/> Public LI <input type="checkbox"/> CRDS <input type="checkbox"/> Pvt.Tank	<input type="checkbox"/> Own <input type="checkbox"/> within village <input type="checkbox"/> Panchayat <input type="checkbox"/> Outside state Specify: .....	
										<input type="checkbox"/> None <input type="checkbox"/> Well <input type="checkbox"/> Tube well <input type="checkbox"/> Private LI <input type="checkbox"/> Public LI <input type="checkbox"/> CRDS <input type="checkbox"/> Pvt.Tank	<input type="checkbox"/> Own <input type="checkbox"/> within village <input type="checkbox"/> Panchayat <input type="checkbox"/> Outside state Specify: .....	
										<input type="checkbox"/> None <input type="checkbox"/> Well <input type="checkbox"/> Tube well <input type="checkbox"/> Private LI <input type="checkbox"/> Public LI <input type="checkbox"/> CRDS <input type="checkbox"/> Pvt.Tank	<input type="checkbox"/> Own <input type="checkbox"/> within village <input type="checkbox"/> Panchayat <input type="checkbox"/> Outside state Specify: .....	
										<input type="checkbox"/> None <input type="checkbox"/> Well <input type="checkbox"/> Tube well <input type="checkbox"/> Private LI <input type="checkbox"/> Public LI <input type="checkbox"/> CRDS <input type="checkbox"/> Pvt.Tank	<input type="checkbox"/> Own <input type="checkbox"/> within village <input type="checkbox"/> Panchayat <input type="checkbox"/> Outside state Specify: .....	

12. Source of finance for agriculture  Last year's profit  Family/friends  
 Personal savings  Local moneylender  Bank

13. Cropping pattern shifts

Land type	Area	Crop	Year	Reason for shift
Paddy land				
Garden land				

**c. Land linkage - Other occupations**

- What is the main commodity / output?
- Major inputs
- Source of inputs  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Labour requirement No. ....
- Source of labour  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Where is the market for the output ?  Same village  Panchayat  Taluk  District  
 Outside district  Outside state Specify : .....
- Source of finance  Own savings  Money lenders  Bank  Family/friends  
 Others .....
- Any specific reason for selecting the location  Yes  No if yes, specify .....

**VI. WATER LINKAGES**

**a. Domestic**

- a. Do you have a well?  Yes  No  
 b. Do you have a tank?  Yes  No
- Source of meeting domestic requirements  Pipe (KWA/ Local)  Well  River  Tank  other
- Are there any problems in drinking water?  None  Scarcity summer  Scarcity always  
 Poor quality
- Was the scarcity/ poor quality experienced  Last 10 years  5 years  2 years  Last year
- Action taken for meeting shortage / for quality improvement in the past 5 years  
 New well  Tube well  Buying water  Water harvesting  Any other  None
- If you have bought water last year  
 Source                      Quantity                      Price                      Time of the year

7. Is the water shortage in your area is recent phenomenon?  Yes  No

Specify .....

8 Is there any regular water logging in your area during monsoons  Yes  No

9. Have you given/sold water last year?  Yes  No

10. If yes,

<b>Rate</b>	<b>Quantity</b>	<b>Period</b>	<b>Customers</b>
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**b. Occupational**

1. Occupational use of water  Yes  Not much If yes, specify .....

2. Nature of use	Source	Quantity
------------------	--------	----------

3. How do you dispose wastewater?

Water treatment plant  Sump pit  Into the river  Other specify .....

4. Has your workplace experienced any water shortage anytime in the last 5 years?  Yes  No  
if yes, specify .....

5. How has your workplace managed water shortage in the last 5 years?

Buying water  Tube well  Water harvesting  Any other Specify .....

6. If your workplace has bought water

<b>Source</b>	<b>Quantity</b>	<b>Price</b>
---------------	-----------------	--------------

OWN OBSERVATION

1. Roof type:  Thatched  Tiled  Concrete  Concrete and tiled  
 Single storied  Double storied

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