ECONOMIC AND ECOLOGICAL ASPECTS OF LAND AND WATER USE DIVERSIFICATION

A Case Study of the Agriculture - Aquaculture Interface in two Coastal Villages of Andhra Pradesh

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Certificate

I hereby affirm that the research for this dissertation titled **Economic and Ecological Aspects of Land and Water Use Diversification** ***A Case Study of The Agriculture-Aquaculture Interface in Two Coastal Villages of Andhra Pradesh*** being submitted to the Jawarhar Lal Nehru University for the award of the Degree of Master of Philosophy was carried out by me at the Centre for Development Studies, Thiruvananthapuram.

Ashok

Thiruvananthapuram
3rd July, 1997.

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Certified that this dissertation is a bonafide work of Mr Emani Ashok and has not been considered for the award of any other degree by any other University. This dissertation may be forwarded for evaluation.

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TO MY PARENTS

SMT KAMALA SARASWATHI

SRI EMANI VERESWARA SARMA

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Chapter 1

Introduction

1.1 The background

Agricultural diversification has been one of the development strategies adopted in most of the states in India. The state of Andhra Pradesh has also been witnessing a wide range of agricultural diversification. Over time, diversification has become more specific to regions according to their crop specialisation. The process of diversification is not static, rather dynamic depending upon the emerging social, economic, and ecological milieu. As a corollary, it is not surprising that diversification has gained an added momentum in the post-1990's with the introduction of economic reforms.

Given the resource base of an agrarian economy, the interconnections of diversification, social processes, and environmental deterioration cannot be denied.[1] The way resources are exploited affects the distribution of benefits both in the short-run and in the long-run. Allocational effects of natural resources are, thus, at the core of environmental problems. This allocation is motivated by 'economic forces' which are supported by the standard economic doctrine of 'firms maximising their profits and individuals maximising their utility'.

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[1] These interconnections can be captured at multilevel and organisational mechanisms involved in expanding agricultural products, their relationship to changes in access and use of resources, and their impact on the regional economy and ecology.

1.2 Diversification and New Economic Policy

Orthodox economics has traditionally focused on the efficiency of allocation and avoided questions concerning with the outcomes of social equity and their ecological entailments (Mohan Rao, 1995). Ecological concerns are handled with the twin assumptions of free disposal and super abundant natural resources. These two assumptions have led to intensification in the use of natural resources for growth which, in turn, has produced social conflicts. Gadgil and Guha (1992), Mohan Rao (1995), Centre for Science and Environment (1987), Society for Promotion of Wasteland Development (1991) have shown the growing pressure on land and forest resources, and the consequent impact of this on ecology and economy. It is in this context, the response and the promotional measures taken by Government under the New Economic Policy have to be examined.

The adjustment policies did not make any specific reference to agriculture but on the whole were concerned with the entire economy. Nevertheless the changes implied in the stabilisation and structural adjustment programme were bound to have significant impact on the agricultural sector. The economic policies emphasised on export-led growth. This would mean that agricultural sector would have to be more export oriented and meet the requirements arising from export oriented industries. Meeting the changing demand implies that this sector have to diversify.

Agricultural diversification is a complex process with a number of different dimensions. Schuh and Barghouti (1988) identify four broader dimensions. First, changes in the cropping pattern as a

response to market incentives or disincentives. This occurs at farm level. Second is the addition or expansion of existing crop or other related activities. This occurs at sectoral level. As sectoral expansion takes place, some regions start enjoying specialisation based on their endowments. This is the third dimension. And, the fourth one occurs at national level involving a shift of resources out of agriculture and diversification of the economy as a whole. Each process of diversification has its own implications. The present study is broadly concerned with second and third dimensions. As a prelude, the first dimension has been examined for the economy on the whole. The Table 1.1 shows the changes in cropping pattern as a percentage of total gross cropped area during the period 1951 to 1992 for all India (see Table 1.1).

Table 1.1: Changes in the Cropping Pattern, All India (as % TCA)

Crops	1950-51	1960-61	1970-71	1980-81	1990-91	1991-92
Cropped Area (m ha)	**131.9**	**152.8**	**165.8**	**173.1**	**185.9**	**182.7**
Total foodgrains	**76.7**	**75.7**	**75.4**	**73.9**	**68.9**	**67.2**
Rice	23.6	22.3	22.6	23.3	23.0	23.3
Coarse Cereals	30.0	29.4	27.8	24.6	19.5	18.6
Total cereals	61.1	60.2	61.4	60.7	55.4	54.7
Total Pulses	15.6	15.5	14.0	13.2	13.5	12.5
Sugarcane	1.3	1.6	1.6	1.6	2.0	2.2
Total Non-foodcrops	**23.3**	**24.3**	**24.6**	**26.1**	**31.1**	**32.8**
Total Oilseeds	8.3	8.3	8.9	9.2	13.5	14.9
Cotton	4.3	5.0	4.7	4.5	4.1	4.2
Tobacco	0.3	0.3	0.2	0.3	0.2	0.3

Source: Nadkarni, 1996.

As seen in Table 1.1, significant changes in the cropping pattern has taken place in recent years. Liberalization of agriculture, as it is widely believed, will result in the displacement of foodgrain cultivation in favour of non-foodgrains in the drive to export more. As noticed in Table 1.1, though the shift in favour of non-foodgrain cultivation has taken place since the fifties, the eighties has witnessed a tremendous shift which continued in the early 1990s.

The observed shift in the cropping pattern in favour of non-foodgrain cultivation can be attributed to two factors (Nadkarni, 1996). First, as the commercialised sector grows relative to the subsistence sector, the importance given by farmers to food crops as a source of subsistence declines. Secondly, with economic growth, the demand from the larger economy for non-foodgrain commodities increases due to a higher income elasticity of demand for them. For the purpose of analysis, what is relevant, however, is the acceleration in commercialization and growing diversification of Indian agriculture after 1980-81.

In India, the constituent States have offered different incentives to attract investors to their respective states.[2] It is to be seen as their responses to the overall changing economic milieu.

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[2] For instance, Haryana has set up high powered committee to take spot decisions on foreign investments, NRI projects and 100 percent Export Oriented Units. It has also announced all projects will be cleared by State Pollution Control Board (SPCB) within 15 days. Kerala has introduced a green channel scheme to expedite clearances. Punjab has constituted a committee to provide land 'off the shelf' and formulating a policy to ensure clearances within 24 hours of submission of a proposal. Rajasthan has exempted 155 small scale industries from obtaining no objection certificate from SPCB.

As noted earlier, exports were given priority in the overall economic policies. Accordingly, some thrust sectors were identified for export promotion.

In the period after 1991, for which the all-India data is not yet available, diversification took place not only within the crops towards cash cropping in agriculture, but also into other enterprises like fisheries and aquaculture, floriculture. Aquaculture is an activity which takes place at the interface of land and water. Aquaculture interacts with the environment and cause changes in the entirety of environment by utilizing its resources.[3] Most of the interactions are beneficial. Generally the socio-economic benefits arising out of aquaculture expansion include provision of food, contributing to improved nutrition and health; generation of income;[4] diversification of primary production; and, foreign exchange earnings through export of high-value processed products. Thus, promotion of aquaculture has assumed importance.

As part of promotional measures, state sponsored financial institutions provided financial assistance. In the area of fishing, NABARD started financing brackishwater shrimp farming from 1989 onwards in a substantial way. Of the total disbursement of Rs. 158 crores to the fisheries sector during 1991-94, around 27 per cent was for brackishwater culturing. Discounting the area

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[3] Sustainable development of aquaculture can contribute to the prevention and control of aquatic pollution since it relies essentially on good-quality of water resources.

[4] Aquaculture compensates for the low growth rate of capture fisheries.

under traditional shrimp farming, the involvement of the bank in promoting scientific and commercial shrimp farming in the country accounted for nearly 30 per cent of the development (NABARD, 1994). Further, of the total financial outlay for the development of brakishwater aquaculture, with the areas of 5950 ha, NABARD assistance accounted for 55 per cent (NABARD, 1994: Table 5, p. 14). Of this assistance, the state of Andhra Pradesh alone had a share of 76 per cent.

Along with financial assistance by state sponsored financial institutions, some measures to provide impetus for private initiatives were taken. Joint ventures which were 100 percent export oriented were given green signals. In fishing sector alone, 82 companies were given clearance for the joint ventures during 1991-94 (Kothari, 1995).

Against this background, the present study intends to address the diversification in the use of the two 'vital' resources, namely, land and water, in the Coastal region of Andhra Pradesh, on which agriculture as well as non-agricultural activities depend. The Coastal region, with its 975 kilometers coast line stretch, is endowed with abundant land and water resources, suitable for a variety of activities. The land resources are natural phenomenon and, thus, very useful to look at all land resources from the view point of land use (Vink, 1975). Looking at the topography, the region has three parallel strips of land with forested hills on the west, irrigated uplands in the middle, and coastal irrigated plains abutting the Bay of Bengal at the eastern end (AERC, 1989). The present study relates to the coastal plains, and it concentrates on

the economic and ecological aspects of the diversification in land and water use at microlevel in two coastal villages.

The study intends to present the dynamics of an agroecosystem diversification based on the use of land and water resources in coastal regions within agriculture and from agriculture to aquaculture. This diversification is being prompted by the crops which have high demand in the market at the local, state, national or international levels, leading to a shift from a `traditional'[5] to `non-traditional'[6] cropping pattern. The traditional cropping system has shifted from minor millets to cereals to cash crops such as sugarcane, oilseeds, cotton and tobacco in these regions. The latest addition to this is shrimps through aquaculture.

1.3 Aquaculture in Andhra Pradesh

Andhra Pradesh is one of the leading states in culture fisheries. A government survey conducted in 1980, identified 63,360 hectares of brackish water suitable for aquaculture along the coastline. With the opening up of the export market for shrimps, there has been a large scale conversion of lands for aquaculture activity. For instance, lands close to the sea in the coastal mandals, which were either agricultural fields, salt pans or fallow, were being converted into aqua ponds.

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[5] By traditional cropping pattern we mean those crops which were grown over generations of farmers.

[6] By non-traditional cropping pattern we mean those crops which are grown over two to three generations, and also other non-agricultural products such as floriculture and aquaculture which share land and water like agriculture.

Aquaculture embraces the culturing of seaweed, bivalve and shrimp culture.[7] However the present study confines to the shrimp culture which is going on particularly in Coastal Andhra Pradesh. In India, shrimp ponds may cover extensive coastal areas which are obtained mostly by clearing the paddy fields, salt pans, coconut and sugarcane fields, abandoned lands and mangrove forests. Majority of lands in the Coastal regions of Andhra Pradesh have been culled out from fertile agricultural lands for construction of shrimp aqua farms. Figure 1.1 shows the two types of coastal zones which can be utilised for shrimp culture : (i) Intertidal zone (ii) Supratidal zone. Intertidal zones are the interface zone between the sea front and the land side and are always submerged in water giving rise to natural marshes. These sites are encountered in Sunderbans in West Bengal, Coringa in Andhra Pradesh among other areas. Supratidal zones are the zones which are elevated above the mean sea level. On the supratidal zones mostly agriculture is taken up. However the proximity of these zones to the sea makes it possible for taking up aquaculture. Most of the aquafarms in India, especially in Andhra Pradesh, are in supratidal zones.

In the supratidal zone, artificial conditions for rearing shrimps is created by pumping sea water through jetties. Construction of jetties/channels for water supply and drainage and pumping of brackish water inland, results in hydrological changes, siltation and saltwater intrusion. Pumping and trucking of saltwater to inland backyard hatcheries may affect ground water quality. Extraction of groundwater for freshwater supply for intensive

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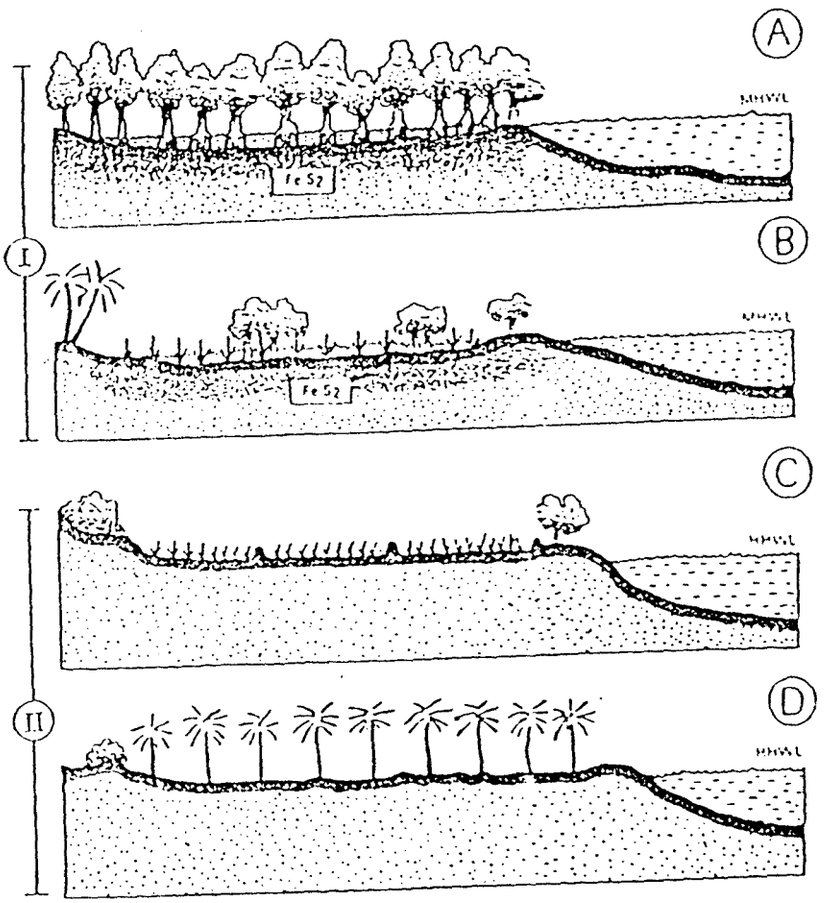
[7] See Appendix A, for various facets of shirmp aquaculture system.

FIGURE 1.1
TYPES OF COASTAL ZONES
FOR SHRIMP CULTURE



1. INTERTIDAL ZONE
   A. MANGROVE VIRGIN FOREST
   B. SECONDARY FOREST
II. SUPRATIDAL ZONE
   C. RICE FIELD
   D. COCONUT PLANTATION

culture may also result in the salinisation of the emptied freshwater aquifers. These are some of the varied consequences on the agroecosystem resulting from aquaculture. The study examines these consequences of conversion within Andhra Pradesh, a leading state of shrimp farming in India.

Commercial shrimp aquaculture can be traced back to early eighties when Bhagavatula Charitable Trust at Elamanchili started extensive shrimp culture adjacent to the creeks along with salt production (Srinivas Rao, 1989). Aquaculture known for its potential for generating quick money in considerably less period of time embraced the Coastal Andhra Pradesh during eighties when the agricultural sector was witnessing the entry of capitalist farmers. All the nine districts were identified with potential areas for taking up shrimp aquaculture industry. All the available land both from cultivable and non-cultivable were converted for culturing shrimps. The shift from agricultural food crops to aquaculture has been most dramatic in Andhra Pradesh. Between 199Ø-91 to 1995-96 as much as 61619 hectares of land in the coastal tracts were converted into brackishwater shrimp aquaculture.

Throughout the coastal region semi-intensive method of culturing shrimps is going on. This method involves conversion of land in the supratidal zones near the sea into culture ponds and pump the sea water through jetties. Export oriented production started in late eighties. The corporate sector triggered into the production system by investing heavily in collaboration with the multinational companies. Two companies, Hindustan Lever and ITC are collaborating with the Indian counterparts in these regions.

1.4 Objectives of the study

In the wake of above discussion the study intends to address the following objectives:

a) Considering agro-climatic specificities, the study examines the land and water use diversification at the state and district levels (coastal and non-coastal districts taken as two separate entities) giving emphasis to the economic and ecological aspects of the changes,

b). Focusing on the shift from agricultural crops to the growing of shrimp, we attempt to examine the dimensions and the dynamics of this transition at the coastal districts, mandal and village levels studying the varying socio-economic and ecological effects of the process.

1.5 The approach and sources of data

To achieve the above objectives apart from extensive use of secondary data at the state, regional and mandal levels, we have also undertaken two village studies to obtain the dynamics at the micro level. Two villages from the coastal mandals[8] of Visakhapatnam and Nellore district were selected.

A socio-economic survey was undertaken to get a better understanding of local specificities of the problems related to the changes within agriculture and to other enterprises like aquaculture. A village level survey was conducted during 1996, in each of the villages - Peddauppalam in Visakhapatnam district and Thuppilipalem in Nellore district. In both the surveys, one of the panchayats was selected from the revenue villages[9].

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[8] In 1984 each district in the state was reorganised into mandals, which replaced taluks, for administrative efficiency. Each mandal comprises of at least fifteen to twenty-five villages.

[9] A revenue village comprises of two to three village panchayats.

Purposive identification of the households followed by indepth interviews of the households was made the basis for the survey. The analysis integrates qualitative and quantitative data collected from the villages surveys, statistical and documentary sources, and interviews with the farmers, aquafarm owners, government official and local non-governmental organisations. As environmental consequences were not only confined to the particular village area, key informants from other and distant villages were also interviewed.

Secondary data pertaining to the village, coastal mandals, districts and state were obtained from the Mandal Office and Bureau of Economics and Statistics. Aquaculture related statistics were obtained from the Directorate of fisheries, Hyderabad and also from various journals. Reports from Agro Economic Research Centre, Visakhapatnam and Centre for Economic and Social Sciences, Hyderabad, have been used.

1.6 Chapterisation Scheme

Along with the introductory chapter, the study is organised into five chapters. The second chapter provides a review of literature. The third chapter begins with a detailed account of the agro-climatic specificities of non-coastal and coastal regions of the state. This is followed by an analysis of area under food and non-food crops in the three regions and coastal mandals. Further, changes within agriculture and from agriculture to aquaculture in the coastal mandals are discussed. The fourth chapter examines changes in the cropping pattern and sectoral diversification to aquaculture in the study villages. At the end of the chapter, a

comparison of the salient similarities and differences observed in the dynamics between these two villages. Chapter five sums up the study.

Chapter 2

The Interface of Land and Water

2.1 Introduction

Most of the human activities that sustain life are dependent on the two vital resources - land and water. Agriculture is the most important economic activity which is dependent on land and water resources. However, studies on agriculture usually deal with these two resources in isolation. The studies consider these resources to be separable and take into account only specific issues, for instance cropping pattern in an area, irrigation development etc. Nevertheless, it is to be recognised that these resources are inseparable and are very much intertwined with each other. The issues with the use of land and water at the interface are far more numerous and varied. The interface gets established in two ways - natural and man-made. Moreover, natural interfaces of land and water give rise to the wetlands. With increasing human interference on the use of land and water various economic, ecological and social issues are cropping up. Aquaculture like agriculture is dependent on land and water. Therefore for taking up the activity an interface of land and water is created by artificially simulating the natural systems. In such simulated environments, individuals can manipulate the products according to the demand and their choice. In this direction the present study is an attempt to understand the cause-effect relationship emerging from the interface use of these resources especially with aquaculture activity.

Traditional inland aquaculture has been practiced in our country for many centuries in some of the states. For instance, Bheries of

West Bengal, Gheri of Orissa, Pokkali of Kerala, Khar lands in Karnataka (Shiva and Karir, 1996). Of more recent origin is the conversion of agricultural lands to aquaculture. This has attracted researchers especially from two disciplines, environmental sciences and social sciences. The interests of these researchers are in search of sustainability of the natural resources on which agriculture and aquaculture depend.

With this background, we intend to look into some of the studies concerning the economic and ecological aspects of land and water use diversification in coastal Andhra Pradesh. We attempt to put together various studies intended to trace the diversification process within these two activities in various states with different socio-economic backgrounds.

The changes in the land use affect the ecosystem of an area in terms of vegetation, local weather conditions, land quality, and the quality of life that can be sustained. The changes in the land use pattern and the associated ecological changes generally being long drawn, the gravity of their consequences becomes truly appreciable only through long run analysis. The benefits of faster agricultural growth in the short run overlooked the potential threats in the long run on the deteriorating conditions of land quality through soil erosion, waterlogging, salinity and alkalinity problems. Various studies on land and water use diversification have been considered below. The studies relating to changes within agriculture are presented first followed by the studies related to aquaculture.

2.2 Diversification within Agriculture

The study by Pandey and Tewari (1987), examined the land use dynamics and its ecological implications by budgeting the land use changes in Uttar Pradesh. The study used the land use statistics reported in the country by the Directorate of Agriculture and grouped the land endowments into three broad sectors, namely, (i) ecological sector, (ii) non-agricultural sector and (iii) agricultural sector. Their study addresses the implications of changes brought about by the fluctuations in any one sector on the remaining sectors. The present study follows the same pattern, however there is deviation in grouping the land endowments. We intend to study the conversion of land to aquaculture, therefore categorise the land endowments into two categories, namely, (i) cultivable land and, (ii) non-cultivable land. We try to correlate the spread of aquaculture to the change in the area of land under these two categories. Apart from looking into the changes in the land allocation we are trying to capture the economic aspects of these changes in the land use within agriculture and to aquaculture.

Crop acreage is used to define the diversification process in non-coastal region, coastal region, and coastal mandals in Andhra Pradesh over time. Crop acreage method is a sensitive measure used for measuring diversification process and has been empirically tested for its reliability on the relation existing between the crop diversification and some of the socio-economic variables such as, farm-size, experience (Gupta and Tewari, 1985).

We find that the factors causing ecological imbalances of a region are the changes in the cropping pattern and excessive and indiscriminate use of chemicals to boost the production. Subba Rao and others (1987) view that the change in crop ecosystem in two coastal districts (Guntur and Prakasam) in Andhra Pradesh is taking place on account of cotton farming. With the evolution of potentially high-yielding hybrid varieties of cotton, there is dramatic change in the cropping pattern and management practices. The high-yielding varieties (HYV) require phenomenally high doses of fertilisers and continuous use of pesticides resulting in minor pests transforming into major pests, posing threat to the crop. Under such circumstances, most of the time, mono-cropping results in the multiplication of pests and ideal crop rotation is abandoned in the mono-cropping leading to fertility loss of the lands in long run.

Satya Sekhar (199Ø) examines the growth performance of agriculture and assess the demand for and supply of agricultural commodities in Andhra Pradesh. The study observes that an increase in income levels brings a shift in demand from inferior cereals like jowar, consumed largely by the poorer sections, to cereals like rice and wheat. The declines in the crop production profitability and increase in farmer's income, have increased interest in crop and income diversification. Thailand, a predominant rice exporter, has exhibited the ASEAN region's highest levels of diversification out of rice production. Compared to this there has been smaller, though significant, movement out of rice monoculture in the Philippines and Indonesia (Pingali, WBTP-178). The study opines the diversification out of rice monoculture into a multicrop enterprise

system as an essential component of agricultural development, induced by the changing relative profitability of rice and non-rice enterprise. The diversification out of rice to non-rice crops is not always profitable and there are constraints, such as markets and infrastructure, which restrict diversification.

The potential for diversifying out of any crop production system depends on both physical and economic factors. The feasibility and cost of substituting other crops vary across the basic agro-ecosystems, namely, irrigated and rainfed lowlands, tidal and deep-water wetlands, and uplands. The routes followed are different in different agro-ecological systems. Each of these ecosystems presents different seasonal profiles which requires different levels of physical and human effort to switch from crop to crop.

The economic factors responsible for inducing the diversification process are brought about by the changes in the structure of institutions. "Induced development model" explains the technical and institutional changes which are induced through the responses of farmers, agribusiness entrepreneurs, scientists and public administrators (Ruttan and Hayami, 1972). The social impacts are the compound influence of interactions between the institutions including markets, technology, and demography. Policy interventions of the state contributed to the emergence and growth of a whole set of institutions which integrate the rural markets with the wider markets.

Significant changes in the cropping patterns and tremendous growth of other enterprises such as dairying, poultry, aquaculture,

floriculture has taken place in recent years. The switchover to other enterprises shows that the rural economy is getting both commercialised and diversified at a faster rate.

Upadhya (1988), explains the rise of dynamic entrepreneurial class of coastal Andhra with reference to the convergence of several historical processes: the development of a productive and commercialised agrarian economy in the late nineteenth century and the emergence of a rich peasant class, the integration of town and countryside, an early interest in education on the part of the rural elite, the politicisation of caste identity, and, late green revolution and land reforms. The study explains that the high productivity and profit rates in agriculture have contributed to the development of capitalist tendencies in the system of agricultural production, and the capitalist farmers are accumulating surpluses which they seek to invest in ever more profitable enterprises. The reinvestment behaviour is observed in enterprises like aquaculture in the Coastal Andhra.

During the process of economic development and particularly under a strategy of 'primary export led growth' diversification from agriculture is expected to make a significant contribution to net foreign earnings. In the era of liberalisation, it is no longer appropriate to treat agriculture as a leading export sector. Instead, it is more relevant to reduce dependency on food imports and attain greater self-sufficiency in food at national level.

Export growth through agricultural diversification has been the basis of development in Central America since fifties.

Nontraditional exports, such as shrimps, exacerbated inequalities and social differentiation in southern Honduras (Stonich, 1992). She finds that the priorities of national government, developmental organisations, multinational organisations and individuals focus on short-term needs and this creates extremes of wealth. The uneven growth of export production is demonstrated as the production of agricultural exports expand an escalating percentage of total product comes from larger producers with superior access to credit, technology and markets, while a growing number of smaller producers become displaced and destitutes.

India, like several of the other Asian countries, has a comparative advantage in agriculture and considerable scope for raising farm income and employment by stepping up agro-based exports without jeopardising the food security already achieved (Rao, 1995). Agricultural sector can serve as bigger safety net in the process of structural adjustment in India. Structural adjustment measures are designed basically to improve allocation efficiency through the operation of incentives in a market economy.

The experiences of the Mexican and sub-Saharan African economies shows that, under a liberalised regime, agricultural production becomes more export oriented and this takes place at the expense of the decline of foodgrains production for the population of these countries. Apprehending on the basis of the experience of these countries, liberalisation may result in the substantial alteration of land use and cropping pattern of our country by the action of the powerful magnet of international demand, just as it was in the colonial regime.

Apart from trade policy reforms, domestic reforms are likely to significantly alter the existing cropping patterns. The main input subsidies received by agriculture in our country relate to fertilizer, electricity and irrigation. The subsidies received varies considerably across crops[1]. Assuming that the farmers are motivated by the profits and respond to the market incentives and disincentives, it is likely that any change in the cropping pattern is likely to take place in favour of those crops which are competitive in the world markets and which are also not much affected by the changing domestic policies.

Another important feature that needs attention in diversification is the emphasis given to the development of agro-processing as an instrument for agricultural and rural development under the new economic policy. Under the new economic regime floriculture, horticulture, aquaculture, livestock, poultry and other related activities are likely to spread with the increase in demand for these products both at the home market and external market.

2.3 Diversification to Aquaculture:

Seafood exports have been one of the most promising segments of the export sector, even before the post-liberalisation era. The composition of Indian seafood export show a predominant dependence on frozen shrimps from marine sources.

1. By far the most subsidised crop in terms of incidence of budgetary subsidies as a percentage of cost of production are sugarcane and wheat, with rice and cotton receiving subsidy less than average.

During the last decade, shrimp aquaculture has become a major sector of fish farming in terms of space occupied and of market value. Nonetheless it makes only a small contribution towards meeting human needs for food. Shrimp exports bring substantial foreign exchange to poor countries and may contributed regional and national short-term economic growth.

The demand for sea food and shrimp in particular has thrown open the door for rapid development of brackishwater shrimp farming in India. The major environmental issues confronting the Indian shrimp aquaculture industry summarised in a paper by NABARD are - resource use conflicts, unregulated extraction of ground water and unregulated effluent discharge, damage to mangroves and spread of shrimp diseases among others (NABARD, 1994). However, the NABARD study could not bring out any particular case studies to focus on the issues relating to the socio-economic and environmental aspects at micro level.

Commercial shrimp aquaculture is considered to be an industry because it integrates the whole production chain of which the cultivation stage is only the first link. It combines many elements from fisheries and agriculture.

Discussing the aquacultural developmental policies Dehadrai (1994), opines that the development planning should be based on clear cut definition of sectoral and sub-sectoral policies. In absence of these policies it is impossible to select among development options, to set up priorities and to allocate properly resources among competing users.

A study by Murlidharan and Udaya Shanker (1994), in Krishna and Guntur districts of Andhra Pradesh, elaborates on the aquafarm activities taken up by different farmers. However the study does not give a clear picture of the status of the owners who have started and their involvement in the aquaculture activities.

Discussing the issue of aquaculture and food security Brian O'Riordan (1996), explains how appropriate small-scale aquaculture can contribute as an important source of livelihood. According to him intensive aquaculture has been the cause of environmental degradation in coastal areas and scarce agricultural lands in many countries. The rush to develop intensive shrimp farms in response to a strong market demand and the possibility of large profits has converted many previously ecologically rich coastal ecosystems into barren and polluted wastelands. Fish is a much-needed and affordable source of high-quality animal protein, but if aquaculture is to play a major role in the food security of low income countries, then attention needs to be focused on decentralised production using diverse, environmentally compatible, low-cost and sustainable farming methods.

Among the Indian states the coastal belt of Andhra Pradesh is experiencing signs of social and environmental upheaval as a result of the on going shrimp-aquaculture projects on its coasts.

Barraclough and Finger-Stich (1996), review the recent trends in Asian shrimp production and look at the interrelated social and environmental impacts of shrimp aquaculture that have been largely neglected. They present a critical analysis based on the available

data and a few case studies appearing in the literature. However, in the study emphasis is lacking on how the diversification to aquaculture took place in the countries which are endowed with the resources.

There has been a wide literature available on the social, economic ecological degradation caused by shrimp aquaculture from the major shrimp producing regions. The reports present that the deforestation of mangrove areas worldwide is having a major impact on the coastal fisheries and the communities whose livelihoods depend on them (Creech,1995; Ibrahim, 1995). The people and organisations from outside the local communities are found to be the root cause for the deforestation.

Protests over shrimp farms started throughout the coastal states of India. Hundreds of the rural communities joined together to protest against the spread of the commercial aquaculture shrimp farms on large stretches of land along the seafront in coastal states (Khor, 1995). Inspite of this, in some of the districts the protest are not to that extent where the small farmers are involved. The Supreme Court verdict[2] of December 1996 for the closure of the shrimp farms is based on the study which describes the violation of the rules of costal zone regulation.

2.4 Relevance of the present study

The studies, which have been detailed above, carried out on diversification of natural resource use, were either purely from economic point or purely from ecological point of view. In one

[2] For the recent Supreme Court order see Appendix B.

sense the shortcomings of the studies were that an holistic approach to the study of diversification of natural resource use is lacking.

The present study is a modest attempt in the direction of looking at diversification of land and water resource use at a very disaggregated level involving all the three levels : macro level (non-coastal and coastal districts), mezo level (coastal mandals) and micro level (village). The study not only looks at the economic and social aspects of the diversification within agriculture and from agriculture to aquaculture but also the ecological aspects involved in all the stages. This study integrates the two aspects, viz., economy and ecology at all the levels of regionalisation and tries to articulate the problems of natural resource use diversification. The micro level study is conducted in two villages of coastal mandals located in Visakhapatnam and Nellore districts (details of the selection of these villages presented in the following chapter). Also our study looks into the reasons for the fragmented protests from the three zones of the coastal region.

However there are limitations on data availability at all the stages of the analysis. Aquaculture data could not be made available at disaggregated levels of mandals. Also the scope of the investigation is restricted to the analysis of diversification on the basis of acreage changes. There are other methods of looking at the process of diversification of land and water use, which are however beyond the scope of the present study.

Chapter 3

Dynamics of Land and Water Utilisation: A Macro Perspective

3.1 Introduction

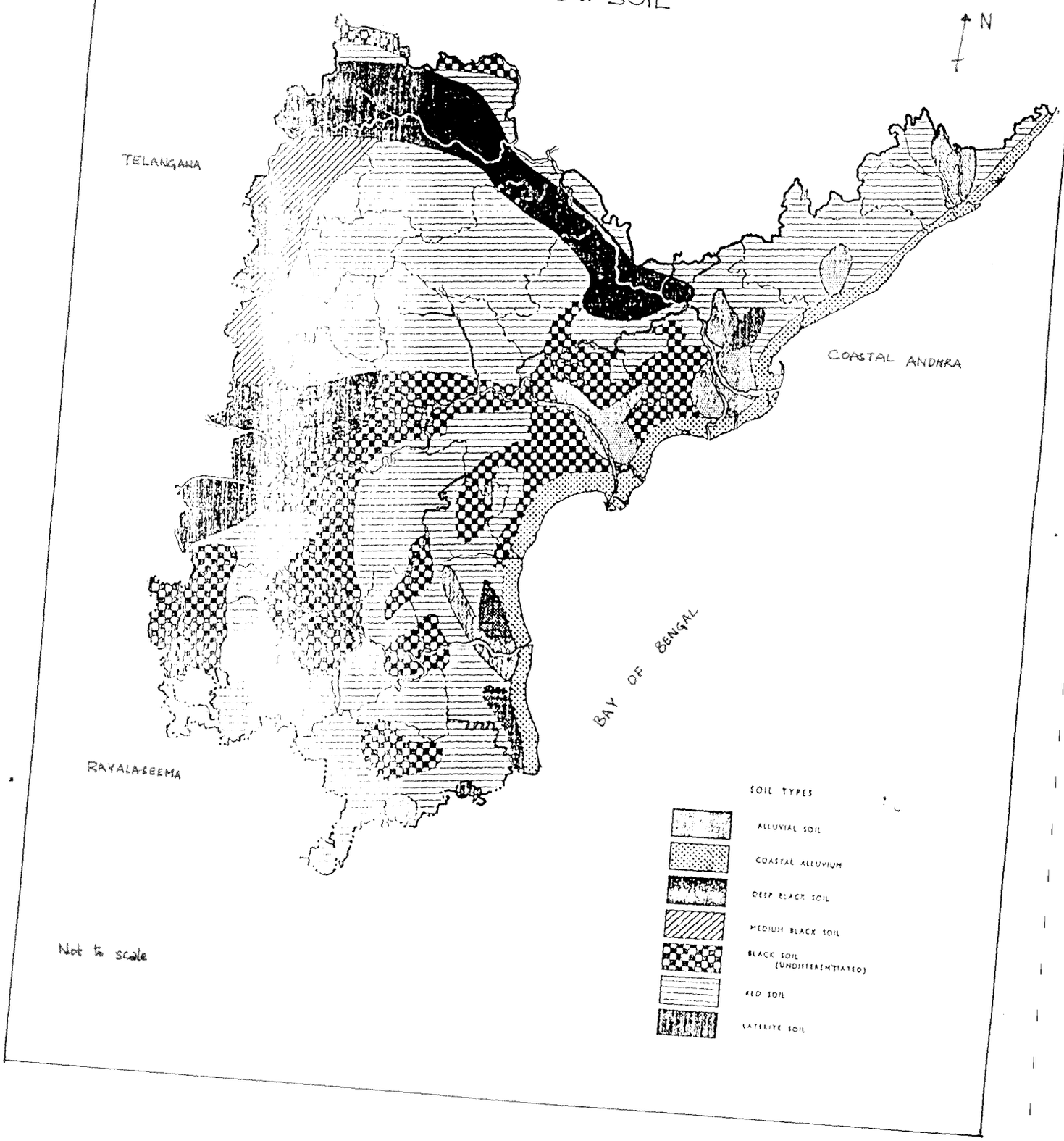
The State of Andhra Pradesh is located between latitudes 12° 38′ and 19° 55′north and longitudes 76° 45′ and 84° 45′east forming the south-eastern land mark of India. The State is formed of 23 districts and consists of three administrative regions, namely, Coastal Andhra, Rayalaseema and Telangana (Figure 3.1). These regions when viewed from the east forms three distinct physical regions, viz., i) the Coastal Plains, ii) The Eastern Ghats and, iii) the Western Peneplains. The Coastal Plains stretch right along the coast of the state from the northern most part in Srikakulam district to the southern most point in Nellore district. Next to the Coastal Plains to the west, except for a wide stretch between Godavari and Krishna rivers, a series of hills are met with, both to the north of river Godavari as also south of river Krishna. These hills are referred to as Eastern Ghats. The Western Peneplains consist of Rayalaseema and Telangana regions of Andhra Pradesh.

3.2 The Agroclimatic Specificities of Andhra Pradesh

The three regions of Andhra Pradesh can be distinguished based on the predominant soils found in them (Figure 3.1). Land used for agriculture is highly dependent on bioclimatic conditions which, in combination with soils, physiography and other factors, decide the agro-ecological zones. The soils in turn determine the land utilisation pattern of each region. Table 3.1 classifies the regions based on the soil type, the ideal crops for such soils and the crops cultivated.

FIGURE 3.1

PHYSIOGRAPHY OF ANDHRA PRADESH SHOWING REGIONS AND TYPES OF SOIL



Not to scale

Table 3.1 : Classification of Andhra Pradesh based on the predominant soils and the crops best suited.

Region	Soil Type	Ideal Crops	Major Crops Cultivated
Telangana	Black & Red	Cotton,Groundnut,Coarse cereals	Jowar, Bajara, Paddy, Groundnut.
Rayalseema	Deep black cotton & Red soil tracts.	Cotton, Chillies,Coarse cereals Tobacco, Groundnuts.	Jowar, Paddy, Cotton, Chillies, Groundnuts.
Coastal Andhra	Red soils, Alluvium, Deep Black and Laterite soils.	Paddy, Cotton, pulses, Tobacco Horticulture crops.	Paddy, Millets, Pulses, Cotton, Sugarcane, Tobacco, Coconut.

Source : Compiled from AERC (1989); Biswas et.al. (1985); Raman et.al.(1985)

Soils of Andhra Pradesh have been classified on the basis of colour, texture, formation, physical, chemical and morphological properties (Rajan & Rao, 1978). Red soils with laterites occupy 66 per cent of the land area. These comprise red sandy soils, red earths with loamy sub-soils, red loamy soils, red loamy soils deep to very deep and red soils with clayey sub-soils. The red soils are rapidly to moderately permeable and well-drained to water. The texture becomes more clayey with depth, thus permeability decreases with depth. The soils are neutral in reaction (pH 6.5 to 7.5) and non-saline. The soils of flat topography on bordering riverlets and situated in low rainfall districts of Nalgonda and Anantpur have problems of salinity and sodicity. The upland soils of North Coastal districts and agency tracts of Khammam are highly leached and acidic.

Laterites are medium to fine textured with clay sub-soils, acidic, rapidly permeable and well drained. Black soils include deep and moderately deep black soils and occupy 25 per cent of the total area of the state. The deep soils have high clay content and are slowly permeable and ill-drained, pH ranges between 8.Ø to 9.Ø .

These soils are usually saline at the surface, salt content increases with depth and have a salt accumulation zone containing gypsum at a depth of Ø.6 to 1.2 meters. Moderately deep soils are loamy to clay loam with sub-soil, moderately drained, neutral to moderately alkaline in reaction, but their salt content is more than the red soils. Deltaic soils are very deep and cover 5 per cent of the total area of the State. The Godavari and Krishna delta soils are fine and those of the Pennar delta are coarse in texture. Drainage is the main constraint in these soils.

Coastal soils are very deep (1.8 to 5.Ø metres and over), coarse textured with sandy sub-soils encountered all along the coast of Andhra 3 to 12 km from the sea and occupy 3 per cent of the total area. These soils are readily permeable, neutral in reaction with sub-soil salinity.

3.3 Land Utilisation Pattern

Agricultural productivity depends largely on the top soil (± 2Ø cm in thickness), as it serves many functions like rooting zone for plants, supplies plant nutrients, stores and releases soil moisture, etc. All these functions are essential for maintaining tilth, fertility and productivity of soils. The land use pattern in the three regions is detailed in the Table 3.2.

Table 3.2: Regionwise Land Use Changes in Andhra Pradesh, 1980-81 & 1992-93.
('000 hectares)

	Telangana		Rayalaseema		Coastal	
	1980-81	1992-93	1980-81	1992-93	1980-81	1992-93
Geographical Area	**114,77**	**114,77**	**6710**	**6710**	**9252**	**9252**
Forests	2794	2823	1491	1473	1940	1984
	(24.1)	(24.6)	(22.2)	(21.9)	(20.9)	(21.4)
Waste Lands	1389	1153	1085	1050	1663	1448
	(12.1)	(10.0)	(16.1)	(15.6)	(17.9)	(15.7)
Net Area Sown	4525	3893	2422	2705	3791	3867
	(39.4)	(33.9)	(36.1)	(40.3)	(41.0)	(41.8)
Current Fallows	1462	2156	695	424	404	301
	(12.7)	(18.8)	(10.4)	(6.3)	(4.4)	(3.3)
Land Under Misc.	75	78	67	56	125	122
tree crops	(0.6)	(0.7)	(0.9)	(0.8)	(1.4)	(1.3)
Land not available	679	739	520	569	968	1117
for Cultivation	(5.9)	(6.4)	(7.7)	(8.5)	(10.5)	(12.1)
Miscellaneous	553	619	430	433	361	413

Source : GOAP, Season and Crop Reports, Bureau of Economics and Statistics, Hyderabad.

Over the years between 1980-81 to 1992-93, the net sown area is increasing and area under current fallows is decreasing in the regions of Rayalseema and Coastal Andhra whereas the same is showing opposite movement in Telangana region. Current fallows are defined as the land which are left uncultivated for two or three agricultural calendar years. Agriculture in Telangana and Rayalseema region is mostly dependent on the rainfall. So, any change in the rainfall pattern affects the cropping pattern in these regions. However, in Rayalaseema over the decade some of the irrigation development projects have been commissioned. With the introduction of irrigation the individuals go for crops demanding water. Therefore we observe that with a corresponding decline in the area under current fallows, there is increase in the share of area under net area sown. Coastal region is endowed with perennial

water sources of rivers which form a network throughout the regions.

Telangana region represents the less developed region of the State from the point of agricultural activity. This region is under monsoon shadow zone and, thus, receives comparatively less rainfall. Apart from this the poor soils and the rugged terrain pose a major drawback in the agricultural development of this region. The farmers in this region have not yet developed the standards of cultivation. The lesser development of intensive cultivation in this region may be attributed to the institutional factors such as absence of incentives for the direct producers under the semi-feudal agriculture, decay of tank irrigation and also perhaps to the absence of an enterprising middle class peasantry having both labour and capital.

The soils of the Rayalaseema region are prone to soil erosion. The farmers in this region hardly get a good and normal crop once in every three years. So, they invariably try to cultivate enough food and fodder crops for their family and cattle and cultivates the remaining extent of holding, if any, with cash crops like cotton, groundnut, chilies, etc. This has placed the farmers of this region in a better position compared to that of the Telangana region.

Soil degradation occurs if wrong crops are cultivated (Dasgupta, 1993). The implication of change from food to non-food crops is that it directly affects the soil. The soils may get prone to soil erosion as the crops in the non-food category are less dependent on water. This make the upper layer of the soil loosely packed. Such

soils are more prone to soil erosion by grazing animals. At the global level it is estimated that accelerated soil erosion has irreversibly destroyed some 430 million hectares of land covering 30 per cent of the present cultivated area in different countries of the world (Brown, 1984).

Rayalaseema and Telangana regions of the State together form the non-coastal regions. These regions are somewhat dry. Therefore the symbiotic relationship between soil quality and vegetation cover are central to innumerable problems such as availability of water. The management of dry lands has to be sensitive to such relationships. The major crops grown in this region are jowar, bajara, groundnut, cotton, chilies and pulses. The share of area under paddy is comparatively less compared to other food crops.

As compared to the above regions, the Coastal region is more developed. It forms one third of the total area of the State. Coastal region has shown the maximum area under cultivation and a number of crops are cultivated. Commercialization has taken place to a large extent as compared to the other two regions of the State (Duvvury, 1986; Parthasarthy and Pothana, 1983). Also the farmers have diversified their economic activities, from conventional farming to other allied activities. In Coastal region, over the last two decades crop diversification is taking place. Apart from diversifying to various crops, the capitalist farmers are engaging themselves in various other enterprises, such as pharmaceutical industries, aquaculture, etc. among other in this region (Upadhya, 1988).

Therefore, we intend to study the changes brought about by the shift in and diversification in the use of natural resources available in this region. For this we undertake an analysis of cropping pattern of non-Coastal and Coastal regions for the last one and half decade i.e., from 198Ø to 1996. An analysis of the food crops at state level shows that there is shift of area from the low valued millet crops to high valued cereals. Since 198Ø onwards area under non-food crops increased in all the regions. In the non-Coastal regions the rate of decline in area under the food crops is around 39 per cent and 22 per cent in Rayalaseema and Telangana regions respectively, whereas in the Coastal region there is marginal increase of less than 5 per cent between 198Ø and 1992. The rate of growth in all the regions is positive for the area under non-food crops. The growth rate between 198Ø-81 and 1992-93 for Rayalaseema is found to be around 95 per cent and for Telangana region around 58 per cent whereas for coastal region it is around 4Ø per cent.

We analyse the shifts within these two broad categories of food and non-food crops in details in the following sections. Also, while analysing the shifts from one crop to other we would like to discuss some of the aspects of economic and ecological implications of the shifts within agriculture and from agriculture to aquaculture.

3.4 The Shift Within Agriculture

This section accounts briefly for the changes brought about within agriculture in the non-Coastal regions (Rayalaseema & Telangana) followed by an elaborate account of these changes in the Coastal

region. We intend to confine our detailed analysis to the Coastal region for two reasons: first, it is in the Coastal region that the maximum growth of agriculture has taken place; and secondly, the farmers in the region also diversified their activities into other enterprises like aquaculture (moreover shrimp aquaculture is possible only in the Coastal regions which provide sea front). Also we intend to study the spread of aquaculture in relation to the shifts within agriculture.

3.5 Non-Coastal Regions

In the non-Coastal regions, it is observed that total cropped area has remained constant, when examined with regard to the two end points - 198Ø and 1992 (Table 3.3). Consequently the changing shares of the area also reflect corresponding changes in the actual acerages under the concerned crop. The share of the area under food crops declined from 75.5 per cent of total cropped area in 198Ø to nearly 56.1 per cent in 1992. Correspondingly there is an increase in the share of area under non-food crops from 25 per cent to nearly 44 per cent between the same time period.

Table 3.3: Area under crops as per cent of total cropped area in non-coastal Regions.

	1980	1983	1986	1989	1992
TOTAL CROPPED AREA ('000 ha)	7486	8335	6760	7996	7457
TOTAL FOOD CROPS	75.5	73.3	69.5	NA	56.1
of which					
Paddy	17.9	20.7	16.3	21.8	17.6
Jowar	23.7	21.0	22.0	15.0	13.4
Bajra	4.3	3.8	2.9	1.8	1.1
Other Millets	11.3	10.4	9.2	6.4	5.4
Sugarcane	1.2	1.1	1.1	1.3	1.5
Total Cereals & Millets	57.2	55.9	50.4	45.0	37.5
Total Pulses	12.7	11.9	12.3	10.1	10.1
Others	4.4	4.4	5.7	NA	7.0
TOTAL NON-FOOD CROPS	24.5	26.7	30.5	NA	43.9
of which					
Cotton	3.7	3.1	3.5	5.3	7.1
Groundnut	14.6	16.8	19.0	24.3	27.1
Sesamum	1.1	0.9	1.2	0.9	0.9
Coconut	0.0	0.0	0.0	0.0	0.1
Tobacco	0.5	0.4	0.6	0.7	0.5
Others	4.6	5.5	6.2	NA	8.2

Source: GOAP, Season and Crop Reports, Bureau of Economics And Statistics, Hyderabad, Various issues.

The share of area under paddy varies from 16 to 21 percent between 1980-1992. Millets which occupied just over a quarter of the area in 1980 had a reduced share of 14 per cent by 1992. The stagnation in the share of area under paddy cultivated may be due to the properties of red soils dominating this region. These soils, which are rich in phosphoric content, have poor moisture holding capacity and if there is enough moisture content throughout the soils, can support cereal crops. Therefore, irrigation is necessary to raise good crops of cereals especially paddy. In the absence of proper irrigation facilities in this region, there is no scope for growing paddy at large scale. The minor millets grow best in soils which

hold less water. However, the millet crops are no longer cultivated and instead cash crops are being cultivated. Probably with the relative growth of commercialised sector to subsistence sector the importance given by the farmers to food crops as a source of subsistence declines (Nadkarni, 1996).

Corresponding to the decline in the share of area under food crops, there is increase in the share of area under non-food crops like groundnuts, cotton and sugarcane. The share of area under cotton and oilseeds registered considerable increase. These crops are best grown on black soils of this region. Black soils are rich in calcium and potash but poor in nitrogen. As nitrogen is one of the important nutrient required for cereal crops especially paddy, therefore these soils are not suitable for cereal cultivation. Major property of the black soils is that it retains the moisture and thus not much irrigation is required. Therefore, these soils are suitable particularly for cotton cultivation. Apart from these commercial crops, leguminous plants (some of the pulses) can also be grown which can fix nitrogen.

Having seen the difference in cropping pattern in the non-Coastal regions, we conclude that industrialisation (Geertz, 1963), development of technology, etc among other reasons, the agroclimatic conditions also determine the shifts from food crops to non-food crops. We now analyse the same factors at the Coastal region.

3.6 Coastal Andhra Region

With this background, we analyse the shifts in coastal regions, where there is a shift within agriculture from one crop to other crop and also a shift from agriculture to non-agricultural activities such as aquaculture. Aquaculture in the form of shrimp culture has come up in this region during the late eighties. This culturing of shrimps is not restricted to the intertidal zones of swamps or the wetland areas of this region but has encroached both the cultivable and uncultivated lands in the supratidal zone.

Before getting into the details of cropping pattern and the diversification process in this region it is important to note the important agroclimatic specificities of the coastal region.

3.6.1 Agroclimatic Specificities of Coastal Region

Coastal Andhra region comprises of the eastern plains and hills spread over the entire nine districts. The climate of the region is subtropical, characterised by high temperatures and medium rainfalls. The soil varies along the entire stretch of 975 km of the coast (AERC, 1989). Depending upon the predominant soils found, the Coastal region can broadly be classified into three zones (Figure 3.2). Zone I: North coastal zone comprised of Srikakulam, Vizianagaram and Visakhapatnam districts. Zone II : central coastal zone comprises of East Godavari, West Godavari, Krishna and Guntur districts; and Zone III: south coastal zone made up of Prakasam and Nellore districts. Table 3.4 classifies the zones on the basis of the soil characteristics of the regions.

FIGURE 3.2

ZONAL CLASSIFICATION OF COASTAL ANDHRA

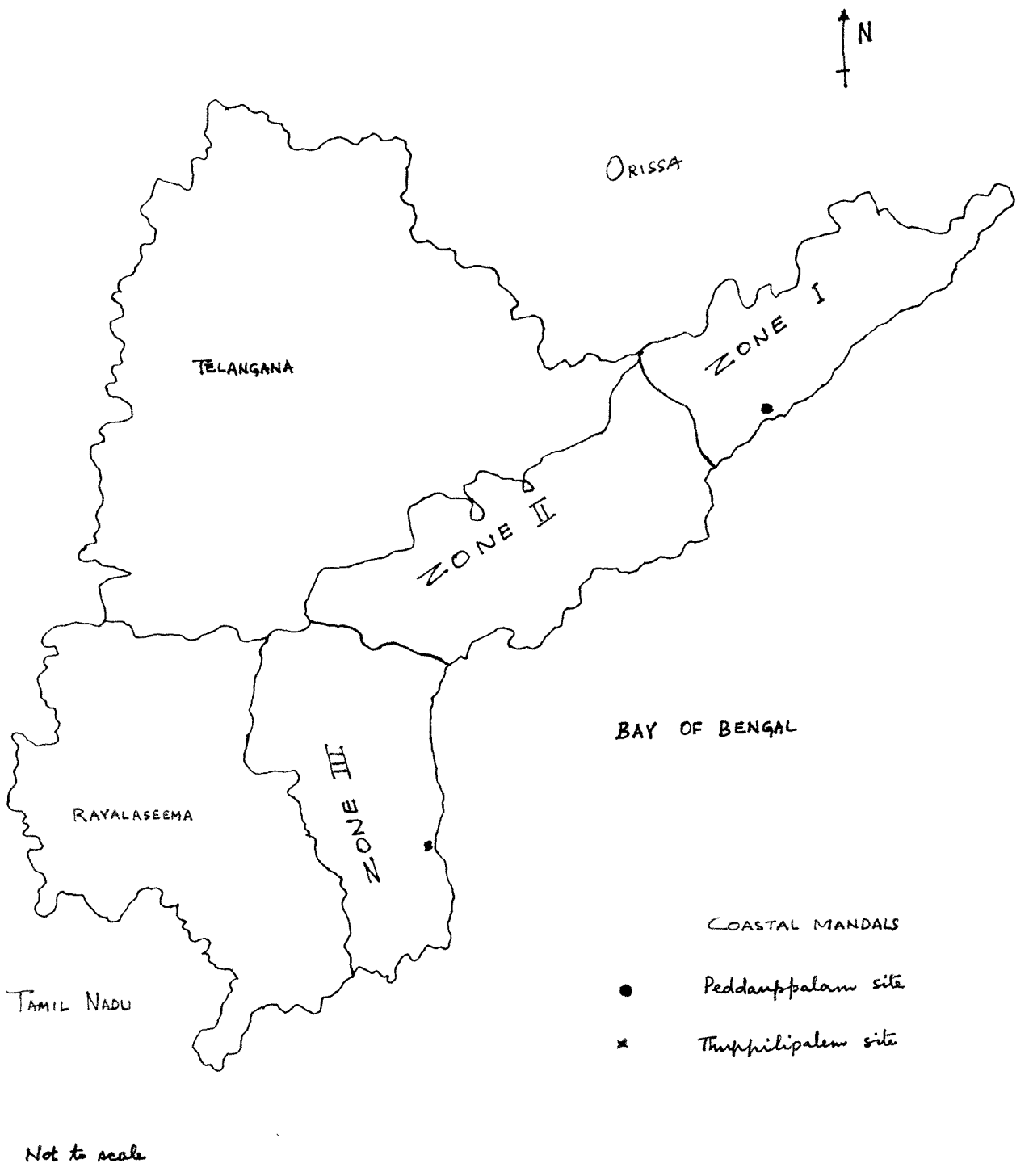


Table 3.4: Classification of Coastal Andhra Pradesh.

Zone		District Composition	Soil Type	Ideal Crops	Present Major Cultivating Crops
I	North Coastal	Srikakulam, Vizianagaram & Visakhapatnam.	Red soil & coastal alluvium	Paddy, Millets & Oilseeds.	Paddy,Sugarcane, Oilseeds Cotton, Coconut.
II	Central Coastal	East Godavari, West Godavari, Krishna & Guntur.	Deltaic Alluvium with black soils	Paddy, Cotton, Coconut, Tobacco	Paddy, Sugarcane, Chillies Coconut, Tobacco.
III	South Coastal	Prakasam and Nellore.	Red & Sandy Loam Coastal alluvium & Black soils.	Paddy, Cotton, Chilies & Tobacco	Paddy, oilseeds, Tobacco Cotton, Citrus *sps.*

Source : Compiled from AERC (1989); Biswas et.al. (1985); Raman et.al.(1985)

Cultivation of rice\paddy has a direct relation with the type of landforms and soil types. Mostly wet rice is grown in coastal plains and fluvial lowlands. A fine loam to fine clay particle size is ideal for cultivating rice. Coarse soils lead to inefficiency in use of water and nutrients owing to high drainage loss.

The main soils on which millets are grown range from sandy soils to light loamy soils. This is also grown on shallow mixed black and red light-coloured upland gravelly soils. For millets water is not a constraint to grow. This crop does not tolerate waterlogging. Oilseeds grow best in well-drained soils of loose consistence. Light-textured soils allow ease of sowing and establishment. Heavy clay soils make harvesting difficult. Waterlogging affects the growth of rhizobia of young plants when nitrogen is in high demand. Groundnuts are particularly sensitive to low levels of available calcium. Calcium deficiency is revealed by `pops´ i.e., pods containing aborted or shrivelled kernals.

As mentioned earlier, red soils with clayey base are best suited for growing crops which require less water such as coarse grains

and oilseeds. Deltaic alluvium is better suited for the crops which require standing waters. Paddy and coconut are best suited for such type of soils. Loamy soils have 50 percent of sand and 50 percent of clay or silt or both. Such type of soils generally do not hold any water. Also the soil moisture retention is not sufficient for propagating any crop which requires continuous water supply.

3.6.2 Cropping Pattern in Coastal Region

The following Table 3.5 presents the cropping pattern in the coastal districts of the region.

Table 3.5: Area under crops as per cent of Total Cropped Area in Coastal Districts

	1980	1983	1986	1989	1992
TOTAL CROPPED AREA (000 ha)	**4794**	**5057**	**4932**	**5261**	**5359**
TOTAL FOOD CROPS	**81.3**	**79.4**	**79.3**	**72.5**	**76.7**
of which					
Paddy	47.1	48.2	47.7	46.8	42.8
Jowar	5.8	4.4	3.4	2.1	1.0
Bajra	4.0	3.6	2.8	2.1	1.7
Other cereals & millets	6.2	2.3	4.4	3.6	3.3
Sugarcane	1.7	1.6	1.8	2.0	3.3
Total Cereals & Millets	**63.1**	**58.5**	**58.3**	**54.6**	**48.8**
Total Pulses	**10.3**	**10.0**	**11.9**	**0.0**	**15.5**
Others	**6.2**	**9.3**	**7.3**	**15.9**	**9.1**
TOTAL NON-FOOD CROPS	**18.7**	**20.6**	**20.7**	**27.5**	**23.3**
of which					
Cotton	**3.0**	**4.4**	**3.5**	**4.3**	**5.1**
Groundnut	**4.4**	**5.2**	**5.8**	**6.5**	**6.5**
Sesamum	2.1	1.9	1.9	1.4	1.6
Coconut	0.8	0.9	0.9	1.1	1.3
Tobacco	2.8	3.0	2.2	2.0	2.5
Others	5.6	5.2	6.4	12.2	6.3

Source: GOAP, Season and Crop Reports, Bureau of Economics And Statistics, Hyderabad, Various issues.

The coastal region has got a good network of perennial rivers. Therefore this region is assured of water throughout the cropping seasons. The soils are very fertile and a variety of crops are cultivated on these soils. We observe that assured availability of the water and the cropping pattern of the region shape up the region to development.

The total cropped area increased between 198Ø and 1992 in the Coastal region (Table 3.5). It may indicate that the number of crops cultivated (cropping intensity) within a season increased over time ie., the intensification of crop cultivation took place over time. Coastal region followed the same pattern in the share of area under food crops and non-food crops, as it was observed in the non-Coastal regions. However, the share of area under food crops declined from 8Ø to 75 per cent between the time periods, 198Ø and 1992. The share of paddy is about 45 per cent on the average whereas the share of area under millets registered below 12 per cent and gradually declined to less than 5 per cent by 1992. The share of area under sugarcane, cotton and groundnut increased marginally over the period. There has been significant addition of land to coconuts. The share of area under tobacco remains more or less same around 2 per cent throughout between 198Ø and 1992.

The intensity of cropping pattern is determined by the ecological endowments in the form of fertile soils and availability of water in the form of rivers. The nature of crops as well as the ecology of the region shape the institutions, social relations and technological development (Bray, 1983).

Technological development in the form of Green Revolution in this region has stimulated the growth of capitalist farmers in agriculture. The new capitalist farmers had diverse economic interests and were not confined to agriculture (Sau, 1988). The capitalist farmers diversified to the other enterprises which gave them more profits. Gail Omvedt (1981) highlights the structure and characteristics of the main rural classes and stresses that the growth of capitalism in Indian agriculture and brings about the growing links between agriculture and industry, the city and the countryside. She observes that

> their property and power is not simply in agriculture. After the coming of independence, rich peasants, landlords, and the emerging capitalist farmers began to invest on a wider scale rather than simply consuming surpluses. The establishment of tiny transport companies, tea shops, small flour mills, oil mills, brick kiln, etc, were all the process. Some moved into trade in direct competition with the previous merchant classes/castes.... The spread of rural education with the establishment of numerous societies running schools and colleges has also been their work. (Omvedt, 1981: A 149).

The introduction of certain non-food crops such as tobacco and cotton in certain districts has not followed by an intensification of subsistence crops so as to keep the food grain production at the same level. What indeed happened was a shift to cash crops, with the possibility of food imports from the neighbouring districts and the movement of relative prices in favour of cash crops. With this the relative prices moved in favour of commercial crops and the expansion of commercial crop cultivation took place. Expansion of area under `cash' crops took place at the expense of foodgrains. The composition of commercial crops changed dramatically along with the changing market conditions (Duvvury, 1986).

The Green Revolution also emphasised more dependence on the fertilizers and pesticides for increasing the food production sufficiently. Since then more reliance is being placed on the artificial manuring and increased use of pesticides.[1] Monoculture and the use of hybrid varieties invite a host of pests and pathogens besides eroding the native genetic variability. The reliance on synthetic fertilizers, on which the agriculture is heavily dependent, deteriorates the water resources. Inadequate drainage facilities in the expanded irrigated fields causes salinity. The link between the irrigation and the process by which land becomes increasingly saline are much noted in the ecological literature (see Dasgupta, 1993). Apart from the salinity problems in well irrigated regions, it is believed that intensively irrigated paddy cropping results in the release of methane which is one of the important gases of the green-house phenomenon.

Consumption of pesticides is far lower in our country than in some of the developed countries. Despite this what is important is the type of pesticide we use. Some of the pesticides used are not degradable and continued to persist in the environments in which they were applied. The number of persistent pesticides used and sold today is of grave concern. The most productive agricultural

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[1] India is the largest producer and consumer of pesticides in South Asia. Andhra Pradesh is the largest user of pesticides in the country followed by Tamil Nadu and Utter Pradesh. Per hectare use of the plant protection chemicals is highest in Tamil Nadu which is far ahead of the second and third major users, Punjab and Andhra Pradesh.

and aquacultural regions in the country have been showing severe pesticide pollution[2].

The indiscriminate use of pesticides has also led to the emergence of more virulent pests that have developed a built-in resistance to some of the frequently used chemicals. In the cotton belts of Prakasam and Guntur districts in Andhra Pradesh, the farmers sometimes go in for 2Ø-25 sprays of pesticide on cotton as against recommended 1Ø-12. The repeated and indiscriminate use of synthetic pyrethrum and sub-standard chemicals had resulted in the development of new race of pest, *Helicoverpa armigera*, which ravaged the whole crop. Besides these, there are reports of pesticides poisoning and death of human and livestock.

In a study of cotton farming in Guntur and Prakasam districts of Andhra Pradesh, Subbarao et al (1987) show that mono-cropping has distributed the natural ecosystem & the special inputs like pesticides and fertilizers aggravated the situation in the areas. As shown in the Table 3.6, the pesticide expenditure to total operational costs was more than 2Ø per cent among all the categories of farmers. Even the fertilizer application was quite high in these farms.

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[2] Kuttanad, the rice bowl of kerala is facing serious fish diseases, which had been caused by the pesticide released from agricultural applications. Several of the natural predators of the crop pests have also vanished with the excessive use of pesticides. It is found through an extensive survey the presence of a banned chemical, DDT, in this region. The ecology of this rice belt has been altered drastically (Venkatramani, 1992). Fate of the lakes, Chilka in Orissa and Kolleru in Coastal Andhra is more or less similar. The pesticide in the water-spread of these lakes target the birds and aquatic animals. The fish population has also came down in these natural ecosystems over the years.

Table 3.6: Extent of Fertilizer Application & Expenditure on Insecticides in Cotton Farming in Guntur & Prakasam Districts.

Size group	Nitrogen (kgs)	Expenditure on insecticides (Rs)	% of Pesticide Exp. to Total Opertional Exp.
Small	183.5	2Ø24.Ø8	24.18
Medium	187.1	2Ø88.Ø6	24.66
Large	172.7	1843.43	2Ø.49
Overall	178.Ø	1929.96	21.87

Source : Subba Rao D V et al (1987).

It is estimated that yields declined to the extent of 6Ø per cent in Guntur district and 75 per cent in Prakasam district. A study of the pesticide use pattern in the country has revealed that cotton, which accounts for just 5 per cent of cropped area in the coastal districts, consumes about 52 to 55 per cent of the total pesticides. Rice grown over 24 per cent of the cropped area uses about 18 per cent; vegetables raised over 3 per cent area about 14 per cent; plantation crops covering 2 per cent of area uses about 8 per cent; cereals, millets and oilseeds extending over 58 per cent of the area uses 7 per cent (Venkatramani, 1992).

The main factors responsible for the shift of cropping pattern from food to non-food crops are rise in the relative profitability and the policies pursued by the State and Central governments (Reddy, 1985). The development policies of central and state government such as making available the state of art technology to the farmers, giving subsidies etc promoted certain crops like cotton, tobacco, sugarcane, groundnuts in this region.

The development of irrigation projects also promoted the change of the cropping pattern to commercial crops. The changes brought about

by a shift from traditional crops to commercial crops are seen all over the regions of Andhra Pradesh and especially in coastal region. These changes are embedded with serious social, economic and ecological implications. In the culture of almost all the regions, men control cash income while women control food. Various studies suggest that the women's incomes decline to the extent as the proportion of cash cropping increases.[3] In turn the family's nutritional status (especially the nutritional status of chldren) deteriorate.[4]

The degradation of land that irrigation leads to, takes the form of waterlogging[5] and salinity. Large tracts of land go out of cultivation due to waterlogging (Kanchan, 1989). Alternatively, the productivity of the cultivated area decreases, and as a consequence an ecological imbalance is initiated in the local ecosystem. For irrigating the lands, canal water in the head reaches is overused and groundwater is over drawn. The reason for this is the very insignificant regulating costs which are prevalent in our country.

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[3] Studies in Nigeria, Kenya, India and Nepal. (Braun & Kennedy, cited in Dasgupta,1993)

[4] In much of the Sub-Saharan Africa, for instance, men and women plant crops but do so with different goals. Husbands and wives maintain separate managerial and financial control over the production, storage and sale of their crops. Men grow cash crops and keep the income from them. Women, by contrast, use their land to provide shelter, clothing, school fees, and medical care for themselves and their children; and so must earn income to cover what they cannot produce or collect from the village commons. Given adequate acreage, high yields or both, women do plant and market surplus crops to earn cash when land is scarce or the soil poor, they sell their labour or put more time into other income-generating activities (Jacobson, 1993).

[5] Biologically waterlogging causes reduction of oxygen available to the plant root systems by forming potent barriers to gaseous diffusion. Poor soil aeration suppresses root hair development and reduces the rates of absorption of water and nutrients. This affects the productivity of land.

The system adopted for pricing the water and electricity is making the marginal cost of using water as zero. This in turn leads to environmental problem of waterlogging.

Salinity is another related form of land degradation. It has been much noted in the literature about irrigation and the process by which the land becomes saline. Geo-chemical evolution of salinity is a complex phenomenon. In the absence of adequate drainage, continued irrigation slowly but remorselessly destroys agricultural land through the salts left behind by the evaporation of water.

Both these problems of waterlogging and salinity were neglected and only the development of agricultural base was given priority. The surpluses derived by the peasant class as a result of large ownership and control of land with use of wage labour were diverted for the development of agricultural base. This accumulation and diversion of capital strengthened the rich peasants (Parthasarthy and Pothana, 1983) and led to diversification of enterprise in the coastal region.

Thus, diversification of interests represents the investment of accumulated agricultural surpluses outside agriculture. It is also a protection against the risks of pure cultivation. Thereby giving rise to new farmer-capitalists in the Coastal region (Upadhya, 1988). The investment of the capitalist farmers into various business took various interests over time. During late eighties, some of these capitalist elites channelled their surpluses into a very sophisticated business of aquaculture.

3.7 The Shift to Aquaculture

As noted in the earlier chapter the aquaculture activity was initiated around early eighties. Shrimp aquaculture activity took roots along the 975 km coast line of the coastal region of the State in the late eighties. Soil type plays a major role in the selection of sites for aquaculture too. Soils of small particle size bind together firmly and remain in position for longer time. These soils also provide the natural feed to the growing shrimps as these soils facilitates the growth of phytoplanktons. The ideal soil conditions for aquaculture are present in the north and central coastal zones. The soils of south coastal zone provide with fine particles. The binding capacity of the soils in the north and central coastal zones helps to maintain the ponds for longer and also provide natural growth of phytoplankton which acts as feed for the shrimps. The porous structure of the soils of south coastal zone exposes the ponds to siltation. Also the soils of this zone (Zone III) are highly susceptible to seepage of water.

Water is important for both the activities, agriculture and aquaculture, but the quality of water used is crucial in aquaculture activity. Water quality in ponds is maintained by regular re-filling of the ponds with fresh sea water. The out flowing pond water pollutes the coastal water with nutrients, pesticides, antibiotics, protozoans, bacteria, and viruses. The volume of the effluent is directly related to the level of the farming activity. The ability of the coastal waters to dilute and disperse the pollutants decreases rapidly as the number of ponds increase. Coastal waters and estuaries in particular have high retention times, and a point is rapidly reached at which the

quality of the pond water intake is insufficient to maintain the health of the shrimps in the ponds. Sustained intensive shrimp-farming ultimately leads to collapse, as the ability of both the ponds and the local aquatic resources around it to recover from the continued abuse is finally over-stretched. Apart from this the potable water also gets contaminated in some of the severely affected areas. For instance, in Kurrupatnam village in Nellore district about 6ØØ families were without drinking water (Shiva, 1995).

The shrimp cultivation now-a-days is taking place as far as 2 to 3 kilometers away from the coast. Initially, the spread was restricted within the intertidal zone of the coast. Subsequently, with increasing profitability in this sector, the activity moved its tentacles towards both cultivated and uncultivated in the supratidal zones of the sea coast. Since then there has been a remarkable increase in the area under aquaculture in this region.

Aquacultural activity has been promoted in our country by the MPEDA[6]. Both the Central and State Government have shown keen interest in promoting aquaculture. The Union Government gave top

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[6] Marine Products Export Development Authority (MPEDA) is an autonomous body under Ministry of Commerce which promotes the spread of aquaculture in all the potential states. MPEDA through its extension services helped the states in setting up the hatcheries, conduct micro level surveys, preparing the feasibility reports, liaisons with banking institutes and providing technical guidance in aquaculture. It has also come up with various draft action plans for setting up shrimp farming in the coastal districts of the states and working in co-operation with the state government. In AP it has helped in setting up a large hatchery capable of producing 4Ø million seeds per annum. In the year 1989 MPEDA has helped to bring 543Ø hectares of land under prawn farming from the total identified land of 6Ø,461 hectares in the state which is around 9 per cent.

priority for establishment of commercial fisheries and urged the State Governments to set up a chain of commercial fish seed hatcheries. MPEDA has helped the State to set up a society, the Andhra Pradesh Shrimp Seed Production Supply and Research Centre (TASPARC) for promotion of commercial scale shrimp farming. This project has achieved a remarkable success in shrimp production through semi-intensive culture methods. The project was set up on the leased private land at Pudiparthi Village near Nellore. It was financed by Department of Bio-Technology of Ministry of Science and Technology. The production achieved from an area of 5.8 hectares (11 ponds) was 23.117 tones which accounted for a value realisation of over Rs. 2Ø.25 lakhs. The income from the project to the production of one ton of prawn was of the order of Rs. 88,ØØØ within 11Ø days against an investment of Rs. 62,ØØØ or a return of 21 per cent.[7]

Though the aquaculture activity is very lucrative, we did not learn much from its devastating effects experienced by most of the East Asian countries. Intensive shrimp farms rely heavily on high inputs of artificial feeds, pesticides and antibiotics for maintaining high productivity. This dependence is not much different from the intensive farming activity as cultivation of high-yielding crop varieties which require high levels of inputs and interventions to control competitors, predators, and disease. The only difference is that the intensive shrimp farming is unable to prevent the adverse changes in the local environment that are caused by intensive raising of shrimps in very small ponds which acts as a negative feedback for the production system itself. The

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[7] Cited from Fishing Chimes 1991.

metabolic activities of the shrimps generate urea and faecal matter. Larger the number of shrimps the more it will produce the two. These combined with the nitrates and phosphates released by the breakdown of the unused feed becomes a rich source of nutrients to the micro-organisms. These micro-organisms multiply at uncontrolled rate. The uncontrolled growth of micro-organisms depletes the available oxygen available at the mud-water interface creating a state of anoxia. If sustained these anoxic conditions lead to the alterations in the chemical compositions of the mud, releasing toxic compounds in the surroundings. This particularly causes stress and increases the vulnerability of diseases to the shrimps.

The initial entry of the corporate sector and private investors took place in the beach-based aquaculture in the south coastal zone of Andhra Pradesh. During early nineties shrimp farming emerged as a major organised industry attracting virtually anyone with the money to invest. With its high return on investment in a short gestation period of about three to four months, it has become a rage like the readymade garments exports. From a low profile avocation in the agriculture sector, aquaculture shrimp farming spawned a boom in captive industrial production.

The shrimp aquaculture activity started simultaneously in all the zones of the coastal region in late eighties. The central coastal zone witnessed the maximum involvement of the small farmers, converting their agricultural lands. In north and south coastal zones the involvement of small farmer in shrimp farming was very less as compared to the central coastal zone.

Early nineties saw a spurt of corporate firms in the aquaculture industry in Andhra Pradesh. Two multinational companies, ITC and Hindustan Lever Ltd, started operating aquafarms through their Indian counterparts in the State. They found Zone III to be ideal and started production in collaboration with some of the multi-national companies. The corporate firms flourished in Zone III due to the availability of large tracts of land. It would have been difficult for these companies to procure land in the central coastal zone as the land distribution is very fragmented. And the task to persuade the individual farmers was more difficult. The south coastal zone was preferred by the MNC's as it was near to Madras, from where the coordination to other firms located in surrounding areas was convenient. Also the export of the product was much easier. All the aquaculture activity in Zone III was mostly taken on large tracts of land, it is convenient for them to divide the large ponds into small ponds with the help of sand filled gunny bags. However the large investments involved in the setting up of the ponds restricted small and medium farmers entry into this business. Therefore, only corporate firms could enter Zone III.

3.8 Patterns of Shift & Diversification in Coastal Mandals

Shrimp aquaculture activity has come up in most of the coastal mandals in the Coastal region. As referred in chapter I, mandals are the administrative blocks of the district. There are 426 mandals and in about 74 mandals aquaculture activity is taking place in the nine coastal districts. We analyse now the changes in the utilisation of land in these mandals of the coastal region in

the wake of the shift in agricultural cropping pattern and diversification to aquaculture.

We first analyse the changes in land use in the coastal mandals in the respective zones for the averages of area between the years 1986-89 and 1990-93.

3.8.1 Land Use in Coastal Mandals

Land use pattern in the 74 coastal mandals is shown in the Table 3.7.

Table 3.7: Land Utilisation in coastal mandals of the Coastal Region (in hectares).

	Zone I		Zone II		Zone III	
	1986-89	1990-93	1986-89	1990-93	1986-89	1990-93
Total Geographical Area	1051770		1922844		940816	
Total Cropped Area	206430	232152	396752	390396	221598	231334
	(19.6)	(22.1)	(20.6)	(20.3)	(23.6)	(24.6)
Cultivated Land	190656	193455	264162	244780	215234	220178
	(18.1)	(18.4)	(13.7)	(12.7)	(22.9)	(23.4)
Non-Cultivated Land	59988	68094	105056	97184	143590	140912
	(5.7)	(6.5)	(5.5)	(5.1)	(15.3)	(15.0)

Note : Figures are the averages for the periods indicated.
Percentage expressed in parentheses is to total geographical area.
Source: GOAP, District Handbook of Statistics, Bureau of Economics And Statistics, Hyderabad, Various issues.

From Table 3.7 it is seen that the total cropped area as per cent of the total geographical area show noticeable increase between the two time periods under study in zone I and zone III. In zone II (central coastal zone), there is a marginal decline. Similarly area under cultivable land follow the same trend in all the three zones of coastal region between 1986-89 and 1990-93.

3.8.2 Cropping Pattern in Coastal Mandals

Table 3.8: Areas under crops (in hectares) in coastal mandals in 1986/87-1992-93 and their shares as percentage in Total Cropped Area.

Zones	Zone I		Zone II		Zone III	
Crops	1986-89	1990-93	1986-89	1990-93	1986-89	1990-93
Total Cropped Area	206430	232152	396752	390396	221598	231334
Paddy	60873	76593	322740	227064	116436	113078
	(29.5)	(32.9)	(81.3)	(58.2)	(52.5)	(48.9)
Sugarcane	6417	6843	468	471@	628	1596
	(3.1)	(2.9)	(0.12)	(0.16)	(0.28)	(0.69)
Oilseeds	33165	31914	7524	5884	15346	36108
	(16.1)	(13.7)	(1.9)	(1.51)	(6.9)	(15.6)
Cotton	neg	neg	neg	neg	4454	3012
					(2.0)	(1.3)
Tobacco	neg	neg	neg	neg	11242	14344
					(5.1)	(6.2)
Coconut	neg	neg	15024*	18040*	neg	neg
			(7.6)	(9.24)		

Note : Figures in () represent the percentage of area under the crop to total cropped area.
@ data not available for Guntur district.
* Includes average area only for East Godavari and West Godavari.
neg denotes negligible.

Source: GOAP, District Handbook of Statistics, Bureau of Economics And Statistics, Hyderabad, Various issues.

The jurisdiction of the Coastal mandals on the average extends between 15 to 20 kilometers from the sea. From Table 3.8, we can see that the important crops which are cultivated throughout the coastal mandals are paddy, sugarcane, oilseeds (groundnuts & sesamum), cotton, tobacco and coconut. Of these paddy, sugarcane and oilseeds are cultivated in all the coastal mandals of all the coastal zones. Coconuts, cotton and tobacco are concentrated in certain coastal mandals of central and south coastal zone of Coastal region. Paddy occupies the maximum extent in the central coastal zone as compared to other zones. This is because zone II is endowed with natural supply of water in the form of two rivers Godavari and Krishna. The ensured supply of water throughout the seasons makes this zone a paddy cultivating zone. Also the rate of

returns are more for paddy than to any other crop. The reason is the short gestation period of cultivating the paddy crop as compared to other crops. Thus more crops per season of paddy. In zone I and zone III much of the diversification has taken place to crops other than paddy.

Also it is observed that the share of area under paddy to total cropped area registered a significant decline in coastal mandals of zone II (from 81 per cent to 58 per cent) and zone III (from 53 to 49 per cent). However there is a marginal increase in the area under paddy in region I (from 3Ø to 33 per cent). Similarly the share of area under sugarcane in coastal mandals show a decline in north and south coastal zones, but only a marginal increase in central zone. The share of area under oilseeds show a decline in the coastal mandals of both north and coastal zones whereas it increased in south coastal zone.

The decline in the share of area under major crops like paddy can be attributed to the conversion of the agricultural lands in all the zones to other non-agricultural activities like aquaculture. The policies of the State and Central Government promoted aquacultural activity in these regions. There has been a co-ordinated effort in bringing up aquacultural activity in the potential regions. Mr Goka Ramasawmy the then Minister for Fisheries in 1982 elaborated the enormous scope for the growth of shrimp farming in Andhra Pradesh (Fishing Chimes, 1982).

Apart from conversion of lands to aquaculture, some of the mandals specialised in monocrops in agriculture. The reason for such

monocropping may be developed technology, such as availability of improved seed varieties of paddy with reduced gestation period of crops for harvesting.

The area under these major crops may have come down because of the distribution of subsidised rice through PDS. Also the decline in the share of area under millets can be attributed to the lack of alternative usage of these millet grains either for poultry or other agencies (Naidu et. al., 1994).

3.8.3 Aquaculture Activity - Spread and Expansion

Aquaculture relies on the natural environment for land, water, feed and seed, as do the activities of fisheries and agriculture. Initially the practice of culturing was limited to the brackishwater land available in the state. The State Government made available about 3000 to 6000 hectares for the shrimp culture in each of the coastal district during mid eighties. Between 1990 and 1996 the area in AP increased from 6000 hectares to 82143 hectares. This accounted for about 50 percent of the total estimated brackish water area in Andhra Pradesh. The spread of aquacultural activity in Andhra Pradesh is uneven across the coastal region. From Table 3.9, it is evident that the aquacultural activity is concentrated mostly in zone II. This zone is known as the rice bowl of Andhra Pradesh. Zone II accounted for about 80 to 90 per cent of total cropped area under paddy, the highest among all the three zones (Table 3.8). But the same has come down to about 60 per cent. In some of the coastal mandals of the zone II especially in Krishna the water available for irrigation is saline. So the farmers are not cultivating paddy. To utilise their

resources, the farmers of this region converted their lands into aquafarms. Similarly, zone III showed a significant decline in the share of paddy in the total cropped area probably for taking up aquaculture.

Table 3.9: Aquacultural Activity across the Zones in Coastal Andhra Region. (in hectares)

ZONES	AQUACULTURAL ACTIVITY 1994	1995	1996	Average for 1990/93*	1994/96	Change	Changes in Zone
Zone I	581	1021	814	96	806	710	**710**
Zone II							**53414**
East Godavari	4647	7606	14743	777	8999	8222	
West Godavari	12735	14374	14374	2129	12479	10350	
Krishna	29602	32857	32862	4948	32448	27500	
Guntur	8808	8821	8813	1472	8814	7342	
Zone III	8089	7913	10539	1352	8847	7495	**7495**
TOTAL STATE	**64462**	**72592**	**82145**			**61619**	**61619**

Note : * Figures for 1990-93 are estimates based on the area of 1994 and extrapolated backward assuming the growth rate of the area for 1994-96.

Source : Handbook of Fisheries Statistics, Directorate of Fisheries, Hyderabad, Various Issues.

We see from Table 3.9 that the share of area under aquacultural activity increased in all the coastal mandals of zone II. Coastal mandals in Krishna district showed the maximum increase in area under aquaculture followed by West Godavari and East Godavari. The spread of aquacultural activity of zone III is a little more than Guntur district of zone II. This activity is least developed in the northern zone (zone I) of coastal region. One of the reason for less penetration of this activity in these districts might be rather late starting. Moreover, zone I of the coastal region

concentrated on the research and development work in aquacultural activity.

The phenomenal increase in aquaculture activity in Zone II has prompted us to assess the sources from which land is provided for aquacultural activity in Zone II. Land is made available for aquaculture either from cultivable or non-cultivable lands. The cultivable lands consist of area under net area sown and the current fallows. The non-cultivable[8] land consists of area under barren, cultivable wastes, land put to non-agricultural uses, culturable wastes, land under miscellaneous trees, permanent pastures and other fallows. The distribution of land under these cultivable and non-cultivable categories is presented in the Tables 3.1Ø and 3.11 respectively.

Table 3.1Ø: Changes in Cultivable Land Use in Coastal Mandals for Zone II. **(in hectares)**

ZONE	Cultivable Land Average for the years 1986/89 (A)	199Ø/93 (B)	1994/96* (C)	Changes from 1986/89 to 1994/96 (A-B)+(B-C) =		Total Change D
Zone II						
East Godavari	95261	92988	9Ø77Ø	2272	2218	4491
West Godavari	65279	51168	4Ø1Ø8	14111Ø	11Ø6Ø	25171
Krishna	51149	49193	47312	1956	1881	3837
Guntur	52473	51431	5Ø4Ø9	1Ø42	1Ø22	2Ø64
					TOTAL	35563

Note : * Figures for 1994-96 are estimates based on the area of 1993 and forward extrapolated assuming the growth rate of the area for 199Ø-93.
Source :GOAP, District Handbook of Statistics, Bureau of Economics And Statistics, Hyderabad, Various issues.

7. . For our analysis forests and land put to non agricultural uses are not included in this category since the share of forests in coastal mandals is very less. And area allotted to non-agricultural use is not put to aquaculture use.

Table 3.11: Changes in Uncultivable Land Use in Coastal Mandals for Zone II (in hectares)

ZONES	Uncultivable Land Average for the years 1986/89 (A)	1990/93 (B)	1994/96* (C)	Changes from 1986/89 to 1990/96 (A-B)+(B-C) = D		Total Change D
Zone II						
East Godavari	19414	18155	16978	1259	1177	2436
West Godavari	29739	29435	29135	303	300	603
Krishna	44370	40435	36848	3936	3587	7522
Guntur	11532	9158	7272	2374	1885	4260
					TOTAL	14821

Note : * Figures for 1994-96 are estimates based on the area of 1993 and forward extrapolated assuming the growth rate of the area for 1990-93.

Source :GOAP, District Handbook of Statistics, Bureau of Economics And Statistics, Hyderabad, Various issues.

From the above Table 3.11 we see that between 1986/89 to 1990/93 and 1990/93 to 1994/96 significant decline in the cultivable and non-cultivable land in zone II. The total sum of the changes in cultivable land and uncultivable land is 50384 hectares (35563+14821). This is almost equal to the 53,414 hectares under the aquacultural activity for the average of the years 1990/93 and 1994/96 in zone II (see Table 3.8). From these calculations, we can infer that the land for aquaculture is largely made available from cultivable and non-cultivable lands.

A wide literature (Muralidharan et al. 1995; Prasada Rao, 1989; Shiva, 1995) discuss on the conversion of cultivable and uncultivable land in coastal mandals to aquaculture. Around 1989, brackishwater farms have come up in the coastal mandals of north-west parts in Zone I. About 367 hectares of land has been converted in Mulakuddu, Rajayyapeta, Vakapadu, Pentakota, and

Vadacheepurupalli in Visakhapatnam district in Zone I (Parthasarthy and Dixitulu).

Apart from the land, natural lakes were converted into ponds. For instance, the Kolleru lake, which has a spread of 35Ø miles covering the districts of West Godavari and Krishna, provided the most ideal ground for the development of aquaculture in the state. The ponds were formed around 1989 in this lake by the Fisherman's Co-operatives and by individual farmers themselves taking loan on their own or from banks. About 16,188 hectares of Kolleru lake has been converted into freshwater fish ponds. This activity has been expanding since 1977, mostly by the conversion of the agricultural lands and the marginal areas of the lake.

Pontumarru village in Krishna district located about 4Ø kms from Eluru between Krishna and Guntur river basins has totally converted its 56Ø hectares of agricultural lands. This village was initially dependent on agriculture since generations. Agriculture was supported by a minor irrigation canal (Gopal Rao, 1989).

Small farmers in Krishna, Guntur and East Godavari started shrimp farming at the tail end of the irrigation and drainage channels. Most of them have been allotted patches of less than 2 hectares of land under D-patta (government leased) ownership for agriculture (Muralidharan and Udaya Sankar, 1995). This conversion was either due to the salinisation of the land through salt water intrusion from the canals or due to the pressure from the surrounding farmers who had converted their fields to prawn farms.

In another instance for the welfare of the backward classes the land was converted into shrimp farming. In Mulakuddu village of Bhimili mandal in Visakhapatnam district about 5Ø acres of government land was converted into shrimp farming (Parthasarthy and Dixtitulu,1995).

The low lying lands in Guntur district were allotted for the prawn farming activity. In East Godavari the state government allotted brackishwater lands to several technocrat applicants at 4 hectares each (Fishing Chimes, 1988).

This rapid expansion of the shrimp aquaculture inevitably generated competition with the other users of the land and water. This included peasant farmers, artisans, livestock holders, fuelwood gatherers, fishermen, local elites, local traders, conservationists, urban consumers, the tourist industry and some State agencies. Many of these conflicts result from direct competition in the use of land, water and labour among the users of coastal resources.

Despite the numerous conflicts which the expansion of aquaculture has engendered, the overriding reason for its rapid expansion is the profitability of the enterprise. The best indicator of this is to be found in the rising earnings from the exports.

The export statistics of Vishakhapatnam port (Table 3.12) reveals that the quantity of shrimps exported increased from 8426 tones in 199Ø/91 to 169Ø3 tones in 1995/96. The value for the same increased from Rs. 1Ø8 crores to Rs. 585 crores during the same period. The

unit value realisation increased continuously from Rs. 1.3 lakhs per tonne in 1990-91 to Rs. 3.5 lakhs per tonne during 1995-96. This quantity of shrimp has been processed in the freezing factories in Andhra Pradesh.

Table 3.12: Shrimp Export from Vishakhapatnam Port.

YEAR	Quantity (tonnes)	Value (Rs. crores)	Unit Value Realisation (Rs lakhs/tonne)
1990-91	8426	108.00	1.3
1991-92	10050	199.76	2.0
1992-93	11759	278.81	2.3
1993-94	14411	443.51	3.1
1994-95	15635	567.67	3.6
1995-96	1690 3	585.50	3.5

Source : Fisheries Statistics of AP 1996, Hyderabad.

Apart from the exports there has also been a trans shipment of shrimps to other states in India from Andhra Pradesh. The quantity exported increased from 430 tones to 2449 tones between 1993/94 to 1995/96.

Table 3.13: Movement of Shrimps from A.P.to Other States

YEAR	Quantity (tonnes)	Value (Rs. Crores)	Unit Value Realisation (Rs lakhs/tonne)
1993-94	430.33	11.36	2.5
1994-95	1133.06	29.12	2.6
1995-96	2448.73	57.07	2.3

Source : Fisheries Statistics of AP 1996, Hyderabad.

Corresponding increase in the value took place from Rs. 11.36 crores to Rs. 57.07 crores. However unit value realisation decreased from Rs. 2.5 lakh per tonne to Rs. 2.3 lakhs per tonne. It is likely that this indicates the quantity transported from Zone III (south coastal) to neighbouring Tamilnadu for processing and export from Madras port.

Table 3.14: Area under Shrimp culture in Andhra Pradesh

ZONE	Upto 2 hactares			Upto 5 hactares			Above 5 hactares			TOTAL		
	No of Unit	Ext. of Land	Water Area	No of Unit	Ext. of Land	Water Area	No of Unit	Ext. of Land	Water Area	No of Unit	Ext. of Land	Water Area
Zone I	61	74	64	17	59	52	24	448	380	102	581017	495086
Zone II	60949	50100	39865	886	2731	2172	139	1175	966	61974	51086	43004
Zone III	1459	1409	1174	338	1217	1024	259	5462	4027	2056	8088	6226
TOTAL	62469	51663	41104	1241	4007	3248	422	7086	5373	64132	62755	49726

Source : MPEDA, 1994.

The number of the shrimp farm varies in all the zones (Table 3.14). There are about less than one per cent in Zone I, about 97 per cent in Zone II and around 2 per cent in Zone III below two hectare farms. Number of farmers below 5 hectares are around one per cent in Zone I, nearly 71 per cent in Zone II and about 27 per cent in Zone III. Above five hectare plots number more in zone III followed by Zone II and Zone I. The statistics, show that 80 per cent of the extent of land is distributed among 95 per cent of the total units below 2 hectare ponds. This is mostly concentrated in zone II. Whereas 10 per cent extent of the land is distributed among less than a half per cent of the units above 5 hectares. This is mostly concentrated in zone I and zone III.

In Zone I the ratio of water spread to extent of land under aquafarm is above eighty five per cent among all the size-class. In Zone II the same ratio is about 79 per cent in size-class below two and five hectares. It is about 82 per cent in above 5 hectares size-class. Similarly the water spread to the land under aquaculture in Zone III is above 80 per cent. The ratio indicates that about 80 per cent of land is covered with saline water for

whole year. With such a huge amount of water standing for a long time will certainly lead to ecological implications. In what follows we discuss the ecological impacts of the aquaculture activity.

3.9 Ecological Impacts of Aquaculture

The intensive shrimp farming is leading to the destruction of an extremely valuable local resource of fauna and flora. The deforestation of mangrove area is having a major impact on coastal fisheries and the communities whose livelihoods depend on them. The habitat of juvenile shrimps is disturbed by the aquaculture activity. In South-east Asia, particularly, coastal communities have witnessed the destruction of an ecologically diverse, productive, and sustainable resource. In the process, these communities have experienced increasing economic marginalisation as local fish population declined, traditional sources of food disappear and once-abundant forest products became scarce.

Shrimp aquaculture is itself a polluter of water and gets affected by the polluted water. The impact of shrimp aquaculture on biodiversity is manifold. The ponds cover vast areas and pollute large volumes of water. Modified water circulation systems are altering wild fish and crustacean habitats. The risks of disease spreading out of the ponds into the wild stocks are increasing. Pollution from the farms contribute to the increasing frequency of red tides which endanger the native fauna and flora.

Industrial aquaculture by its very nature of activity displaces others involved in small-scale domestically oriented food

production. This activity is responsible for initially displacing the paddy production activity along the coastal regions by competing for the same plot of low-lying lands. Subsequently, after a few years of shrimp culture, the aquaculturist may leave the area as a result of declining productivity and/or due to other reasons affecting their profits. The land left behind is rendered useless for any other agricultural operations because of alteration in the soil conditions due to sea water intrusion and use of chemical in the culturing process (Kurien, 1996).

The process of affecting the food production goes hand in hand with jeopardising the right to work and livelihood of coastal communities. Encroachment of the common resources by the corporate giants creates tension among themselves and the local communities dependent on the resources. This affects the communities from the landward end by physical displacement, restriction of their access to these common lands held by them since ages.

Coastal zone norms are violated in the wake of the expansion of the aquaculture farms. Recently the Supreme Court of India has passed a verdict to ban all the intensive and semi-intensive aquafarms functional within 500 metres high tide zone.[9] It is of significance to note that all the adverse ecological impacts mentioned above have been most evident in Andhra Pradesh.

3.10 Observing the Micro Level

With so many shifts and diversification observed in the coastal region, it is important to observe and analyse such changes at

[9] See Appendix B for the Supreme Court verdict.

micro level, i.e., through village study. Ideally three villages, one each from all the zones of the coastal region, would have given a clear understanding of these changes. This however did not materialise. We were able to select one village from Zone I and Zone III. The village in Zone I was selected as there were contacts in the village for survey and also at the mandal office from where the secondary data was made available. The second village was selected from zone III because of the high profile in relation to the publicity the zone had gained both at national and international levels in relation to the ill-effects of aquaculture. We were unable to select a village from zone II due to the prevailing adverse weather conditions at the time of the field survey. The cyclone affected most of the villages and affected the transport system badly. However, this is an important limitation of the present study.

The two villages selected are located in Visakhapatnam (Zone I) and Nellore (Zone II) districts of the coastal region. Both the villages are unique as their economy is dependent on two diverse activities. Village Peddauppalam is an agricultural village and 5 km away from the Bay of Bengal, whereas the economy of Thuppilipalem village abutting the Bay of Bengal is dependent on fishing with agricultural activity limited to some households.

These two villages are presented as separate case studies in the chapter that follows. With the help of these village studies the shifts and the diversification in the use of land and water and the consequent economic and ecological aspects of these changes are elaborated.

Chapter 4

A Case Study of Two Villages in Coastal Andhra

4.1 Introduction

As mentioned in the earlier chapter the coastal region of the State consisting of 9 districts abutting the Bay of Bengal on the eastern side, comprises of three zones based on the agro-climatic conditions (see Figure 3.1). Two villages from coastal mandals have been selected from zone I and zone III, for understanding the changes in land and water use at the micro-level. These two villages are socio-economically distinct. Peddauppalam village is basically dependent on agriculture and other allied activities. It is located in Sarvasidhi Rayavaram mandal of Visakhapatnam district in zone I. In contrast Thuppilipalem is primarily a marine fishing village with a few households practicing agriculture. Thuppilipalem is located in Vakadu mandal of Nellore district in zone III.

Here both the villages will be presented as two case studies. The data are collected through household interviews. We discuss Peddauppalam village followed by Thuppilipalem village. A comparison is presented between the two villages at the end of the chapter.

4.2 Case Study of Peddauppalam Village

The setting

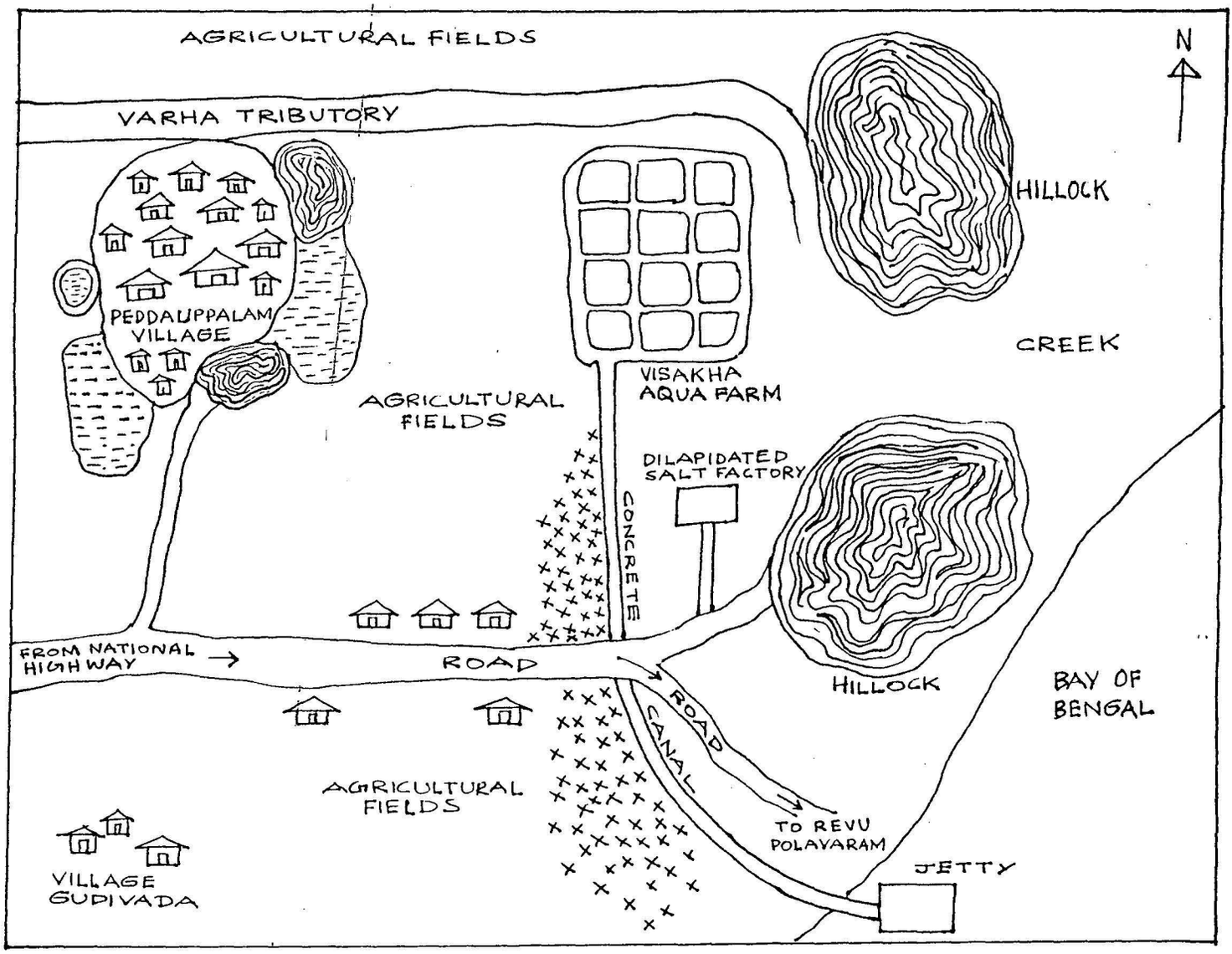
Peddauppalam village is a revenue village located in *Sarvasidhi Rayavaram mandalam* of Vishakhapatnam district. This revenue village comprises of three panchayat villages which are spatially distanced by a tributary of Varaha river. One of these panchayat village is Peddauppalam, located about 5 kilometers away from the

Bay of Bengal. The total households in this panchayat are around 380. This village is 17 kms away from the mandal office and is well connected with major centres in the district by road.

Peddauppalam village is situated in undulating terrain between two hillocks one on the southern side and the other on the eastern side both of which form the interrupted stretch of Eastern Ghats (see Figure 4.1). The hillock on the eastern side is around 4 kilometers away, in continuation with the others, along the sea coast in Bay of Bengal, which gives way to the creeks located at the interface. Apart from the undulating hillocks the village is enclosed by two ponds one each on east and west side, and towards north side a channel from river Varaha flows. This channel supplies water to the pond/tank on eastern side. The pond on western side draws water mostly from rain and water from the well adjacent to it. This is the only panchayat well supplying drinking water. The agricultural sites (fields) are scattered all around the village. The aquaculture farm is located on the eastern side about 2 kms from the village. The aquaculture farm draws sea water through a jetty of about 3 kms length, built across the south-eastern side cutting through sea coast, roads and agricultural fields of other villages. The waste water is let into channel of Varaha river flowing next to the aqua farms.

The major activities based on land and water in the surroundings of the village are agriculture and aquaculture. Agriculture is the major activity of most of the individuals of this village. Possession of land is regarded as a symbol of status and individuals of this village attach much importance to the

FIGURE -4.1
VILLAGE PEDDAUPPALAM
LOCATION MAP



LEGEND

RESIDENTIAL LOCALITY

HILLOCKS

WATER LOGGING AFFECTED AREA

possession of land. The size of (owned) land holdings in the village ranges from Ø.3 ha to 4.8 ha.

Majority of land owners belong to the velama caste who account for 42 per cent of village population. This is followed by the chettybaliji, mala, madiga who account for 58 per cent of the population. The velama community plays a major role in any sort of the village activities. The major positions (for example, village president) are held by the members of this class. Most of the labour families belong to the chettybalaji caste. A few brahmin households are also present.

4.2.1 Land use in the Village

The total land available in the village is 1194 hectares. Of this, the distribution of land between non-cultivable (government owned) and the cultivable (individually owned) is in the ratio of 2Ø:8Ø respectively. Table 4.1 shows the pattern of land utilisation in the village.

Table 4.1: Land Utilisation in Peddauppalam Revenue Village, 1995.
(in hectares)

Pattern of land use	Areas (in hectares)	Percentage to total
A. Cultivable (a+b)	960	80.40
a. Wet	648	54.27
b. Dry	312	26.13
B. Non-cultivable	234	19.60
Total (A+B)	1194	100.00

Source: Village Survey

Of the total cultivated land, 67 per cent of land is under wet cultivation and 33 percent is under dry cultivation. The cultivated

land is distributed among resident and non-resident agricultural households. The resident landowners account for 90 per cent of the land and the non-resident owners hold 10 per cent of the land in the village.

Major distribution of non-cultivable land (government land) is under roads, bunds, drains, gorge, village site, mortuary and land under miscellaneous uses. The cultivable land is under various crops. Land for aquaculture is drawn from both cultivable and non-cultivable land. The cultivable land is possessed only by agricultural households. So, at this juncture it is important to look into the household structure and distribution of land among households.

4.2.2. Household Structure and Land Holding

During the early 1990's the land was distributed among the resident and non-resident households. With the introduction of aquaculture almost all the absentee landowners have sold their land to the aquafarm which had been set up in the village. In 1996, the household structure of this village can be broadly classified into two categories, i) Agricultural Households, ii) Labour or Worker Households. The distribution of these two categories is shown in Table 4.2.

Table 4.2: Present Household Status in Peddauppalam Village, 1996.

Type of Households	Number of Households
Agricultural Households	2ØØ
Labour/Worker Households	18Ø
Total Households	38Ø

Source : Village Survey.

Altogether forty eight households were interviewed. Out of them 3Ø households (63 percent) are agricultural households and 18 (37 percent) landless households. The erstwhile non-resident landowners could not be contacted. Members in the agricultural households, apart from working on the fields are engaged in concurrent occupations such as teacher, mahila mandal president, post master. Some of these households are going out for work on other fields.

Landless workers include casual agricultural labourers, aquaculture employees, and individuals engaged in activities other than agriculture.

All the agricultural households interviewed held some cultivable land. These households have been categorised into marginal, small and medium households.[1] The study of land use reveals much, when observed in dynamic terms. An attempt is made towards bringing out the dynamics of the village Peddauppalam. Table 4.3 presents the distribution of land in this village between 198Ø and 1996.

[1] There is only one household each under medium and large size-class in the sample, and therefore these two size-classes are merged into semi-medium and is termed as medium farmer household.

Table 4.3 : Land Holding Pattern of Agricultural Households in Peddauppalam Village. (in Hectares)

Size-Class	Extent of Land Owned 1980		1996		Land Operated 1996	
	H H	Extent	H H	Extent	H H	Extent
Marginal < 1 hectares	13 (43)	6.4 (14)	14 (46)	7.7 (20)	14 (46)	9.8 (24)
Small 1-2 hectares	10 (33)	12.4 (26)	11 (37)	14.3 (37)	11 (37)	15.8 (39)
Medium > 2	7 (24)	28.8 (60)	5 (17)	16.5 (43)	5 (17)	14.8 (37)
Total	30	47.6	30	38.5	30	40.4

Source : Village Survey, 1996.

From Table 4.3 it is evident that the extent of land owned by the sample households has declined from 47.6 hectares to 38.5 hectares between 1980 and 1996. The decline in land owned can be attributed to the sale of land. The sale of land took place to buyers both within and outside the village and to the aqua farm. Land sold to the aqua farm has been converted into culture ponds. The three land sales made to the aquafarm belong to marginal (two households) and small (one household) farmers. Considering the total sale of land which took place in the sampled households, the maximum land was sold by the medium households followed by an equal amount by small and marginal. From the Table 4.3 we also see an increase in the extent of land held by marginal and small farmers, whereas a decline is observed among medium farmers between 1980 and 1996. From these observations we may deduce that consequent to sale of land, the inequality of land holdings has declined. The extent of land owned and operated on an average by a household in the village in 1996 is 1.28 hectares and 1.35 hectares respectively.

4.2.3 Agriculture and Aquaculture Activity

Agriculture is the major activity in this village in terms of employment and the area it occupies. Apart from agriculture, of late, aquacultural activity has started around this village. However the aquacultural activity has given good employment during the initial stages of its installation but in the subsequent stages the employment opportunities reduced. In terms of total absorption of labour, aquacultural activity lags behind agriculture. The employment opportunity created by this activity is discussed later in the chapter.

Aquaculture has come up around this village due to the locational specificities essential for aquaculture to flourish. It is generally believed that the aquaculture activity is confined to the coasts. However, it is found in this village that the aquacultural activity is taking place as far as about 2 to 3 kilometers away from the coast. The ponds have been constructed on the cultivable and uncultivable lands. The aquacultural activity taken up by the firm is semi-intensive.

Another interesting observation is that the aquacultural activity is not taken up by individual agricultural farmers like in most of the central coastal zone. Instead the activity has been taken up by a corporate firm called Visakha Aqua Firm. This firm is 100 per cent export oriented and is owned by a Visakhapatnam-based entrepreneur who belongs originally to a district in the central coastal zone.

Of nearly 40 hectares of land owned by the aquafarm in the village, around 1992 about 10 hectares of land has been sold by the erstwhile absentee landowners of Peddauppalam now residing in the towns of Visakhapatnam, Anakapalle, Elamanchili. Nearly 3 hectares of land was sold to aqua farm by resident households. The remaining land of 27 hectares are leased in from the State and purchased from owners of the adjoining villages. The details of selling of land across different size-classes is discussed latter in this chapter.

The absentee landowners, before selling their land to the aquafarm, had leased out their lands to some of the farmers belonging to landowning and landless households. The land owning farmer did not suffer much from the withdrawal of lease from absentee landowners. However the landless were greatly effected. One of the landless households interviewed during the survey revealed that they had taken one hectare of land on lease and were cultivating paddy on it. To quote the farmer, "... though the produce from the parcel of land was not sufficient for the family of six to survive throughout the year but lack of land is now a handicap for us". There are a few more cases in this village who had been adversely affected by the sale of land for aquaculture and many more in surrounding villages.

Having seen this difference in the use of land in two diverse activities viz., agriculture and aquaculture, it is interesting to understand the practices followed in these activities. In doing so we look in the cropping pattern. The cropping pattern of the village which not only depends upon the individual rationality but

also on various factors, among others, like soil conditions, labour, and technology.

4.2.4 Cropping Pattern in the Village

A walk through the agricultural fields shows that the texture of soil is dominated by red soil with clayey particles. The soils in *pallam* (low lying lands) are more silt laden compared to *meraka,* (high lying land). As the study is concerned with the changes in the use of land and water it is felt necessary to understand the initial cropping pattern of the village. For obtaining this valuable information, the eldest and the oldest person in the sample households were questioned about the cropping pattern which their earlier generations used to follow. The following Table 4.4 presents the cropping pattern before 1980's in the village Peddauppalam.

Table 4.4: Initial Cropping Pattern in Peddauppalam village prior to 1980: Area under crops in hectares.

Size-Class	No of HH	Area Operated	Millets	Paddy	Miscl.
Marginal	13	6.6	3.9 (59) [33]	2.7 (40) [30]	0.01 (1) [3.3]
Small	10	11.2	6.7 (60) [27]	4.2 (38) [23]	0.3 (2) [3.3]
Medium	7	28.7	14.4 (50) [23]	13.4 (47) [23]	0.9 (3) [6.7]
TOTAL	30	46.5	25.0	20.3	1.21

Note : (i) Figures in () denote the per cent of area under respective crop to total operated area in the sampled households.
(ii) Figures in [] denote the per cent of households to the total sample households cultivating the crop.
Source : Village Survey, 1996.

From the acreage allotted to the two crops it appears that the area under millets and paddy expressed as the per cent of total cropped area in the village among marginal and small farmers is nearly in the ratio of 60:40. The share of area under other crops in these classes is less than 2 per cent of the cropped area. On the whole more than half the area cultivated was cultivated with millets, less than half of the area was cultivated by paddy and a marginal proportion area was cultivated among other crops. From the distribution of crops, it can be inferred that millets along with paddy were the major crops prior to eighties. The cropping of millets and paddy can be considered as the `traditional cropping' pattern of this village.

The traditional cropping pattern or the region specific cropping system of the village in the pre-1980 period has undergone significant changes with what is observed at present in the village. The dominant standing crops in the fields observed at the time of survey were of paddy, sugarcane, sesamum and plantations of coconuts (see Table 4.5).

Table 4.5: Cropping Pattern in Peddauppalam village during 1996 - Area under crops in hectares.

Size-Class	Operated Area	C Paddy	R Sugarcane	O Coconuts	P S Oilseeds	Miscllaneous
Marginal	9.8	5.3 (55) [40]	2.5 (26) [20]	0.8 (8) [25]	0.5 (5) [15]	0.6 (6) [10] -
Small	15.8	8.1 (51) [37]	4.9 (31) [27]	1.4 (9) [7]	0.3 (2) [10]	1.1 (7) [3.3]
Medium	14.8	6.1 (41) [17]	3.0 (20) [10]	5.1 (34) [17]	0.2 (1) [3.3]	0.6 (4) [3.3]
TOTAL	40.4	19.5	10.4	7.3	1.0	2.3

Note : (i) Figures in () denote the per cent of area under respective crop to total operated area in the sampled households.
(ii) Figures in [] denote the per cent of households to the total sample households cultivating the crop.
Source : Village Survey, 1996.

This is evident from Table 4.5 that the majority of the sampled households concentrate on paddy followed by sugarcane, coconuts and oilseeds. It is observed that the land converted for cultivating commercial crops is more among medium farmers followed by small farmers. There is slight improvement in the share of area under paddy between 198Ø to 1996 from around 4Ø per cent to a little less than 5Ø per cent. During 1996, the share of area under paddy among medium farmers is less (around 4Ø per cent) as compared to other farmers from marginal and small size-class. Among medium farmers the share of area under different crops is around 6Ø per cent, whereas in the case of marginal and small farmers the share of area under other crops are less than 5Ø per cent and a little over 5Ø per cent respectively. This difference in the share of areas under different crops and paddy may arise due to two reasons. First the medium farmers are maximising their income through diversifying to commercial crops which requires less labour. Also these farmers hold fixed shares in the market of co-operative factories (like sugar factory) which is decided on the basis of land holding of these farmers. These shares are of constant source of income, as they get some remuneration for fulfilling the quota to the factory for every season, in the form of sugar. The marginal and small farmers send their produce through the medium farmers as they do not have shares in the factory. There are two possible reasons for this process. Firstly these individual farmers may not ensure to the factory the required tonnage and secondly they may not fulfill the criteria of holding the required amount of land. Also for the marginal and small farmers rice is equally a good commercial crop as it can be directly sold into the market without

any involvement of intermediaries. This is similar to medium farmers supplying the sugarcane to the factory.

Another interesting feature which emerges among the crops cultivated between 198Ø and 1996 is that the share of area under millets decreased significantly. This decrease is due to the change in the perception of the individuals in the consumption of food grains. Also the distribution of rice through PDS at the rate of Rs. 2 per kilogram around mid eighties may have reduced the share of area under this crop. This might have led to the generation of paddy surplus and export of this surplus to other states. However still in some of the farmer households part of the cultivable land is cultivated with millets.

4.2.5 Rationale for the shift in cropping pattern

Having seen the changes which have taken place in the cultivation of crops in Peddauppalam village before 198Ø's and in 1996, it is important to find out the factors responsible for the changes over time. We try to examine some of the reasons behind the shift from `traditional cropping' system to the present cropping pattern in this village.

According to the reasons put forth by the villagers, it is found that the technology and market played important role in modifying the cropping pattern of the village. In what follows, we will analyse the effect of these two factors in some of the major crops.

Paddy

The villagers stated that the new varieties of paddy, that is high yielding variety (HYV), with their short durations of gestation was preferred by most of the farmers. The HYV paddy had many advantages over the traditional variety of paddy and this initiated conversion of cultivable land used for cultivating millets to paddy. Also there was a shift in consumption of foodgarins from millets to rice during the last ten years. This change in the habit of consuming rice over other inferior cereals might have paved the way for conversion. Also the subsidies provided for cultivation of paddy by the state in order to achieve self sufficiency in food might have led to the change in cropping pattern.

Sugarcane

According to the villagers, market value of sugarcane during the initial stages of its cropping around early eighties is seen to be an important factor for shift towards this crop. Coupled with the high rates of sugarcane the functioning of a co-operative sugar factory at Darlapudi around early 80's initiated conversion of cultivable land to sugarcane cultivation. This factory is situated closer to this village than other factories located at Anakapalle and Gowada. As there was a market for their produce the villagers started converting their cultivable lands into sugarcane fields. Apart from this they converted some of the low lying fields where paddy was cultivated earlier, for cultivating sugarcane. Though the amount obtained (rupees per acre) for paddy and sugarcane during later half of eighties were same, villagers preferred sugarcane as it was encouraged by the factory.

Coconut

During the same time an agricultural research station situated at Anakapalle propagated a hybrid variety of coconut. They started distributing coconut saplings to farmers initially free of cost and later at a very marginal cost. Initially the farmers started planting coconuts on the bunds but subsequently shifted to proper development of land under plantation.

Complementary to this during the same period the office of the Irrigation Development Corporation at Elamanchili started a scheme of providing borewells costing Rs. 1.3 lakhs almost free of cost. They have provided about 60 to 70 wells in this particular mandal. Apart from this, modern methods of irrigation such as drip irrigation were promoted by government and non-governmental agencies in this region. According to some of the villagers there is a noteworthy increase in the yields of nuts per tree from late 80's to the recent period.

All these developments in and around the village seems to have a profound impact in shifting from one crop to other over time.

It is of interest to look for other important activities taken along with agriculture in the village. We present here some of the other agriculture allied economic activities taking place in the village.

4.2.6 Agriculture and Allied Activities

Subsistence farming: From the information given by the farmers, it is learnt that some of the farmers especially small are engaged in

subsistence cropping along with some of the commercial crops. The commercial crops which are cultivated on their fields is out of the desire to earn money for their livelihood. Apart from commercial crops, one of the household interviewed sells the vegetables and coconut within the village and to the nearby village. This farmer is surviving on the sale of these products and lending his labour for agricultural work on other fields.

Commercial Cropping : Among food crops, paddy and sugarcane are considered as commercial crops. Among non-food crops, commercial crops are groundnut and coconut. These crops are cultivated by almost all the farmer classes. The produce of these crops find a direct sale in the market without any processing. Market for coconut exits in the mandal itself. All the coconuts are supplied from the village to the godown on the national highway. As per the villagers about 60 coconut trees can be accommodated on an acre of land. Income for various size class from coconut is presented in Table 4.6.

Table 4.6: Income for different size-classes per household from Coconut Trees

Size-Class	Number of Nuts per year	Amount(Rs/year/HH)
Marginal	648	227
Small	1116	1563
Medium	4092	2292

Source : Village Survey.

Livestock Rearing : Another interesting phenomenon observed in the village is that of cattle rearing. With the given unequal distribution of land and other disparities, the social and economic relation cannot exist without interdependence and this proved in

this setup of livestock rearing. The interdependence gives rise to a sort of relationship of patron-client. The landless households adopt a unique system of rearing cattle based upon traditional patron-client relationship which are in vogue for over several generations. This relationship get established from within the village or from outside the village. The client rears the cattle and takes full responsibility for feeding and caring. The proceeds after the sale are divided equally between the patron and the client. Some of the landless households rear cattle and earn their livelihood from this kind of animal husbandry. In the rearing business the involvement of the women's is found to be much more. Mostly the girls in the family take the cattle for grazing. One of the families has five female members and all of them are engaged in rearing of the cattle. Apart from the landless households, all the agricultural households rear cattle either for milk or for farm works. Marginal and small farmers rear the cattles for farm activities also. The composition and quantity of cattle across size-classes is presented in Table 4.7.

Table 4.7: Cattle distribution across Size-class in Village, 1996.

Size-Class	No of H H	Number of Milch	Non-milch
Marginal	8	1Ø	2
Small	8	14	3
Medium	4	5	6
TOTAL	2Ø	29	11

Source : Village Survey.

Most of the households rear cattle for their own use and also for selling milk to the milk co-operative. In mid eighties there were only government cooperative working in the area. However, now

private milk purchasing agencies have come up. All these organisations rate the milk according to the fat content. Apart from selling milk some of the households sell butter milk within village.

The cattle are reared through stall feeding and also taken for grazing them in open uncultivated lands. Inspite of taking for grazing on open grounds households feed the cattle in the stall to get milk with more fat content. The fat content of the milk determines per liter rate of milk.

Mahila Mandal Schemes: With the help of local NGO (NEEDS), the women of this village are in a project for rearing fresh water fish in the village ponds. The project envisages the economic upliftment of the women in the village through their coordinated effort. The participation of the women is ensured through their involvement in the maintenance of the ponds and through feeding and looking after the ponds. The sale of fish is to be made through auction and thereafter equal distribution of proceeds between all the members of the scheme.

Shrimp Cultivation : Shrimp cultivation by the Visakha Aqua farms is taken up very near to the village. This farm has provided employment for a few individuals from the village. Seasonal labour required for the maintenance for the ponds is met from the village as well as from the surrounding villages.

4.2.7 Development of Aquaculture

Among many villages in this *mandal*, this village is one where semi-intensive shrimp production activity has penetrated on land. The peculiarity of the activity in this region is that none of the individuals from the village or the adjacent villages have started aquaculture on their own. Instead a person migrated from a far away place to this district started the aqua farm. He owns the aquafarm which is a 100 per cent export oriented unit. The Table 4.8 presents the sources from where the land for aquaculture has been acquired in village Peddauppalam by the aquafarm owner. The government land was made available with a notification following a request from the farm to the government for lease of land which was lying in between the farm. Government positively responded and allotted 27 hectares to the aquafarm.

Table 4.8:Sources of Land acquired by the Aquafarm in the Village.

Source of Land	Extent (in hectares)
Absentee Landowners	10
Government Owned	27
Resident Landowners	3

Source : Mandal Office, S. Rayavarm Mandal.

The development of aquaculture in this village is on the hinter land which is 2 to 3 km away from the coast. So, the aquaculture activity in this village is spared from the recent Supreme Court verdict as it is not within the 500 meter zone of Coastal Regulation Zone.

The development of the farm in this village has not only affected individuals of this village but also individuals from other villages and in totality the whole sub ecosystem of this region. A jetty pumps sea water into a concrete canal of about 3 to 4 kms long, running all along from the coast cutting a number of agricultural fields, hindering the flow of water from the agricultural fields and roads and making the life of the villagers difficult. The natural drains taking away the water from the fields is hindered due to the concrete canal creating artificial waterlogging conditions initially and subsequently getting permanent. The crops, as enquired, getting adversely affected by the waterlogging conditions when the water for crop is not required for the further development of the crops.

Aquacultural activity in this village has greatly boosted the land values. Prior to the introduction of aquacultural activity, land transaction took place only for agricultural purposes. The rate of land for such transaction was around Rs.6ØØØ to Rs.9,ØØØ per acre in the late 198Øs. With the introduction of aquaculture in the village the rate of the same parcel of land went up to Rs.4Ø,ØØØ and Rs.6Ø,ØØØ in early 199Øs. As mentioned earlier, in an agricultural setup like this, much importance is attached with the possession of land. So, the individuals in the village who sold off their land to the aquafarm purchased lands in areas far away at cheaper rates.

Land Market and Sale of land

In reality the land market got activated in this village only after the introduction of aquaculture. Aquacultural activity has directly

and indirectly influenced all the three groups of landowners (mentioned above in table 4.8) to put their land for sale/lease. This activity triggered off a chain reaction in the land market raising the land rates. Here it is identified that one group has helped initiate the sale of land, other group helped promote the sale whereas the third group were really involuntary followers who were forced to sell their lands to aquafarms.

Initiators: The first group, absentee landowners, were the activators of the land market in the present land utilisation pattern of aquaculture. They succumbed voluntarily to the lucrative rates offered by the aquaculture entrepreneurs in the region.

Promoters: The administration announced the lease of the government owned lands through a notification following the aqua entrepreneurs' representation to the State. Thus, the State actively promoted aquaculture business in the village by leasing out the land at the rate of Rs. 5000 per acre per year.

The sudden quantum hike in the rate of land initiated two reactions. On one hand, the hike in rates of land resulted in the voluntary jump of the absentee landowners forwarding their land for sale. And on the other hand, the purchase of this land helped the aqua entrepreneurs to get the lease of Government lands which were lying in between their agricultural lands which were now being used as aquacultural farms.

Involuntary Followers: The third group's entry into the land market was totally involuntary. The sale of the land was more because of

compulsion. The landowners whose lands were within immediate vicinity of the aquafarms resorted to distress sales. Before the aquaculture production started, some of the key persons started spreading information as `the land adjacent to the farm will get affected by the production process and it is better to sell the land'. This fear gripped most of the landowners in the vicinity of the aquafarm and they resorted to distress sale. Some of the land owners did not succumb to the rumours and continued with their agricultural activity. As soon as the aquaculture production started, in the first year itself these plots were affected. And ultimately these landowners had to sell their land. Also, there are cases of forceful sale of land. In a nearby village, a villager was forced to sell his land as he was denied access to his fields passing through the aqua farm lands. This obstruction for entry to his field compelled him to sell the land.

Total sampled households who had sold their land constituted about 46 per cent. All the transactions to aquaculture took place after 199Ø. The amount obtained after the sale to aquafarm was reinvested by small and medium farmer household on land itself in other far off villages. Marginal farmers had invested some amount on purchasing cattle and cleared their debts.

The sale which took place among the absentee landowners and aquafarms has adversely affected the class of people who were dependent on those lands for employment. Both the parties were rational enough to maximise their net private benefits. However, this Pareto optimality condition of the parties led into serious distributional implications. These distributional aspects took the

form of externalities which were reflected on the landless households or the class which is dependent on these parcels of land for employment. These externalities are reflected as disturbances at local level ecosystems by giving rise to many biological and physical cause effect relationships.

Forms of leasehold tenure are present in the village and is prevalent in agriculture. For aquaculture activity the government leased the land to the aquafarm. Forms of leasehold tenure persisting in the village include formal fixed rent tenancies, share cropping arrangements and pledging.

Labour force and Employment Scenario

From the distribution of households in this village, we see that there are almost equal number of households of laborers as that of agricultural households. This is supported by the fact that all the holding size-class employ labor from within the village. Seventy three per cent of the agricultural households employ labor. Moreover the laborers from this village go for work to other villages (see Table 4.9).

Table 4.9: Hired Labor for one year of Paddy Crop across Farmers in Peddauppalam Village.

Size-Class	No. of Persons Employed			Persondays/ha/year
	Male	Female	Total	
Marginal	28	5Ø	78	585
Small	2Ø	38	58	435
Medium	26	56	82	615

Note : PD represents persondays.
Source : Village Survey, 1996.

Laborers of this village are engaged broadly in three major activities. They are employed as agricultural labor, aquafarm labor and other type of labor work. Of the 18 worker households interviewed 9 are engaged in agricultural labor activities, 4 are engaged in aquacultural labor activity and remaining 5 are engaged in other labor activities. Other labor/ worker are engaged either as coolies, or as middlemen weighing the agricultural produce etc. These specific activities of third category of laborers are inherited from generations within such families. Depending upon the crop cultivated the operations change.

In cultivation of paddy, various stages of operations are involved. At each stage the requirement of labor is different. The sequence followed for paddy in this village is somewhat like this. First the field is ploughed and watered for some 3 to 4 days. This activity is done solely by male workers. Ploughing on most of the fields in this village is done with the help of farm animals. Most of the agricultural households own farm animals. Another practice which is followed currently is to hire a tractor on rent. This is mostly adopted by a few medium class farmers. So ploughing and preparation of the agricultural fields require less labor due to adoption of farm mechanisation. Simultaneously seedlings are prepared on a small piece of land. Seedlings are known as *nara*. Then this *nara* is transplanted into the watered field. This process of transplantation requires mostly female laborers who are skilled in work which requires bending of back. Also this operation employs the much of labor. Weeding process is conspicuously absent as the conditions prevailing in the fields do not promote the growth of weeds. The reason might be that the fields are watered which does

not allow any growth of weeds. In between several processes are taken care by the farmer himself. Next requirement of labor is at the time of harvest. During this time both male and female labor are absorbed equally. They cut the produce and leave it in the field itself for some time and let it dry in the sun. After this the produce is brought to the house or within the field at one place known as *paaka*. Here paddy spikes are collected and grass is separated. In this village separation is carried out with the help of farm animals.[2] For next seasons seeds, the spikes are separated manually, as the seeds obtained using animals or machines are not suitable for propagation. In all these process there is much employment generation for the laborers.

The estimates given by the farmers show that for a given paddy field of one hectare, about 29 days of work is generated for a for a season.

In aquaculture, the labor absorption is very high during the start of the industry. This is because various operations are involved for starting of any aquafarm. For instance the land is to be levelled, ponds are to be dug out and various equipments are to be installed. Once these process are over the employment comes down for the years. Except for the seasonal maintenance of ponds, labor is not required much during the season. The firm employs some of the skilled labor for looking after the ponds.

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[2] Also it may be carried out with machines and humans.

An analysis of the labor absorbed in paddy and aquaculture can be worked out in three stages of employment generations. These stages can be categorised in both the activities as i) total employment of labor per year, ii) employment opportunity for male and female absorption.

i) Total Employment (persondays per hectare per year)

Paddy	948
Aquaculture	512

ii) Employment opportunity: Male-female

(persondays per hectare per year)

	Male	Female	Total
Paddy	292	656	948
Aquaculture	472	40	512

From the above analysis we can infer that the employment generated i.e., number of persondays generated per hectare of land per year by cultivating paddy is more than that for aquaculture. About 6 to 8 persons per hectare per year can be employed for paddy cultivation whereas about 2 to 3 persons per hectare per year can be absorbed in semi-intensive aquaculture.

The sex-wise labor employment shows that for cultivating one hectare of land with paddy for one year, the number of female labours employed is 656 persondays and male labor is around 292 persondays. Whereas in aquaculture the number of persondays generated from culturing one hectare of land per year is about 472 persondays for male laborers and 40 persondays for female laborers.

The displacement in terms of opportunity to work is sharp between male and female. The work offered to females in aquaculture declines remarkably. Almost a little over five per cent of female

are with work when there is switch over to aquaculture from paddy cultivation.

The employment scenario in Village Peddauppalam is presented for different crops among the sample households. The number of persondays for different crops is calculated by using the data collected from the villagers through interviews. For aquaculture the number of persondays are arrived from the EIA report submitted to the mandal office. The Table 4.1Ø shows the total persondays required for various crops between 198Ø and 1996.

Table 4.1Ø: Cropwise persondays per year for the total available land in Village Peddauppalam.

Crops	198Ø	1996
Paddy	19244	18486
Millets	2214	na
Sugarcane	na	8Ø34
Oilseeds	na	69Ø
Aquaculture	na	6656

Source : Village Survey & EIA report of Rank Aqua,Vizag.

From the village about 11 individuals were offered work throughout the year in the aquafarm. Three individuals are employed as feeder boys and one as electrician. This electrician completed his course during early 8Ø's however since then he was almost unemployed till he joined this farm.

4.2.8 Ecological Aspects and Access Rights

The major ecological problem observed in the vicinity of the aquafarm is that of waterlogging. The agricultural fields which are surrounding the farm are submerged in the stagnant water. This has

accrued heavy losses to the owners of the fields who are from other nearby villages.

The lands adjacent to the hillocks were used as pasture grounds. With the conversion of lands to aquaculture almost all the nearby villagers have lost their access to the common place. This is a serious issue which has come up with the starting of aquafarm.

4.2.9 Social Protest

Social protest against the aquaculture are the least reported from Zone I. The owner of the aquafarm, who has migrated from the adjacent district (from Zone II), is well known in the all the surrounding villages. Prior to taking up aquaculture, the owner of the farm helped number of villagers. So most of them did not protest for the proposal of setting up the aquaculture.

Also the Government administration was in favour of allotting the lease to the owner. The aquafarms in the mandal are scattered throughout and are not in continuation. Therefore the negative effects of the discharge of effluents from the farm are not felt on massive scale. The few who get affect are unable to raise any protest.

The non governmental organisation who are active in these regions are interested more with the issues of social forestry, joint forest managements and less interested with the cause-effects of aquaculture.

Thus we see a village which is dynamic and adapting itself to the changes brought about at the micro and macro level.

4.3 Case Study of Thuppilipalem Village

The Setting

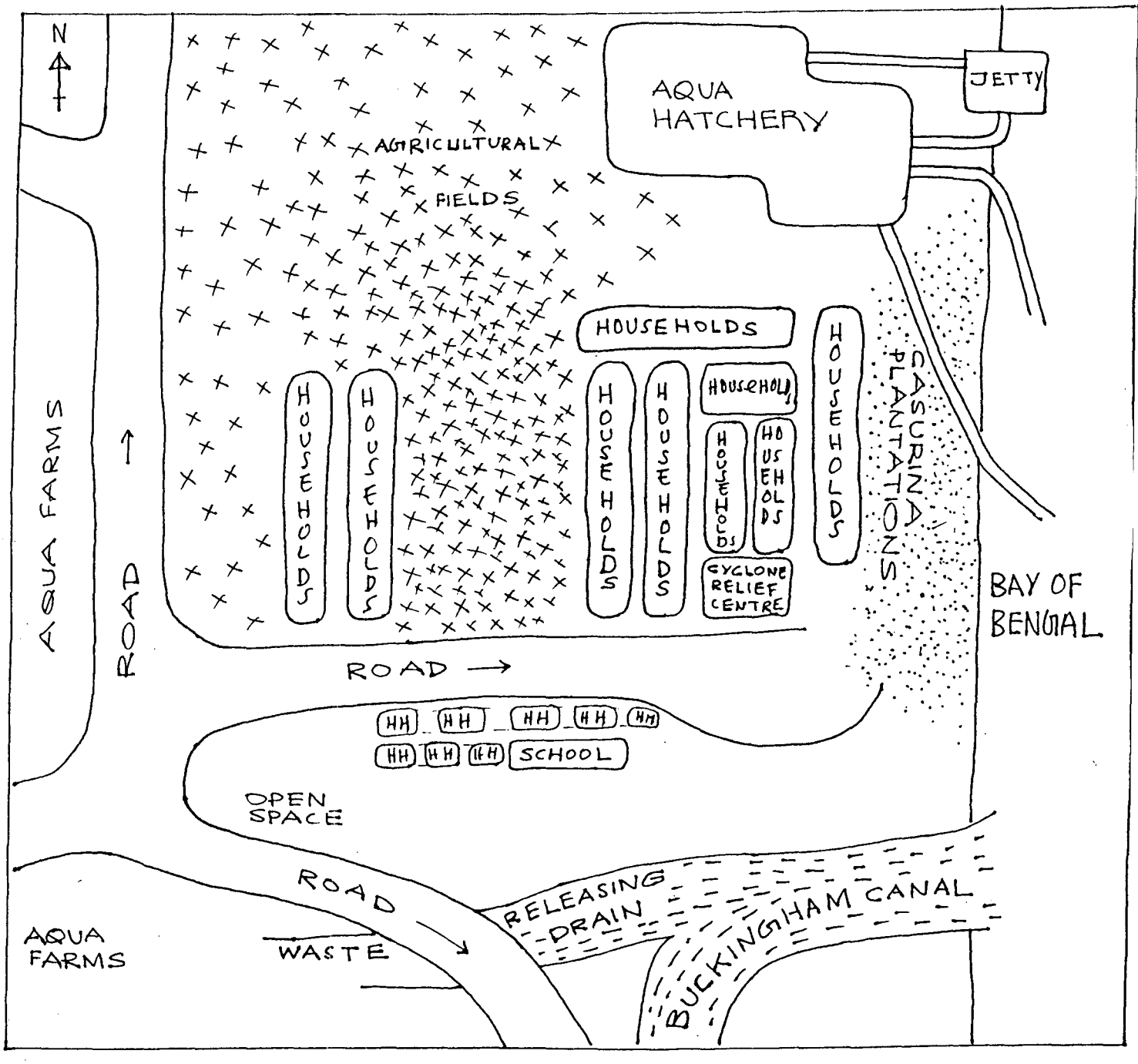
Thuppilipalem village is a panchayat village located in Vakadu mandal of Nellore district in south coastal zone. The nearest bus station is about two kilometres.

Thuppilipalem village is surrounded by shrimp farms on the three sides and on the other side by Bay of Bengal (see Figure 4.2). Apart from the village site and the agricultural lands possessed by the villagers, only the roads are the terrestrial connections left which connect this small village of 180 households to the rest of the mandal. Buckingham canal which runs throughout the whole beach area upto Madras is seen silted near this village. Towards the western side of the village, approaching Andalmala village, in the midst of the abandoned ponds a patch of barren and uncultivable land can be observed. This village has got a government guest house and a cyclone relief shelter on the eastern side. Most of the houses are thatched kutcha houses. There are a few concrete houses. At the time of the survey it is observed that many of the house constructions were going on.

Major activities in and around the village are fishing, aquaculture and agriculture. However fishing is the major activity of this village. Before the aquaculture activity was taken up almost all the households were engaged simultaneously in fishing and

FIGURE 4.2

VILLAGE MAP OF THUPILLIPALEM



agriculture. At present a few households are engaged in agriculture. All the households belong to fishing community and are known as *pattapus*.

4.3.1 Land use in the Village

The land use pattern of the village shows that nearly 73 per cent of the land is non-cultivable. This portion of land is held by the government. The rest 27 per cent of the land is cultivable.

The soils of the region are coarse textured red soils with moderate to high proportion of sands. The soils are lacking clay content and thus are loosely bound to each other. Also the moisture retention of the soil is low.

The crops which are grown on these soils are mostly paddy, sugarcane and oilseeds. After the aquaculture is introduced in this region most of the cereal crops couldn't be grown. Only the crops which can tolerate salt are able to grow. The soils can support aquaculture but the costs incurred by the individuals is more. Therefore the small farmers are not able to venture into aquaculture activity, whereas the corporate firms are only thriving. The aquafarm managed by the corporate firms are very large (above 100 hectares) and the size of the ponds is also large. The ponds are partitioned by using sand filled gunny bags. These bags avoid silting of the pond bunds.

The broad land utilisation pattern of the village is presented in the Table 4.11. The available land can be classified as cultivable

land and non-cultivable land. Non-cultivable land can further be divided into culturable wastes and land under non-agricultural use.

Table 4.11 : Land Utilisation in hectares for Thuppilipalem village, 1995.

Total Land	Cultivable	Non-Cultivable	
		Culturable Waste	Area Under Non agricultural Use
27Ø	72	134	64

Source : Village Survey, 1996.

Area under non agricultural use include rastas and roads, bunds, sand stretches towards coast, village pond, drains, gorge, village site and a casurina belt which stretches along the Bay of Bengal.

4.3.2 Household Structure and Land Holding

The households in this village can be classified into fishermen, agricultural and labor households. The household classification (Table 4.12) shows that about 81 per cent of the households are fishing households 11 per cent are agricultural households and 8 per cent are worker households.

Table 4.12: Household Classification in Thuppilipalem Village, 1996.

Type of Households	Number of Households
Fishermen Households	145
Agricultural Households	2Ø
Labor/Worker Households	15
Total Households	18Ø

Source : Village Survey.

Twenty households were interviewed involving all the three strata. As we were mainly interested in understanding the changes in the use of land, our thrust was mostly focussed on the agricultural households who owned land. Moreover all the fishing households are homogenous. Fourteen agricultural households, four fishermen and two labor households were interviewed. Almost all the fishermen households were dependent on open sea fishing. Most of the fishermen families were migrants from Tamil Nadu around three to four generations back. They are still closely linked to their villages of origins in Tamil Nadu. Most of the elderly persons in this village know Tamil. Some of the households of the worker class are trading fish in Tamil Nadu.

Almost every land owning household from this village had sold some of their agricultural land to the aquaculture farm. Among the interviewed households all of them had sold some of their lands to the aquafarm.

Generally, in marine fishing villages agricultural activities does not take place simultaneously. But the specialty of this fishing village is that agricultural activity is regarded as a subsidiary occupation along with fishing. One of the fisherman cum agriculturist was recalling that they cultivated enough rice to have a good meal along with the fish and were self sufficient for their food needs. Over time agricultural activity got reduced to a few households. One of the reason attributed for the decline in the area under cultivation over time was aquaculture activity.

Aquaculture in this village was started by late Magunta Subbi Rami Reddy, MP from Prakasam district. The firm which is centered in this village owns about 486 hectares of land. Of the total, 162 hectares is operational at present.

4.3.3 Land Holding

The households who are owning land considerably depend on land and attach importance to their land holdings. All the households have their homesteads on which they have built their houses. The space around the houses is common for two to three houses. Despite the pressure from the conversion of land to aquaculture, most of the households owning land held back some portion of their land. Table 4.13 presents the land holding pattern of the village between 1980 and 1996.

Table 4.13 : Land Holding Pattern of Agricultural Households in Thuppilipalem Village. **(in Hectares)**

Size-Class	Extent of Land Owned 1980		1996		Land Operated 1996	
	H H	Extent	H H	Extent	H H	Extent
Marginal < 1 hectares	6 (46)	3.9 (19)	10 (72)	4.2 (30)	10 (72)	4.0 (39)
Small 1-2 hectares	4 (31)	6.0 (29)	2 (14)	3.4 (24)	2 (14)	3.4 (33)
Medium > 2	3 (23)	10.7 (52)	2 (14)	6.6 (46)	2 (14)	2.8 (28)
Total	13	20.6	14	14.2	14	10.2

Source : Village Survey, 1996.

From Table 4.13, it is evident that extent of land owned by the total households has declined from 20.6 hectares to 14.2 hectares between 1980 and 1996. The decline in land holdings is due to sale

of land for aquaculture activity. Land sold to the aquafarm has been converted into culture ponds.

In the early 198Ø's, marginal farmers had less than 2Ø per cent of land in their possession and around 5Ø per cent of land was in the hands of medium farmers. By 1996, the share of land owned by marginal farmers increased to 3Ø per cent whereas the share of area owned by medium farmers declined by almost 6 per cent.

The downward movement of the agricultural households by size-class between 198Ø and 1996 as a result of the sale of land to aquafarm is no sign of distress. The amounts obtained for the sale of land were very rewarding. The sale price of the land went from a very low of Rs.4Ø,ØØØ to Rs. 1,ØØ,ØØØ per acre between 1988 to 1996. It was this high amount offered for a parcel of land which attracted many villagers to offer their land for sale. The reason for the sale of land by most of the farmers was the proximity of the aquafarm to their fields and the consequent fear of degradation due to intrusion of saline water.

Thuppilipalem village is one among a few villages in Nellore district where almost all the lands, both cultivable and uncultivable lands, have been converted into aquafarms. As there are no lands left to purchase in the surroundings of the village, land is regarded as an important resource by all the households. The amount obtained from the sale of land cannot be reinvested in land in far off places because their main occupation is fishing. Therefore, whatever land is left with the individuals is preserved with utmost care. The amount obtained from the sale of land, in

this village, is spent on construction of houses and purchase of two wheelers etc. At present the sale of land has virtually come to an end for two reasons: firstly the villagers are not willing to sell their land any more and secondly the aqua entrepreneurs are also not in a position to decide whether to expand their business in the wake of the recent Supreme Court decision.

4.3.4 Cropping Pattern in the Village

The soil type of this village shows loamy structure with a moderate proportion of sand. The crops cultivated here are mostly paddy, sugarcane, millets and oilseeds. At the time of visit, standing sugarcane was seen in the fields along with some sesamum.

It is observed that the crops cultivated in the village are predominantly rain-fed. Apart from this the fields are irrigated by open wells. A seasonal canal, known as *yeru*, develops during rainy season and merges with the Swarnamukhi river flowing through Vakadu mandal. This seasonal stream also provides drinking water to all the surrounding villages. Due to the seasonal stream the water tables in the surrounding area is moderately high.

Though this village is a coastal fishing village it is different from the other coastal villages of the delta region. In the other villages of the delta region there is no beach front as such between the fields and the sea. The agricultural fields creep till a few meters from the sea. This type of situation is however not seen in this village. The soils of this region do not permit such extensive cultivation. Based on the soils of this region it is

interesting to note the type of crops cultivated about two decades ago. Table 4.14 presents initial cropping pattern prior to 198Ø.

Table 4.14: Initial Cropping Pattern in Thuppilipalem village prior to 198Ø - Area under crops in hectares.

Size-Class	No of HH	Area Operated	Millets	Paddy
Marginal	6	3.9	2.7 (69) [29]	1.2 (31) [12]
Small	4	6.Ø	2.6 (43) [28]	3.4 (57) [35]
Medium	3	1Ø.7	4.1 (38) [43]	5.1 (48) [53]
TOTAL	13	2Ø.6	9.4	9.7

Note : (i) Figures in () denote the per cent of area under respective crop to total operated area in the sampled households.
(ii) Figures in [] denotes the per cent of households to the total sampled households.
Source : Village Survey, 1996.

From Table 4.14, it is evident that the land operated is almost equally distributed between two major crops namely paddy and millets during the 8Ø's. Other crops such as oilseeds, which occupied a very small share of area, were mostly cultivated by medium farmers. It is observed that the number of households cultivating millets are more in marginal farmer category, whereas the number of households cultivating paddy are comparatively more in small and medium farmer households. While enquiring into the status of agricultural production in the village, it became evident that the village was self sufficient in cereals required for

household consumption. Prior to eighties, significant changes took place in the agricultural scenario over the last two decades or so.

The same proportion of millets and paddy crops were not maintained and the scenario changed with the cultivation of other crops. In the present cropping pattern, there is a shift in the variety and type of crops cultivated compared to the initial crops cultivated. Table 4.15 presents the area under different crops across various holding size class during 1996.

Table 4.15: Area under Different Crops across Size-class in Thuppilipalem Village during 1996. (in hectares)

Size-Class	Operated Area	C Paddy	R O Oilseeds	P S Miscl. Crops
Marginal	4.Ø	3.1	Ø.5	Ø.4
Small	3.4	1.4	1.6	1.4
Medium	2.8	1.6	-	-
TOTAL	9.Ø	6.1	2.1	Ø.8

Source : Village Survey, 1996.

Though area cropped has declined substantially, there is a shift in terms of crops which are cultivated in the village compared to the initial periods (8Ø's) when much of the cropped area was cultivated for paddy and millets. The shift has taken place to the crops which can easily adapt to the prevailing environmental conditions and among these crops oilseeds and sugarcane emerged over time. Sugarcane is found to tolerate some of the saline conditions of soils. With more and more of saline water intrusion on the land, crops like sugarcane seems to be good alternative compared to the traditional crops like millets and paddy.

The present cultivation pattern of the village shows that of the total operated area, among the interviewed households, nearly sixty eight per cent of cultivable land is occupied by paddy, twenty three per cent by oilseeds and remaining nine per cent is occupied by miscellaneous crops in which sugarcane figures prominently. The oilseeds which the households grow are sesamum and groundnut. The shift to oilseeds can be attributed to the following reasons: first that this crop requires less water and that too only during certain stages of development and secondly the market price of oilseeds is more. Therefore, for household consumption they started cultivating these crops.

4.3.5 Economic Activities in the Village

Apart from agriculture, the other economic activities which are taking place in this village are related to fish and fish products. There is a diversification of the products in fishing itself. Most of the women are engaged in preparation of fish products. This has helped the women to form a mahila mandali organisation and also to run a thrift society.

One of the fishing households in the village is trading in fish and shrimps. This particular householder purchases the fishes caught in the sea during fishing and sell them to some of the aqua feed preparing companies in Nellore for supply to the domestic market in other districts. The preparation of fish feed is one of the activity in which the district has reached saturation. The feed manufactured over here is exported to other coastal districts and neighbouring states.

of a jetty on the beach hinders the free movement of fishermen. Apart from that the water is pumped to the hatcheries based on the land next to the villagers residential area. The wastes from this hatchery are left on the beaches which is affecting the area and the fisherfolks. Also the wastes from the grow out ponds is channelled to the sea through a waste canal which joins the Buckingham canal on the south. Earlier this canal served as a transport route to Madras. Also this canal was full of fish which were harvested by the residents when they did not go to sea for fishing.

4.3.7 Labor market and Employment

From the survey it is found that the requirement of labor for the agricultural operations is not fully met from within the village. The agricultural households depend upon the labor supply from the neighbouring villages. The employment scenario of the village shows that there is increase in the number of person days between 198Ø and 1996 (see Table 4.16).

Table 4.16: Cropwise persondays per year for the total available land in Village Thuppilipalem.

Crops	198Ø	1996
Paddy	9196	5783
Millets	833	na
Sugarcane	na	87
Oilseeds	na	189
Aquaculture	na	3277

Source : 1) Village Survey and 2) GOI, Cost of Production report.

The composition of hired labor in the village shows that the absorption of male and female labor per hectare on an average is

more in small size holding class. Though the other villages surrounding this are agricultural based, the availability of labor for agriculture during some of the seasons, such as when there is work in the aquafarm, is scarce. In this process agriculture and aquaculture compete for labor and agriculture suffers in the process.

4.3.8 Ecological Aspects

The village is facing the problem of salinisation of water aquifers in and around the aquafarms. This problem is getting aggravated in summer. On examination of the water quality it is found that the water is laden with suspended solubles which might have leeched from the wastes of the aquafarm. The quality of water is deteriorating to such an extent that it will be unacceptable to any outsider. With saline waters the households who take up agriculture are unable to cultivate any staple crop.

In the particular mandal due to leeching of chemicals from the aquafarm the tamarind and neem trees are showing signs of wilting and so are dying.

On account of aquaculture in almost all the coastal mandals of this district, the forest cover has declined over the years. In Vakadu mandal to which Thuppilipalem belongs, the forest cover declined from 2.8 per cent in 198Ø to a mere Ø.7 per cent of geographical area in 1996.

The right to access and use to the common lands of the fishermen is grossly violated in village Thuppilipalem. The fishermen who were

earlier using the beach for their net drying and mending are not allowed to do so. Instead they have to mend them in front of their homesteads.

Traditionally the villagers were in the possession of the coastal forests. The Government in early 1980's on the pretext of social forestry and farm forestry programmes took away the forest from the control of the villagers. The Government formed an organisation called Shore Area Development Authority. This organisation restricted the villagers from using the coastal areas. Later this very organisation of the Government paved way for the aquaculture farms by leasing the lands. In this way the government alienated the villagers from their right to use.

The site where the jetty is placed is hindering the movement of fishermen. They complained about loss to their fishing nets. The parking place of their kattamarams is encroached by the aquafarm.

4.3.9 Social protest and the role of women

Women of the village have to walk about 2 kilometers, upto the *yeru*, to fetch drinking water for their families. The borewells in the village have become saline due to the intrusion of salt water intrusion from the surrounding aquafarms. Till the early eighties the coastal forest were in the possession of the village community. The intervention of Government in implementing social forestry and farm forestry programmes alienated the villagers from the use of the forests. Earlier the women of the village used to collect the wood required for their households from the nearby coastal forests. Now they have to collect the wood from far off places.

The misery did not end with the collection of wood and water for the family. Another problem the women of this village had faced was the evil of arrack. Arrack has destroyed the whole economy of most of the villagers.

To fight against this evil, women of this village organised themselves into a strong organisation. They got the support of the mandal revenue officer and the collector of the district. This organisation has actively participated in the anti-arrack movement and earned credit for banning arrack.

Kottamma, the person behind all these narrated her experience about the days of the anti-arrack movement. She blamed aquaculture to be the real culprit for ruining their lives. She explained how conversion of paddy fields to sugarcane displaced the labor and reduced the days of employment. Displaced labor started spending more money on arrack sitting at home. For want of money the head of the family, finally resorted to sell the land to the then emerging aquaculture. Growth of aquaculture displaced sugarcane and caused further reduction in the employment prospects. This compelled all the womenfolk to unite and fight against arrack until the arrack ban came into force. Afterwards, this organisation continued and are taking up activities to elevate their economic status.

Realising the importance of land for their survival the villagers came together to fight against the ill-effects of aquaculture. The villagers joined the campaign against shrimp aquaculture. Social Action Groups working at various levels in AP and other States formed a consultative body in the campaign against shrimp

industries. A *pada yatra* was organised throughout the villages where the aquaculture is practiced on large tracts of land along the seafront. The yatra was organised with the intention of educating the villagers of the ill-effects of commercial shrimp farming. The way through which the villagers were educated, took the form of a mass protest against shrimp aquaculture. The protest got recognised and gave a boost to their morale with the temporary stay order to stop any new construction of shrimp aquafarms. In all these movements the role played by the women of this village was commendable.

4.4 Dynamics of Conversion: Comparison of Peddauppalam and Thuppilipalem Villages

The above discussions highlighted the diversification in the use of land and water in the two villages Peddauppalam and Thuppilipalem. We have seen that the two villages are totally distinct, the former being an agricultural village and the latter being predominantly a fishing village. Aquaculture activity has come up as a process of diversification in land and water use surrounding the two villages. This part intends to make an attempt to highlight some of the processes witnessed by these two villages. In doing so, we discuss the changes not only in terms of the social forces which have brought them about, but also in terms of the alterations made in the use of natural resources, especially land and water, when subjected to these forces.

In Peddauppalam village we see that agriculture is the predominant activity. In Thuppilipalem village we see two diversified occupations are taken up by the villagers - fishing and

agriculture. Initially, in both the villages a shift has taken place in cropping pattern over the period. Subsequently, both of these villages diversified to aquaculture. The aquaculture activity in both the villages in not in the hands of the agricultural households, instead it is in the hands of an entrepreneur who is not from the same region.

Peddauppalam diversified its economic base by getting into agriculture related activities such as cattle rearing. This feature is absent in Thuppilipalem. Instead it diversified to fish products which was not initially marketed to the adjacent villages.

In both the villages much importance was given to possession of land. However the villagers in the Peddauppalam invested in land in far off places from the village at cheaper rates. Whereas Thuppilipalem village the amount was spent on construction of permanent houses and purchase of vehicles.

In Peddauppalam village the process of commercialisation was of gradual nature. The produce went through the markets of village, mandal, state and then international. In Thuppilipalem village, the integration in the market took giant leap from local to the international market. There is a diversified product market existing in Peddauppalam village. Paddy finds its way upto national level markets, coconuts and sugarcane upto state level market, oilseeds at mandal level market, and shrimps go to international level. The demand for food grains has grown considerably over time in national context. Also the consumption habits have changed at national and international levels which also determine space for

the product in market. In Thuppilipalem village the production is basically of a subsistence type. Only shrimps are meant for international market. Production of shrimps which started during early 90's found immediately its market at international level. Actually the market came first then the shrimp aquaculture in Thuppilipalem.

Apart from the influence of markets on the activities taken up in the villages, there has been considerable change in the land use pattern. The forests in both the mandals have shown a decline. Sarvasidhi Rayavaram to which Peddauppalam belongs the forest cover declined from 5.5 per cent in 1985-86 to 2.5 per cent in 1991-92, whereas in Vakadu mandal under which Thuppilipalem comes showed a decline from 2.8 to 0.7 per cent of the geographical area.

The shrimp production process in Peddauppalam is of more recent origin (about three years back) whereas in Thuppilipalem the production started around six years ago.

The protest against aquafarms is more in and around Thuppilipalem village. This sort of social protest is conspicuously absent in Peddauppalam village. The reason might be that Peddauppalam and the surrounding village have enough of land and water resource left to their share that they are not bothered with what is happening in a small piece of land some distance from their village habitat. Whereas in Thuppilipalem land and water are scarce and the extent of deterioration is now visible on both of them, so all the protests have been registered from this region.

The environmental problems arising due to diversification are different in these two villages. In Peddauppalam waterlogging has been created due to improper construction of the concrete jetty, obstructing the drainage system of the agricultural fields. In Thuppilipalem the environmental problem arise in the form of salinisation of ground water aquifers. In both the villages the land there was salinisation of land due to intrusion of salt water. However, the nature of soil probably ensures that the ill effects (such as salinisation) do not show up so quickly in village Peddauppalam.

In village Thuppilipalem the livelihood of the fishermen is affected due to aquaculture activity. The fishermen have to restrict their movement away from the place of the jetty pumping water to the ponds and hatcheries. They are effected directly by the water which is released from the hatcheries and grow out ponds which is let out on the beaches, the dwelling place of most of the habitants.

The involvement of the government in promotion of aquaculture is equal in both of the villages. It is the promotional attitude of the government which paved the way for the spread of this activity. The government is entitled to allocate the suitable land to all the petitioners depending upon their category. According to the Government policy land is supposed to be allotted in the ratio of 60:20:20 to fishermen, unemployed youth and entrepreneurs respectively. However while distribution of land this has not been taken care and all the land is leased out to corporate firms. This has created distributional implications and questions for the

equity of the communities who are traditionally dependent on these resources for long.

In nearby village of Peddauppalam there is an instance of forceful occupation of the government leased land from a farmer without providing any alternative source of income to them.

Women are more dynamic in Thuppilipalem village than in Peddauppalam village. They have organised themselves and are running a thrift society. They are able to fight against the social ills of their villages. Though there is mahila mandali in village Peddauppalam, the works are restricted upto the schemes which are implemented by the government.

Nevertheless the agroclimatic specificities though different in terms of the soils the two villages in the coastal regions favoured diversification of land use from agriculture to aquaculture. Aquaculture activity is in the hands of corporate firms who have taken up this activity on semi-intensive scale. However the perceived impacts are more determinant in village Thuppilipalem than in village Peddauppalam. Effects of the conversion of land in these two location are not the same. The soils of Thuppilipalem are more porous and pervious. This nature of soil has led to unidirectional externalities on a wider section of the people in the village. Another reason for the determined effect of the activity on the individuals is availability of rather scarce land and water resources. The village is enclosed on the three sides by aquafarm ponds and on one side by sea. In Peddauppalam village, the environmental degradation has taken form of waterlogging which has

shown effect on the fields of other villages. The dynamic changes taking place in the villages have given rise to protests in one village and in the other almost with no protests.

Chapter 5

Summary and Conclusions

The present study made a modest attempt towards studying diversification in the use of land and water brought about by the interplay of given natural resources and evolving human activities. The initial nature and quality of land resources of any region determines the present land use. The land utilisation changes depend upon the social and economic conditions of the past and the perceived future expectations.

The first chapter elaborates on the agricultural diversification strategies adopted by many states from the mid of 1980's. With further economic reforms and the post-1990 liberalisation measures, agriculture in India and especially in Andhra Pradesh exhibited a marked diversification to other non-traditional activities. Aquaculture is one of the activities which has spread all over the coastal districts of Andhra Pradesh in a very short span of time. Considerable support is given by the State and financial and scientific institutions in the State for the promotion of the various aquaculture systems.

The second chapter reviews the literature regarding the diversification of land and water resource use. The issue of land and water diversification is examined with a view to explore agriculture and aquaculture interface. Although numerous studies have been carried out on this issue, very few have looked into the process of diversification taking a holistic view of economy and ecology. This is our point of departure and we set out to integrate economy and ecology at all levels of regionalisation and present

the problems associated with natural resource use diversification in Andhra Pradesh.

The third chapter looks into the agroclimatic conditions of Andhra Pradesh and the cropping pattern during the period from 198Ø to 1992. We find that agro-climatic specificities of any region, which are endogenous, determine the development of activities utilising land and water. Agriculture activities depend upon the fertility of the soil among others factors. The properties of soil play a crucial role to determine the initial cropping pattern of a region, which in a broader sense is one form of land use. We see how, apart from the nature of soil, the cropping pattern is determined by the exogenous variables such as available technology, market forces, and government policies.

The technology and development strategies prove to have both positive and negative impacts on the ecosystem and society. In this context the chapter gives specific emphasis to the Coastal region of Andhra Pradesh and dwells at length on the dynamics of conversion of land from the traditional to the non-traditional cropping system in the context of resource allocation. Initially there is diversification in the use of land within agriculture (from cultivation of cereals to cash crops) and subsequently to aquaculture in these parts of the State. The rural economy gets commercialised and diversified at a faster rate with the introduction of the new economic policies of 198Ø's and 199Ø's. Crops ideally suited for the soil conditions (such as coarse cereals) of the coastal region have been displaced by the crops less appropriate on the sole consideration of profitability. This

transition has been made possible due to the changes in the technology and the institutional support received from the agencies of the State.

In the coastal region, the share in the area under food crops declined over the period from 1980 to 1992. Correspondingly there is an increase in the share of area under non-food crops comprising mostly cash crops. Cultivation of cash crops stimulated the accumulation of surpluses and led to the evolution of a rich dynamic capitalist farmers in agriculture. These farmers diversified to other enterprises, investing their surpluses. This has been observed in the central coastal zone (Zone II). These capitalist farmers migrated to other districts and invested in enterprises that were profitable. They moved to Zone I and Zone II which are comparatively poorer in resource endowments from the perspective of land and water use, and productivity. In the coastal region, especially in coastal mandals, the farmers diversified to shrimp aquaculture in the last decade.

The spread of aquaculture throughout the coastal zones is skewed in distribution. The activity proliferated mostly in the central coastal zone (Zone II) followed by the south coastal zone (Zone III). The control over the aquafarms in Zone I and Zone III is in the hands of the corporate sector comprising a few firms. They hold the maximum amount of land under aquaculture in these zones. The remaining is distributed among small farms. In the central coastal zone (Zone II), the aquafarms are owned by hundreds of small farmers. While the control of the production activity is by and large in the hands of small holders, the effective control of the

inputs and outputs which make up the activity is with the corporate sector.

The fourth chapter verifies the changes observed at the macro level by studying two village cases. The case studies confirm the changes brought about in the cropping pattern at the macro level. These are influenced strongly by the market and Government policies. The shift to aquaculture in these two villages is not determined by the individual farmers. Rather, the entrepreneur determined to establish aquaculture activity in both the villages. The activation of the land market played an important role in the development of this activity in both the villages.

The economic and ecological aspects of these changes are varied and are evident in all the zones. The shift to non-food crops resulted in loss of employment. The employment opportunity in aquaculture has pruned the employment potential significantly as compared to paddy cultivation. We also see that the female employment has come down drastically in aquaculture activity. This must have had a bearing on the socio-economic status of women. In one village (Thuppilipalem) this must have been the base for initiating collective action against the aquaculture activity.

The ecological deterioration took the form of salinity and waterlogging in the two villages. The problem of salinity and waterlogging developed as a result of pumping of sea water onto the land for culturing shrimps. Due to the salinity problem, the farmers are not able to grow staple crops which they were initially cultivated. The freshwater aquifers in and around the village were

also badly affected due to the seepage of saline water into them. The water has turned tasteless and in some seasons it becomes saline. The overall water quality has come down considerably. Objectionable suspended particles were traced in the water drawn from borewell. Waterlogging was a result of the construction of a long jetty passing through the agricultural fields, village roads, and beaches. This canal hindered the free flow of water released from agricultural fields. In the absence of canal, water drained from the fields used to flow towards the Bay of Bengal. Apart from these problems the rights of access to the lands is denied in these two villages. The fishermen of village Thuppilipalem are not allowed to use the lands on the coast which traditionally belonged to these communities.

To conclude, the diversification of land and water use is fuelled by the economic conditions involved in the processes. The economic conditions give rise to two aspects - economic incentives and ecological ill-effects from any activity. The economic benefits are not distributed equally by all sections. Some are benefitted more than others. A large section of the people are excluded from the process or merely partake in its crumbs. Additionally they also have to bear a disproportionate burden of ecological ills created by the process of diversification. These populations are marginalised more and more at the behest of intensive diversification. The panacea for the ills caused by diversification of resource use fuelled exclusively by market considerations lies at the core of the development indicative planning from above and participatory decision making from below. Since it is the local communities who suffer the most, their involvement at all stages of development

planning is an important solution for managing changes in land and water use which can become economically beneficial, socially acceptable and ecologically sustainable.

Appendix A

Aquafarming Systems

This appendix intends to discuss briefly about aquafarming systems since knowledge about them is not very widespread.

There are three types of aqua farming systems. These are extensive, semi-intensive and intensive farming system. Table 1.4 presents the summary of major shrimp aquaculture systems.

Table A.1: Summary of Shrimp Aquaculture Systems.

Characteristics	Extensive	Semi-Intensive	Intensive
Pond size	1 to 5 ha	0.2 to 0.5 ha	0.03 to 0.1 ha
Stocking Density	Natural & Artificial 10,000 / ha	Artificial 1 to 3 lakhs / ha	Artificial 5 to 20 lakhs/ha
Water Exchange	Tidal & Pumping	Pumping	Pumping
Diversity of crops	Occasionally polyculture majority monoculture	Monoculture	Monoculture
Diseases	Rare	Moderate to frequent	Frequent
Employment	315 persondays/ha/cycle	1 to 3 persons / ha /26 days.	1 person / ha. 6% of the operating budget is for labor
Environmental Implications	Self sustaining;Requires land to be cleared	System relies on inputs; self polluting	System relies on inputs & pollutes the environment.
Social Implications	Provides employment; source of food if not exported	Product exported; mechanised; Little employment	Product exported; mechanised; little employment
Viability of the system	Productivity of the system is 15 to 20 years	Less than 10 years	Between 5 to 10 years.

Source : From Vandana Shiva and Gurpreet Karir, 1996.

In extensive farming system cultured organisms are kept at low densities and may occasionally receive additional nutrition through fertilisation. In semi-intensive aquaculture, cultured organisms are kept at higher densities than in extensive systems. The cultured media is often fertilised and supplementary feed may be provided. In intensive aquaculture, cultured organisms are kept at high densities and feeding is regular, usually in the form of specially prepared manufactured feeds.

Aquaculture embraces the culturing of seaweed, bivalve and shrimp culture. However the present study confines to the shrimp culture which is going on particularly in coastal Andhra Pradesh. In India, shrimp ponds may cover extensive coastal areas which are obtained mostly by clearing the paddy fields, salt pans, coconut and sugarcane fields, abandoned lands and mangrove forests. Figure 1 shows the two types of coastal zones which can be utilised for shrimp culture : (i) Intertidal zone (ii) Supratidal zone. Intertidal zones are the interface zone between the sea front and the land side and are always submerged in water giving rise to

natural marshes. These sites are encountered in Sunderbans in West Bengal, Coringa in Andhra Pradesh among other areas. Supratidal zones are the zones which are elevated above the mean sea level. On the supratidal zones mostly agriculture is taken up. However the proximity of these zones to the sea makes it possible for taking up aquaculture. Most of the aquafarms in India, especially in Andhra Pradesh, are in supratidal zones.

In the supratidal zone, artificial conditions for rearing shrimps is created by pumping sea water through jetties. Construction of jetties/channels for water supply and drainage and pumping of brackish water inland results in hydrological changes, siltation and saltwater intrusion. Pumping and trucking of saltwater to inland backyard hatcheries may affect ground water quality. Extraction of groundwater for freshwater supply for intensive culture may also result in the salinisation of the emptied freshwater aquifers. Fertilizers, such as triple-superphosphates, urea, cow dung, chicken manure and rice bran which are used to promote growth of shrimp food organisms, may contribute to excessive nutrient and organic load.

A variety of chemicals are used in shrimp aquaculture. Antibiotics such as chloramphenicol, furazolidone, nitrofurazone etc are applied in shrimp hatcheries and grow-out ponds to treat and prevent outbreaks of diseases. Over-use of antibiotics could be dangerous due to the potential generation of drug-resistant shrimp pathogens and the risk of transfer of drug resistance to human pathogens. Unwanted species are being eradicated by applying copper sulphate as algicide, plant-based biodegradable piscicide, such as tobacco dust (nicotine), tea seed cake (saponin), derris root extract (rotenone); organo-pesticides such as chlorinated hydrocarbons (DDT, thiodan). These organo-pesticides are of particular concern due to their toxicity and persistence, and their potential implications for product quality and human health. There is growing evidence that some shrimp pathogens such as the infectious hypodermal hematopoietic necrosis virus (IHHNV) and monodon bacilo virus (MBV) have been disseminated through introduction and transfer of commercial shrimp species. Outbreak of diseases can be attributed to excessive intensification and deterioration of water and sediment quality in shrimp ponds and adjacent waters due to waste overloading.

Appendix B

Supreme Court Ruling

The recent order of the Supreme Court of India banning shrimp farms in coastal areas is a landmark judgement. Excerpts:

...This petition under Article 32 of the Constitution of India - in public interest - has been filed by S. Jaganathan, Chairman, Gram Swaraj Movement, a voluntary organization working for the upliftment of the weaker sections of society. The petitioner has sought the enforcement of Coastal Zone Regulation Notification dated February 19, 1991 issued by the Government of India, stoppage of intensive and semi-intensive type of prawn farming in the ecologically fragile coastal areas, prohibition from using the wastelands/wetlands for prawn framing, and the constitution of a National Coastal Management Authority to safeguard the marine life and coastal areas.

...Keeping with the international commitments and in the greater i\national interest, the Government of India and the Governments of the coastal States are under a legal obligation to control marine pollution and protect the coastal environments.

...While the production increases and export earnings of the industry are well publicised, the socioeconomic losses and environmental degradation affecting the well-being of the coastal population are hardly noticed.

...In fact, shrimp farms are developing at the expense of other agriculture, aquaculture, forest uses and fisheries that are better suited, in many place, for meeting local food and employment requirements. Intensive and semi-intensive types of shrimp production hardly seem to meet these requirements.

...We may refer to constitutional and statutory provisions which mandate the State to protect and improve the environment. Article 48-A of the Constitution of India states that "the State shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country". Article 51-A of the Constitution imposes as one of the fundamental duties on every citizen, the duty to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. The Environment (Protection) Act 1986 (the Act) was enacted as a result of the decisions taken at the United Nations Conference on the Human Environment, held at Stockholm in june 1992, in which India participated.

...This Court in Vellore, Citizens Welfare Forum vs Union of India and others...has dealt with the concept of `sustainable development´ and has specifically accepted `the precautionary principle´ and `the polluter pays´ principle is part of the environmental laws of the land.

...We therefore, order and direct as under.

1. The Central Government shall constitute an authority under Section 3 (3) of the Environment (Protection) Act, 1986 and shall confer on the said authority all the powers necessary to protect the ecologically fragile coastal areas, seashore, water front and other coastal areas, and specially to deal with the situation created by the shrimp culture industry in the coastal States and Union Territories. The authority shall be headed by a retired judge of a High Court. Other members, preferably with expertise in aquaculture, pollution control and environmental protection, shall be appointed by the Central Government. The Central Government shall confer on the said authority the powers to issue directions under the Act and for taking measures with respect to the matters referred to in clauses (v), (vi), (vii), (ix) and (xi) of sub-section (2) of Section 3. The Central Government shall constitute the authority before January 15, 1997.

2. The authority so constituted by the Central Government shall implement the `Precautionary Principle' and the `Polluter Pays' principles.

3. The shrimp culture industry/shrimp ponds are covered by the prohibition contained in para 2 (1) of the CRZ notification. This shall be applicable to all seas, bays, estuaries, creeks, rivers and backwaters. This direction shall not apply to traditional and improved traditional types of technologies, as defined in Alagarswamy's report, which are practiced in coastal low-lying areas.

4. All aquaculture industries/shrimp culture industries/shrimp culture ponds operating/ set up in the coastal regulation zone, as defined under the CRZ Notification, shall be demolished and removed from the said area before March 31, 1997.

   We direct the Superintendent of Police/Deputy Commissioner of police and the District Magistrate/Collector of the area to enforce this direction and close/demolish all aquaculture industries/shrimp culture industries, shrimp culture ponds on or before March 31, 1997. A compliance report in this respect shall be filed in this court by these authorities before April 15, 1997.

5. The farmers who are operating traditional and improved traditional systems of aquaculture may adopt improved technology for increased production, productivity and return, with prior approval of the`authority' constituted by this order.

6. The agricultural lands, salt pan lands, mangroves, wetlands, forest lands, land for village common purpose and the land meant for public purposes shall not be used/converted for construction of shrimp culture ponds.

7. No aquaculture industries/shrimp culture industries/shrimp culture ponds shall be constructed/set-up within 1000m of Chilka lake and Pulicat lake, including bird sanctuaries namely Yadurapattu and Nelapattu.

8. Aquaculture industry/shrimp culture industry/shrimp culture ponds already operating and functioning in the said area of 1ØØØm shall be closed and demolished before March 31, 1997. We direct the Superintendent of Police/Deputy Commissioner of police and the District Magistrate/Collector of the area to enforce this direction and close/demolish all aquaculture industries/shrimp culture industries, shrimp culture ponds on or before March 31, 1997. A compliance report in this respect shall be filed in this court by these authorities before April 15, 1997.

9. Aquaculture industry/shrimp culture industry/shrimp culture ponds other than traditional and improved traditional may be set up/constructed outside the coastal regulation zone as defined by the CRZ notification and outside 1ØØØm of Chilka and Pulicat lakes, with the prior approval of the `authority' as constituted by this court. Such industries which are already operating in the said areas shall obtain authorization from the `authority' before April 3Ø, 1997, failing which the industry concerned shall stop functioning with effect from the said date. We further direct that any aquaculture activity, including intensive and semi-intensive, which has the effect of causing salinity of soil, or the drinking water or wells and/or by the use of chemical feeds increases shrimp or prawn production with consequent increase in sedimentation which on putrification is a potential health hazard, apart from causing siltation, turbidity of water courses and estuaries with detrimental implication on local fauna and flora, shall not be allowed by the aforesaid authority.

1Ø. Aquaculture industry/shrimp culture industry/shrimp culture ponds which have been functioning/operating within the coastal regulation zone as defined by the CRZ notification and within 1ØØØm from Chilka and Pulicat lakes shall be liable to compensate the affected persons on the basis of the `polluter pays' principle.

11. The authority shall, with the help of expert opinion and after giving opportunity to the concerned polluters, assess the loss to the ecology/environment of the affected areas and shall be liable to compensate individuals/families who have suffered because of the pollution and shall be liable to compensate individuals/families who have suffered because of the pollution and shall assess the compensation to be paid to the said individual/families. The authority shall further determine the compensation to be recovered from the polluters as cost of reversing the damaged environment. The authority shall lay down just and fair procedure for completing the exercise.

12. The authority shall compute the compensation under two heads, namely for reversing the economy and for payment to the individuals. A statement showing the total amount to be recovered, the names of the polluters from whom the amount is to be recovered, the amount to be recovered from each polluter, the persons to whom the compensation is to be paid and the amount payable to each of them shall be forwarded to

the Collector/District Magistrate shall recover the amount from the polluters, if necessary, as arrears of land revenue. He shall disburse the compensation awarded by the authority to the affected persons/families.

13. We further direct that any violation or non-compliance of the directions of this Court shall attract the provisions of the Contempt of Courts Act in addition.

14. The compensation amount recovered from the polluters shall be deposited under a separate head called "Environment Protection Fund" and shall be utilized for compensating the affected persons as identified by the authority and also for restoring the damaged environment.

15. The authority, in consultation with expert bodies like NEERI, Central Pollution Control Board, respective State Control Pollution Boards, shall frame a scheme/schemes for reversing the damage caused to the ecology and environment by pollution in the coastal States/Union Territories. The scheme/schemes so framed shall be executed by the respective Governments/Union Territory Governments under the supervision of the Central Government. The expenditure shall be met from the "Environment Protection Fund" and from other sources provided by the respective State Governments/Union Territory Governments and the Central Government.

16. The workmen employed in the shrimp culture industries which are to be closed in terms of this order shall be deemed to have been retrenched with effect from April 30, 1997, provided they have been in continuous service as defined in Section 25B of the Industrial Disputes Act,1947, for not less than one year in the industry concerned before the said date. They shall be paid compensation in terms of Section 25B of the Industrial Disputes Act, 1947. These workmen shall be paid, in addition, six years wages as additional compensation. The compensation shall be paid to the workmen before May 31, 1997. The gratuity amount payable to the workmen shall be paid in addition.

The writ petition is allowed with costs. We quantify the cost at Rs 1,40,000 (Rupees one lakh and forty thousand) to be paid by the States of Gujarat, Maharashtra, Orissa, Kerala, Tamil Nadu, Andhra Pradesh and West Bengal, in equal shares of Rs 20,000 each. The amount of Rs 1,40,000 realized from the seven coastal states shall be paid to Mr. M.C.Mehta, Advocate who has appeared in this case throughout. We place on record our appreciation for the assistance rendered by Mr.Mehta.

This judgement was delivered by Justices Kuldip Singh and S. Sagir Ahmad of the Supreme Court of India at New Delhi on 11 December 1996.

Source: *Samudra Report: International Collective in support of Fishworkers*, March 1997, No.17, pp.41.45.

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