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The Need for Premium Agri-fisheries for the Disaster-Affected Areas of Leyte, Philippines

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On 8 November 2013, Super Typhoon Yolanda (internationally, "Haiyan"), a category-five typhoon, traversed the central Philippines. It was reportedly the strongest recorded storm ever to hit land, with winds over 300 km h^{-1} and storm surges over 4 m around coastal towns of the central Philippines. Total losses from the storm were PHP 571.1 billion (USD 12.9 billion); the estimate for Leyte Province was PHP 9.4 billion. In Leyte, the typhoon almost totally destroyed most crops, fishing boats and gear, aquaculture infrastructure, seaweed farms, mangroves, onshore facilities, and markets.

The Leyte Rehabilitation and Recovery Plan was initiated to restore the economic and social conditions of the people in Leyte to at least pre-typhoon levels, and to establish greater disaster resiliency. However, to simply re-establish pre-typhoon conditions would be a missed opportunity. The tragedy should be used to foster sustainable and climate-resilient agri-fisheries in the province of Leyte. The typhoon calamity demonstrated that the current practice of mono-cropping (or monoculture) is unsustainable and not resilient to climate change. Agriculture systems that are small-scale and labor-intensive, with diverse crop strategies that consider on-farm, farm-related, and off-farm food and income generation should be developed. Fisherfolk and coastal communities need holistic programs that ensure destroyed areas are sustainably rebuilt with a long-term perspective. Premium fisheries programs should develop the capacity of fisherfolk to diversify their income sources. The focus should be on the link between nutrition and agri-fisheries to improve nutrition. This would involve incorporating crops with various nutritional values, crop duration, seasonality, and resilience to the changing climate into farms, home and school gardens.

Successful post-disaster recovery will require an effective partnership with the local people. To be sustainable, the local people must take ownership of the development project; this requires knowledge and sensitivity to local cultures, beliefs, and practices.

Key words: rehabilitation and recovery, Super Typhoon Yolanda (Haiyan), sustainable agri-fisheries

Introduction

On 8 November 2013, Super Typhoon Yolanda (internationally referred to as "Haiyan"), a category-five super typhoon, cut a swath of destruction across the central part of the Philippines, severely affecting areas in Eastern, Central, and Western Visayas and beyond, to the northern part of Palawan (Fig. 1). The typhoon was one of the strongest storms ever recorded with wind speeds of more than 300 km h^{-1} and storm surges of over 4 m. The storm surge around the coastal towns of Eastern and Western Samar and Leyte led to severe loss of life and massive damage to private and public assets. The disaster-modelling firm, Kinetic

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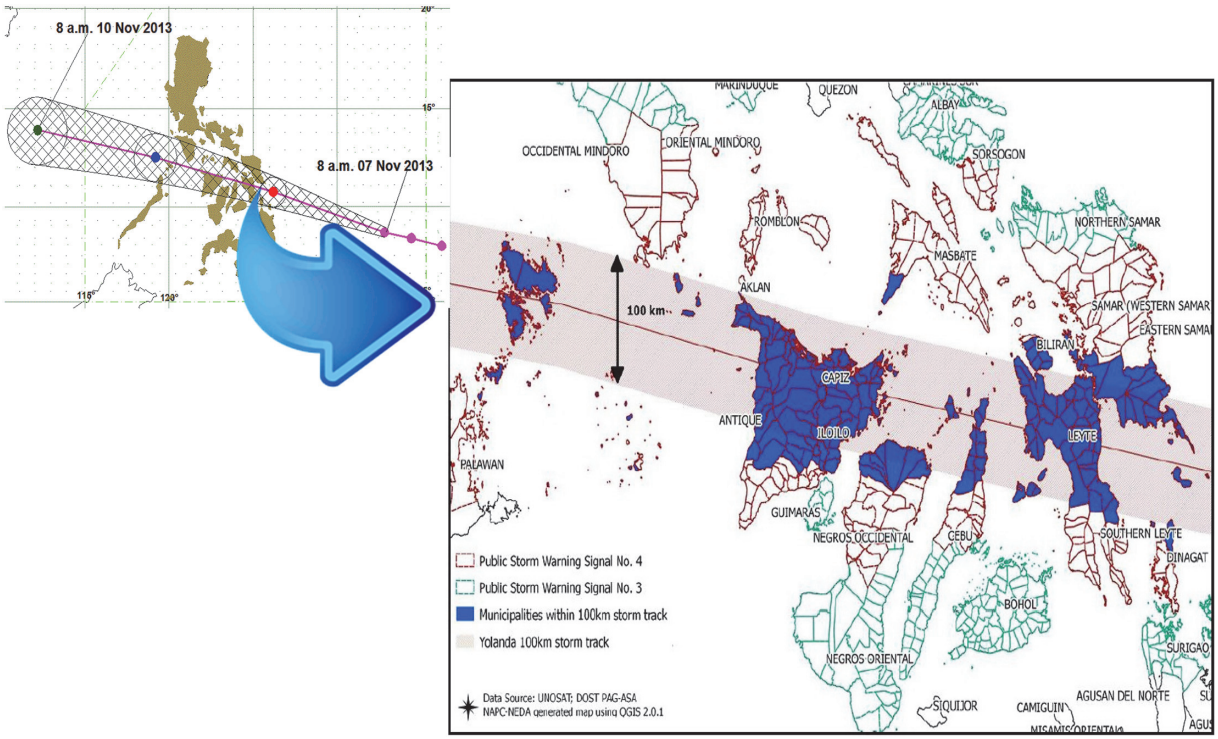

Fig. 1. Map showing 100-km-wide storm track of Typhoon Yolanda through the Philippines in November 2013 (Source: NEDA, 2013).

Analysis Corporation, estimated that the devastation will cost USD 13−18 billion (Rodrigues, 2013). The typhoon's destruction is likely to erase recent economic growth, pushing the 40% of the country's population that live on less than USD 2 d^{-1} further into poverty.

In response to the devastation, the Philippine government, working in close cooperation with local and international development partners, rapidly mounted an unprecedented humanitarian effort to deliver relief to more than four million people displaced by the typhoon. The Philippine government's strategic plan for reconstructing the economy and livelihood in all affected areas (NEDA, 2013), shows that 9 of the country's 17 administrative regions were affected by the typhoon; this includes 12, 122 barangays in 44 provinces, 591 municipalities and 57 cities (NDRRMC, 2013).

The Province of Leyte, one of the hardest hit by Super Typhoon Yolanda, had a poverty incidence of 40.5% in 2006; it was ranked number 31 among the 81 provinces in the country in terms of poverty (NEDA, 2011). It is also physically vulnerable to typhoons, flooding, and rainfall-induced erosion (Fig. 2) (Planet Action, 2009).

The official report of the Leyte Provincial Planning and Development Office (Leyte EconoMICS, 2014) indicates that there were 399,473 families, with 1,900,810 persons, directly affected by Super Typhoon Yolanda. The official number of casualties is 4,744, with 16,996 injured and 1,484 still listed as missing.

The total damage incurred from Super Typhoon Yolanda, based on initial damage reports of both the provincial local government and the various municipalities, was estimated at PHP 9.41 billion. The bulk of the damage (96.5% or PHP 9.08 billion) was as follows: infrastructure (bridges, roads, power lines, etc.), PHP 5.09 billion; agriculture, PHP 3.37 billion; houses/dwellings, PHP 504.29 million; environment, PHP 118.2 million. The remaining 3.5% (PHP 327.69 million) included damage to infrastructure facilities funded by the provincial government (3.0%, PHP 283.42 million), and to hospital equipment (0.5%, PHP 44.27 million).

As of 13 March 2014, the Office of Civil Defense, Regional Office No. 8, reported that the total damages and losses in the Province of Leyte were valued at PHP 74.97 billion (Leyte EconoMICs, 2014). Of this, 67.9

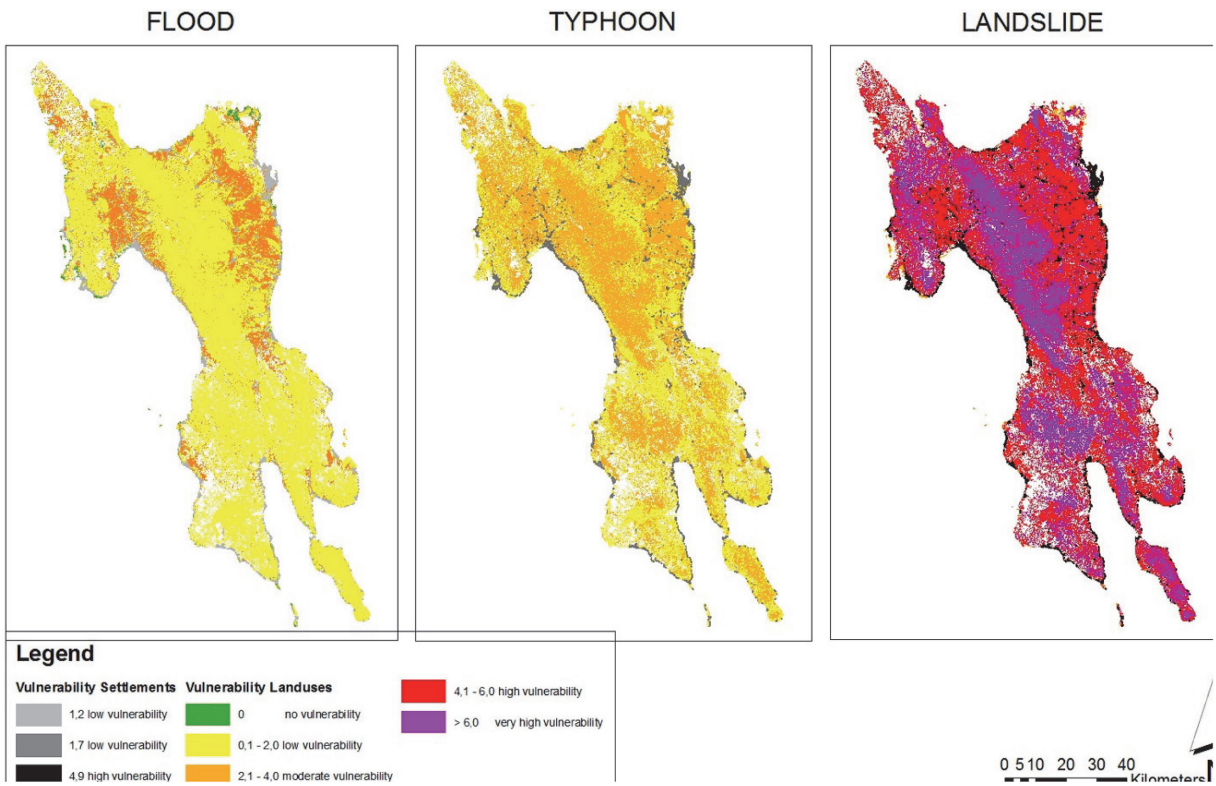

Fig. 2. Vulnerability to floods, typhoons and erosion in the Province of Leyte, Philippines, for settlements and other land-uses (crops, mangrove, and forests). (Planet Action, 2009)

%, or PHP 50.91 billion, was the total from damage, and 32.1%, or PHP 24.06 billion, represents the total from losses.

According to the Post-Disaster Needs Assessment (PDNA) of the Office of the Civil Defense, the death total from Super Typhoon Yolanda has reached 6,268, with a vast majority concentrated in the province of Leyte. The Human Recovery Needs Assessment reports an increase in the incidence of poverty in the affected areas, with fisherfolk and farming households suffering total destruction of their livelihoods.

This paper aims to determine the need for appropriate and sustainable agri-fishery projects in development efforts with regard to rehabilitation program especially after a devastating natural disaster like typhoon among other calamities.

Methods

Among the areas hardest hit by the typhoon was the Province of Leyte. The senior author, who is a native of this province, has an established link with the Provincial Planning and Development Office and has visited and gathered first-hand information from key informants in the fisheries sector from many typhoon-affected areas in the province while working for an international non-governmental organization (NGO). Documentation was done through non-structured interviews of key informants; focus group discussions (FGD), and actual observations of the typhoon-affected areas and people. Secondary agri-fisheries and nutrition data were also gathered. Primary and secondary information were collated and summarized, and data validation was conducted among key informants.

Leyte Province, Philippines: Conditions before Super Typhoon Yolanda

The Province of Leyte in the Philippines is one of six provinces in Region VIII or the Eastern Visayas. It is bounded by the Province of Biliran to the north, the San Juanico Strait and the island of Samar to the east, the Visayan and Ormoc Seas to the west, and the Province of Southern Leyte to the south. It has a total land area of 571,280 ha. The province has a total population of 1,782,638 (NSO, 2012), including 914,052 males and 868,626 females. Of the total

surface area of 725,810 ha, 31.5% of Leyte Island is covered with closed forest, 31.6% with perennial crops, 16% with annual crops, and the rest is pastures, shrubs, or barren land (REIS, 2009) (Table 1).

Leyte has fertile land, mineral and aquatic resources and a large labor force. It therefore has good potential for agricultural, fisheries, and industrial development (Sicat, 2014). During the 1960s and until the mid-1980s, Leyte was an economic leader among the Visayan provinces. This was in part due to strong political connections. This good luck changed after 1986, the time of the "people power revolution", when former President Marcos was deposed. Leyte remains part of the country's economic chain of strength. Its geothermal resources have been tapped, producing electricity for the national electric grid. Its rice (*Oryza sativa*), coconut (*Cocos nucifera*), abaca (*Musa textilis*), and other produce have contributed toward raising the national economic status.

Before Super Typhoon Yolanda, poverty was worsening in Leyte Province (Sicat, 2014). While the nation's overall economic situation had been improving on average, the region's poverty rate worsened from 2006 to 2012. In 2006, it was the 7th poorest out of 17 regions, with 41.5% of people in poverty; in 2012, the poverty rate rose to 45.2%, making it the second poorest region in the country.

Agriculture profile

The agriculture, fisheries, and forestry sectors contributed 19.9% to the provincial economy. The industrial sector, which contributed 11. 3%, includes large-scale corporations engaged in the processing of sugar and molasses, copra, copra oil and pellets, industrial lime, phosphatic fertilizer, refined copper, soft drinks, and bentonites (Leyte EconoMICs, 2013).

Major agricultural crops have been contributing to the growth of the local economy in the province. Rice is widely grown in relatively flat coastal areas; rice cultivation is one of the major economic activities. However, rice production is beset by the high cost of production inputs. Despite this constraint, Leyte, the province that bore the full brunt of the typhoon, is a category II rice-producing province, meaning that it has more than 100,000 ha of land available for rice cultivation (IRRI, 2013). Between 2000 and 2009, Leyte posted the third biggest increase in rice production among all provinces, only behind the traditional rice granary provinces of Nueva Ecija and Iloilo. It had the highest average annual growth rate in terms of yield per hectare.

Fisheries profile

The province of Leyte has a total of 44 cities/municipalities, 30 of which are coastal. The major fishing grounds of the province are Leyte Gulf, San Juanico Strait, Ormoc Bay, Camotes Sea, Visayan Sea, Biliran Strait, Carigara Bay, and San Pedro Bay (Fig. 3). There are 94 commercial fishing boats using trawl nets, Danish seines, ring nets, and bag nets. With a local fish demand of 47.89 t, municipal fish production is 303 t comprising 31 fish species. Mariculture production was estimated at 7.6 t, with six processing plants for dried seaweeds, canned abalone, pickled crab meat, and frozen octopus, abalone, shrimp, and carpet shell (*Ruditapes philippinarum*).

The province is gifted with abundant freshwater resources. However, these resources are used only for

Table 1. Land-cover distribution in Leyte, Philippines

Land cover type	Area (ha)	Percent cover (%)
Closed forest	228,665.33	31.5
Mangrove forest	6,567.31	0.9
Shrubs	53,957.19	7.4
Barren land	5,133.39	0.7
Annual crops	117,022.72	16.1
Perennial crops	229,610.37	31.6
Pastures	71,979.91	9.9
Roads, settlements, rivers	12,873.98	1.7
Total	725,810.19	100

Source: REIS, 2009

agricultural and domestic consumption; unused water flows downstream to the sea. Hence, there is very high potential for backyard fishpond culture, although this is not yet popular because of the ready supply of marine fishes in the market. Leyte has a total of only 1539.27 ha of fishpond area. However, the demand for a cheap source of protein is increasing; tilapia (*Oreochromis niloticus*) at the desirable size of 3−5 fish to a kilogram demands a price as high as PHP 80.00 kg^{-1}. However, there are currently only 163.5 ha of backyard tilapia fishponds involving 1,325 fish farmers.

Nutrition profile

Malnutrition and under-nutrition are common among the majority of school-aged children in the Philippines. The 2008 National Nutrition Survey of the Food and Nutrition Research Institute of the Department of Science and Technology of the Philippines found that out of every 100 school children aged 6−10 years, 26 were underweight, 33 were under-height, and 2 were overweight (FNRI-DOST, 2010). From 2005 to 2008, there was a notable increase in the proportion of underweight (22.8% to 25.6%) and under-height (32.2% to 33.1%) school children. The poor nutrition responsible for these conditions inhibit cognitive development of children and consequently lead to poor health and poor performance in school. In 2000, the Journal of the American Dietetic Association reported that inadequate nutrition, particularly the low intake of protein and iron, impacts negatively on intelligence and academic performance in children attending school. Children who meet their daily nutritional requirements perform better in school (Fordham, 2002).

According to the "World Declaration on Education for All", poor health and nutrition are crucial underlying factors for low school enrolment, absenteeism, poor classroom performance, and early dropouts (UNESCO, 2014). In the Philippines, learning and school performance are compromised by ill health, hunger, and under-nutrition, which affect a significant proportion of school-aged children.

The Province of Leyte is the largest province in the Eastern Visayas region; it comprises 25.5% of the region's total land area of 22,427.60 km^2. Pre-disaster data also show that the regions affected by Super Typhoon Yolanda have high rates of malnutrition. Eastern Visayas, for example, had the second highest rate of child mortality in the Philippines. It ranks below the national average in immunization coverage, skilled birth attendance, and access to skilled prenatal care, while exhibiting some of the worst health outcomes, including a higher than average incidence of diarrhea and fever among children (NEDA, 2013).

The Provincial Nutrition Cluster Partners of Leyte have screened a total 57,291 children and detected 188 cases of severe acute malnutrition and 1,161 cases of moderate acute malnutrition after the typhoon (Table 2). In the absence of provincial data on the nutritional status of 6- to 12-year-old children, the regional data (Table 3) were used and compared with data for the National Capital Region (NCR) with Metro Manila as its capital city. On one hand, protein energy malnutrition, particularly as evidenced in under-weight children and stunting, but not wasting, was higher in Eastern visayas compared to the NCR means. On the other hand, anaemia was less prevalent than the NCR means, but mild iodine deficiency disorders (IDD) were higher among children in Region VIII.

Vulnerability of Leyte to climate change and other disasters

The province of Leyte, which sits within the typhoon belt along the eastern seaboard of the Philippines, is physically vulnerable to typhoons, flooding (21% of total land area) and rainfall-induced erosion (50% of total land area) (Fig. 2). The latest version of the Business Risk Assessment and the Management of Climate Impacts (WWF, 2013) assessed the climate-change preparedness of Tacloban City, Leyte. This assessment, based on 20 years of data, showed that climate change is taking a toll on the city's major sources of economic growth. Climate change causes extreme droughts, stronger storms, rising sea level, aggravated flooding, and landslides. Leyte has 24 seaports, two of which, located in the cities of Tacloban and Ormoc, are considered national ports. These ports are of major economic concern, because the ports and the entire fishing industry are vulnerable to sea-level rise and ocean acidification, both of which are effects of climate change (Ranada, 2013).

The same study (WWF, 2013) also reported that Tacloban's weather is getting "wetter", as demonstrated by the sharp rise in its average annual rainfall, from 1,853 mm in 1998 to 4,768 mm in 2011. Cyclones were also getting stronger in the five years from 2009 to 2014 (Sarmiento, 2014). This does not bode well for a city susceptible to heavy flooding and

Table 2. Nutritional status and interventions in the Province of Leyte, Philippines (updated 5 February 2014)

Nutrition information and intervention	Count
Children screened	57,291
Children with severe acute malnutrition	188
Children with moderate acute malnutrition	1,161
Children admitted to inpatient treatment program	23
Children admitted to outpatient treatment program	127
Children received blanket supplementary feeding program with high energy biscuits and ready-to-use supplementary foods	36,172
Children received targeted supplementary feeding program	397
Pregnant and lactating women screened	3,928
Pregnant and lactating women with moderate acute malnutrition	122
Mother- and-child friendly spaces established	21
Pregnant and lactating women counseled	7,142

Source: Napari, 2014.

Table 3. Prevalence of protein energy malnutrition, anaemia, iodine deficiency disorders (IDD) and vitamin A deficiency disorders (VADD) among 6- to 12-year-old children in the Philippines. Source: FNRI-DOST, 2008

Region	Protein energy malnutrition			Anaemia (%)	IDD[a] (ug L^{-1})	VADD[b]
	Under-weight (%)	Stunting (%)	Wasting (%)			
National	25.6	33.1	6.1	19.8	132	11.1
NCR[c]	20.0	23.1	6.1	19.1	202	
Eastern Visayas	31.6	44.7	5.6	17.7	83-mild	

[a] Based on median urinary iodine excretion
[b] No regional data because VADD is not a public health problem among school-aged children
[c] NCR, National Capital Region

landslides (Fig. 2). Floods will submerge its low-lying wetlands, while landslides can obliterate its upland villages. Moreover, sea-level rise due to the melting of the ice caps could eventually submerge the port. Tacloban's proximity to the Pacific Ocean, a major source of tropical storms, exposes its port and fishermen to extreme weather events like storms. Super Typhoon Yolanda brought storm surges that destroyed the port and crippled the fishing industry. Tacloban's unique vulnerability results in part from the city's large population, high level of urbanization, location, and unprotected coastal areas.

Rehabilitation projects following Super Typhoon Yolanda

National government plan

The Philippine government has completed a comprehensive rehabilitation and recovery plan called "Reconstruction Assistance on Yolanda" (NEDA, 2013) that covers four basic recovery sectors with a

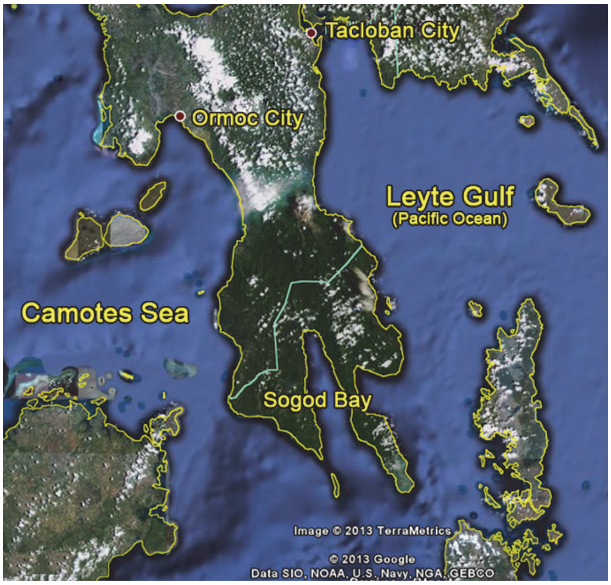

Fig. 3. Major fishing grounds of Leyte, Philippines.

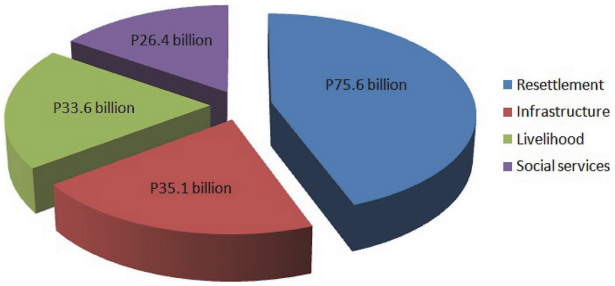

Fig. 4. Financial requirements of the Typhoon Yolanda rehabilitation and recovery plan.

total budget of about PHP 170.7 billion (Fig. 4). The sector-level damage and loss assessments are based on the United Nations Economic Commission for Latin America and the Carribean's (ECLAC, 2003) Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters, an internationally recognized post-disaster assessment methodology (Balisacan, 2013). Based on this methodology, the total damage and loss from Super Typhoon Yolanda was initially estimated at PHP 571.1 billion. This includes physical assets and reductions in production, sales and income, as well as the value of increased operating costs resulting from the disaster.

In the UN-ECLAC methodology, "damage" is defined as the total or partial destruction of physical assets. "Loss", on the other hand, is the change in economic flows, referring to loss of incomes, revenues or operational costs. "Needs" refers to the overall recovery and reconstruction requirements for the public and private sectors in the short and medium term. The UN-ECLAC methodology yielded the following estimates on the impact of Super Typhoon Yolanda on agriculture at the national level (Balisacan, 2013):

- Damage and loss: PHP 62.11 billion
- Investment requirements for recovery and reconstruction of agriculture including crops, livestock, and fisheries: PHP 18.70 billion
- Estimated recovery and reconstruction: PHP 18.680 billion

The rehabilitation and recovery plan, which was consultative and participatory, addresses concerns such as climate-change adaptation, environment, gender-sensitive needs and equality, and disaster preparedness for future hazards. It incorporates the following documents from official organizations:

- The strategic framework, called the Recovery Assistance on Yolanda, (RAY), released by the National Economic and Development Authority in December 2013 with estimated rehabilitation costs at around PHP 360.9 billion (USD 8.17 billion)
- The PDNA vetted by the Office of Civil Defence
- The local rehabilitation and recovery plans
- The cluster action plans

The plan adheres to the internationally recognized "build back better" principle for disaster-hit areas and adopts a "bottom-up" approach to rehabilitation to avoid too much bureaucracy. This means doing rehabilitation on a per-province basis, instead of all at once on a national scale.

Leyte provincial rehabilitation, reconstruction, and development plan

The Provincial Government of Leyte has finalized the Rehabilitation, Reconstruction and Development Plan (Leyte EconoMICs, 2014) to meet the goal of rehabilitation and recovery in line with the national government's strategic (RAY) plan aimed at reconstructing the economy and livelihood in all affected areas of Leyte. The main objectives of Leyte EconoMICs are to restore the economic and social conditions of the people to at least pre-typhoon levels, and to establish a higher level of disaster resiliency in all affected areas in the province. The plan includes sectors e.g., investments in infrastructure and utilities, housing, health facilities and services, livelihood

assistance in agriculture and marginal sectors, employment opportunities, and support to social welfare services and the environment (Leyte EconoMICs, 2014).

The funding in the provincial Rehabilitation, Reconstruction, and Development Plan for 2014−2016 goes mainly to infrastructure (41%), resettlement (28%), the environment (19%), and social services (7%). Agriculture and fisheries account for only 3% of the total budget (PHP 715 million), while livelihood receives only 1% (PHP 310 million). Sectoral development strategies for agriculture include the implementation of sustainable and resilient rural-based livelihood recovery projects to support the farmers and fisherfolk.

The PDNA details short-, medium- and long-term strategies for the rehabilitation of agriculture. Short-term strategies call for cash-for-work schemes, distribution of coconut seedlings, rice and corn seeds, vegetables and tubers, distribution of farm inputs such as fertilizers, tools and machinery, construction of poultry facilities, and restocking of animal livestock. Medium-term strategies include rehabilitation of post-harvest facilities, coconut replanting, and intercropping. Long-term strategies include disaster risk and reduction management planning, and research and development of drought- and flood-resistant rice varieties.

National government agencies such as the Department of Agriculture (DA) Bureau of Fisheries and Aquatic Resources (BFAR) allotted PHP 36 million to provide oyster farm implements, cages, and seed oysters; PHP 18 million for seaweed farming materials such as rope and floaters; and PHP 62 million for rehabilitation of mariculture parks. Leyte has 2,516 ha of potential mariculture areas. International NGOs are also involved; for example the Japan International Cooperation Agency in construction of a new hospital building and rehabilitation of the Leyte Marine Biotoxins Testing Center, and the German Development Cooperation for livelihood support and coastal resource assessment.

The Sustainable Development Imperative for the Development of Leyte

There are many programs that are being implemented for the recovery and rehabilitation of areas affected by Typhoon Yolanda; the national government alone has allocated a total budget of PHP 22 billion for the recovery and rehabilitation of the Province of Leyte. However, rehabilitation that aims only to restore pre-catastrophe conditions misses the whole point.

The combined Eastern Visayas is the second poorest region in the Philippines with 45.2% poverty; almost double the national average of 25.2% as of 2012 (NSO, 2012). If this region was in such dire straits even before Super Typhoon Yolanda, and is even worse now and will be in the coming years, then what this region needs is a development strategy within a sustainable agriculture framework anchored on achieving food security and alleviating poverty; adapting to and mitigating the effects of climate change while critical resources such as water, energy, and land become increasingly scarce. Sustainable agriculture simultaneously increases production and income, adapts to climate change and reduces greenhouse gas emissions, while balancing crop, livestock, fisheries and agroforestry systems, increasing resource use efficiency (including land and water), protecting the environment, and maintaining ecosystem services (NAS, 2010).

Premium Agriculture

Super Typhoon Yolanda almost totally destroyed most of the crops in Leyte, especially in the eastern part (Kirk, 2013). A total of 170,000 t of rice was destroyed from 38,000 ha that were ready for harvesting and another 117,000 ha were lost that were already planted but not yet grown. Note that Leyte farmers are resource poor, cultivating an average of 0.8 ha, 70% of which was destroyed. The worst-hit areas of Eastern Visayas accounted for 69% of total damage at PHP 4.73 billion. The province of Leyte alone accumulated PHP 2.22 billion in losses, about half of which represents ruined palay (unhusked rice) (Domingo, 2013). Data gathered by the DA shows that, in the aftermath of the typhoon, around 100,000 farmers need to be provided with seeds and fertilizer. The typhoon also severely damaged coastal areas, such as in the municipality of Palo and the city of Tacloban, where 49% of the mangroves died and 57% were defoliated, respectively (Fig. 5) (DENR-ERDB, 2014).

Coconuts and bananas (*Musa* sp.) are commonly planted on sloping land. Leyte is the highest coconut-producing province in Region VIII in terms of area (208,337 ha), number of coconut trees (22 million), and number of nuts produced (672 million). Before the destruction by Super Typhoon Yolanda, coconut

was a strongly performing industry; it is considered a current strength but will need strategies and interventions to be globally competitive with other palm-oil products. Coconut farming suffered the most damage of all agricultural crops from Super Typhoon Yolanda. Farmers typically had on average about 80 or so coconut trees, but these fell by the thousands as a result of the storm (Kirk, 2013). Twisted and uprooted coconut trees lined the roads which are still littered with debris, and hillsides were covered with coconut trees that looked like broken matchsticks (Fig. 5). Facilities for processing coconuts and producing copra, one of the major products of Tacloban—a trading city—are almost entirely gone.

The immediate response of the DA and local and international NGOs to assist the farmers and fisherfolk was to provide cash subsidies or distribute equipment, boats, nets, fertilizer and other farm tools, as well as seedlings of short-duration crops (e.g., rice, corn, root crops, vegetables). This direct assistance enabled farmers to till their lands and plant crops within a month after Super Typhoon Yolanda (Villegas, 2013).

Considering the pre-Typhoon Yolanda agriculture situation in Leyte, interventions that promote and implement agriculture production systems that are large-scale, highly specialized, capital- and external input-intensive should be avoided. These industrial agriculture systems destabilize the natural resource base, contribute to loss of biodiversity, contribute to greenhouse gas emissions, and have high potential to irreparably damage the environment, compromising the local capacity to produce food in the future. Instead, small-scale, labor-intensive production systems with diverse livelihood strategies that consider on-farm, farm-related and off-farm food and income generation interventions for long-term sustainability should be developed, promoted and implemented.

A case in point is coconut, the sector most adversely affected by Super Typhoon Yolanda in Leyte. The Philippines is a major supplier of coconuts in the world market, and the coconut industry in Leyte is one of the biggest producers of coconut products in the Philippines. Paradoxically, coconut farmers are among the poorest rural people in the Philippines; 6 out of 10 coconut farmers are living in poverty. While the immediate response of the DA Philippine Coconut Authority of distributing seedlings of high-yielding varieties for replanting is noteworthy, replanting coconuts alone will result in the farmers remaining poor. Pabuayon *et al*. (2009) reported that this is

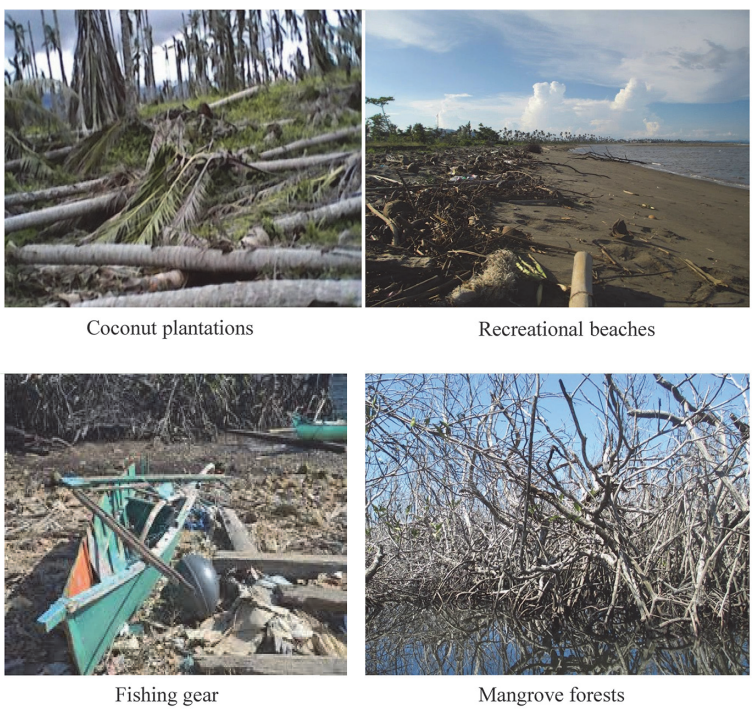

Fig. 5. Damage caused by Typhoon Yolanda (Haiyan) in Leyte, Philippines.

because coconut farmers have limited participation in the coconut distribution chain; they remain at the lowest level of the chain and sell only raw materials. The other requirements reported as necessary to alleviate the conditions of coconut farmers include those related to their inadequacy in capital, technical and entrepreneurial skills, equipment and tools, and market access and information. Specific measures could involve making credit accessible to farmers, providing training on product processing and quality improvement, and linking the products with favorable markets. Furthermore, coconuts to the farmers of Leyte mean a lot more than copra; there are other coconut-related products such as "tuba" (natural coconut wine), virgin coconut oil, coco sugar, coco nectar, coco coir, and activated carbon that could be a source of income. Hence, there is a need to support farm enterprise and entrepreneurial development to increase the capacity for local value-adding activities.

Although there are other more profitable high-value crops that could be planted aside from coconut, e.g., coffee (*Coffea* sp.), cacao (*Theobroma cacao*), fruit trees, and vegetables, among others, the farmers are already very familiar with coconut trees, which are adapted to their province. Hence, coconut should remain the primary agricultural commodity in Leyte. However, the coconut replanting program should be carried out with a coconut-based farming system in mind, such as a productive multi-storey cropping system as developed in Cavite and Batangas, two provinces in Region IV-A (de Guzman *et al*., 2014). For this to be implemented, locally adapted, quality planting material for high value crops (e.g., fruit trees, coffee, cacao, cashew (*Anacardium occidentale*), abaca, black pepper (*Piper nigrum*) should be made available to the farmers to complement the traditional coconut farming system. Leyte has high potential for pili (*Canarium ovatum*) production. There is strong and growing demand for pili nuts and oil, and the tree is extremely resistant to high winds. Abaca and banana also offer excellent intercropping options.

Premium Fisheries

Fisheries, one of the main livelihoods in Leyte, were devastated by Super Typhoon Yolanda. The storm destroyed everything from fishing boats and gear to aquaculture facilities, small-scale seaweed farms, onshore fish processing facilities, and markets (FAO, 2014). An estimated 30, 000 boats were affected, including 10,000 lost or destroyed by the typhoon's storm surge, leaving fishermen and women without income (Tran, 2014). The majority of those reliant on the sea and mangroves to earn a living also face possible relocation far from the sea because of a government law banning the building of homes within 40 m from the coastline. Moreover, the fishing industry suffered because stocks of fish in protected areas were lost. Also, the industry has to cope with the loss of untold hundreds of small fishing boats as well as docks and processing facilities. It should be noted that even without Yolanda's devastation, fisherfolk are the most economically vulnerable sector in the country (Ranada, 2013).

The BFAR is implementing the fishery rehabilitation component called "AHON" (which is a local term for "to rise") in coordination with local government units, the private sector and the surviving fisherfolk (PTV News, 2014). Among the activities of BFAR are repair and construction of damaged bancas (traditional outrigger fishing canoes), provision of fishing gear and seaweed-farm implements, and the distribution of fish fingerlings. A total of 11,356 boats were repaired or constructed; repair or construction of another 12,661 boats is ongoing.

To help the fisherfolk, the DA plans to distribute 1,300 boats and 4,000 nets to fishermen who survived Yolanda but lost their boats. However, it was reported by Mallari (2013) that close to 150,000 fisherfolk need to be provided with fishing boats and gear. A local NGO (Pamalakaya) working with fisherfolk in the region contends that this response is not sufficient because there were close to 100,000 fishermen who lost their boats when Yolanda struck in Eastern Visayas and other areas. The 1,300 fishing boats that the DA planned to distribute were sufficient for only one fishing village in Tacloban City, one of the three cities in Leyte.

In addition to the distribution of boats, around 2,000 sets of fishing gear have already been distributed in Region 6 (Western Visayas), and other sets of fishing gear that will go with the repaired and constructed boats are currently being procured. A total of 857 sets of seaweed-farm implements have already been distributed to affected seaweed farms (PTV News, 2014). BFAR's National Payao Program is notable. Although not fishing gear *perse*, "payaos" (fish aggregation devices) attract and concentrate fish, making them more easily caught by fishermen. The device mainly aggregates adult pelagic species and could be a way to

transfer fishing pressure away from coral reefs and other sensitive areas where there is already excessive fishing pressure.

Developing the capacity of fisherfolk to diversify their income sources is critical to enabling fishing communities to recover from disasters such as Super Typhoon Yolanda. This was clearly shown in the key informant interviews (KII) with the fisheries technicians of the Municipal Agriculture Office and in the FGD with the fisherfolk associations. These interviews and discussions were conducted in seven coastal municipalities facing Leyte Gulf that are members of the Alliance of Local Fishery and Aquatic Resources Management and Development Councils (Box 1).

Nutrition-sensitive agri-fisheries

Super Typhoon Yolanda highlighted underlying challenges in a province already showing higher malnutrition rates than the country's national average (Table 3). According to the national nutrition cluster, up to 12,000 children are believed to be suffering from severe acute malnutrition, and more than 100,000 pregnant and lactating women are at risk of malnutrition and micronutrient deficiencies in Typhoon Yolanda-affected areas (UNICEF, 2014). One in two children aged 6−11 months already suffered from anemia before the disaster, as did 43% of pregnant women and nearly one in three lactating women.

The overall objective of the provincial government in addressing the nutrition problem is to help reduce the risk of excessive mortality and morbidity among children aged 0−5 years by maintaining the nutritional status of vulnerable groups at pre-crisis levels. The provincial government, in collaboration with 22 local and international NGOs and agencies, has come up with the following strategies and key activities (Napari, 2014):

1. Promotion & protection of Infant and Young Child Feeding in Emergencies (IFE Core Group, 2007) as a lifesaving child survival intervention;
2. Prevention and management of acute malnutrition and micronutrient deficiencies among vulnerable groups, including boys and girls under 5 years of age, pregnant and lactating women, and older persons;
3. Nutrition assessment and information management; and
4. Strengthening cluster-coordination capacity focusing on the sub-national level which is composed of committees or groups in the program with specific mandates or tasks, e.g. agriculture, health and nutrition, infrastructure, etc.

Against this backdrop, there is an opportunity for the development and implementation of a post-Typhoon Yolanda nutrition-sensitive agri-fisheries program (NSAP). Nutrition-sensitive agri-fisheries aim to narrow the gap between available and accessible food needed for a healthy and balanced diet for all people by explicitly incorporating nutrition objectives into agriculture and addressing food and nutrition security in both food production and utilization, including health, educational, economic, and social aspects. In Leyte, the focus should be on using agri-fisheries to improve nutrition.

An NSAP looks at agri-fisheries with a specific "nutrition lens". It highlights the nutrition-related aspects of agriculture and the entire food system, i.e., how can agri-fisheries and the food system deliver better nutritional products that can be better utilized, particularly by undernourished and micro-nutrient deficient people. Overall, this requires a paradigm shift from producing large quantities of food to supplying nutrients.

In practical terms for Leyte, agri-fisheries could be used to improve nutrition through an NSAP. In simple terms, this would involve incorporating crops with various nutritional values, crop duration, seasonality, and resilience to the changing climate. The following are examples of vegetables crops that should be planted on farms, in homes, and school gardens to address nutritional problems:

- Early-maturing vegetables that can be harvested within 2−4 months after planting such as tomato (*Solanum lycopersicum*), pechay (*Brassica rapa*), or sweet corn (*Zea mays*);
- Semi-annual vegetables that mature at 6−9 months such as winged bean (*Psophocarpus tetragonolobus*), bitter gourd (*Momordica charantia*), cucumber (*Cucumis sativus*), or ginger (*Zingiber officinale*);
- Annual vegetables such as lima bean (*Phaseolus lunatus*), pigeon pea (*Cajanus cajan*), upland 'kangkong' (*Ipomoea aquatica*), or 'alugbati' (*Basella alba*); and
- Permanent crops such as papaya (*Carica papaya*), pineapple (*Ananas comosus*), sugarcane (*Saccharum officinarum*), yam beans (*Pachyrhizus erosus*), malunggay (*Moringa*

oleifera), banana, or citrus (*Citrus* sp.).

To address specific nutritional problems such as protein energy malnutrition, anaemia, iodine deficiency, and vitamin A deficiency, the following crops are recommended:

- For protein: winged bean, mungbean (*Vigna radiate*), soybean (*Glycine max*), cowpea (*Vigna unguiculata*), lima beans, string bean (*Vigna unguiculata sesquipedalis*), jute mallow (*Corchorus olitorius*), high protein corn ("quality protein maize", QPM)
- For carbohydrates: cassava (*Manihot esculenta*), sweet potato (*Ipomoea batatas*), taro (*Colocasia esculenta*), yam (*Dioscorea esculenta*), ubi
- For iodine: onion (*Allium cepa*), okra (*Abelmoschus esculentus*)

Conclusions and Recommendations

The Philippines, because it is an archipelagic country and its proximity to the sea, is particularly exposed to natural hazards such as cyclones, flooding, rainfall-induced erosion, sea-level rise, and extreme weather events. It is therefore not surprising that the Philippines is ranked the world's third most disaster-prone country in the World Risk Index (Mucke, 2012) with an index of 28%, out-ranked only by the two island states of Vanuatu and Tonga.

The country's vulnerability was best shown through the devastation of Leyte Province, by the Super Typhoon Yolanda. The devastation to life, physical assets, property and infrastructure, livelihoods, agri-fisheries, and the environment was enormous, requiring world-wide support from all sectors for relief, rehabilitation, recovery and post-disaster reconstruction. After relief operations, the focus should be long-term development using a sustainable development framework.

According to the National Academy of Sciences Report "Toward Sustainable Agricultural Systems in the 21st Century" (NAS, 2010) development programs, to be considered sustainable, should be evaluated on the basis of progress towards four goals: (1) producing enough to satisfy human needs; (2) enhancing environmental quality and protecting the na-

Box 1. Summary of Outcomes from Key Informant Interview with the Fisheries Technicians of the Municipal Agriculture Office and focus group discussions with the fisherfolk associations conducted by the senior author (Bernardo, D.F.H. in 2014).

To determine the needs of the community and ensure that assistance provided is addressing their needs, KII with Fisheries Technicians of the Municipal Agriculture Office and FGD with fisherfolk associations were conducted in seven coastal municipalities facing Leyte Gulf, a major fishing ground in the province, that are members of the Alliance of Local Fishery and Aquatic Resources Management and Development Councils.

The top four fishery-based activities identified were mariculture, fishing, aqua-silviculture, and gleaning. Alternative sources of income for fisherfolk included selling of scrap metal, tending a variety store, rice and root-crop farming, working as pedicab drivers and construction workers, and selling of mangrove propagules.

The socio-economic projects identified that need start-up capital and raw materials or inputs are as follows: (a) raising livestock and poultry (hog/piggery, goat, poultry/egg); (b) meat/food processing; (c) fishing, with needs such as fish nets and gear, feeds for milkfish, fishing boats, freezers for post harvest preservation and handling, fish marketing, repair of tilapia hatchery, and mud-crab culture; and (d) other activities such as reconstruction of day care centers, capacity enhancement training for income generating activities and/or alternative sources of income/livelihood, e.g., rice store, crop planting, and farm machinery that they can use and rent out.

It will be easier to provide financial and technical assistance for production, processing, and marketing (farm to table) once the fisherfolk have a juridical body, willing officers, and interested members who are guided by written by-laws and articles of cooperation, preferably registered by the Cooperative Development Authority as required and stipulated in the Philippine Cooperative Code.

tural resource base; (3) being profitable; and (4) increasing the quality of life for farmers, farm workers, and society as a whole. Farm systems also must be flexible enough to adapt to natural and economic stresses as they strive towards these four goals.

The tragedy brought about by Super Typhoon Yolanda could be used as an opportunity to usher in a new dawn for sustainable agri-fisheries development in Leyte. Key to all successful approaches in development and maybe more so in post-disaster recovery and building resilience, is the effective partnership and democratized engagement of the local people. The local residents, who are integrally linked to the land and resources and have valuable local knowledge, must play central roles in planning, implementing, evaluating and benefitting from agri-fisheries development programs and initiatives. Development programs are most likely to succeed and be sustainable long after the termination of the program if project entry points are those that are familiar and acceptable to local people, in contrast to unfamiliar, externally imposed strategies and interventions. The development of a project requires knowledge and sensitivity to local cultures, beliefs, and practices (Zamora *et al*., 2013).

One of the valuable lessons learned from Super Typhoon Yolanda is that the current practice of monocropping (or monoculture) is unsustainable and not resilient to climate change. Instead of monocropping, biodiversity-based farming systems should be promoted. Biologically diverse agricultural systems, which include underutilized or minor grains, pulses, fruits, vegetables, root and tuber crops, in addition to the common staple crops of rice and corn, contribute to a balanced diet (Keatinge *et al*., 2010) and environmental resilience. Many of these alternative food crops not only diversify agro-ecosystems and rotations; they also increase chances of crop survival, insulate against the unpredictable price of food, ensure harvests throughout the year, provide resilience to biotic and abiotic stresses and produce harvestable yields where major crops may fail, and most importantly, they are more adapted to extreme climatic conditions. These systems are time-tested, locally adapted, and resilient to climate change (Zamora, 1996; Zamora *et al*., 2013). For centuries, farming communities worldwide have used crop diversity for food and economic security through a complex array of home garden designs, and diversified and integrated lowland farming and agroforestry systems.

In the Philippines, examples of biodiversity-based farming systems are plentiful. At present, indigenous peoples on their swidden farms have numerous species and varieties planted at the same time. What appears to be a chaotic mess of annuals and perennials is actually a highly sophisticated mixture of species and varieties that provide food, feed, fuel, medicines, building materials, and cash crops. Growing of livestock (including fishes), even in rice fields, adds even more diversity to the system. In all these examples, the message is clear: farmers have developed and adapted farming systems that provide stability and sustainability of the agricultural production system even under adverse weather conditions, and hence food security, through the utilization of functional diversity in their farms and farming systems (Zamora, 1996).

For fisherfolk and coastal communities, what is needed are holistic programs that, in addition to repairing or reconstructing damaged infrastructure and replacement of lost fishing gear, would ensure that destroyed areas are rebuilt in a sustainable way that addresses the fisherfolk's long-term future. For the total and long-term sustainable development of the fisherfolk and fishing communities, we subscribe to the following recommendations gathered through consultations and focus group discussions conducted among fishing communities (Oxfam, 2014).

- Assess coastal habitats and their resources;
- Implement coastal zoning;
- Create fisherfolk resettlement areas consistent with existing laws to reduce the vulnerabilities of coastal communities;
- Define the scope and process of resource assessment, which will serve as basis for short and long-term plans;
- Develop other livelihood opportunities;
- Establish participatory monitoring and evaluation processes, identify and develop fisherfolk settlement sites, and rehabilitate settlement areas;
- Implement a settlement/resettlement strategy that includes fisherfolk settlements and coastal zoning; and
- Restore marine resources and marine protected areas.

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