

## The impacts of cyclone Nargis on relative and absolute poverty in the Irrawaddy Delta, Myanmar\*

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### ARTICLE INFO

Keywords:  
natural disaster, well-being,  
poverty, income inequality,  
Myanmar

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### ABSTRACT

In the absence of before-and-after data on the same community, the goal of this study is to infer, through contemporaneous comparisons of two study areas differentially affected by cyclone Nargis, the impacts of the cyclone on physical well-being, income, income distribution, and poverty. Profiles and characteristics of small farm households using income/consumption, health, and education are drawn and compared against an exact poverty line developed for this study through the Cost of Basic Needs Method. The Gini measure of relative inequality, as well as the Foster-Greer-Thorbecke-Schoch coefficients of the incidence, depth, and intensity of poverty, are all more acute in the heavily affected area than in the lightly affected area. Recommendations are made to local and national governments, NGOs, and the affected communities themselves as to how to reduce absolute poverty; and to anticipate, protect against, and reduce the impacts of such natural disasters.

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## 1. Introduction

### 1.1 The real world problem

Myanmar is one of the lowest-income developing countries, with a GDP per capita rank of 182 out of 213 (Central Intelligence Agency, The World Fact Book) and a HDI index of 138 out of 182 countries in 2007. The total population of the country was 60 million in 2009 (Central Statistical Organization, Myanmar 2010). Agriculture is the most important sector of the national economy, with a contribution to total GDP in 2007 of

approximately 45 percent. Myanmar remains a predominantly agricultural society with the mass of its population heavily dependent upon agriculture and related activities. About 76 percent of the rural population is engaged in that sector. Moreover, the urban population is largely dependent food produced in rural areas. Agricultural productivity and stability are therefore of pivotal importance since they have a direct bearing on all other socio-economic aspects of Myanmar. (Myanmar Agriculture by U Myint Thein \_ <http://www.unescap.org/rural/doc/sads/index.htm>)

The country's macroeconomic imbalances, particularly high inflation and persistent budget deficits, are prominent concerns in the economy. These factors tend to increase the input cost of rice production

\* The authors wish to express their gratitude to the Heinrich Böll Foundation, which provided a generous scholarship and research budget for the completion of this research.

for the struggling rural poor. Furthermore, the economic growth of Myanmar has been dampened by such factors as inadequate infrastructure, outdated and inappropriate production technology, inappropriate environmental legislation, state price supports to unproductive sectors, and the lack of advanced skilled workers in the labor force.

Successful paddy output for a specified season determines not only the next paddy cultivation; it also leads to nonfarm opportunities for employees. Present farm family income is low because of low farm productivity. Furthermore, primary products are marketed with little or no value added at the household level, creating very low profit margins to growers. Farm wages are barely enough to provide food, with little left over for clothing, school fees, shelter, supplies, or medicines. Most rural areas are much worse off today than a decade ago.

The Irrawaddy Delta is known as the “rice bowl” of the Myanmar economy. Agricultural uncertainties in the region therefore have a major impact upon the income of households in other sectors. Overall in the Delta, 32 percent of the landless work in agriculture as renter/sharecroppers, agriculture workers, or seasonal agriculture workers, a figure above the 26 percent national average. The other two-thirds work in such other sectors as fisheries, salt production, trade and transportation. Indeed, the landless are more likely to be poor in the Delta region than elsewhere: 44 percent of the landless live below the government poverty line, compared with the 33 percent nationally. Of the “poor” in the Delta, 31 percent were landless, while the “very poor” were almost always landless: 85 percent. “If a natural disaster occurred, both of the economic bases, the food base and the wage base of the economy, would be destroyed.” (PONJA\_ Post Nargis Joint Assessment, July 2008)

Against this backdrop of endemic deprivation, in May, 2008 cyclone Nargis caused immense human suffering and

exacted a severe social and economic toll on the affected families and communities. The incidence of flooding, unexpected pest and disease attacks reduced the earnings from paddy-related activities. In terms of scientific research, this also causes an enormous obstacle to the comparisons of the cyclone’s impact on the poverty, dependency ratio, income per capita, etc. This is because many people died, and they were largely the very old, the very young, and the very sick. So paradoxically, the income per capita and the dependency ratio may have actually improved as a result of the cyclone, but at a huge human price.

Even without such a disaster, rural poverty affects a significant portion of the country’s population. Poverty reduction has been slow due to widening inequalities among income groups, as well as insufficient investment capital. According to the Agriculture Census of 1993, about 36 percent of total farming households owned less than three acres of land; these households can be thought of as the “hardcore poor.” In 1997, the Central Statistical Organization (CSO) collected household consumption in both food and non-food expenditures, covering all States and divisions. The Asia Development Bank (2001a) found that Myanmar is trapped in abject poverty despite its rich resource base, and the trend of impoverishment has been steadily increasing over the last ten years.

The Irrawaddy Delta is by no means significantly poor than other parts of the country (29 percent of the population was poor in 2004-05, compared with 32 percent). However, development is relatively limited, and life can be harsh, in particular when crops fail. Forty-four percent of agricultural households experienced floods during the last five years, and 43 percent experienced drought. Because of the geography of the Delta region, these figures are well above the national average.

## 1.2 The scientific challenge

The study of objective well-being from an economic point of view aims to estimate

as rigorously as possible the general forms of several variables that are hypothesized to affect poverty. The empirical results may be useful for understanding the well being in developing economies, and for designing policy and projects that will help to lift a substantial number of households out of poverty. The well-being of individuals should be considered within the context in which they live. Rural areas of developing countries differ substantially from urban areas in terms of the commodities they possess, their needs, their livelihoods and their physical environments. The basic needs approach is a useful tool for understanding the development.

One of the problems of employing this concept is how to identify the basic needs and to determine the level of needs that should be considered as “basic.” Thus, the most important question for decision-makers (i.e., researchers, NGOs, policy makers) is to identify the components of basic needs (Streeten, 1984). The Millennium Development Goals agenda uses the ideas of basic needs to identify targets and construct indicators to follow up on the fulfillment of needs in the areas of health, education and employment. The literature on subjective well being also leads individuals to make precise estimates of their own well being. This paper uses a subjective approach to measuring a food poverty line and a food-plus-other basic needs poverty line. By means of econometric techniques, the research then estimates the determinants of falling below that poverty line, as well as the determinants of income in general.

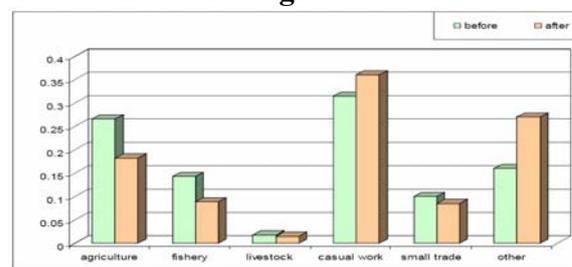
Given the possible greater incidence of death on the very old and the weak, as noted above, this research is designed to evaluate the effects of that toll upon people’s absolute, and relative poverty. But it may also be true that the sources of income which are available to people in the heavily affected have changed dramatically. The present research will seek to trace the changes in those sources of income.

Cyclone Nargis caused extensive damage and loss of life, livelihoods,

employment and income of the people living in the affected areas of the coastal zone, and the urban and pre-urban areas. Since poor people live in these zones and depend upon agriculture and fishing for their livelihoods, their entire living standards are expected to have been severely damaged by the cyclone. Small holder farmers and rural communities depend upon small-scale inshore and offshore fishing, landless poor households depend upon wage-labor in agriculture, and skilled workers previously employed in a wide-range of resource-based small and medium scale of manufacturing and processing firms lost income earning opportunities for a substantial period. Early recovery activities focused on helping people restore their livelihoods, including through the provision of farming and fishing implements, as well as funds to self-reliance and livelihood groups. Job losses fell largely in the informal sector, notably seasonal jobs in agriculture, short-term jobs in community works, small-scale fishing, rice mills, fish processing, salt production, wood cutting, and other resource-based economic activities.

Data from the Post Nargis Joint Assessment (PONJA) show that, indeed, there was an important shift of occupations in the Irrawaddy Delta as a result of the disruptions in economic activity caused by Nargis (Figure 1).

**Figure 1: The shift of occupations before and after Nargis**



Source: PONJA\_ Post Nargis Joint Assessment, July 2008\_ Tripartite Core Group

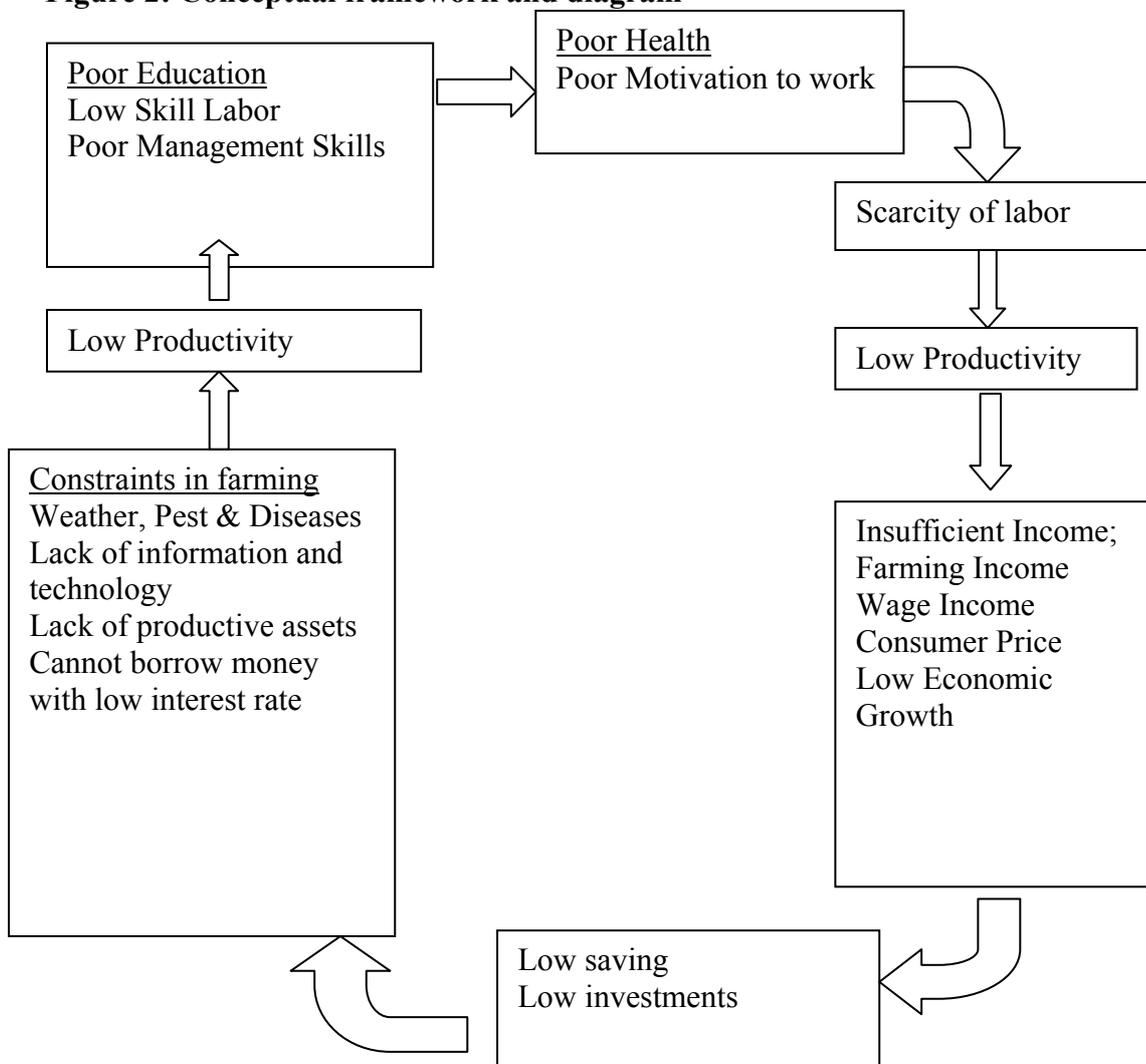
In addition to these sudden forced changes in jobs, the agricultural households of the Delta who live a hand-to-mouth existence and lack sufficient

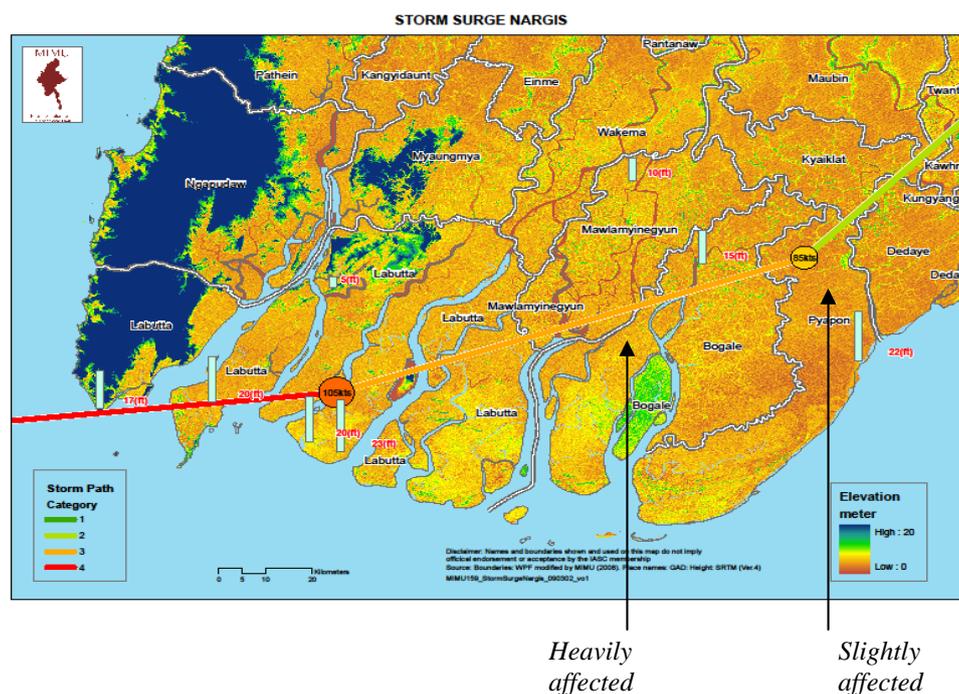
education often make suboptimal decisions. The lack of proper of education gives unskilled laborers poor management skills in agricultural production and marketing. Therefore no progress is made in farming. Poor families often have little or no allowance for good health, which undermines the motivation and ability to work. The supply of labor with low skills is high, but the demand for the work force is limited due to low investment. As a result, poor families do not have sufficient income to access the basic needs.

Farming communities in the Irrawaddy delta have always followed a cycle of debt. Each year, wealthy land owners would

lend farmers money, tools and cattle needed to till the soil. After the harvest, the debt is re-paid at a high interest rate in cash or kind, and the cycle continues for almost all small scale farmers. The root problem concerns under-investment in small household farming. The vicious cycle of the poverty trap in the Irrawaddy Delta is portrayed in Figure 2. That cycle, as well as the impact of Nargis in intensifying it, forms the conceptual framework of this paper. Figure 3 shows the path of Nargis and differentiates between heavily and slighted affected areas.

**Figure 2: Conceptual framework and diagram**



**Figure 3: Map of Cyclone Nargis affected areas**

### 1.3 Goal and objectives of the Study

The overall goal of this study is to estimate the impacts of cyclone Nargis upon physical well-being, income, income distribution, and poverty; and to make policy recommendations for the alleviation of some of the worst effects of the cyclone. In the absence of before-and-after data on the same community, we shall have to infer, through counterfactual comparisons of two study areas differentially affected by cyclone Nargis, the likely impacts of the cyclone upon these various dimensions of well-being.

In order to achieve this overall goal, we have set five specific objectives:

1. To portray the profiles and characteristics of small farm households in one heavily affected and one slightly affected township in the Irrawaddy Delta using data on income, consumption, health, education, and poverty.
2. To establish an accurate poverty line by means of the Cost of Basic Needs Method.
3. To assess and compare the relative and absolute poverty conditions (using the Gini, Theil, and Foster\_Greer\_Thorbecke-

Schoch coefficients) of small farm households in the two study areas.

4. To estimate, explain and test the significance of the levels of well-being (access to basic needs) by respondents in both study areas.

5. To make recommendations to local and national governments, to NGOs, and to the affected communities themselves as to how to reduce absolute poverty, and anticipate, protect against, and reduce the impacts of such natural disasters.

## 2. Literature Review

This study focuses on the poverty and well-being of the areas seriously damaged by Nargis affected in May 2008, forcing them to rebuild all dimensions of their lives. The people of Myanmar lack socio-economic or political power, and have had to face substantial challenges in their day-to-day lives. The following are the theoretical concepts which the researcher has used in this field research.

It is important to derive poverty lines that provide consistency in welfare measurement over space and time.

Poverty is defined in different ways by various organizations. Poverty lines are generally defined as the per capita monetary requirements for an individual adult male equivalent to afford the purchase of a basic bundle of goods and services, including notably food and shelter. Different poverty concepts define the different poverty methods. According to the United Nations (1998), poverty is a denial of choices and opportunities, a violation of human dignity. It signals a lack of basic capacity to participate effectively in society. These concepts are directly inspired by the pioneering thought of Amartya Sen.

According to the Asian Development (1999), "Poverty" means more than lack of adequate income. A state of poverty has non-economic dimensions such as discrimination, exploitation, lack of power, and fear. Thus, poverty means lack of human development, lack of a voice in decision making or empowerment, and a high degree of vulnerability. The variables considered are the access to land; population growth; overall GDP growth emanating from agriculture; the rate of inflation; the infant mortality rate; and the gross primary school enrollment ratio. Several of these economic and social factors are highly correlated. Furthermore, the 1980s was characterized by a rapid increase in the study of "gender" issues. The debate moved from a focus on women alone to wider gender relations (Gender and Development). There is a strong correlation between rural poverty on the other hand and a number of major economic and social development variables on the other.

While the Asia financial crisis in the late 1990s adversely affected the welfare of the region's population, Southeast Asia's achievements in economic and human development during the past quarter-century remain impressive, especially when seen against the performance of South Asia. These

achievements, however, have not been uniform across countries in the region. While Indonesia, Thailand and Vietnam have posted rapid economic growth and are well on their way to achieving the Millennium Development Goals (MDGs), the same cannot be said for Cambodia, Lao PDR, Myanmar or the Philippines, whose growth rates of output were extremely low, and population growth rates high. Even within these countries, the diversity of performance in growth and poverty reduction is very evident (Balisacan, 2004; Balisacan and Fuwa 2004). Sub-national studies suggest that the nature of growth, not just its speed, matters to production. They also suggest considerable heterogeneity in impacts across households with different characteristics, including location, at any given level of income (Ravallion 2004). As is the case in developing regions of the world, nearly three-fourths of the poor in Southeast Asia live in rural areas; the majority must rely upon agriculture.

Like other developing countries, the incidence of poverty is significant in Myanmar, particularly in the remote and border areas. The economy slowed to an estimated growth rate of GDP per capita of 3.6% in fiscal year (FY) 2008 (ended 31 March 2009) from 5.5% in FY2007. Myanmar was not directly hit by the global recession and world financial crisis, given its absence of trade and financial linkages with industrial countries. However, exports and private consumption were reduced by the combined effect of economic slowdowns in neighboring economies, a collapse in commodity prices, and the impact of Cyclone Nargis. Economic growth likely picked up to about 4.4% in FY2009, in tandem with a recovery in regional demand and a partial recovery in agricultural production in areas damaged by the cyclone. Private consumption is, however, likely to have remained subdued by a slowdown in inward remittances, and stagnant rural incomes as farm-gate prices

remained depressed. Inflows of foreign direct investment into the energy sector helped to lift international reserves from about \$4 billion in FY2008 to \$5 billion at the end of FY2009, equivalent to 8 months of imports. A joint United Nations Development Programme (UNDP)–Government of Myanmar Integrated Household Living Conditions Assessment (2007) places poverty incidence at 32%, with rural poverty significantly higher (36%) compared to urban poverty (22%). In the latest 2007 Human Development Index released by UNDP (the index is used to measure the level of human development of countries based on measures of life expectancy, literacy, and standard of living), the country was ranked in the bottom fourth (138 out of 182) among the countries surveyed. Cyclone Nargis, which hit the country in 2008, resulted in extensive loss of life and physical damage and may have further worsened poverty incidence in the country.

Myanmar does not have an official poverty line. The percentage of expenditure on food items as a percentage of total household expenditures is a widely used indicator to measure household access to food. According to the IHLCS (2007), 69 percent of all household expenditures, including health, are spent on food nationally which is very high. In all States/divisions the percentage exceeds 60 percent, which indicates the broad scope of household vulnerability to food insecurity. Although average consumption expenditures of non-poor households are nearly twice that of poor households, the percentage spent on food is also high, indicating that vulnerability to food insecurity is not limited to the poor in Myanmar. The average cost of a monthly food basket at the poverty line is approximately 118 492 Kyat (USD 990 at the unofficial exchange rate). The poverty line is 162,136 Kyat per adult per year.

### **3. Questions and hypotheses of the study**

#### **3.1 Research questions**

Many research questions must be addressed in order to understand, prevent and diminish the negative consequences of such disasters in Myanmar and elsewhere. These questions include:

1. Is two years enough for a hard-hit area to catch up with a mildly hit area?
2. Do the people in both types of area still lack of basic needs?
3. What are the economic and employment possibilities for the people as they try to recover their livelihoods?
4. What policy recommendations can be made for national, state, local officials, civil societies and farmers to improve the living standards of the population?

#### **3.2 Testable hypotheses**

To provide statistically valid answers for the above questions, the following hypotheses are composed for this study.

1. “Current levels of net farm income and self-produced income in kind are adequate to supply 2100 calories and 95 grams of protein per day per adult equivalent to the majority of small scale farmers only in the slightly, but not the heavily, affected areas of the Irrawaddy Delta.”
2. “Relative poverty (as measured by the Gini and Theil indices) is significantly higher in the heavily Nargis affected area.”
3. Absolute poverty (incidence) is the same in both areas; but the depth, intensity, and urgency of poverty are significantly higher in the heavily Nargis affected area.
4. The principal constraint facing agricultural households in slightly affected Pyapon are those of weather, whereas in heavily-affected Bogalay they are economic in nature
5. The relative share of various sources of income has changed significantly for the Nargis heavily-affected areas as compared to the slightly-affected area.
6. The intensity of food poverty significantly increases with household size,

total number of problems in farming, dependency ratio, age of household head, and the intensity of Nargis damage; and decreases with acres of farmland, total number of jobs in the household, highest education of any household member, and the average number of daily meals per household member over the previous week.

7. The negative determinants of the intensity of food poverty are the simple mirror image of the positive determinants of income per capita.

#### **4. Methods of sampling and data collection**

##### **4.1 Choice of study area**

This survey research investigates the impacts of natural disaster on physical well being, income and poverty in two Nargis-affected areas. It is positive, rather than normative, research. In this study, a household is defined as a group of individuals residing together, who pool all or most of their income and resources, and basically share the same economic benefits from their livelihoods.

The research areas, Pyapon Township and Bogalay Township are located in Irrawaddy Division, basin of Irrawaddy River and famous for paddy production among all others districts in country. It has been 27 months since the Nargis catastrophe. For selecting the respondents, the criterion was Cyclone Nargis affected people who engaged in farming before Nargis and the small farmers who are holding under 5 acres (2 ha). Interviewees included both village leaders and the heads of households in randomly selected villages. Bogalay and Pyapon Township were selected based on the different level of damages affected by Cyclone Nargis. Bogalay lay directly in the path of the cyclone as it made land-fall in Myanmar. The extent of damage and loss of life was therefore extreme. In fact, in the whole Irrawaddy Delta area, Bogalay sustained the greatest physical damage. In contrast, Pyapon lies farther inland and had the

advantage of being much closer to the markets in the then-capital city Yangon. It sustained far less physical, environmental, human, and economic destruction than Bogalay. For that reason, Pyapon was selected to be the proxy for the “before-cyclone” situation in Bogalay.

It should be noted, however, that, in the absence of a true baseline survey for Bogalay from the period before the cyclone, no township in the Delta could be used as a perfect proxy. In the case of Pyapon, better market access may mean the standard of living was already higher before Nargis than in Bogalay. However, the research team agreed that there was no more similar site to Bogalay in terms of a township with many rice farms of less than two hectares.

##### **4.2 Selection of households**

The researcher collected the secondary data related to the study area known as the country’s rice bowl, Irrawaddy Division. The major sources for secondary data were the Myanmar Agriculture Services (MAS), the Settlement and Land Record Department (SLRD), the Central Statistical Organization (CSO), the United Nation Development Program (UNDP), the Food and Agricultural Organization (FAO), the World Food Program (WFP), the United Nations Office for Coordination of Humanitarian Affairs (UNOCHA), the United Nations International Children’s Emergency Fund (UNICEF), le Groupe de recherche et d’échanges technologiques (GRET), and other non-governmental organizations. Secondary data included township and village profile data, maps, annual progressive reports, project documents and research papers/reports. The sources of data were both local and national.

After collecting secondary data from different sources to give better insights into the study area, the researcher selected the sample study sites based on the different level of damage affected by the cyclone Nargis. To confirm the presence of substantial differences and test the survey instrument, a preliminary survey was

conducted by the researcher in two random selected villages of Bogalay and Pyapon Townships on May, 2010.

Once the survey questionnaire was adjusted for the observations gleaned from the preliminary survey, the researcher and team started the main survey to collect the data with the structured questionnaires by purposive sampling in the selected areas. First, sample selection focused on the households from Cyclone Nargis affected areas who engaged in farming before Nargis and held under 5 acres (2 ha) of farmland. Second, the sample study sites Bogalay and Pyapon were selected based upon their differential level of damage from the cycle. Finally, individual agricultural households were selected from the different villages to represent the population which was affected by the cyclone Nargis. In this study, the information collected was concerned not only with monetary expenditures but also with quantities relating to food items purchased or acquired for consumption. In addition to income and expenditure data, other demographic data, socio-economic data on basic needs, livelihood, social capital and the self-perceived happiness level<sup>1</sup> of the farmers was collected through the structured questionnaire.

### 5. Methods of data analysis

Subjective well being approaches have been used to measure the perceived poverty line, thus complementing or replacing income-based approaches (Kingdom and Knight, 2006; Pradhan and Ravallion, 2000; Rojs, 2008). In this paper, the researchers propose the simple method of measuring poverty by using the basic needs approach as it is perceived by the household. Therefore we also capture the psychological, demographic and social aspects that are

taken into account in subjective well being approaches by considering the individual or household as poor or non poor. The researchers applied this framework to the data set and argued that due to the completeness of the concept, the perceived basic needs approach is more accurate than poverty lines related to income.

The calculation of the five measures of inequality and poverty to be reported in this article are as follows:

**Gini Coefficient of income** =  $2 * \sum (i^{th} \text{ number of Sample Population} * \text{Per Capita Income}) / (\text{Total Income} * \text{Total Number of Sample Population}) - (\text{Total Number of Sample Population} + 1) / \text{Total Number of Sample Population}$

### Foster\_Greer\_Thorbecke-Schoch measures of absolute poverty

$$FGT_{\alpha} = \frac{1}{N} \sum_{i=1}^H \left( \frac{z - y_i}{z} \right)^{\alpha}$$

- N = number of people in the sample population
- H = number of poor people
- z = poverty line
- y<sub>i</sub> = actual expenditure on food consumption per adult male equivalent
- α = 0, incidence of poverty, the Headcount ratio, or the fraction of the population which lives below the poverty line.
- α = 1, depth of poverty, how much government must give, on average, to each poor household to eradicate poverty.
- α = 2, intensity of poverty, the index combines both poverty and income inequality among the poor.
- α = 3, urgency of poverty, i.e., if we do not support them soon, they will likely starve.

<sup>1</sup> Due to the complexity of the analysis of the effects of the cyclone on happiness and social capital, this subject is beyond the scope of the present paper. It will be presented in future research.

## 6. Empirical results

### 6.1 Calculations of Food- and overall Poverty Lines

The Food Poverty Line is defined as the amount of money required to purchase the minimum food requirements of the each male adult equivalent in a given household. In the case of the Nargis affected study areas, the food poverty line estimated by the Cost of Basic Needs Method refers to the subsistence minimum food energy requirement of 2100 calories per person per day plus other essential goods (Foster et al., 1984; Ravallion, 1998). The Cost of Basic Needs Method was applied in constructing the poverty line for the two Nargis affected areas. The lowest quartile's food consumption was used as a reference for food consumption in order to avoid the underestimation of poverty. Using the FAO calorie conversion table of 1985, each food quantity was converted and then scaled up by 1.13 to reach the recommended intake of 2100 kcal per person per day. The food

poverty line was estimated at 920 Kyats per person per day by multiplying the food quantities by average food prices. The population of the research area relies principally upon rice to get their required energy. They derive fewer calories from other food items. They prefer to take fish, which are produced and readily available in the study area.

After estimating the poverty line, the non food poverty line can be estimated as follows:

$$\text{Non Food Poverty Line} = \text{Food Poverty Line}(1 - \alpha).$$

Therefore, Non Food Poverty Line = 920 Kyats (1 - 0.81) = 174.8 Kyats  $\approx$  175 Kyats. Hence, the absolute poverty line is 920 + 175 = 1095 Kyats. That poverty line is converted to US\$ in current price in 2010, it is equal to US\$ 1.1. This value is very close the commonly used international standard of 1.25 \$ per day.

**Table 1: Calculation of Food Composition and Food Poverty Lines**

Food Composition and Respective Food Poverty Line in the Study Area					
Items	Food Quantities of Ref. Household x 1.13 (gm/person/day)	Received Average Calorie (kcl/person/day)	Average Food Expenditure (Kyat/person/day)	Calorie Contribution	
				From Survey	FAO Recommended
Rice	482	1701	200	81	45
Cooking Oil	40	3	100	0.1	10
Meat and Fish	50	120	100	6.7	20
Eggs	0.05	3	100	0.1	n.a.
Pulses	50	74	100	2.6	5
Vegetables	185	50	100	2.4	5
Spices	59	32	40	1.5	n.a.
Sugar	25	86	30	4.1	n.a.
Beverage	4.32	12	100	0.6	
Other foods	17	19	50	0.9	15
<b>Total</b>		<b>2100</b>	<b>920</b>	<b>100</b>	<b>100</b>

Source: Adapted and Modified from Gender and Rural Poverty in Myanmar and field survey August, 2010

The total number of resident adult male equivalents for basic needs or workforce calculation is as follows: (boy 0-7 = 0, girl 0-7 = 0, male 8-12 = 0.3, female 8-12 = 0.3, male 13-15 = 0.5, male 16-17 = 0.9, female 16-17 = 0.9, men 17-60 = men 17-60 = 1, female over 60 = 0.6, males over 60 = 0.75). The food poverty comparisons for the two areas showed that the headcount poverty rate of the heavily affected area is higher than slightly affected area. Crop yields are affected by climatic conditions, usage of quality seeds with the correct ratios of organic and chemical fertilizers, soil fertility level, production technology, and pest and disease incidence. Farmers of the Irrawaddy Delta already lacked quality seeds, some types of chemical fertilizer and production technology. In addition, in 2009-2010, the farmers faced crop failure because of late and heavy rainfall, pest and disease incidence. Among Nargis affected areas, the heavily affected areas were likely to face more pest and disease problems than the slightly affected areas.

The 920 Kyat poverty line is applicable for the Irrawaddy Delta area, as a household in rural areas faces relatively modest food prices. The researchers used the food

poverty line for the calculation of the incidence, depth, intensity and urgency of poverty in the two areas (Figure 4). Income tends to be understated for many reasons:

1) People forget, particularly when asked in a single interview, about items they may have sold, or money they may have received.

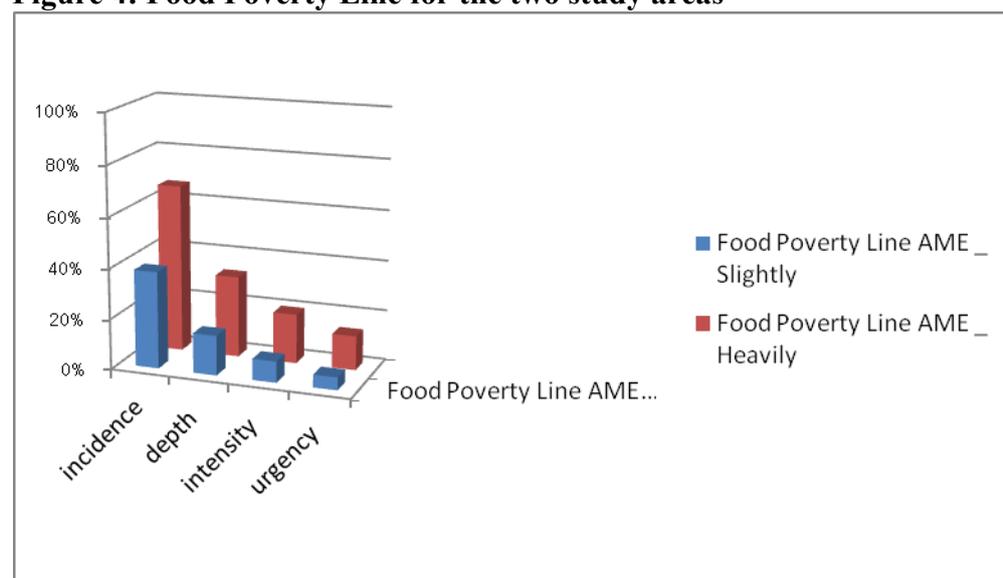
2) People may be reluctant to report income, especially if it is earned illegally.

3) Some portions of household income are difficult to calculate, for example some family members work at the seasonal informal sectors and do not have regular income.

4) Income levels may be affected by short term fluctuations for the seasonal pattern of home agricultural production. Since time series data and secondary data for the previous time period were not accessible in this study and the prices and income of a base year were unknown, real income and expenditures could not be calculated. Nominal income and expenditure were therefore used to indicate the state of distribution.

Even with these caveats, there is a clear distinction between the two study areas in terms of the degree and severity of poverty.

**Figure 4: Food Poverty Line for the two study areas**



AME= Adult Male Equivalent ratio

We therefore “accept” (fail to reject) hypothesis 1, to the effect that “*Current levels of net farm income and self-produced income in kind are adequate to supply 2100 calories and 95 grams of protein per day per adult equivalent to the majority of small scale farmers only in the slightly, but not the heavily, affected areas of the Irrawaddy Delta.*” A full 67% of the population in heavily affected Bogalay is food poor, while “only” 39% in slightly affected lack adequate money to purchase food. Similarly, the depth and intensity of poverty are substantially higher in the heavily-affected area.

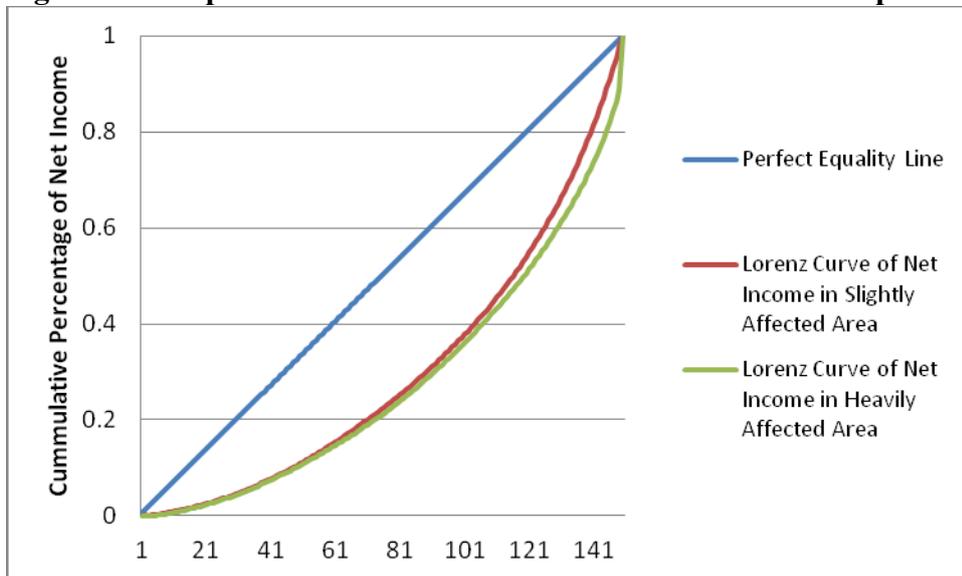
We must however reject hypothesis 2, to the effect that “*Absolute poverty (incidence) is the same in both areas, but the depth, intensity, and urgency of poverty are significantly higher in the heavily Nargis affected area.*” In fact, all FGTS measures of poverty (incidence, depth, severity, and urgency) are far worse

in heavily affected Bogalay than in slightly affected Pyapon.

### 6.2 Income distribution

Turning now to relative rather than absolute poverty, the Lorenz curves of the net income per capita (Figure 5) point to greater inequality of income in heavily affected area. Still, there is a very little difference in the Lorenz curves of net income per capita. The result is confirmed by the calculation of Gini coefficients, which show that the Heavily Affected Area has higher inequality in income. The Gini coefficient of Pyapon Township, the slightly affected area, is 0.4 while that of heavily affected Bogalay is 0.45. This signifies that Bogalay has somewhat more intense income inequality. The Theil Index of the slightly affected area, Pyapon is, however much lower (0.25) than that of the heavily affected area, Bogalay (0.38).

**Figure 5: Comparative Lorenz Curve of the Net Income Per Capita**



It will be noted from Figure 4 that the Lorenz curve of income in both areas is almost same at the origin showing that the income distribution among the poor is virtually the same. At the higher classes, however, the Lorenz curve of heavily affected Bogalay is steeper than slightly affected Pyapon. This isolates the greater

inequality in Bogalay at the upper end of the curve, suggesting that certain favored households were helped more by relief efforts in the heavily affected areas. We therefore fail to reject hypothesis number 3, which states that “*Relative poverty (as measured by the Gini and Theil indices) is significantly higher in the heavily Nargis*

affected area.” Both the Gini and Theil measures of inequality are significantly higher in heavily affected Bogalay.

Table 2 summarizes the various measures of absolute and relative poverty for the two study areas.

**Table 2: Levels of relative and absolute poverty in the two study areas**

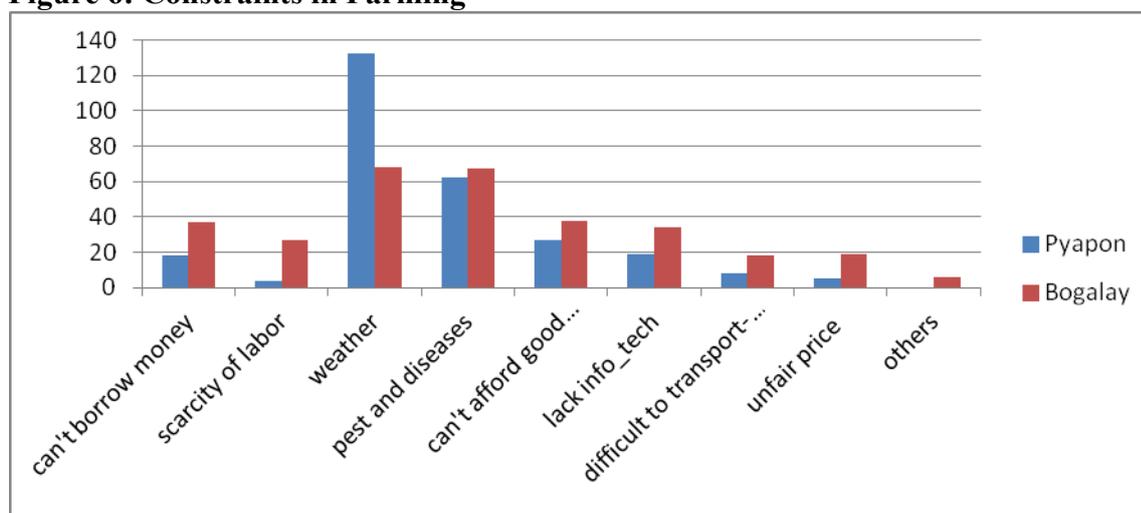
Nargis Areas	Slightly Affected Area (Pyapon)	Heavily Affected Area (Bogalay)
Incidence	39%	67%
Depth	16%	32%
Intensity	8%	20%
Urgency	5%	17%
Gini	0.40	0.45
Theil Index	0.25	0.38

### 6.3 Constraints to farming

Over 298 households, 290 households faced constraints in farming. Household were asked to list the main constraint or obstacle to farming. Figure 4.3 shows the types of constraints in farming form those

two areas. They faced with difficulties with weather and pest more than others constraints after Nargis. Bogalay, the heavily affected area is likely to face more difficulties than slightly affected area.

**Figure 6: Constraints in Farming**



Most of the households from the affected areas who earn income do so in the informal sectors. Although the informal sector is not precisely defined, it typically consists of workers with poor education, technology, productive assets; credit with very high interest rates; and employment in the family farming business. Because of the lack of production capital in agriculture, the basic economic sector, a substantial part of farm household livelihoods comes directly from

farming. If support for livelihood activities does not continue, there is a risk that many people will face severe hardship, especially given the failure in harvesting for 2010. Access to credit on reasonable terms or direct inputs of funding to help farmers replace lost assets remains a major requirement. As yet, there is no indication that the government will step in to resolve this issue.

The independent sample Student t-test was used to test for the differences

between slightly affected Pyapon and heavily affected Bogalay in terms of the constraints to farming (Table 3). The livelihood situation after Nargis was

expected to be different and socio-economic variables are supposed to be similar.

**Table 3: t-test between the two areas for per capita income and farming constraints**

Variables	Nargis affected status	N	Mean	Std. Deviation	F	Sig.	t	Sig. (2-tailed)	Mean Difference
<i>total gross income per capita</i>	heavily	150	389784.52	262029.26	3.357	.068	2.876	.004	81546.80
	slightly	148	308237.73	226336.10					
<i>% income for livestock sales</i>	heavily	150	.022867	.0842761	15.017	.000	1.994	.047	.0152315
	slightly	148	.007635	.0403785					
<i>% vending sales</i>	heavily	150	.006133	.0431913	14.107	.000	-2.051	.042	-1.765E-02
	slightly	148	.023784	.0954788					
<i>Can't borrow money</i>	heavily	150	.25	.433	33.953	.000	2.815	.005	.125
	slightly	148	.12	.328					
<i>scarcity of labor</i>	heavily	150	.18	.385	103.408	.000	4.473	.000	.153
	slightly	148	.03	.163					
<i>weather</i>	heavily	150	.45	.499	222.418	.000	-9.107	.000	-.439
	slightly	148	.89	.312					
<i>lack technical information</i>	heavily	150	.23	.420	20.842	.000	2.233	.026	.098
	slightly	148	.13	.336					
<i>difficult transport-market</i>	heavily	150	.12	.326	16.942	.000	2.013	.045	.066
	slightly	147	.05	.228					
<i>farming_unfair price</i>	heavily	150	.00	.000 <sup>a</sup>	39.874	.000	2.991	.003	.093
	slightly	148	.00	.000 <sup>a</sup>					

The basic demographics of the two areas -- age of household heads, schooling year of household heads, household sizes -- are not significantly different. However, the relative ranking of the most limiting constraints in the heavily affected area is significantly different from those in the slightly affected area. According to the t-tests, the percentage of income from livestock, percentage of income from vendor, total gross income per capita and borrowing money, labor, weather, lack of information technology, difficulty to transport to market and unfair price for constraints in farming are significantly different between two areas. Livestock is

the secondary occupation for these two areas and percentage sales of income from heavily affected area is high and also variance. The constraints in farming for borrowing money, finding laborers, acquiring information technology, and managing transport to market are significantly higher in heavily-affected Bogalay. The credit for food, health, and business are significantly higher in heavily-affected Bogalay (Table 4). That is why the people from heavily affected area likely to face greater difficulties to face with food sufficiency, health care, and business rehabilitation than lightly hit Pyapon.

**Table 4: t- test between sources of credit**

Variables	Nargis affected status	N	Mean	Std. Deviation	F	Sig.	t variance s	Sig. (2-tailed) means	Mean Difference
Source of credit for food and drink	heavily	27	2.85	1.433	14.758	.000	-1.947	.058	-.694
	slightly	22	3.55	1.057					
Source of credit for health care and medicine	heavily	25	3.32	1.249	83.199	.000	-2.806	.010	-.704
	slightly	41	4.02	.156					
Source of credit for business	heavily	128	3.54	1.034	26.952	.000	-2.576	.011	-.290
	slightly	117	3.83	.711					

Taken together, the above empirical results do not permit us to reject hypothesis 4, which states that “*The principal constraint facing agricultural households in slightly affected Pyapon are those of weather, whereas in heavily-affected Bogalay they are economic in nature.*”

#### 6.4 Determinants of income

Income per capita is highly correlated with the acres of farm land and negatively

correlated with household size, as farming is unproductive (Table 5). The higher the number of family members in the household, the lower will be the net income per capita. Furthermore, the number of boys who are studying is negatively correlated to the net per capita income. Boys are considered to be more productive than girls for farming and casual labor. If they are not studying, they can work for the family.

**Table 5: Regression of net household incomes per capita on socio economy and geography**

Net Income per Capita	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Arable land available for each household member	174016.700	23309.213	.600	7.466	.000
Employment Rate	117760.487	65605.650	.177	1.795	.074
Age of household head	-2928.145	949.869	-.395	-3.083	.002
% income from livestock	1000107.496	208349.293	.195	4.800	.000
% income from casual jobs	191966.290	115180.065	.074	1.667	.097
Nargis affected status	12208.145	27311.099	.025	.447	.655
Average score across physical, mental, emotional, and spiritual happiness	27686.267	16799.979	.250	1.648	.100

Adjusted R square= 0.553

F= 53.427

The percentage of sales income from livestock and casual labor also highly correlated to the net per capita income because when the farming is unproductive,

the livestock, fishing and casual labor are very important source of income for them. Fishing has many constraints for them especially capital is too high. So, for low

income small farmers, secondary income depends on the livestock and causal labor. Finally, average score across physical, mental, emotional, social and spiritual questions is positively and highly correlated with net capita income. People who are happy and healthy in all dimensions of their lives will work with greater efficiency and productivity, thus generating higher income.

The total gross income per capita is also significantly different for these areas. But both the mean and the standard deviation of total income per capita of heavily affected area is higher than slightly affected area. This explains why the income inequality and the percentage of people below the food poverty line are significantly higher in the heavily affected area. Livestock is a good source of income but most of the livestock from heavily affected area were killed by Nargis. The percentage of income from vendor is significantly higher in the slightly affected area. The households from the slightly affected shifted their livelihood to that

economic activity from farming when they lost their productive assets during the cyclone. We therefore cannot reject hypothesis 5, to the effect that *“The relative share of various sources of income has changed significantly for the Nargis heavily-affected areas as compared to the slightly-affected area.”*

**6.5 The intensity of poverty**

Living in strongly affected Bogalay, as well as and other factors (Table 6) strongly determine the intensity of food poverty. For example, household size is strongly significant. The higher the household size, the higher intensity of poverty. The intensity of food poverty is also correlated with the adult male equivalent ratio. Acres of farm land are one of the prominent factors of the intensity of food poverty. As the research focuses on the agriculture of small farmers, the intensity of food poverty is directly and highly correlated with the lack of arable land.

**Table 6: Regression to explain the intensity of food poverty**

Intensity of Food poverty	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Household size	.039	.008	.680	4.643	.000
Acres of farmland	-.056	.009	-.749	-6.025	.000
Total number of problems in farming	-.018	.008	-.162	-2.240	.026
Total no. of jobs in household	-.055	.019	-.383	-2.908	.004
Highest education of any household member	-.011	.004	-.331	-2.661	.008
Dependency ratio	.025	.010	.195	2.536	.012
Average no. meals per hh member in past week	.081	.017	.852	4.644	.000
Age of household head	.002	.001	.373	2.615	.009
% income from casual jobs	-.314	.103	-.159	-3.055	.002
Nargis affected status	.059	.023	.158	2.530	.012

Adjusted R square = 0.460

F= 26.258

We therefore cannot reject hypothesis 6, which states that *“The intensity of food poverty significantly increases with household size, total number of problems in farming, dependency ratio, age of household head, and the intensity of Nargis damage; and decreases with acres of farmland, total number of jobs in the*

*household, highest education of any household member, and the average number of daily meals per household member over the previous week.”*

But we must reject hypothesis 7, which states that *“The negative determinants of the intensity of food poverty are the simple mirror image of the positive determinants*

of income per capita.” Simple visual inspection of Tables 5 and 6 reveals little parallelism between the significant determinants of income and poverty intensity.

## 7. Summary and conclusions

In the absence of before-and-after data on the same community, the goal of this study has been to infer, through contemporaneous comparisons of two study areas differently affected by hurricane Nargis, the impacts of the hurricane on physical well-being, income, and income distribution. Profiles and characteristics of small farm households using income/consumption, health, and education were drawn and compared against an exact poverty line developed for this study through the Cost of Basic Needs Method. The Gini measure of relative inequality, as well as the Foster\_Greer\_Thorbecke-Schoch coefficients of the incidence, depth, intensity and urgency of food poverty in the two study areas were also calculated and compared.

The results of our hypothesis testing have confirmed that current levels of net farm income and self-produced income in kind are adequate to supply 2100 calories and 95 grams of protein per day per adult equivalent to the majority of small scale farmers only in the slightly, but not the heavily, affected areas of the Irrawaddy Delta. Relative poverty (as measured by the Gini and Theil indices) is significantly higher in the heavily Nargis affected area; as are all measures (incidence, depth, severity and urgency of absolute poverty). The relative share of various sources of income has changed significantly for the Nargis heavily-affected areas as compared to the slightly-affected area. The principal constraint facing agricultural households in slightly affected Pyapon are those of weather, whereas in heavily-affected Bogalay they are economic in nature. Finally, the intensity of food poverty

significantly increases with household size, total number of problems in farming, dependency ratio, age of household head, and the intensity of Nargis damage; and decreases with acres of farmland, total number of jobs in the household, highest education of any household member, and the average no. of meals per household member for a day in the past 7 days. These factors are not the simple opposite of the factors that increase income.

Recommendations must be made to local and national governments, to NGOs, and to the affected communities themselves as to how to reduce absolute poverty; and to anticipate, protect against, and reduce the impacts of such natural disasters. Since the two study areas differ substantially, and the determinants of income per capita are not the simple opposites of the determinants of the intensity of food poverty, policy implications must be carefully targeted both geographically and in terms of the dimension of well-being. The government and non-governmental organization should put in place new credits or loans to help farmers in reestablishing their livelihoods. Support could be provided to strengthen local seed production, community-based storage, and the capacity of support service providers including extension and financial services. To assure minimum food and income security for cyclone-affected groups, farmers need to be taught how to implement and manage intensive backyard gardening and small fishpond cultivation.

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