



Adaptive capacity of indigenous peoples to changing climate: The case of the *Aytas* of Floridablanca, Pampanga, Philippines

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Abstract

The livelihoods of *Aytas* of Floridablanca, Pampanga, Philippines are dependent on natural resources, which are prone to climate change impacts. To assess their adaptive capacity, this paper analyzed the different resources available in their community using the Sustainable Livelihoods Approach Framework. The five livelihood assets (human, natural, financial, social, and physical) of the *Aytas* were accounted for and used as indicators for the Household Adaptive Capacity Index (HACI).

The resulting HACI was 0.49, indicating a medium-level adaptive capacity, limited by poor infrastructure, high dependence on agriculture for income, high poverty incidence of 72 percent, low level of education, and social capital bounded mostly in interactions. Also, farming income of the *Aytas* was highly seasonal and vulnerable to typhoons, prolonged drought, and excessive rains.

Having limited livelihood assets, *Aytas* will find it difficult to adapt to climate change-related impacts. As such, they need support to enhance their adaptive capacity. This paper recommended that programs and projects, which enhance their adaptive capacity, be formulated in consideration of the existing indigenous knowledge, values, and belief systems, as well as their assets.

Keywords: Climate change · indigenous people · adaptive capacity · sustainable livelihood

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Introduction

Indigenous peoples (IPs) are generally dependent on natural resources for their livelihood. However, there have been constraints on the use of these resources to achieve sustainable development in their ancestral domain (Sobrevilla, 2008). To address this, the United Nations Development Program (UNDP, 2010) has provided interventions to assist IPs and concerned government agencies in the areas of leadership, governance, empowerment, and community development. Additionally, emerging as an area of concern is the adaptive capacity of IPs to climate change. The IPs often inhabit marginal areas in fragile ecosystems that are vulnerable to climate change (Salick & Byg, 2007; Baird, 2008), which threatens the IPs' ancestral domain as well as the security and sustainability of their livelihoods.

Vulnerability is composed of exposure (e.g., exposure to climate change related events), sensitivity (e.g., poverty or resource-dependent livelihoods), and adaptive capacity (Turner et al., 2003). An entity is vulnerable when it is prone to and incapable of dealing with the negative impacts of climate change (Intergovernmental Panel on Climate Change [IPCC], 2007). Exposure is the presence of people, livelihood, environmental services and resources, or other assets in places that could be adversely affected (IPCC, 2014). Meanwhile, sensitivity refers to the tangible characteristics of human beings, infrastructure, and environment to be affected by a hazardous phenomenon due to susceptibility (Cardona et al., 2012). Poverty and reliance on natural resources for livelihood, for instance, can make IPs more sensitive to the impacts of climate change (Baird, 2008; Cardona et al., 2012).

Adaptive capacity, especially when improved, could reduce vulnerability. It enables "systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC, 2014, p. 1758). As a household or community obtains the capacity to adapt, its vulnerability decreases even if it may be extremely at risk to climate change (Zhu et al., 2011; Cardona et al., 2012).

Vulnerability encompasses larger socio-economic processes that may marginalize people and make them more susceptible to impacts of disasters. Certain communities or sectors of society may have persistent and intractable sensitivities; measures that fail to address them may undermine their success and sustainability (Nelson et al., 2007 as cited in Miller et al., 2010). In order to lessen the probability of creating unsustainable strategies or undermine adaptive capacity, the political, cultural, and socioeconomic factors should be addressed, and available assets and indigenous knowledge accounted for (Nawrotzki & Kadatska, 2010; Ingram et al., 1981 as cited in IPCC, 2001).

This study examined the different livelihood assets of IPs to identify areas of intervention that could improve their adaptive capacity to climate change. It focused on the *Ayta*¹ Indigenous Cultural Community (ICC) in Floridablanca, Pampanga, Philippines. Results of the study could provide lessons to other IP communities.

Methodology

Analytical Framework

The adaptive capacity of the *Aytas* of Floridablanca to climate change was assessed using the Sustainable Livelihood Approach (SLA) Framework (Figure 1) as it allows a deep understanding of the livelihoods of poor people (International Fund for Agricultural Development [IFAD], n.d.). Specifically, data on the five types of assets, or capital, (Department for International Development [DFID], 1999) that affect livelihood were collected. The study collected data through survey, focus group discussions, key informant interviews, and secondary sources.

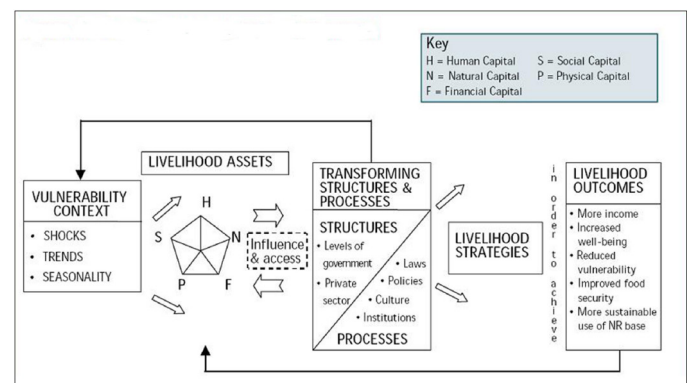


Figure 1. Sustainable Livelihood Framework (DFID, 1999)

Livelihood assets refer to various kinds of capital which are used to produce livelihood either directly or indirectly. In effect, a number of products can be created through it. These products can be used to replace depleting resources or as investment for impending livelihood opportunities. The SLA analyzes how the five types of assets affect people's livelihoods, as well as the relationships between and among them. The DFID (1999) categorized the assets as follows (as cited in Haidar, 2009, p. 6):

Natural capital – consists of land, water, and biological resources such as agriculture and forestry.

Physical capital – refers to the kind of asset which is created by economic production such as infrastructure like roads, transport, irrigation works, energy, communication, schools, and shelter.

¹ *Ayta* (or *Aeta*) is an indigenous group in Central Luzon, Philippines. The Ancestral Domain Sustainable Development and Protection Plan of *Ayta* Tribe of Floridablanca refers to them as mountain people described as having dark skin, short and small frame, kinky hair, snub-nose, and big black eyes.

Economic/Financial capital – consists of stocks of money or other savings in liquid form, easily disposable assets such as livestock, and other resources such as savings, credit, and income from employment, trade, and remittances. It also includes household members' occupation, household ownership of assets, distribution within society of financial savings, access to credit, and debt levels.

Human capital – is determined by household size, education, age, and health of household members.

Social capital – are assets derived from membership in a group such as rights or claims including groups and networks, collective action and cooperation, social cohesion and inclusion, empowerment, and political action.

Data on the five different assets were used to analyze relationships between assets at the household, community, and regional levels with a focus on better understanding the vulnerability to climate variability and change for the *Aytas* of Floridablanca.

Study Site

The study covered the *Aytas* in the Floridablanca ICC (Figure 2). Floridablanca is a first-class municipality located in the western part of the Province of Pampanga. It has a Type I climate marked by: (a) dry season from December to April and (b) wet season for the rest of the year. There are four cultural minority settlements in Floridablanca: Barangay Nabucloc, Barangay Mawacat, Sitio Malabni, and Sitio Camatchile. These settlements are rural areas and approximately 30 minutes away from the *Poblacion*, the center of the municipality. The *Aytas* represent 4.64 percent of Floridablanca's 2010 population of 110,747 (PSA, 2014). They also comprise 27 percent of the total *Ayta* population of 19,010² in the province of Pampanga.

Data Collection and Analysis

In coordination with the National Commission of Indigenous Peoples (NCIP) in Region III, the study sought the approval of the Floridablanca *Ayta* ICC to collect data. Upon the release of the Certification Precondition, a certificate of the *Aytas*' approval of the study, data collection ensued. Coordination with the local government unit of Floridablanca was also done.

² Source: NCIP Region III Pampanga Service Center, Floridablanca, Pampanga

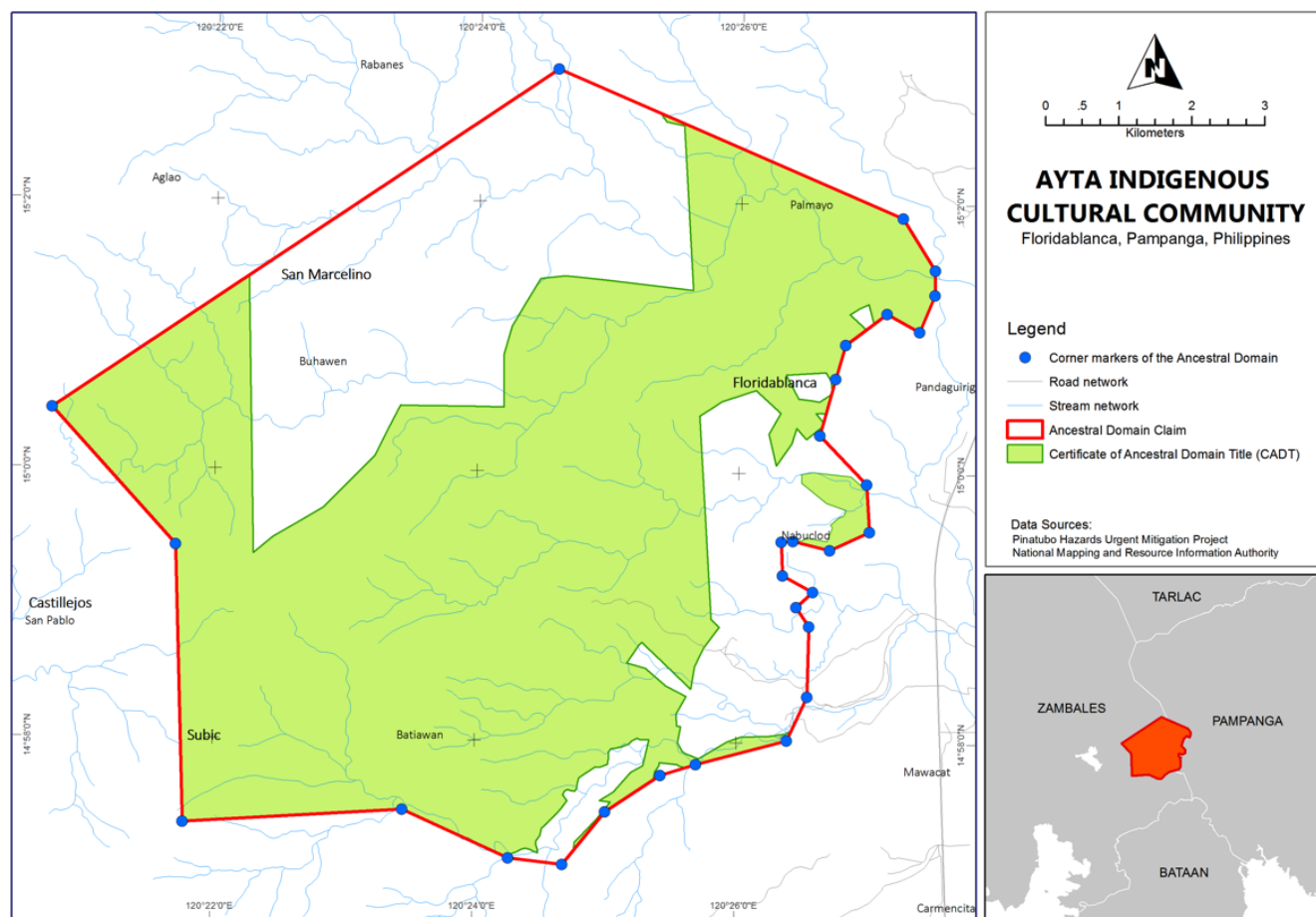


Figure 2. Boundary Map of Ancestral Domain of Floridablanca Indigenous Cultural Community based on the Certificate of Ancestral Domain Title and the Ancestral Domain Claim of the Floridablanca ICC, 2016

Data on livelihood assets, as well as observed climatic changes and their impacts on livelihoods and resources, were collected from primary and secondary sources. Primary sources include the *Ayta* households who participated in the survey. A total of 60 out of 816 households from Sitio Camachile, Barangay Nabuclod, and Barangay Mawacat were purposively sampled based on their accessibility. The distribution of the households per location in the ICC is indicated in Table 1.

Table 1. Distribution of respondents per location in Floridablanca ICC, 2014

Location	Number of Respondents	Percent
Sitio Camachile	28	46.67
Barangay Nabuclod Proper	19	31.67
Barangay Mawacat	13	21.67
TOTAL	60	100.00

Nine key informants from NCIP Region III, Local Government Units, Municipal Agriculturist Office, Municipal Social Welfare and Development, and the Provincial Environment and Natural Resources Office were also interviewed to identify policies, programs, and projects affecting the *Ayitas*' access to resources. Their respective offices provided documents which were reviewed for secondary data (e.g., climate, infrastructure, markets, and natural resource stocks).

The specific data collected for the livelihood assets were the following:

Natural capital – average agricultural land area, land ownership, source of irrigation, and proportion of respondents who rely on the forest for livelihood;

Physical capital – distance from Poblacion, mode of transportation, type of road, type of house material, number of storeys, location of house (e.g., along the slopes, coastal, plain), average estimated value of house, main source of power, source of drinking water, distance of drinking water source, existence of early warning system, type of evacuation center, distance of house from designated evacuation center, accessibility of evacuation center, source of information, and frequency of receiving information;

Economic/Financial capital – average annual income, sources of income, annual income level, savings, loan acquisition, and source/s of loan;

Human capital – education, attendance to training, and types of training attended; and

Social capital – existence of conflict/issues, existence of organizations/institutions, membership in organizations, frequency of interaction, benefits of interacting, sources of assistance, and types of assistance.

These data were used to calculate a normalized adaptive capacity indicator value for each livelihood asset. The method applied is similar to the method used by Peñalba and Elazegui (2011). Normalization was done using the method applied to the Human Development Index by the UNDP (Anand & Sen, 1994) as shown in the following equations:

(1) Normalized value _(where higher is better) is equal to:

$$\frac{\text{Value of the indicator to be normalized} - \text{Minimum value of all indicators}}{\text{Maximum value of all indicators} - \text{Minimum value of all indicators}}$$

(2) Normalized value _(where lower is better) is equal to:

$$1 - \frac{\text{Value of the indicator to be normalized} - \text{Minimum value of all indicators}}{\text{Maximum value of all indicators} - \text{Minimum value of all indicators}}$$

Meanwhile, the average of the normalized indicator values represented the overall Household Adaptive Capacity Index (HACI). Values for the indicators and index were between 0 and 1, with 1 signifying the highest value and 0 signifying the lowest value (Peñalba & Elazegui, 2011).

Results

Profile of the Respondents

Most of the respondents identified themselves as household heads (76.67%) (Table 2). They were dominantly male (73.33%) and only two households were headed by a female, typically by widows (3.33%). The average age of the respondents was 43 years old, while the average age of a household (including age of children and relatives living within the same house) was 23 years old. The average household size was 5.5.

Table 2. Characteristics of respondents

Item	Number	Percent
Head of household	46	76.67
Male	(44)	(73.33)
Female	(2)	(3.33)
Spouse of HH head	14	23.33
Male	(0)	(0)
Female	(14)	(23.33)
TOTAL	60	100.00

Sources of income of the households were on-farm cropping (98.33%), off-farm labor³ (15%), non-farm work⁴ (65%), and selling of forest products (40%) (Table 3). Identified alternative sources of income were backyard livestock-raising and domestic remittances from children and relatives.

³ Off-farm labor involves farm work (e.g., transplanting, weeding) done on somebody else's farm.

⁴ Non-farm work includes employment and business which may be agri-based but does not include farm work, e.g., trading, clerical work, retail store operations.

Table 3. Number of households engaged in work by work type*

Item	Number (n=60)	Percent
On (own) farm	59	98.33
Off-farm	9	15.00
Forest-based (charcoal, bamboo)	24	40.00
Non-farm (e.g., employment, business)	39	65.00

*multiple response

Livelihood Assets

Natural Capital

The *Aytas* considered agricultural lands, forest, and water resources within their ancestral domain as their natural capital. Almost all respondents (96.67%) own the land where they live and cultivate, while others either had no land to till (1.67%) or cultivated a relative's land rent-free (1.67%). Based on the *Aytas*' estimation, they own or inherit an average of 2.75 hectares of agricultural land. However, they cultivate only a portion of their farm land per season then transfer to another portion for the next season. This cultural management practice allows the land to lie fallow.

The ancestral domain is also endowed with rivers and springs fit for drinking and other uses at the time of the study. Yet, the respondents did not have proper technology to utilize these for irrigation. Over 93 percent of the respondents depended on rain for irrigation. Others relied on shallow tube wells (3.33%).

The forest is a source of alternative livelihood for 40 percent of *Aytas*. They collect branches from the forest for charcoal making. They also cut bamboo and sell them as house building material.

Physical Capital

Road network. The *Ayta* settlements were located 13 to 16 kilometers away from the Poblacion. The road network to Barangay Nabuclod was cemented but the rest were rough roads accessible only to limited types of vehicles (e.g., jeepneys, four-wheel drives, and tricycles). The bridge linking the main road to Sitio Camatchile was in bad condition and impassable to all types of vehicles. Moreover, the road to Barangay Mawacat was rough and unpaved.

Housing. Most respondents owned houses made of light materials (58.33%), while some owned houses made of semi-permanent materials (mix of light and permanent materials) (25%). The houses were usually one-storey high and built along the slopes (60%) or on flat areas on the mountain (28.33%). Few lived along riverbanks (10%) and one household lived in the lowland area of the ancestral domain. The respondents' average estimated value of their houses was PhP 29,345.

Utilities. Over 88 percent of the households had access to electricity. Meanwhile, 81.67 percent sourced their drinking

water from hand pumps which were communally used; with distances of approximately 500 meters to more than a kilometer away from their homes.

Early warning systems. Forty percent of the respondents were familiar with early warning systems. However, these were limited only to monitoring the river level, warnings/alerts, and pre-emptive evacuations. They also remembered that members of the barangay council roam around the community to alert them of an upcoming calamity.

Other infrastructures and sources of information. The distance of the barangay hall and identified evacuation centers (e.g., school and church buildings) from the households was more than two kilometers. Respondents said that climate-related information was available to the households through news programs on television (91.67%) and radio (50%).

Financial Capital

Respondents had diversified income sources, with an average annual income of PhP 127,659. Still, almost 72 percent of the sample households were poor, earning an amount below the poverty threshold level (Table 4). More than half did not have savings (53.33%). A high loan acquisition rate from formal (18.34%) and informal sources (43.34%) exists.

Table 4. Frequency distribution of households below and above poverty threshold level^a, with savings and with loan

Item	Average (in PhP ^b)	n	%
Total no. of respondents		60	
Annual income	127,659.46		
Below PhP 105,336	46,879.14	43	71.67
PhP 105,336 – PhP 150,000	120,140.00	4	6.67
Above PhP 150,000	397,169.62	13	21.67
Households with savings		28	46.67
Households with loan from formal sources		11	18.34
Households with loan from informal sources		26	43.34

^a 2014 Poverty threshold level is at PhP 105,336 or US\$ 2,237.74 for a family of five projected based on the poverty threshold from years 2000 to 2012 (Philippine Statistics Authority [PSA], 2015)

^b PhP 44.688 = US \$ 1.00 (2014 Average); Source: Bangko Sentral ng Pilipinas, 2016

Human Capital

A big proportion of male (45%) and female respondents (50%) finished only some years in elementary level. Twenty percent of the male respondents were not able to study at all. Meanwhile, a pattern of female respondents receiving more education was observed. Specifically, more female respondents completed high school (12.5%), an alternative learning system education (6.25%), and some years in college (6.25%) (Figure 3).

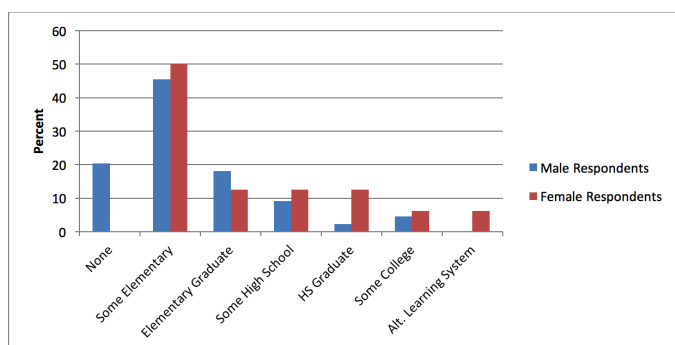


Figure 3. Proportion of respondents who attained a certain level of education

Thirty percent of the *Aytas* were able to attend various trainings or seminars. However, attendance was observed only among *Aytas* involved in the local government (barangay level to municipal level). Everyone who attended a training or seminar said the knowledge gained on climate change awareness, disaster risk reduction and management, and environmental protection was useful.

Social Capital

Existing organizations in the ICC include the Council of Elders and barangay council—the primary decision-making bodies in the community. The former is concerned with community issues (e.g., conflict and encroachment of lowlanders), while the latter on local governance. These councils address issues related to land use (68.7%), water resources (15%), and forest (23.3%).

At the municipal council, the *Aytas* were represented by the Indigenous People Mandatory Representative (IPMR) to ensure their participation in local government planning. Government agencies also provided various assistances. Sixty percent of the respondents had access to some kind of assistance, including financial (41.67%), medical (33.33%), and transportation assistance (8.33%). Other forms of assistance were relief goods and livelihood opportunities (e.g., participation in the National Greening Program).

About 28 percent claimed they were members of local organizations (e.g., Ancestral Domain Federation and religious organizations). More than half (51.67%) of the respondents reported that there was interaction among the *Aytas* which allowed the sharing of information.

The Household Adaptive Capacity Index

The overall HACI was computed by averaging the value of the indicators previously discussed. HACI for the Floridablanca ICC was 0.49, indicating a medium adaptive capacity to climate change (Figure 4).

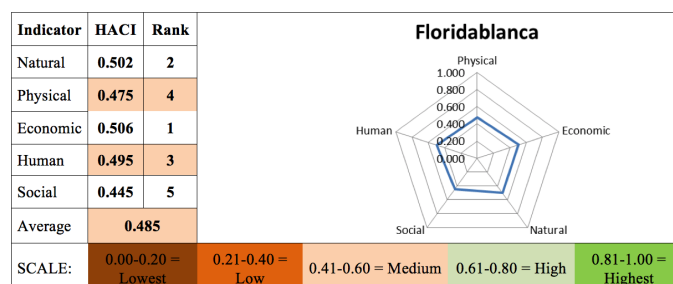


Figure 4. Household Adaptive Capacity Index for the Floridablanca ICC

Impacts of Climate-Related Events

Typhoons, prolonged drought, and excessive rain were identified by the *Aytas* to be the most damaging climate-related events impacting their livelihood and community. However, typhoons were identified by 43 percent of the households to cause the most damage to crops. *Aytas* also observed the occurrence of the following: landslides, damage to houses and roads, decrease in soil fertility, and decrease in quality of drinking water due to muddy springs.

Annual average farm income loss per household (on-farm, off-farm and forest-based income) from the three climate-related events were estimated at PhP 18,206 for typhoons; PhP 11,991 for prolonged drought; and PhP 8,000 for excessive rains (Table 5). Average reported losses in non-farm income due to typhoon were PhP 6,636, while losses due to excessive rain were PhP 2,000. The maximum reported damage caused by typhoons was PhP 100,000, in contrast to PhP 40,000 maximum reported damage caused by prolonged drought and PhP 21,000 maximum damage caused by excessive rains. Farm income losses caused by typhoons varied widely. The overall losses from non-farm income were less variable.

Table 5. Estimated annual income loss of households due to climate-related events

Descriptors	Type of Event		
	Typhoon	Prolonged Drought	Excessive Rain
Estimated Loss in Farm Income (in Peso)			
N	59	11	4
Mean	18,206	11,991	8,000
Minimum	300	1,500	1,000
Maximum	100,000	40,000	21,000
Estimated Loss in Non-Farm Income (in Peso)			
N	25 ^a	-	1 ^a
Mean	6,636	-	2,000
Minimum	400	-	2,000
Maximum	30,000	-	2,000

^a Out of 39 respondents with non-farm income

Occurrence of climate-related events caused sickness to a few households (Table 6). Having been exposed to weather elements under almost the same living conditions over time, these households observed that the changing pattern of extreme climate events in recent years affected the health of some family members. Typhoons induced the most number of sickness (e.g., fever, cough, cold, and diarrhea), affecting 25 percent of households. During prolonged drought, the households experienced cough, colds, nose bleeding and elevated blood pressure; while during excessive rains, they experienced cough and colds.

Discussion

Ayta households are generally young—the household heads were of middle age and their children were young—indicating a high dependency ratio. Their household size (5.5) was bigger than the national average of 4.6 (PSA, 2012a). They had diversified income sources dependent on natural resources. Some engaged in various types of non-farm work that were less vulnerable to extreme climate-related events. Some families received domestic remittances from children who worked outside Pampanga.

The *Aytas'* ancestral domain served as their natural capital. Almost every household claimed ownership to an average of 2.75 hectares of land. Their indigenous practice of land fallowing caused them to cultivate only approximately one-third of their land per season then transfer to another portion for the next season.

Meanwhile, high dependence on rainfall for planting season resulted from the lack of irrigation system in the study area. Dependence on rain sometimes resulted in delayed planting season and crop damage since respondents found it difficult to transport water for their crops every day.

Available physical capital, in terms of functioning infrastructures, was limited. Most road networks were not paved while the bridge going to Sitio Camatchile needed rehabilitation. Housing materials used by *Aytas* were not

strong, could easily catch fire, or could easily be destroyed by strong winds. Access to clean water was a problem during rainy season as water from springs and wells become undrinkable.

Majority of the *Aytas* have electricity in their homes and could receive weather updates from news on radio or television. There were evacuation centers in the community, nevertheless, the approximate distance of 500 meters to two kilometers from their homes make them poorly accessible. In case of a strong typhoon, the residents have to evacuate early. The role of the barangay council in providing early warning and conducting pre-emptive evacuations is important.

Poverty seemed concentrated in the IP Community as 72 percent of the sample households were in poverty in contrast to Floridablanca poverty incidence of only 6.8 percent (PSA, 2012b). Their poverty resulted in their inability to save and tendency to acquire loans from formal and informal sources for farm capital and household needs. Sakadores, or traders, usually provide loans in the form of agricultural inputs in exchange for the *Aytas'* produce. However, Sakadores often buy at prices lower than the prevailing market price.

Human capital level in the community was low as young men stopped attending school as soon as they were physically capable to work, while women stopped at a young age, usually at puberty, since arranged marriage was still practiced. Scholarships were made available to encourage *Aytas* to continue studying, but elders observed that the distance of secondary and tertiary schools in Poblacion from the community and the treatment *Ayta* students experienced (e.g., comparison between aptitude of *Aytas* and lowlanders and discrimination due to ethnicity) affected their enthusiasm for education. Meanwhile, attendance to trainings and seminars was observed only for *Aytas* involved in the local government.

Part of the social capital in the community was the Council of Elders. Even though a barangay council existed in the community, barangay captains still sought permission or advice from the Council of Elders, specifically on issues or conflicts related to the ancestral domain and their customary laws (e.g., encroachment). Other types of conflicts were handled by the barangay council. Social capital formation in the community occurred due to

Table 6. Number of households who reported sickness of family members due to climate-related events

Number of Family Members Affected	Climate-related events					
	Typhoon		Prolonged Drought		Excessive Rain	
	Number	Percent	Number	Percent	Number	Percent
1.00	7	11.67	1	1.67	1	1.67
2.00	2	3.33	2	3.33	-	-
3.00	2	3.33	-	-	-	-
>3.00	4	6.67	-	-	2	3.33
No answer	45	75.00	57	95.00	57	95.00
Total	60	100.00	60	100.00	60	100.00

interaction among families and community members within the *Ayta* community. Through interaction, respondents shared climate-related information including observed changes in weather and disaster warning.

Other existing social networks in the community included the IPMR who represented the community in the local government unit, organizations in which some *Aytas* were members, and government agencies that provided various forms of assistance (e.g., relief goods during disasters).

Utilizing the aforementioned capitals, HACI resulted in a medium adaptive capacity level of *Ayta* households. Households with diversified income sources, especially income from non-farm sources, could be expected to have lower vulnerability because their income sources were less affected by climate-related events. However, 48 percent of the households relied only on on-farm and off-farm income, and selling of forest products, resulting in higher vulnerability since their income sources were easily affected by climate-related events. Adaptive capacity could be limited not only by reliance on on- and off-farm income but also by education gained, training received, household size, and age of family members. In some households, parents might be the only people capable of preparing for typhoons or finding work to recover monetary losses. Limited interactions among community members and the low incidence of involvement in organizations reduced social capital.

Conclusion and Recommendations

The *Aytas* of Floridablanca were vulnerable to climate change because they were dependent on natural resources which are prone to climate change impacts. Despite diversification of income sources, they were still generally poor and had limited assets. These limitations made adaptive capacity in the face of more than one climate change-related impact difficult. The medium adaptive capacity index value reflects this. Since the Luzon regions encounter an average of five destructive typhoons per year, and increase in temperatures and rainfall in the future are expected (Ortega, 2015; Philippine Atmospheric Geophysical and Astronomical Services Administration [PAGASA], 2011), improving adaptive capacity to successive events will be even more challenging.

The *Aytas* need support that complements their assets to improve their adaptive capacity. In order to do so, the five assets must simultaneously be increased. Strategies that protect or enhance their natural capital should be in place, since it is their most valuable asset. Improving infrastructures and utilities available in the area, such as rehabilitation of roads and bridges, projects to utilize water for farm and domestic use, and improving early warning systems would be beneficial in enhancing their physical capital. Additional livelihood opportunities could help reduce poverty and dependence on Sakadores, and would be expected to enhance economic capital. Increasing level of

education through programs addressing discrimination, access to secondary schools, and provision of alternative learning programs would help improve human capital. Social capital in the community had the lowest value among indicators, and enhancing it would enable economic transactions, access to information, collective actions, and flow of assistance through social networks and institutions (Adger, 2003; Zhu et al., 2011). Activities that would initiate collective action (e.g., National Greening Program), increase interaction, and form organizations could be beneficial. Finally, it is essential to offer long-term solutions that will enable participation in increasing adaptive capacity and respect in their indigenous knowledge and customary laws. Programs and projects for the enhancement of adaptive capacity should be formulated in consideration of the existing indigenous knowledge, values, belief system, and natural resources. Such steps are expected to decrease failure of implementation and may lead to improved appreciation by the community.

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