

### 3 Livelihood Systems and Dynamics of Poverty in a Coastal Province of Vietnam

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#### Abstract

It is well recognized in the development literature that movement in and out of poverty is caused by several demographic, economic and natural factors that are within and outside the control of the household. This paper uses primary data collected from a sample survey to understand the major factors behind changes in economic conditions in a coastal province in South Vietnam. The survey was conducted in 2001 in five purposively selected villages to (i) understand the livelihood systems in the Vietnam coast; and (ii) analyse the impact of government intervention (construction of embankments and sluices to prevent saltwater intrusion) for water management on rural livelihoods. A comparative analysis of costs and returns of intensified rice farming, rice–shrimp farming and semi-intensive shrimp farming is conducted to study the effect of the change from the brackish-water to the freshwater system on the productivity of land, the most important asset possessed by rural households. An income determination function is estimated to analyse the effect of the endowment of various capital items on household income. Farmers were asked to report changes in economic conditions over the last ten years and the reasons behind the changes. These qualitative data were related to the endowment of capital at the household level to analyse the factors contributing to the poverty dynamics in the region.

#### Introduction

Since the reunification in 1975, the government of Vietnam has sought to improve the livelihood of the rural population mostly through agricultural development focusing on technological progress in rice farming. The *doi moi* policy (renovation) from the late 1980s, with a market-oriented economy, had a positive impact on agricultural production, especially rice production. As a result,

Vietnam turned from being a net importer to a major exporter of rice in the world market. The Mekong River Delta (MRD) has been the major source of the growth in rice production and exportable surplus over the last two decades. However, because of saline intrusion, the growth in rice production in the coastal parts of the delta lagged behind that of other regions. To cope with this problem, the government began investing in the early 1990s in the construction of a series of

embankments and sluices along the coast to prevent saline water incursion, with the objective of intensifying rice production and improving farmers' livelihoods (Hoanh *et al.*, 2003).

This study assesses the effects of government intervention on the livelihoods of the people in Bac Lieu Province, a coastal province in the MRD. We want to test the proposition that, although increasing rice-cropping intensification through control of saline water intrusion could lead to improvements in livelihoods of the people dependent on rice farming, it might adversely affect the livelihood strategies of the people who rely on fisheries and shrimp farming using brackish water, an important resource in the coastal area.

## Conceptual Framework and Methodology

### Sustainable livelihood framework

The Sustainable Livelihood Framework (SLF) (Chambers and Conway, 1992; Carney 1998; Dearden *et al.*, 2002) was used as the framework for the study. Livelihood constitutes the capacities, assets (including both material and social resources) and activities needed for a means of living. Livelihoods are sustainable when they are resilient in the face of external shocks and stresses, are not dependent on external support, maintain the long-term productivity of natural resources and do not compromise the livelihood options of others.

The SLF starts with five categories of *capital* (assets) and an understanding of how people use them as a means for livelihood strategies. These assets are (i) human capital, for example, good health, skills and knowledge; (ii) natural capital such as land, water and biotic resources provided by nature; (iii) physical capital accumulated by the people themselves; (iv) financial capital comprising liquid resources such as cash in hand, savings, jewellery and credit; and (v) social capital such as networks and relationships with people and organizations, and personal qualities. The *livelihood strategy* depends on the household's endowment of these various assets.

The productivity of capital and livelihood outcomes are largely determined by organizations, institutions, policies and infrastructure that are beyond the control of the households. In the SLF analysis, these are called *transforming structures*. The sluice gates and the canal system developed by the government to control intrusion of saline water in the coastal area are examples of a transforming structure. The market forces and institutions that determine the prices of products and inputs are also part of the transforming structure, and they also determine the productivity of capital and returns to enterprises and ultimately have an impact on the *livelihood outcomes*. *Vulnerability context* frames the external environment in which people operate. These are shocks, trends and seasonal fluctuations, such as natural disasters and price fluctuations, that influence people's livelihoods and their belongings, but are beyond their control. An important livelihood strategy is to accumulate enough assets to develop resilience to these external shocks.

### Poverty dynamics

The pathways for moving out of or into poverty that we call 'poverty dynamics' can be analysed using the sustainable livelihood framework. Many earlier researchers (such as Mellor, 1986; Lanjouw and Stern, 1993; Fields *et al.*, 2003) identified the major forces for the enrichment of livelihood. They include (i) technological progress in agriculture; (ii) accumulation of physical and human capital; (iii) occupational mobility from farm to non-farm activities; and (iv) rural-urban migration.

There are also forces that drag households into poverty. The most important is the increasing population resulting from demographic factors. As children grow up and form their own households, the endowment of natural and physical capital declines (Hayami and Ruttan, 1985). The other factors causing downward mobility are death and disability of earning members, natural hazards and market-induced adverse movement in terms of trade for agriculture.

To assess the importance of various factors behind poverty dynamics, panel data for each household through longitudinal surveys are needed. But we do not have such data. Therefore, we asked respondents these questions: 'What has changed in the economic conditions of the household over the last 10 years?' and 'What are the factors behind the change?' We also made a quantitative analysis of the effect of the change from the shrimp-based to rice-based system on the people in different zones with data on costs and returns in rice and shrimp farming.

### Sample selection

The study covers Bac Lieu Province, an area covering 254,000 ha, of which about 200,000 ha are cultivated. It supported a population of 764,000 in 2001. To increase agricultural production, particularly rice, from 1994 to 2000 the government constructed a series of sluices progressively from the east to the west to prevent saltwater incursion (Fig. 3.1). As a result, the canal water progressively became fresh from the east to the west, as indicated by the retreat of the isohalines in Fig. 3.1.

Based on the soil types and the duration since canal water has become fresh, the project area can be classified into three zones.

- *Zone 1* is found in the east of the project site (east of the 1998-isohaline, Fig. 3.1), is characterized by alluvial soil types, with water and environment changed from a brackish-water ecology to a freshwater ecology before 1998. Hereafter, this zone will be called an 'early intervention zone' (EIZ).
- *Zone 2* lies in the middle section of the study area, in between the 1998- and 2000-isohaline. Large areas of this zone have acid sulphate soils. Water and environment changed to a freshwater ecology after 1998 and before 2000. This zone will be referred to as a 'recent intervention zone' (RIZ).
- *Zone 3* lies to the west and north of the 2000-isohaline. This area is not affected much by the closure of sluices because

saline water can flow throughout the area from the East Sea when the sluice system is closed, and therefore is called a 'marginal intervention zone' (MIZ).

To assess the impact of the government intervention on peoples' livelihoods at the study site, we first conducted a participatory rural appraisal (PRA) in order to draw a general picture. Next, we conducted a household survey to gather relevant data on the operation of the household economy and to understand livelihood strategies.

The information obtained at a particular point in time can be used to depict the changes in the livelihood system over time induced by the salinity control intervention. The EIZ represents the situation of stability after the transition from the brackish-water system to the freshwater system is complete. The MIZ represents the situation in the coastal area in the absence (or with little indirect influence) of government intervention. The RIZ represents the situation in transition from the brackish-water system to the freshwater system.

Using this typology and the results from the PRA, we purposively selected five villages: two from the EIZ, two from the RIZ and one from the MIZ. All households in the selected villages were interviewed with a structured questionnaire to collect data on different aspects of the operation of the household economy. The name of the villages and the sample households covered by the survey can be seen in Table 3.1 and locations are shown in Fig. 3.1.

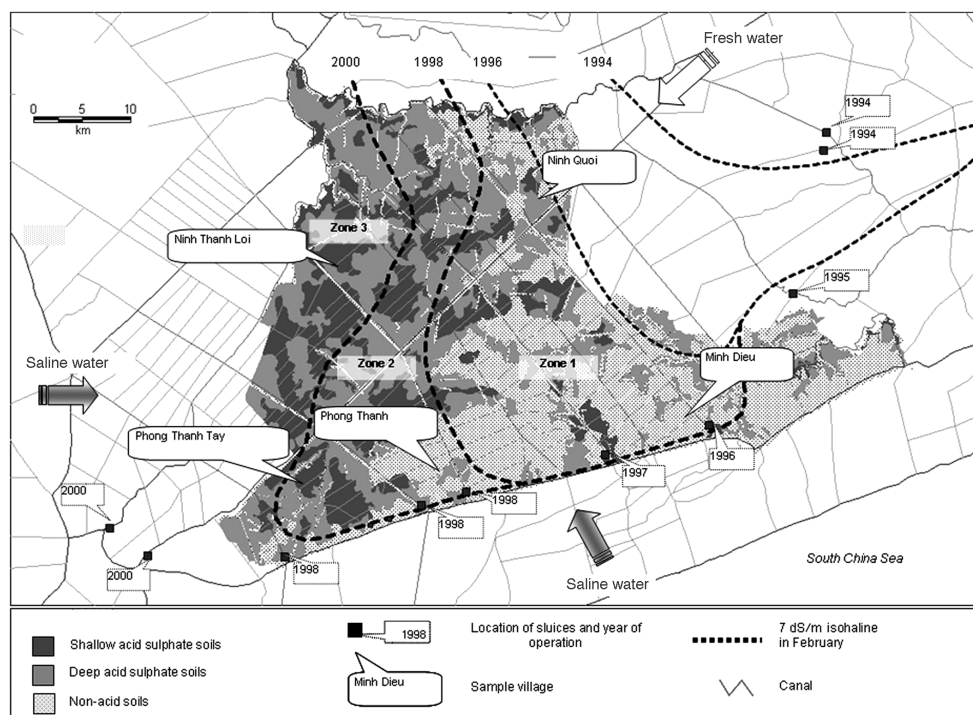
## Results

### Changes in production systems

The following information on the three zones was obtained from key informants through a PRA.

#### *Early intervention zone (EIZ)*

According to the key informants, the salinity in the area started to decrease in 1994, and in 1997 it was about 50% of the level of the pre-



**Fig. 3.1.** Map of the project area with location of sampled villages and zones. Zone 1, early intervention; zone 2, recent intervention; zone 3, marginal intervention or little effects of the interventions.

vious years, and since then fresh water has been found in all canals almost all year round.

Before 1990, swamp land occupied a large area, with abundant supplies of natural shrimp and fish. Most of this swamp land was converted to rice land from 1996 to 1998. With the increased availability of fresh water, rice cropping in the village shifted from one crop of traditional varieties in the 1980s to double cropping by the adoption of short-duration rice varieties. In 1999, farmers tried further intensification by growing three rice crops. But, as the yield for each season dropped, farmers reverted to double cropping of rice. On the relatively high land, they started growing vegetables, maize, sugarcane and fruit trees as the area became flood-free. The natural catch of shrimp and fish decreased substantially, leading to a decline in employment and income from fisheries, particularly for poor households. However, intensification of rice farming generated opportunities for hired work for the landless

and marginal farmers. Labourers from the different upper provinces migrated to compete with local residents for this work, so many poor farmers had to move to the provinces nearby to seek work after the second rice crop. Raising freshwater fish in ponds that were no longer flooded became a common source of supplementary income among the economically better-off households.

#### *Recent intervention zone (RIZ)*

Before 1996, farmers used to cultivate one traditional saline-tolerant rice crop in the rainy season and shrimp in the dry season. Poor households that did not own land worked as hired workers in shrimp fields, cultivated rice and caught natural shrimp and fish. After 1996, as canal water became progressively fresh, the production system changed. In 1998, 10% of the area under shrimp was converted to raising modern, high-yielding rice varieties. The area allocated to rice increased

**Table 3.1.** Distribution of samples of households in the study area.

Name of village	Zone	Type of village	No. of households	Average size of households	Percentage of poor households
Ninh Quoi	1	Early intervention	185	4.96	53
Minh Dieu	1	Early intervention	162	5.29	43
Phong Thanh	2	Recent intervention	197	5.34	55
Phong Thanh Tay	2	Recent intervention	213	4.99	60
Ninh Thanh Loi	3	Marginal (little effect from) intervention	154	4.86	39
Total			911	5.09	51

to 70% in 1999 and to 100% in 2000. Although fresh water was found in the canals, acid sulphate soil caused very low rice yields in spite of the use of high-yielding rice varieties. Farmers saw very low returns to rice production, and some even lost money. The intervention affected the livelihood of all categories of households in this area, but large farmers were particularly hard hit. Some farmers started to raise tiger shrimp but few succeeded in getting a good crop. Since the harvest of natural fish had been the largest share of income of the poor groups, their livelihood was particularly negatively affected by the loss of this source of income due to the enclosure of the sluices. The poor started migrating to other places to trade their labour.

#### *Marginal intervention zone (MIZ)*

Farmers cannot grow rice in the dry season because of the saline soil and water. After one or two shrimp crops in the dry season, farmers rotated with one salinity-tolerant traditional rice crop in the rainy season. This rice–shrimp system proves to have sustainable productivity. Lime is used in shrimp culture to ameliorate soil acidity; it has positive effects not only on shrimp cultivation but also on rice production in the next season. This resulted in an increase in rice yield from 2 t/ha in 1998 to 3–4 t/ha in 2000.

#### **Livelihood systems**

##### *Endowment of capital*

Human capital was the predominant asset in the area. An average household consisted of

5.1 persons. The proportions of males and females were equal. The economically active age group (15–67) constituted 67% of the population. About 92% of the males and 87% of the females in this age group participated in economic activities. The average number of workers per household was 3.3; 85% of them were engaged in agriculture (Table 3.2). The quality of human capital in terms of educational attainment of the workers was low. The average years of schooling for the household head (manager) were 4.4 and for the average worker 4.6. For the household head, 12% had had no formal schooling, 40% had attended primary school only, and just 5.5% had graduated from secondary schools. Nearly 14% of the households are managed by women.

The area was well endowed with natural capital by Vietnamese standards. The average size of land owned by the household was 1.56 ha, compared with 1.15 ha for the Mekong River Delta and 0.72 ha for Vietnam as a whole. Of this land, 0.11 ha was used for homestead and another 0.11 ha as orchards and homestead gardens, and 1.33 ha as cultivated land (Table 3.2). Very little land was used for raising fish or shrimp, except in the village from the MIZ. The land area under shrimp farming in that village was 1.99 ha.

Households that operated no land constituted 16% of all households. The number varied from 6 to 22% among the five villages. The proportion of the non-farm households was higher in the MIZ. Thus, a sizable proportion of the households was dependent on only human capital for their livelihood. Smallholdings with a size of up to 1.0 ha constituted 37% of the households, while

**Table 3.2.** Endowment of capital per household, by zone, a 2001 (from sample household survey, IRRI).

Capital item	EIZ (n = 347)	RIZ (n = 410)	MIZ (n = 154)	All areas (n = 911)
Land owned (ha)	1.34	1.60	1.88	1.56
Land cultivated (ha)	1.12	1.41	1.60	1.33
Shrimp/fish pond (ha)	0	0.04	1.41	0.26
Acidic land (ha)	0.56	1.28	1.41	1.03
Irrigated land (ha)	1.07	1.20	1.58	1.22
Land rented in (ha)	0.01	0.02	0.17	0.04
Agricultural workers (units)	2.91	2.75	2.64	2.79
Non-agricultural workers (units)	0.31	0.43	1.05	0.49
Education of head (years of schooling)	4.72	4.48	3.66	4.43
Education of average worker (years of schooling)	4.85	4.64	4.01	4.59
Agricultural capital (US\$)	282	174	112	205
Non-agricultural capital (US\$)	261	278	210	260
Loan received (US\$)	227	246	133	220

<sup>a</sup> EIZ, early intervention zone ; RIZ, recent intervention zone ; MIZ, marginal intervention zone

farms of over 4.0 ha that could be considered as large constituted only 3.2% of the households. Some 22% of the households operated holdings of more than 2.0 ha and controlled over 52% of the total land. The incidence of tenancy cultivation was rare except in the village in the MIZ, where 10% of the cultivated land was tenant-operated (Table 3.2). Owing to the concentration of the canals, the area had good control over irrigation. Nearly 92% of the land was irrigated, of which 85% was irrigated by pumps and the remaining 15% by a gravity system.

The accumulation of physical capital was still at a low level. About 45% of the total value of non-land fixed assets was used for agriculture (Table 3.2). The amount of money borrowed from different sources was US\$220 per household. Nearly 85% of the loan was obtained from institutional sources.

The level of social capital can be measured by membership of the households in different organizations and networks. Only 11% of the households reported membership in the Farmers' Union, 4.2% in the Veterans' Club and 2.5% in the Women's Union. Members from six out of the 911 households were actively involved with the Communist party.

The variation in capital endowment in the three zones can be noted in Table 3.2. The endowment of land was higher while the

level of education of the workers was lower in the MIZ than in the other zones. For other capital items, there was only a marginal difference.

Among the assets, the physical capital was most unequally distributed, with the bottom 40% of the households owning only 7% of the capital, whereas the top 10% had a share of 42% (Table 3.3). The least unequally distributed capital was the level of skills of the workers. The distribution of land was also fairly unequal. The income originating from the improvement in productivity of land and physical capital is thus expected to be unevenly distributed among the households in the area.

### Livelihood strategy

Households use their capital endowments in different ways to make a living. Table 3.4 provides information on the occupational distribution of the workers at the study sites. In the survey, the respondents were asked to report a maximum of two occupations, the principal (in which the major portion of time was allocated) and the subsidiary for each household member. The responses indicate that about 17% of the workers had a secondary occupation. The dominant source of livelihood was farming (Table 3.4). Other sig-

**Table 3.3.** The degree of inequality in the distribution of assets, 2001 (from sample household survey, IRRI).

Rank of the household on the scale of asset ownership	Cumulative share of land (%)	Cumulative share of physical capital (%)	Cumulative share of human capital/schooling (%)
Bottom 40%	10.6	6.6	23.2
Middle 40%	40.8	34.0	44.2
Next 10% (ninth decile)	17.9	17.1	14.5
Top 10%	30.7	42.3	18.1
Gini coefficient	0.47	0.58	0.25

nificant sources of livelihood were selling of labour to other farms and organizing handicraft production within the homestead (cottage industry), mostly making mats (with nipa leaves) and fishing nets. Non-farm agricultural activities, such as fishing, livestock raising or forestry, are taken up mostly as subsidiary occupations. Only 1.3% of the workers reported them as the principal occupation. Similarly, many more workers had paid agricultural labour as a subsidiary occupation. Very few workers were engaged in trade, business or services. The data show high dependence on land as the source of livelihood. Women were engaged in farming almost to the same extent as men. But some gender difference in the occupational structure can be noted in Table 3.4.

Table 3.5 reveals some differences in livelihood strategy among the three zones. A

larger proportion of workers were dependent on farming in the EIZ than in the MIZ, indicating a positive effect of rice intensification on employment generation. But, the effect on the generation of employment for hired workers was marginal. Engagement in handicraft production was limited mostly to the MIZ. The higher engagement in handicrafts in this zone is presumably due to the availability of raw materials in the saline areas (nipa leaves, mangrove forests, etc.) and also to the demand for products in fishing, fish processing and storage, and fish trade. A substantially larger proportion of workers reported other agriculture (livestock raising, aquaculture, etc.) as a subsidiary occupation in the EIZ. With salinity control came a greater opportunity for earning income through vegetables, horticultural crops and livestock raising.

**Table 3.4.** Sources of employment by sex of workers, 2001 (from sample household survey, IRRI).

Occupation	Male workers ( <i>n</i> = 1419)		Female workers ( <i>n</i> = 1348)		Total ( <i>n</i> = 2767)	
	Primary	Primary and secondary	Primary	Primary and secondary	Primary	Primary and secondary
Agriculture	91.7	105.4 <sup>a</sup>	86.7	96.5	89.2	101.1 <sup>a</sup>
Farming	80.2	85.5	77.5	81.0	78.9	83.3
Other agriculture	1.5	4.3	1.2	5.3	1.3	4.9
Agricultural wage labour	10.0	15.6	8.0	10.1	9.0	12.9
Non-agriculture	8.3	14.2	13.3	18.3	10.8	16.3
Handicrafts	3.5	7.3	7.6	10.4	5.6	8.8
Trade and business	1.0	2.2	3.7	5.5	2.3	3.8
Services	3.3	4.2	1.9	2.3	2.6	3.3
Non-agricultural labour	0.5	0.8	0.1	0.1	0.3	0.4
Total	100.0	119.6 <sup>a</sup>	100.0	114.8 <sup>a</sup>	100.0	117.4 <sup>a</sup>

<sup>a</sup> The total exceeds 100 because workers are counted twice if they reported a secondary occupation.

**Table 3.5.** Sources of employment of workers by zone<sup>a</sup> 2001 (from sample household survey, IIRI).

Sources of employment	EIZ		RIZ		MIZ	
	Primary occupation (% of all total)	Primary and secondary occupation	Primary occupation	Primary and secondary occupation	Primary occupation	Primary and secondary occupation
Agriculture	92.6	109.7	89.8	98.4	80.4	88.6
Farming	83.4	88.7	77.9	81.1	71.4	77.1
Other agriculture	2.0	9.1	0.7	2.5	1.5	1.5
Agricultural wage labour	7.2	11.9	11.2	14.8	7.5	10.0
Non-agriculture	7.4	10.7	10.2	14.2	19.6	34.1
Handicrafts	2.4	3.2	4.1	5.7	16.4	29.2
Trade and business	2.1	3.5	2.7	4.3	1.9	3.2
Services	2.8	3.6	2.8	3.6	1.3	1.7
Non-agricultural labour	0.1	0.4	0.6	0.6	Nil	Nil
Total	100.0	120.4	100.0	112.6	100.0	122.7

<sup>a</sup> EIZ, early intervention zone ; RIZ, recent intervention zone ; MIZ, marginal intervention zone.



The data on the sources of household income show minor involvement of households in many economic activities (Table 3.6). A majority of the households reported some income from cultivation of other crops, livestock raising and forestry, but the amount of income earned from these activities was less than US\$100 per annum. In terms of the contribution to household income, the major activities in order of importance were shrimp farming (43%), rice farming (22%), agricultural wage labour (10%) and non-agricultural labour, including handicrafts (6%).

### Livelihood outcomes

The average income earned by a household was estimated at US\$1032 during the year. With the household consisting of 5.1 members, per capita income was estimated at US\$203 (Table 3.6). About 85% of the income came from agriculture (including aquaculture). However, there was a large variation in income in the three zones (Table 3.7). Per capita income was US\$635 in the MIZ, owing to the large income contributed by shrimp farming and fisheries. Per capita income in the EIZ was less than a quarter of that in the MIZ. Although availability of fresh water facilitated intensification of rice farming, the loss in income from shrimp farming and fisheries far outweighed the increase in income from rice farming.

The average per capita income was only US\$99 for the RIZ. The transition from the brackish-water to the freshwater regime indeed had a much more substantial negative impact on livelihood. Although the average size of cultivated land was higher in this zone than in the EIZ (see Table 3.2), the income from rice farming was less than a fifth, which pushed down the average household income in this zone. Agricultural workers selling labour to rice farmers earned more than the rice farmers themselves. Low rice yield could be attributed to the acid sulphate soil.

The income was also fairly unequally distributed, with a Gini coefficient of total income of 0.56 (Table 3.8). This high degree

of income inequality is mainly due to the highly unequal distribution of income from shrimp farming (Gini coefficient = 0.73). The income from rice cultivation was more equally distributed (Gini coefficient = 0.48). The income inequality analysis at the village level shows relatively less inequality within a village. The Gini coefficient in the two villages in the EIZ was 0.46 and 0.37, whereas the estimate for the village in the MIZ was 0.63. The income situation in the two villages under transition (in the RIZ) was not normal during the year of the survey because of substantial income losses from rice cultivation. Actually, it is the larger land-owning households in these villages that suffered more. As a result, the income distribution was in fact better than in normal circumstances. The concentration coefficient of income in this zone was 0.38 and 0.44. These numbers at the village level suggest that the very high concentration of income for the study area as a whole is partly due to the high inequality of income across villages.

Since the level of income is low, and it is highly unequally distributed, the incidence of poverty is expected to be very high in the study area. We have measured different indices of poverty using the method suggested by Foster *et al.* (1984). The poverty-level income is taken as US\$127 per capita per year, adjusting the norm used by the Vietnam government by changes in the cost of living index. It is substantially lower than the dollar-a-day norm that the World Bank uses for comparing poverty across countries (World Bank, 2001). The estimated numbers are reported in Table 3.9. For all five villages together, the number of households living below poverty was estimated at 44% for the year of the survey. The numbers varied from 23% for the MIZ to 37% in the EIZ, indicating that the intervention had a negative impact on poverty reduction. The poverty incidence was very high for the villages in the RIZ because of the drastic fall in income from the water management intervention. It can be noted that, although the income inequality was very high in the shrimp-producing village in the MIZ, the poverty situation was lower than in the villages that practised intensified rice farming with fresh

**Table 3.6.** The structure of household income, all zones, 2001 (from authors' estimate from household survey data).

Sources of income	Households reporting income from the source (%)	Average income from the source for those who earned from the source (US\$)	Average income from the source for all households (US\$/annum)	Share of the source in total household income (%)
Agriculture	96.6	905	874	84.7
Rice farming	59.2	391	231	22.4
Farming other crops	51.0	58	29	2.8
Fisheries/shrimp	28.5	1546	441	42.8
Livestock	58.5	73	42	4.1
Forestry	51.6	46	24	2.3
Agricultural labour	35.7	298	106	10.3
Non-agriculture	36.2	434	158	15.3
Trade and business	6.6	630	42	4.1
Services	6.3	355	22	2.1
Remittance	7.5	193	14	1.4
Non-agricultural labour <sup>a</sup>	17.0	382	65	6.3
Rents and others	3.8	387	15	1.5
Total income	100.0	1032	1032	100.0
Family size	—	—	5.09	—
Per capita income	—	—	203	—

<sup>a</sup>Includes transport operators, construction workers and workers engaged in cottage industry.

**Table 3.7.** The structure of household income, specific zones, 2001<sup>a</sup> (from sample household survey, IRRI).

Sources of income	Households reporting income from the source (%)			Annual income from the source (US\$)		
	EIZ	RIZ	MIZ	EIZ	RIZ	MIZ
Agriculture	98.8	94.6	96.8	646	326	2847
Rice farming	79.8	43.6	53.9	415	88	198
Other crop farming	68.0	42.7	35.1	33	33	11
Fisheries/shrimp farming	30.8	10.5	71.4	21	31	2481
Livestock farming	64.0	58.6	46.1	65	32	21
Forestry	55.0	44.4	63.0	22	15	53
Agricultural wage labour	36.3	41.2	19.5	91	128	83
Non-agriculture	26.1	37.3	45.5	90	184	239
Trade and business	4.9	7.8	7.1	15	69	28
Services	8.1	5.4	4.5	21	21	28
Remittance	8.6	8.5	1.9	12	20	5
Non-agricultural labour	8.4	17.3	35.7	24	57	178
Rents and others	4.0	4.9	Nil	18	17	—
All sources	100.0	100.0	100.0	736	510	3085
Family size	—	—	—	5.12	5	5
Per capita income	—	—	—	144	99	635

<sup>a</sup> EIZ, early intervention zone ; RIZ, recent intervention zone ; MIZ, marginal intervention zone.

**Table 3.8.** Degree of inequality in income distribution (from authors' estimate from household survey data).

Rank of household on per capita income scale	Cumulative share of total income (%)	Income from shrimp/fish	Income from rice
Bottom 40%	9.7	5.1	10.8
Middle 40%	29.2	17.0	38.7
Ninth decile	15.8	12.1	22.9
Top 10%	45.1	65.7	27.6
Gini coefficient	0.563	0.734	0.476

water. Thus, the change from shrimp farming to rice farming not only reduces the income of the better-off sections of society but also contributes to an increase in poverty.

What do the people themselves think about poverty in a locality? Interest is growing in the participatory measurement of poverty (Narayan, 2000; World Bank, 2001). We asked the respondents to report whether they would consider their households as 'extremely poor', 'moderately poor' or 'non-poor'. The findings on this self-perception of poverty are reported in Table 3.10. The qualitative data should reflect the poverty situation in a normal year, rather than for the year of the survey as measured by our objective

analysis of the quantitative data. For the study area as a whole, 51% of the households considered themselves as 'poor', with 14% as 'extremely poor'. The proportion of poor households was reported to be lower in the shrimp-producing village (MIZ) than in the villages in the EIZ. These findings are similar to those from the objective analysis reported earlier.

Table 3.11 shows self-perception of poverty by major socio-economic groups. The incidence of poverty was substantially higher in the households managed by women than in the male-headed households. Extreme poverty is concentrated in households operating less than 0.4 ha of land,

**Table 3.9.** Measures of poverty by zone, 2001<sup>a</sup> (from authors' estimate from household survey data).

Measure of poverty	EIZ <sup>b</sup>	RIZ	MIZ	All areas
Head count index (%)	36.6	57.8	22.7	43.8
Poverty gap index (%)	17.2	31.0	9.4	22.1
Squared poverty gap index (%)	10.5	21.2	5.2	14.4

<sup>a</sup> The poverty line income for 2001 was measured at US\$126.

<sup>b</sup> EIZ, early intervention zone ; RIZ, recent intervention zone ; MIZ, marginal intervention zone.

**Table 3.10.** Incidence of poverty: self-perception of households (from authors' estimate from household survey data).

Type of zone/village	Percentage of households considering themselves as			
	Extremely poor	Moderately poor	Non-poor	All households
Early intervention				
Ninh Quoi	15.1	38.4	46.5	100
Minh Dieu	14.2	28.4	57.4	100
Recent intervention				
Phong Thanh	12.7	44.2	43.1	100
Phong Thanh Tay	16.0	43.2	40.8	100
MaMarginal intervention				
Ninh Thanh Loi	14.3	24.7	61.0	100
All villages	14.4	36.8	48.8	100

those managed by the less educated and those that have agricultural wage labour as the means of livelihood. The information suggests that, at the present stage of development of the rural economy, ownership of land and a better quality of human capital are important factors behind livelihood improvement.

### Pathways out of and into poverty

#### *Water management interventions*

Government investment in the construction of embankments and sluices for maintaining fresh water for rice cultivation could be considered an element of a 'transforming structure', an external force to promote agricultural intensification and diversification. Since natural capital (land and water) and human capital (workers) are the dominant assets, such an intervention is important to mark the first step towards enrichment by improving the productivity of land and labour.

Table 3.12 presents information on seasonal yields and annual productivity of the rice and shrimp system. The village Ninh Quoi, that produces three rice crops a year, had a total rice production of 11.8 t/ha/year valued of US\$1381 and net returns to the household-owned resources of US\$761. Growing three rice crops is too taxing, however, for maintaining soil fertility. In Minh Dieu, the other village in the EIZ, farmers grew two rice crops a season and had net returns to family resources of US\$606 per year. Farmers of Ninh Thanh Loi village in the MIZ grew one rice crop using traditional varieties and had net returns of US\$243 from rice. But, in addition, the farmers harvested shrimp and fish in the other two seasons from the same land and got a yield of 289 kg/ha/year, equivalent to 16.1 t of rice. The net returns from shrimp/fish cultivation per year were estimated at US\$1337 per ha. The village got total returns of US\$1580 per ha per annum from the rice-shrimp system. Thus, compared with the most intensive rice system that the government intervention has induced, the pre-existing rice-shrimp system

**Table 3.11.** Profile of the poor by socio-economic group (from sample household survey, IRRI).

Socio-economic group	Percentage of households in group	Percentage of households considering themselves as		
		Extremely poor	Moderately poor	Non-poor
Landholding (ha)				
Nil	15.8	47.2	43.8	9.0
<0.4	12.4	22.1	54.9	23.0
0.4–1.0	24.3	13.1	49.3	37.6
1.0–2.0	25.6	3.4	32.2	64.4
2.0–4.0	18.7	1.2	14.0	84.8
>4.0	3.2	0	3.4	96.6
Education of household head				
No schooling	12.2	32.4	39.6	27.9
Attended primary school	40.3	16.6	40.1	43.3
Attended secondary school	42.0	8.6	34.5	56.9
High school graduate	5.5	4.0	22.0	74.0
Source of livelihood				
Farming	76.1	8.9	35.2	55.8
Agricultural labour	7.0	55.6	39.7	4.8
Non-agriculture	16.9	22.6	41.9	35.5
Gender of the head				
Male	85.8	12.1	36.1	51.8
Female	14.2	28.7	40.3	31.0

in the coastal area provided almost twice as much income.

It should be mentioned here that shrimp prices were more favourable than rice prices in the year of the survey. One kg of shrimp was equivalent to 55 kg of rice (US\$6.53 *versus* US\$0.12 per kg). Both rice and shrimp prices fluctuate from year to year, but the shrimp market is more volatile. Even if the relative price of shrimp had declined by 50% from the level of 2001, the rice–shrimp system would remain more profitable than the intensive rice production system.

The other consideration for poverty reduction is generation of employment for resource-poor households. We estimate that the rice–shrimp system generates employment of 57 days per ha per year (35 days in two shrimp seasons and 22 days in one rice season), almost equivalent to the days of employment generated in three rice crops in the intensified rice system. Since shrimp is almost entirely marketed and is a perishable crop, it generates additional employment in

processing, storage, transport and trade, which is higher than in postharvest and marketing operations of rice.

To conclude, the investment in water management intervention did not contribute to improvement in agricultural productivity and employment generation, a step on the road to livelihood enrichment. We have noted in the previous section that the off-farm and non-farm economic activities were still relatively unimportant because of the limited accumulation of physical capital, low levels of education and limited market for non-farm goods and services. The extent of rural–urban migration is also low, as indicated by the small proportion of households receiving remittance (Table 3.7).

#### *Vulnerability and crisis management*

To assess the factors causing movement into poverty, we asked respondents to report the major crises that had hit these households over the previous 10 years, and how they

**Table 3.12.** Productivity and profitability from rice and shrimp systems, 2001 (from authors' estimate from household survey data).

Indicators	EIZ <sup>a</sup>			RIZ			MIZ	
	Ninh Quoi	Minh Dieu	Phong Thanh	Phong Thanh Tay	Ninh Thanh Loi	Shrimp	Rice	
Yield, rice equivalent (t/ha)	11.80	8.31	5.76	4.28	2.90	16.13		
Summer-autumn <sup>b</sup>	3.79	4.71	3.56	2.46	—	9.71		
Autumn-winter <sup>b</sup>	3.50	3.60	2.20	1.82	2.90	6.42		
Winter-summer <sup>b</sup>	4.51	—	—	—	—	—		
Gross value of production (US\$/ha/year)	1381	973	674	500	339	1887		
Paid-out cost (US\$/ha/year)	620	367	423	346	96	550		
Family income (US\$/ha/year)	761	606	251	154	243	1337		

<sup>a</sup> EIZ, early intervention zone ; RIZ, recent intervention zone ; MIZ, marginal intervention zone.<sup>b</sup> Cropping seasons.

coped with these crises. Some 25% of the households reported facing one or more crises during the period. The major crises that caused vulnerability to livelihood were destruction of property by Typhoon Lynda (1997) and floods, death and disability of earning members, an occasional drastic fall in paddy price, death of livestock and loss of soil fertility caused by salinity, in that order of importance. The amount of loss incurred from crises varied from 1 to 10 million VND (US\$66 to US\$660), with a majority mentioning a loss of from 1 to 5 million VND. A majority reported that they coped with a crisis by using their own savings or by selling or mortgaging property. One in four respondents borrowed money and 17% got help from relatives. Only 38% of the people were able to recover from the losses totally, and 51% partially recovered. Twelve percent of the households were unable to recover from their losses.

*Perception of respondents of upward or downward mobility*

Table 3.13 reports the opinions of the respondents on changes in economic conditions over the decade prior to the survey. Downward mobility was reported mostly in the two villages in the RIZ (in transition), where two-thirds of the households reported a deterioration in economic conditions. Upward mobility was most pronounced in the MIZ, where 60% of the households reported upward mobility. The net change was also positive in both villages in the EIZ.

The major factors behind the improve-

ment in economic conditions in the MIZ (the shrimp-based system) were an increase in shrimp or fish production, followed by an increase in rice production (Table 3.14). In the EIZ (the rice-based system), the major factors behind upward mobility were reported as an increase in rice production, followed by an increase in employment opportunities and engagement in livestock production.

The major reasons behind downward mobility in the RIZ were a reduction in both shrimp and rice production. The closure of the sluice gates reduced the availability of brackish water needed for shrimp production. But, the acidity in the soil and the inexperience in the cultivation of modern rice varieties did not contribute to a compensation for the loss through an increase in rice production.

A significant proportion of the households in Ninh Quoi village in the EIZ also reported downward economic mobility. With the availability of fresh water, this village started growing three rice crops, which adversely affected soil fertility and caused a gradual reduction in rice yield. The reduction in rice production was reported as a major factor behind the downward mobility (Table 3.15). Other factors that contributed to the downward mobility in the village were an increase in health hazards for the farmers (increased incidence of malaria because of stagnant water in the canals) and a reduction in income from trade (the construction of sluices adversely affected inland water transport).

**Table 3.13.** Perceptions of changes in economic conditions in 1990–2000 (% of cases)(from sample household surveys, IRRI).

Village and zone	Improved	Unchanged	Deteriorated	Net change
Early intervention zone	41.8	39.2	19.0	22.8
Ninh Quoi	34.6	40.5	24.9	9.7
Minh Dieu	50.0	37.7	12.3	37.7
Recent intervention zone	5.6	25.6	68.8	–63.2
Phong Thanh	9.6	24.9	65.5	–55.9
Phong Thanh Tay	1.9	26.3	71.8	–69.5
Marginal intervention zone				
Ninh Thanh Loi	60.4	23.4	16.2	44.2
All villages	28.6	30.5	40.9	–

**Table 3.14.** Reasons for improvement in economic conditions (% of cases)<sup>a</sup> (from sample household survey, IRRI).

Reasons for improvement	Marginal intervention zone	Early intervention zone	
	Ninh Thanh Loi	Minh Dieu	Ninh Quoi
Increase in shrimp/fish production	91	3	—
Increase in rice production	23	94	75
Increase in income from trade	2	6	9
Increase in employment opportunities	7	16	27
Increase in income from livestock	1	16	23

<sup>a</sup> The total exceeds 100 because of multiple responses.

**Table 3.15.** Reasons for deterioration in economic conditions (% of cases)<sup>a</sup> (from sample household survey, IRRI).

Factors behind deterioration	Recent intervention zone		Early intervention zone
	Phong Thanh	Phong Thanh Tay	Ninh Quoi
Reduction in rice production	61	63	37
Reduction in shrimp/fish production	59	54	—
Reduction in natural fishing	9	21	—
Reduction in employment opportunities	12	16	15
Health hazards for earners	13	7	26
Increase in family size	2	1	17
Reduction in income from trade	5	2	15

<sup>a</sup> The total exceeds 100 because of multiple responses.

## Discussion and Conclusions

The government intervention in water management indeed succeeded in controlling saline water intrusions into Bac Lieu Province. This had encouraged farmers to grow a second rice crop and, in some areas, a third rice crop in the eastern part of the protected area, where there is good alluvial soil and canal water became fresh before 1998.

However, management of coastal areas is not easy with regard to optimal resource use for increasing income, distributing it better and sustaining the quality of natural resources. The increase in rice production in the early intervention zone comes at the expense of a fall in the production of high-value aquatic products, from both the raising of shrimp in brackish water in fields and the capture of natural fish in canals in the recent intervention zone, where the environment was in a transition from brackish-water to freshwater ecology. Given the prevailing

prices of rice and shrimp, even at the low yield (150 kg/ha) under extensive cultivation, shrimp production was many times more profitable than rice production.

The salinity control intervention had a negative impact on the livelihood of the poor. Lacking access to land and with minimal education, the livelihood of the poor depends heavily on catching natural fish and shrimp in the saline canal water. Those with marginal land were also negatively affected because they could not keep up with new technologies, and lacked capital to invest in adopting the new technologies of modern rice cultivation.

The net effect of the government investment in the construction of embankments and sluices was a substantial reduction in farm income at the transitional stage. This situation could improve over time as farmers gain experience with the new land use and cropping patterns. In the long term, the production system in the RIZ may become simi-



lar to that of the EIZ. But, because of the presence of acid sulphate soil, it is not expected that the land productivity will be as high as in the EIZ. Even if the productivity is as good as in the EIZ, farm income would still be lower than in the MIZ, where the production system was similar to that of the RIZ before the intervention.

The high value and higher profitability of shrimp production indicate that the brackish water in the coastal area is no less important a natural resource than rice lands. Findings from this study have helped the Bac Lieu provincial government to readjust the land-use policy and water management strategies that allowed intensification of rice in the east of the province and, at the same time, a shrimp-based production system in the rest of the province. This has helped reverse the downward economic mobility of the transition zone (Hoanh *et al.*, 2003).

The low yield of shrimp under present cultivation practices suggests that the productivity of the brackish-water resource could be further increased by developing and diffusing improved technologies and cultural practices. But this has to be done with caution. It has been shown that large-scale intensive shrimp farming is risky, harmful to the environment and not sustain-

able (see Szuster, Chapter 7, this volume). Even extensive shrimp farming in the long term may also negatively affect the environment and people's livelihood via a reduction in fruit trees, vegetation cover and home-stead and livestock production (see Karim, Chapter 5, this volume). Long-term sustainability of the study area will depend upon limiting the intensification of shrimp culture and concerted action among all stakeholders to adopt integrated management of the environment. Also, shrimp raising would cause socio-economic inequality and worsen the distribution of rural income.

The economy of the study site remains at a low level of development, with land and manual labour as the dominant resources. The limited accumulation of physical capital, low quality of human capital and limited market for non-farm goods and services constrained development of the non-farm economy, which has proved to be a major pathway of poverty reduction in many countries. The government should therefore invest more for education, electrification and transport infrastructure, and develop the infrastructure for research and extension for fisheries in coastal areas, as was done in the past for rice in the deltas.

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