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RESEARCH ARTICLE

IMPACT OF AQUACULTURE ON LAND USE PATTERNS, ENVIRONMENT AND ECONOMY: A CASE STUDY OF WEST GODAVARI DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT

Aquaculture is one of the fast growing and intensively spread in coastal regions especially in the coastal districts of Andhra Pradesh. A large extent of coastal regions and fertile lands which are having rich resource potentials of flora and fauna are converted into fish ponds. This sector provides huge employment directly and indirectly especially in the coastal regions. The un-presidential and indiscriminate growth of aquaculture brings structural changes in the land use patterns especially in the coastal regions. As a result several complex problems arise in various spheres and create adverse effects on physical, environmental and socio economic fronts. Keeping the above aspects under consideration, an attempt is made to analyze the extent of the growth of aquaculture activity as well as determine land use changes reported over the period. Further the study assessed the impact of aquaculture and their adverse effects arise in physical environmental and socio economic aspects. Besides this suitable remedial measures are suggested for the overall improvement of the situation. The study has chosen coastal regions of West Godavari District as the study area because the higher extent of aquaculture activity is clustered in these regions and also reported rapid land use changes and environment and economy due to aquaculture at grass roots levels.

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INTRODUCTION

Aquaculture is one of the fast growing activities and intensively spread in Coastal regions especially in coastal districts of Andhra Pradesh. At present, aquaculture has increasingly become a popular rural based occupation. The total extent of aquaculture ponds is more than 1 lakh hectares in the state, the total production being about 2 lakhs tones. It is estimated that about 2.70Lakh people are employed in various activities related to aquaculture in the state. Further, the shrimp production from the coastal aquaculture in the state is 0.32 lakh tones and stands first in the country. The foreign exchange earned through export of marine products of the country was Rs 6400 crores in the year 2000-01. However, the aqua farmers are suffering losses of Rs 300 crores every year due to the problems of shrimp disease. Andhra Pradesh has rich water resources in major rivers like Godavari and Krishna and several medium and major rivers besides being the second largest maritime state in India having a coastline of 874 Km. Various river systems joining the Bay of Bengal create wetland environment such as estuaries, creeks such as lagoons, mangrove swamps and tidal mudflats, which provide favorable conditions for the development of brackish aquaculture along the coastal line of Andhra Pradesh. The farmers of coastal Andhra Pradesh have always been progressive and innovative in accepting new cropping patterns of agriculture, such as Virginia tobacco, cotton, palm- oil (palm-trees for oil seeds), sun flower, etc. With the same enthusiasm and readiness they have accepted activities like poultry farms, shrimp production and pisciculture through extensive and intensive methods of cultivation. The aquaculture activities have been taken up on a large scale by the corporate sector in many districts of coastal Andhra region. The individual farmers, especially educated entrepreneurs from middle class background entered into this activity in the districts of East Godavari and West Godavari on a larger scale. As a result, there has been a manifold increase in this activity.

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The total extent of land under shrimp culture in the of Andhra Pradesh is about 4.5 lakh acres being operated by 30,000 farmers while the total population depending upon this activity is about 3 lakhs. Shrimp cultivation generates revenue of Rs. 2,500 crores per annum in the state of Andhra Pradesh. About 1.5 lakh hectares of land shrimp culture in West Godavari and Krishna districts are found to be in the regulated coastal zone (i.e., within 500 meters from the high tide live). The remaining land of 3 lakh acres belong to the categories of 'Once-fallow lands' to some extent and the paddy growing lands to a large extent in the Godavari and Krishna delta areas. The shrimp cultivation especially in the delta areas are found to have resulted in environmental, geographic and socio-economic consequences- both positive and negative, which require a deep and comprehensive investigation in order to identify the problems as well as the probable solutions.

The indiscriminate growth of aquaculture activity brought forth structural changes in the physical as well as socio- economic environment and economy of the region, especially in land use patterns, environment and economy. The major changes include : conversation of agricultural land and land under salt production into aquaculture farms, the resources of fresh water are converted into saline water, pollution due to higher use of fertilizers, pesticides and antibiotics, scarcity of drinking water, destruction of mangrove flora and fauna, and decline in the extent of prime cropped areas and agricultural employment, etc. The traditional fishermen have lost their landing grounds for fish catch. Other losses are damage of fishing nets, disappearance of the native fish species, and increase in the incidences of diseases (skin, eye and water- borne diseases) in the contigears population, increase in the encroachments of the government lands, decrease in the fishing grounds of the traditional fisherman, etc. The un-precedence and indiscriminate growth of aquaculture brought structural changes in the land use patterns especially in the coastal region. Large extent of fertile lands in coastal regions having rich resource potential of Flora-Fauna is converted into fish ponds. As a result, several complex problems arise in various

Table 1. Distribution of Land Use during 1980-81 and 2000-01 in the study area

Land Use Category	Bhimavaram Mandal		Kalla Mandalam		Akiveedu Mandalam		Palakol Mandalam		Mogalthuru Mandalam		Narasapuram Mandalam		Total	
	1980-1981	2000-2001	1980-1981	2000-2001	1980-1981	2000-2001	1980-1981	2000-2001	1980-1981	2000-2001	1980-1981	2000-2001	1980-81	2000-01
Aqua culture	-	19650	-	14870	-	8933	-	1215	-	9312	-	8750	-	62730
	(78.2)	(38.7)	(73.3)	(43.3)	(77.5)	(51.9)	(70.3)	(64.6)	(66.1)	(37.3)	(62.3)	(40.6)	(71.52)	(44.02)
Paddy	38305	18655	28574	16861	23225	15546	15044	13829	21352	12040	25167	16417	151667	93348
	(21.5)	(21.5)	(26.7)	(18.6)	(22.5)	(18.3)	(21.3)	(21.3)	(33.9)	(33.9)	(37.7)	(21.5)	(27.54)	(25.46)
Orchards	155 (0.3)	155 (0.30)	-	-	-	-	1814	1814	-	-	-	-	1969	1969
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(8.5)	(8.5)	(100.0)	(100.0)	(100.0)	(100.0)	(0.92)	(0.92)
Waste Land	10510	10510	10395	7238	6734	5480	4549	4549	10974	10974	15245	15245	58407	53996
	(21.5)	(21.5)	(26.7)	(18.6)	(22.5)	(18.3)	(21.3)	(21.3)	(33.9)	(33.9)	(37.7)	(21.5)	(27.54)	(25.46)
Total	48970	48970	38969	38969	29959	29959	21407	21407	32326	32326	40412	40412	212043	212043
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.00)	(100.00)

Source: Mandal Revenue Records of West Godavari District.

Note: Area is given in acres.

forms and create adverse effects on physical environment and socio-economic fronts.

Objective

The paper is divided into three sections. Section I deals with the land use changes while section II discusses the impact of aquaculture on physical and socio-economic environment and section III portrays the remedial measures for the improvement of overall situation.

Study Area

Keeping the above aspects under consideration, an attempt is made in this paper to analyze the extent of the growth of aqua culture activity as well as land use changes during the period covering 1980-2005. Further, the study aims to assess the impact of aqua culture and their adverse effects on Physical-environment and Socio-Economic aspects on the basis of existing studies. Beside this, suitable remedial measures are suggested for the overall improvement of the situation. The study covers the coastal regions of West Godavari District (Bhimavaram, Kalla, Akiveedu, Palakol, Narasapuram and Mogalthuru mandals) because very high extent of aqua culture activity is clustered in these regions and also reports rapid land use changes due to aqua culture at gross roots levels.

Section I

Patterns of Land use during 1980-81 and 2000-01 in the study area

Table 1 & Fig. 1 exhibits that the out of 2, 12,043 acres, maximum extent of land about 1, 51,667 acres is under paddy (71.52%) followed by waste land (27.54%) and orchards (0.92%) in the study area in the year 1980-81. Similarly, the maximum extent of area 93,730 acres (44.02%) is under paddy followed by aquaculture with an extent of 62,730 acres (29.58%) and waste land (25.46%) in the year 2000-01. Regarding mandals, the maximum extent of area under paddy is about 38,305 acres found in Bhimavaram mandal followed by Kalla mandal (28,574 acres) Narasapuram mandal (25,167 acres), Akiveedu mandal (23,225 acres) and Mogalthuru mandal (21,352 acres) while lowest found in Palakol mandal (15,044 acres) in the year 1980-81. Similarly the maximum extent about (19,650 acres) of land is under aquaculture in Bhimavaram mandal followed by Kalla mandal

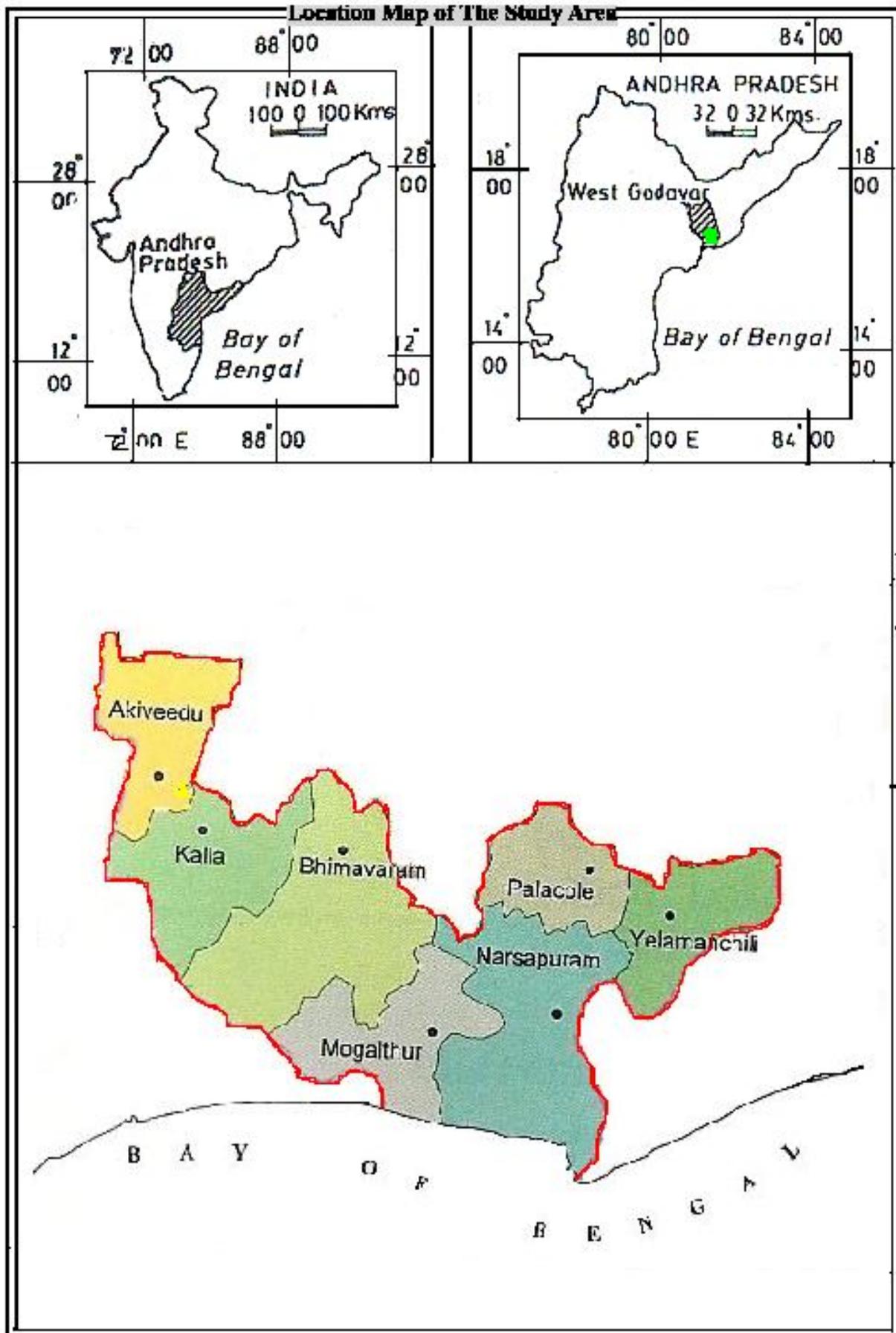
(14,870 acres), Mogalthuru mandal (9,312 acres), Akiveedu mandal (8,933 acres) while lowest found in Palakol mandal (1,215 acres) among the mandals. The major changes in the distribution of land use patterns during 1980-81 and 2000-01 is the aquaculture occupied about 40.11% of area in Bhimavaram mandal, 38.16% in Kalla mandal, 29.82% in Akiveedu mandal, 28.81% in Mogalthuru mandal, 21.56% in Narasapuram mandal, 5.86% in Palakol mandal and 29.58% in the study area as whole. Similarly the percentage of land under paddy is showing decline from 78.21% to 38.71% in Bhimavaram mandal, 73.32% to 43.27% in Kalla mandal, 77.52% to 51.89% in Akiveedu mandal 70.28% to 64.62% in Palakol mandal, 60.05% to 37.25% in Mogalthuru mandal, 62.28% to 40.62% in Narasapuram mandal and 71.52% to 44.02% in the study area as a whole. The remaining land uses such as orchards and waste lands or showing more or less same position during this period. It is evident from the above analysis that paddy areas only converted into aquaculture during 1980-81 and 2000-01. As a result several adverse effects are observed in the region both in physical environment and socio-economic environment. Hence the study analyzes the adverse effects arising due to conversion of paddy fields to aquaculture in details and presented in section II.

SECTION II

Assessment of the Impact of Aquaculture on Physical and Socio-Economic Environment

Impact of Aquaculture on Physical Environment

1. The ponds in the agricultural fields damage the productivity of the adjoining lands due to salinity intrusion.
2. The fish ponds damage the natural drainage systems and also act as obstruction and blocked for the free flows of the water and in turn the intensity of floods is increased abnormally and submerged crop lands and villages.
3. The waste effluents of aqua farmers are cause damages to the quality of surface and ground water resources, because effluents contain harmful chemical metals, toxic and biological substances and internally significantly damage the portability of water resources.
4. The shrimp farms are constructed well above the ground levels. As a result, the seepage of pond's effluent, damages the soil quality in the adjoining lands.



5. The rapid expansion of aquaculture activity destroyed the natural floral resources such as mangroves and coastal vegetation species which are having eco-friendly economical and medical values.
6. The valuable habitat conditions of aquatic fauna damaged due to changes in the ecosystem due to indiscriminate growth of aquaculture activity.
7. The collection of shrimp seed from natural resources by the collectors is creating ecological imbalance due to elimination of the other than shrimp seed. This situation significantly is responsible for the degradation of stocks of various species in natural water resources.
8. To establish more hatcheries to meet the seed demand and imposes ban on the collection of seed from natural resources.
9. To introduce environmental impact assessment and environmental monitoring plans for larger units and self assessment monitoring for smaller units.
10. Determination of safe zones for aquaculture activity.

The suggested measures are helpful not only to control aquaculture activity but also keep in the sustainable manner. Further these measures will contribute for the mitigation of adverse effects caused by aquaculture both in physical and socio-economic environment in the study area.

Impact of Aquaculture on Socio-Economic Environment:

1. Denial of free access is to fisherman to the sea due to obstruction of aqua ponds.
2. Denial of job opportunities.
3. Social displacement.
4. Create scarcity of drinking water.
5. Reduction in grazing ground of cattle and also free access to creek and estuarine waters.

It is evident that the aquaculture activity shows adverse effects in physical environment and also damages the valuable land, surface and ground water resources and floral and fauna resources exist in the coastal regions of the study area. In respect of socio-economic aspects, the aquaculture activity significantly reduces the income levels and also damages the employment avenues due to disturbances of ecosystems. I may conclude that the income earned by aquaculture is very low compared to the losses caused by aquaculture.

SECTION III

Suggestions for the Mitigations of Loses Caused by Aquaculture

1. Identify hazardous aquaculture ponds to the environment and eliminate the ponds quickly.
2. Eliminate the aquaculture ponds found with in the coastal regulation zone.
3. Adopt eco-friendly technologies in shrimp culture (upon use of harmful feed, antibiotics, effluent treatment facility etc.)
4. Provide separate drainage for aqua farms.
5. To allow aquaculture effluent discharges after treatment only.
6. To ban the use of harm full feed materials pesticides and antibiotics.
7. To collect chess (tax) from the aquaculture farms for the use of environment improvement programmes.

Conclusion

It evident from the analysis that the major land use changes in coastal regions of West Godavari District is rapid decline of in the extent of area under paddy and rapid increase in the extent of area under aquaculture is reported in all most all mandals. The other category of land uses as reported marginal changes during this period. This trends of land use changes indicate that relatively higher extent of conversation of paddy areas into aquaculture ponds this phenomenon exist in all most all the mandals in the study area.

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