Journal of Environmental Science and Management 15(2): 1-12 (December 2012)
ISSN 0119-1144

Vulnerability Assessment of Upland Communities in Sibalom Natural Park, Antique, Using Capital-based Approach

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ABSTRACT

Agriculture-based livelihoods of most upland communities are vulnerable to risks associated with climate variability and extremes. These risks are compounded by the different socio-economic and biophysical factors concerning livelihoods. It is imperative that assessment of these vulnerabilities be comprehensive to capture the different significant factors and an alternative method is the use of capital-based approach. Three upland communities in Sibalom Natural Park (SNP) were surveyed and key informants were interviewed to assess the communities' social vulnerability. Social vulnerability index (SVI) was computed from the thirty nine indicators representing human, natural, social, financial, and physical capital assets. There is high vulnerability owing to the low capital assets among households, thus, it is vital to strengthen education, access to government support, regularity and quality of income sources; increase crop production; and provide basic infrastructure such as roads and bridges to minimize vulnerability.

Key words: *adaptation strategies, capital-based approach, livelihoods, social vulnerability*

INTRODUCTION

Most upland livelihoods are based on the natural capital. Its dependency on climatic factors principally for production among others, is undeniable. However, stresses brought by climate variability affects to production may yield risks for producers and instability of the economic market for consumers. Growing evidence suggests that there has already been an increasing occurrence of variable and extreme climate events in most parts of the world and in the country (*Cruz et al 2007*).

There were observed and recognized changes in the climate patterns and occurrence of extremes climate events in the Philippines. These included an increase of 0.14^{o}C in the mean, maximum and minimum annual temperature from 1971 to 2000 and an increase in the annual mean rainfall since 1980s (*Cruz et al 2007*). There was also an observed variability in the number of rainy days since 1990s and an inter-annual variability in the onset of rainfall. The frequency of tropical cyclones entering the Philippine Area of Responsibility (PAR) (*PAGASA 2001 and Cruz et al. 2006, as cited by Cruz et al. 2007*) and the occurrence of strong typhoons in the country (*Pulhin et al 2009*) likewise increased. Recently, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) forecasted that the mean annual temperature will rise by 0.9^{o}C to 1.4^{o}C by 2020, the Southwest monsoon in Luzon and Visayas it is predicted to be more active indicating wetter rainy season, and drier summer season (*Yumul and Servando 2009*).

These evidences and forecasts may pose a threat to upland agriculture. Agricultural productivity is directly affected by climate variability such as changes in temperature and rainfall. On the other hand, indirect impacts of climate variability are decreased soil fertility due to erosion, increase incidence of pest infestation and disease prevalence (*Padgham 2009*).

The threat of environmental change on the socila environmental systems have been observed in the past decade. However, it is only until the recent decade that the concept of vulnerability to risks of climate variability and change emerged as evidence of observed increase in environmental changes.

Vulnerability greatly varies over time and space, and has different impacts. Future vulnerability will remain difficult to assess as it is a state of complex interactions (*Bohle, Downing, and Watts 1994*). Thus, it is essential to analyze vulnerabilities of different groups and sectors to strengthen capacities for managing risks. Examining vulnerability to climate variability and extremes especially of the social system and particularly in the agricultural sector is crucial as the issues of food security and poverty are growing.

Vulnerability studies in the country include vulnerable sectors such as upland farming communities (rice and corn) and indigenous peoples (IPs), hazards such as flooding and landslide, and model scenarios among others. Further studies are essential to broaden knowledge on vulnerability for enhanced adaptation of upland communities in particular Hence, this study aims for an improved understanding of the social vulnerability using the capital-based approach to map

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strong assets and capacities that sustain upland communities.

MATERIALS AND METHODS

The Study Area

Sibalom Natural Park (SNP) was previously declared as the Mau-it–Tipuluan Watershed Reservation under Presidential Proclamation 605 dated June 28, 1990. It was granted a protected area status through Presidential Proclamation 282, pursuant to Republic Act 7586, on April 23, 2000. SNP has a land area of 5,511 ha and lies between 10042'00" to 10049'00" north latitude and 122004'00" to 122011'10" east longitude. It is located in Sibalom, an inland municipality located on the southern portion of the province of Antique bounded by the municipalities of Patnongon on the north, San Remigio on the northwest, Belison on the west, Hamtic on the south, San Jose de Buenavista on the southwest and the province of Iloilo on the east (**Figure 1**). The climate in the area is classified under Type I of the modified Coronas Climate Classification characterized by pronounced dry season from November to April and wet season for the rest of the year. Mean temperature is 27.4°C, while average annual relative humidity is 81.8% and the total average annual rainfall is 3,390 mm with about 80% falling during the rainy season (*NIA 1991*).

The forest-edge communities of SNP were chosen for this study due to the great dependence of the people on rainfall for their livelihood, proximity to the protected area, and conservation importance. Among the eight communities adjacent to SNP, three barangays were selected, namely Imparayan, Tordesillas, and Cabladan.

Data Gathering

A household survey was conducted from January 17 to March 6, 2011 using a semi-structured survey questionnaire. The semi-structured questionnaire was pre-tested prior to the actual survey and was administered among the household heads using the local language. A simple random sampling was employed in selecting the respondents. Those who migrated or were not present during the actual survey period were replaced randomly. The combined total household population of the three barangays was 342, of which 181 household heads were selected based on the matrix of appropriate sample sizes with confidence level of 95% lifted from *Krejcie and Morgan* (*1970*). Only one selected respondent was not interviewed and of the 180 actual respondents, 65 came from Imparayan, 40 from Tordesillas and 75 fro from Cabladan, representing 52% of the total barangay household population. The data obtained from the survey specifically on distance to and from the main road and local organizations existing in the study site were validated by secondary data and interview with key informants.

Data Analysis

Social vulnerability was measured using an index representing the five capitals adopted from the Sustainable Livelihood Framework developed by *Chambers and Conway* (*1992*) as cited in *DFID* (*1999*). The five capitals is composed of human, natural, financial, physical, and social capital assets. A weighting method was used to average

Figure 1. Location of Sibalom Park in Panay Island.

Table 1. Unit of measurement of each indicator and the average, maximum, and minimum values derived.

Indicators/Sub-component	Unit	Scoring	Imparayan	Tordesillas	Cabladan	Combined barangays	Maximum value	Minimum value
A. Human Capital								
Highest educational attainment of household head	Score	0 None 1 Elem grade 1-3 2 Elem grade 4-6 3 HS 1-2 4 HS 3-4 5 Vocational 1-2/ College 1-2 6 College 3-4	2.98	2.60	2.25	2.59	6	0
Educational attainment of HH members (sum of all scores of HH members aged 18 and above)	Average of Scores		3.14	3.13	2.55	2.89	6	0
Dependency Ratio	1/Ratio		1.25	1.12	1.23	1.21	6	0
Skills	Count		1.54	135	1.63	1.52	3	1
Availability of health center	Score	0 No 1 Yes	1.00	1.00	1.00	1.00	1	0
Distance of house to health center	1/km		1.03	2.29	0.43	0.70	200	0
Availability of medicines	Score	0 No 1 Yes	1.00	0.00	0.97	0.77	1	0
B. Social Capital								
No. of organizations affiliated with	Count		0.98	0.45	0.24	0.56	2	0
No. of years in the organization	Years		12.46	2.61	1.07	5.52	40	0
Distance from nearest relative	1/km		7.42	33.14	8.07	9.34	1000	0
Affiliation with local political body	Score	0 None 1 Tanod 2 Kagawad/ Secretary/ BPSO 3 Brgy Captain	0.28	0.30	0.21	0.26	3	0
No. of years served	Years		1.49	0.59	0.68	0.95	26	0
C. Natural Capital								
Area of utilized farmland	Ha		1.81	2.11	1.69	1.83	12	0
Annual Yield (rice) (2010-2011 season)	Kg ha^{-1}		881.5	550.5	953.5	838	3700	0
Diversity of crops	Count		4.71	4.63	5.93	5.20	14	0
Number of animals raised	Count		14.22	10.78	11.17	12.18	57	0
Diversity of animals raised	Count		2.94	2.85	2.53	2.75	7	0
Distance of house from the nearest water source	1/km		1.20	1.86	1.13	1.27	34	0
Distance of farm to nearest water source	1/km		0.35	37.81	7.27	11.56	1000	0

Table 1. Unit of measurement of each indicator and the average, maximum, and minimum values derived. (continued...)

Indicators/Sub-component	Unit	Scoring	Imparayan	Tordesillas	Cabladan	Combined barangays	Maximum value	Minimum value
D. Financial Capital								
Household gross monthly income	PhP		6,438.81	3,476.95	4,188.82	4,843.13	22,923	208
Diversity of income	Count		7.29	5.35	6.64	6.59	21	1
Ownership of land (house)	Score	0 None 1 Pawn 2 Tenant 3 Lease 4 Own	3.85	4.00	3.93	3.92	4	0
Ownership of land (farm)	Score	(same as above)	3.31 3.08	3.53 3.18	3.41 3.13	3.40 3.12	4 4	0 0
Tenure type (house)	Score	0 None/ Squat 1 CSC (ISF-SNP) 2 CARP/CLOA 3 Declaration 4 Title						
Tenure type (farm)	Score	(same as above)	2.83	3.10	2.29	2.67	4	0
House floor area	m^2		204.25	193.25	206.19	202.61	1400	9
Lot area	m^2		156.46	134.63	112.20	133.17	600	25
Roofing material	Score	0 Bamboo 1 Cogon 2 Pawid/ Nipa 3 GI	2.85	2.70	2.56	2.69	3	0
House structure	Score	1 Bamboo 2 Wood 3 Bamboo or wood and cement 4 Cement	1.60	1.63	1.31	1.48	4	1
Value of assets	PhP		6,875.38	5,590.00	2,644.00	4,826.67	89,500	0
E. Physical Capital								
Value of farm production machines	PhP		10,015.38	6,262.50	8,380.00	8,500.00	73,000	0
Storage facility	Score	0 House 1 Kamalig	0.14	0.15	0.12	0.13	1	0
Milling facility	Score	0 Manual milling 1 Rent/ Buy 2 Own	0.97	1.05	0.99	0.99	2	0
Water pipes for irrigation	Score	0 No 1 Yes	0.09	0.55	0.68	0.44	1	0
Potable water facility		0 Well 1 Water pipe	0.98	1.00	0.99	0.99	1	0
Distance of house to main road	1/km		1.10	0.50	0.24	0.39	1000	0
Distance of farm to main road	1/km		0.76	0.41	0.23	0.35	200	0
Electricity in the household	Score	0 No 1 Yes	0.57	0.70	0.76	0.68	1	0
Power duration	Hours		13.66	16.80	8.35	12.14	24	0

Table 2. Indexed sub-components, major components and SVI of Brgys. Imparayan, Tordesillas, Cabladan and the combination of the three communities.

Sub-components	Imparayan	Tordesillas	Cabladan	Combined	Major Component	Imparayan	Tordesillas	Cabladan	Combined
Highest educational attainment	0.49744	0.43333	0.37556	0.43241	Human	0.50027	0.33244	0.47062	0.44967
Educational attainment of HH members	0.52253	0.52092	0.42419	0.48119					
Dependency ratio	0.20754	0.18642	0.20577	0.20211					
Skills	0.26923	0.17500	0.31333	0.26181					
Availability of health center	1.00000	1.00000	1.00000	1.00000					
Distance of house to health center	0.00514	0.01143	0.00213	0.00351					
Availability of medicines	1.00000	0.00000	0.97333	0.76667					
No. of organizations affiliated with	0.49231	0.22500	0.12000	0.27778	Social	0.19216	0.08919	0.05041	0.10940
No. of years in the organization	0.31138	0.06531	0.02667	0.13807					
Distance from nearest relative	0.00742	0.03314	0.00807	0.00934					
Affiliation with local political body	0.09231	0.10000	0.07111	0.08519					
No. of years in the council	0.05740	0.02250	0.02621	0.03665					
Area of utilized farmland	0.15090	0.17604	0.14089	0.15236	Natural	0.20434	0.21364	0.20297	0.20081
Rice yield, 2010	0.23829	0.14883	0.25770	0.22650					
Diversity of crops	0.33626	0.33036	0.42381	0.37143					
Number of animals raised	0.24939	0.18904	0.19602	0.21374					
Diversity of animals raised	0.41978	0.40714	0.36190	0.39286					
Distance of house from nearest water source	0.03539	0.05502	0.03316	0.03728					
Distance of farm from nearest water source	0.00035	0.18907	0.00727	0.01156					

Table 2. Indexed sub-components, major components and SVI of Brgys. Imparayan, Tordesillas, Cabladan and the combination of the three communities. (continued...)

Sub-components	Imparayan	Tordesillas	Cabladan	Combined	Major Component	Imparayan	Tordesillas	Cabladan	Combined
Household monthly gross income	0.27430	0.14391	0.17525	0.20406	Financial	0.49535	0.48230	0.44810	0.47276
Diversity of income	0.31462	0.21750	0.28200	0.27944					
Ownership of land (house)	0.96154	1.00000	0.98333	0.97917					
Ownership of land (farm)	0.82692	0.88125	0.85333	0.85000					
Tenure type (house)	0.76923	0.79375	0.78333	0.78056					
Tenure type (farm)	0.70769	0.77500	0.57333	0.66667					
House floor area	0.14036	0.13246	0.14176	0.13919					
Lot area	0.22863	0.19065	0.15165	0.18812					
Roofing material	0.94872	0.90000	0.85333	0.89815					
House structure	0.20000	0.20833	0.10222	0.16111					
Value of asset owned	0.07682	0.06246	0.02954	0.05393					
Value of farm machines	0.13720	0.08579	0.11479	0.11644	Physical	0.33118	0.41259	0.39007	0.37372
Availability of seed storage facility	0.13846	0.15000	0.12000	0.13333					
Availability of milling facility	0.48462	0.52500	0.49333	0.49722					
Water pipes for irrigation	0.09231	0.55000	0.68000	0.43889					
Potable water facility	0.98462	1.00000	0.99333	0.99167					
Distance of house to main road	0.00110	0.00050	0.00024	0.00039					
Distance of farm to main road	0.00382	0.00204	0.00113	0.00174					
Electricity in the household	0.56923	0.70000	0.76000	0.67778					
Power duration	0.56923	0.70000	0.34778	0.50602					
SVI:	Imparayan	0.36724							
SVI:	Tordesillas	0.34070							
SVI:	Cabladan	0.34376							
SVI:	Combined	0.35037							

the major indicators. *Peras* (*2005*) and *Hahn, Reiderer, and Foster* (*2009*) suggested two options for weighting the subcomponents of an index, the expert's opinion or the stakeholders' perspective. Both methods were highly significant and either of these could be used (*Peras 2005*). To ensure neutrality among the indicators, an equal averaging method was used. Each component or indicator contributed equally to the overall social vulnerability index even though it has different number of subcomponents. The unit of measurement, the average values, and the minimum and maximum possible values of the subcomponents are shown in **Table 2**. To standardize the values of the subcomponents, the unit of measurement was omitted and only the values were used in the data analysis. The possible maximum and minimum values were set by either referring to the scores given or based on the values obtained from the survey.

Given that some crops such as rice, peanuts, ginger, and corn were produced or used as planting material and animals were raised mainly for consumption, the gross value was calculated as quantity produced or number of heads consumed multiplied by the average local price during that period. The value for assets and farm production machines was also obtained by assigning the average local price at the time of purchase.

For variables measuring distance, reference to key informants coupled with eyeball estimation during site reconnaissance were drawn in setting values as secondary data were not available. In the data analysis, an inverse of the value for distance was used since in all the variables, higher value denotes lesser vulnerability. Likewise, an inverse of the dependency ratio was used. The value given for the household without dependents (members under age 15 and over 64) was zero, while the highest score, plus one was given for households with dependents.

The computation for the over-all social vulnerability followed that of *Hahn, Riederer and Foster* (*2009*) which was adapted from the calculation for the Human Development Index (HDI). The index of the subcomponents was obtained using the equation:

$$\text{Index}_s = \frac{S_{max} - S_{min}}{S_{ave} - S_{min}}$$

where S_{ave} is the average value of the subcomponent and S_{min} and S_{max} are the possible minimum and maximum values, determined either from the household data gathered or from the prepared score.

On the other hand, the average value of each capital asset was calculated as:

$$CA = \frac{\Sigma^{n}_{i-1}\ index_{s}}{n}$$

where CA is the capital asset, $index_s$ is the subcomponent, and n is the number of subcomponents. The over-all social vulnerability was determined once each capital asset is averaged using the equation:

$$\text{SVI} = \frac{\Sigma^{5}_{i-1}\ wCA_{i}}{\Sigma^{5}_{i-1}\ w_{i}CA} \qquad \text{or}$$

$$\text{SVI} = \frac{w_{HC} + w_{SC} + w_{NC} + w_{FC} + w_{PC}}{w_{HC}HC + w_{SC}SC + w_{NC}NC + w_{FC}FC + w_{PC}PC}$$

where SVI is the social vulnerability index which is equal to the sum of the weighted average of all the five capitals. The weight of each capital asset is equal to the number of indicators/ subcomponents used. The SVI value ranges from 0 to 1. A value closer to one (1) denotes lesser vulnerability or higher resilience.

RESULTS AND DISCUSSION

Respondent's Profile

Most of the survey respondents belonged to the age 35 to 39 (17%) (**Table 3**). The average age of the respondents was 46 with modal age of 35. The respondents in the three barangays accounted for 56% and 44% for male and female, respectively. Most were married (79%), with four to six family members (51%). Most households were composed of a single family (87%) and majority were born and raised in these communities (92%).

Household Access to Capital Assets

In terms of human capital, Imparayan had the highest value of 0.500 compared with 0.332 and 0.450 of Tordesillas and Cabladan, respectively (**Table 2**). This was supported by the high index rating gained by Imparayan for the average educational attainment of household head (0.497) and household members (0.522), dependency ratio (0.207), and availability of medicines (1). Based on the average score for educational attainment obtained for the three barangays, there was a minimal difference between these scores, with respondents from Imparayan and Tordesillas having attended up to the first two years of secondary education, while those from Cabladan finished only up to the last grade of primary education (**Table 1**). The distance of the sitios to the educational facilities also contributed to the low index rating of Cabladan. Cabladan has the largest land area among the forest-edge barangays and its sitios were distantly located. However, it gained the highest value for skills of the household head (0.313). Aside from farming, some respondents were competent to at most four otherskills such as woodworking and construction, weaving,

Table 3. Profile of the survey respondents.

Respondents' Profile	Imparayan		Tordesillas		Cabladan		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Age								
18 and below	0	0.00	0	0.00	0	0.00	0	0.00
19-24	2	3.08	2	5.00	2	2.67	6	3.33
25-29	4	6.15	3	7.50	5	6.67	12	6.67
30-34	6	9.23	3	7.50	10	13.33	19	10.56
35-39	7	10.77	8	20.00	15	20.00	30	16.67
40-44	3	4.62	3	7.50	9	12.00	15	8.33
45-49	7	10.77	5	12.50	8	10.67	20	11.11
50-54	13	20.00	4	10.00	5	6.67	22	12.22
55-59	9	13.85	3	7.50	4	5.33	16	8.89
60-64	9	13.85	5	12.50	2	2.67	16	8.89
65-69	4	6.15	1	2.50	11	14.67	16	8.89
70-74	0	0.00	1	2.50	4	5.33	5	2.78
75-79	1	1.54	1	2.50	0	0.00	2	1.11
80-up	0	0.00	1	2.50	0	0.00	1	0.56
Gender								
Male	38	58.46	16	40.00	46	61.33	100	55.56
Female	27	41.54	24	60.00	29	38.67	80	44.44
Civil Status								
Single	7	10.77	3	7.50	2	2.67	12	6.67
Married	48	73.85	30	75.00	65	86.67	143	79.44
Widowed	10	15.38	7	17.50	7	9.33	24	13.33
Separated	0	0.00	0	0.00	1	1.33	1	0.56
Family Size								
1-3	17	26.15	7	17.50	17	22.67	41	22.78
4-6	29	44.62	19	47.50	44	58.67	92	51.11
7-9	17	26.15	11	27.50	13	17.33	41	22.78
10-12	1	1.54	2	5.00	0	0.00	3	1.67
13-15	1	1.54	1	2.50	1	1.33	3	1.67
>16	0	0.00	0	0.00	0	0.00	0	0.00
No. of Families in the Household								
1	58	89.23	29	72.50	69	92.00	156	86.67
2	6	9.23	8	20.00	6	8.00	20	11.11
3	1	1.54	1	2.50	0	0.00	2	1.11
4	0	0.00	1	2.50	0	0.00	1	0.56
5 and up	0	0.00	1	2.50	0	0.00	1	0.56
Locality								
Native	63	96.92	33	82.50	69	92.00	165	91.67
Migrants	2	3.08	7	17.50	6	8.00	15	8.33

and driving. On the other hand, Imparayan households had the lowest dependency ratio which indicated that they hadchildren mostly above the age considered as dependents.

Every barangay had its own health center with a barangay health worker supported by a barangay nutrition scholar, but its medicine supply was limited to only those which can cure common illnesses. Among the three barangays, Tordesillas had the highest index rating for distance of house to health center. Most houses were concentrated in the barangay proper, only a few houses were located in the sitios. The respondents claimed to walk an average of 0.437 km to the health center, as compared to 0.973 km and 2.34 km for Imparayan and Cabladan, respectively (**Table 1**). All respondents (100%) from Imparayan also expressed the availability of medicines in the health center. However, respondents from Tordesillas expressed its limited supply or none at all. Tordesillas was the most vulnerable among the three communities for the human capital asset.

Imparayan had the highest value for social capital, with 0.192 rating, while Tordesillas and Cabladan had 0.089 and 0.050, respectively (**Table 2**). This was supported by the high rating gained by Imparayan on the number of organizations that the respondents were affiliated with, the number of years in the organization, and the number of years served in their locality. Imparayan was one of the project sites of the Evelio B. Javier Foundation-Upland Development Project's Antique

Integrated Area Development Program (ANIAD), the Haribon Foundation's Integrating Forest Conservation with Local Governance Project, and a Peace Corps project.

Tordesillas had high index ratings for distance from the nearest relative (0.033) and affiliation with local political body (0.100). The respondents here reported to walk an average of 30 m to get to their nearest family member or relative, as compared with Imparayan and Cabladan which had an average of 135 m and 124 m, respectively.

For the natural capital, Tordesillas had the highest index value of 0.214, followed by Imparayan and Cabladan, with 0.204 and 0.203, respectively (**Table 3**). Although respondents from Tordesillas had larger farmland (2.11 ha), those from Cabladan had a higher average rice yield with 953.5 kg ha^{-1} as compared with 550.5 kg ha^{-1} and 881.5 kg ha^{-1} from Tordesillas and Imparayan, respectively, for the cropping season of 2010 to 2011 (**Table 1**). The proximity and better road network going to Imparayan could be the reason for easier transport of farm inputs to increase yield. On the other hand, Cabladan had more type of crops planted. Aside from the crops raised common to the three communities, respondents from Sitio Apong also grow vegetables such as tomato, radish, scallions, onions and garlic due to favorable cooler temperature.

Animal-raising was a common livelihood diversification strategy in the three communities. However, respondents from Imparayan had higher number of animals raised, with an average of 14 heads compared to 11 heads in both Tordesillas and Cabladan (**Table 1**). Meanwhile, Tordesillas had a high index rating for proximity of domestic (0.055) and irrigation (0.189) water sources since most surface water sources are near their farm and households.

Imparayan still had a higher index value for financial capital (0.495) compared with Tordesillas and Cabladan, with 0.482, and 0.448, respectively (**Table 2**). There was a minimal difference between the values of Imparayan and Tordesillas as these communities each had higher index rating for five sub-components, namely household monthly gross income, diversity of income, lot area, roofing material, and value of asset owned for Imparayan; and ownership of land and tenure type for both house and farm, and house structure for Tordesillas. The average monthly gross income of respondents from Imparayan was PhP 6,438.81. This was higher than the PhP 3,476.95 and PhP 4,188.82 earned by respondents from Tordesillas and Cabladan, respectively (**Table 1**). This high income was attributed to the diversity and number of animals raised. The proximity to the town proper and better mobility of goods were also important factors in promoting economic activities of the people. The diversity of income was also higher (0.315), with contributions from non-farming sources such as charcoal-making, carpentry, ecotourism, and selling of non-timber forest products, albeit minimal (**Table 2**). Carpentry was an important non-farm livelihood of several people in the study area. Thus, carpentry tools contributed to the increase in value of their assets.

For land tenure, most respondents own their house and farms while several respondents from Cabladan was grantees of the Integrated Social Forestry (ISF) program of the Department of Environment and Natural Resources (DENR). The house structure and roofing material were other important indicators of financial capital. The house structure of most respondents from Cabladan was mostly made of bamboo or wood, thus obtaining the lowest score for this component with 0.853.

For the physical capital, Tordesillas gained the highest rating, with 0.413, as compared to Imparayan and Cabladan, with 0.331 and 0.390, respectively (**Table 2**). Tordesillas had the highest index rating for the availability of seed storage and milling facility, potable water source, and power duration. All respondents (100%) claimed to have water pipes to facilitate running water inside their homes. Although most respondents from Cabladan had electricity, Tordesillas had longer power duration, with an average of 16.80 hours, as compared to 13.60 and 8.35 hours for Imparayan and Cabladan, respectively (**Table 1**). On the other hand, Imparayan had the highest rating gained for value of farm machines, with an average value of PhP10,015.38, higher than PhP 6,262.50, and PhP 8,380.00 from Tordesillas and Cabladan, respectively (**Table 1**). It also had higher rating for proximity of house and farm to the main road. The average distance of house to main road for Imparayan was 0.9 km, as compared with 2 km and 4.17 km for Tordesillas and Cabladan, respectively. Meanwhile the average farm distance to main road was 1.32 km, 2.44 km, and 4.35 km for these communities, respectively (**Table 1**).

The comparison of the SVI of the communities showed a variation in the access or ownership of assets, with Tordesillas and Cabladan having the least SVI value while Imparayan had higher resilience highlighted by the high total SVI computed value (**Table 2**). For a holistic assessment, a combined SVI of the three barangays was computed to represent the social vulnerability of the whole forest-edge communities in the study site. The overall combined SVI value of 0.350 was a mediocre numeral representation of the actual situation in the communities. This value showed higher social vulnerability exacerbated by changing climate patterns.

Social Vulnerability of Upland Communities

The SVI of the communities is illustrated in a spider diagram for the five capital assets (**Figure 2**). The center point of the pentagon indicates nil access to the assets

while the outer point indicates higher access or ownership. Generally, the higher and more varied the asset base, the greater is the smallholder/system's adaptive capacity and potential for sustainability (*Chuku and Okoye 2009*). For this study, the highest point obtained was 0.5 or half of the possible highest value that could be generated while the lowest was 0.05.

There was an average access to human and financial capitals, low access to physical capital and very low access to social and natural capitals for Imparayan (**Figure 2**). Meanwhile, Tordesillas had average access to financial and physical capitals, low access to human and natural capitals, and very low access to social capital. On the contrary, Cabladan had an average access to human, financial, and physical capitals, low access to natural capital, and negligible access to social capital. The human capital of Imparayan was strengthened by higher access to education and health, while ownership of land, tenure type and roofing material increased its financial capital. The same factors for financial capital help boosted this asset for Tordesillas, while milling facility, potable and irrigation water provisions, and electricity boosted its physical capital. On the other hand, factors that increased the human, financial and physical capital assets of Cabladan are access to education and health, while ownership of land, tenure type, roofing material, milling facility, potable and irrigation water provisions, and electricity. The average financial capital exhibited by the communities was attributed to the diversification strategies of the respondents. According to *Ellis* (*1999*), diversity was closely allied to flexibility, resilience, and stability.

Social capital was lowest in the three communities due to limited social organizations present in the study sites as well as the low number of respondents affiliated with these organizations. Furthermore, the social network of most respondents was based on family and friends, than having a wide range of network to include government institutions. The natural capital was almost similar in all the study sites.

A deeper examination of the diagram thru overlay showed distinct differences in the human, social, and physical capitals (**Figure 3**). The social capital of Imparayan fared well compared with Tordesillas and Cabladan while the human capital of Tordesillas was comparatively lower than that of the two barangays. For the physical capital, Tordesillas fared higher than the other two barangays. The vulnerability of the communities as conveyed in the diagram is shown weak social resources and natural capital.

Imparayan, with average SVI value for the human and financial capitals and nearing average value for the physical capital, is comparable to the result for one of the communities studied by *Thennakoon* (*2004*). Four Sri Lankan communities were investigated, these were Pannila and Kobawaka (classified as Wet Zones) and Pallekiruwa and Bookandayaya

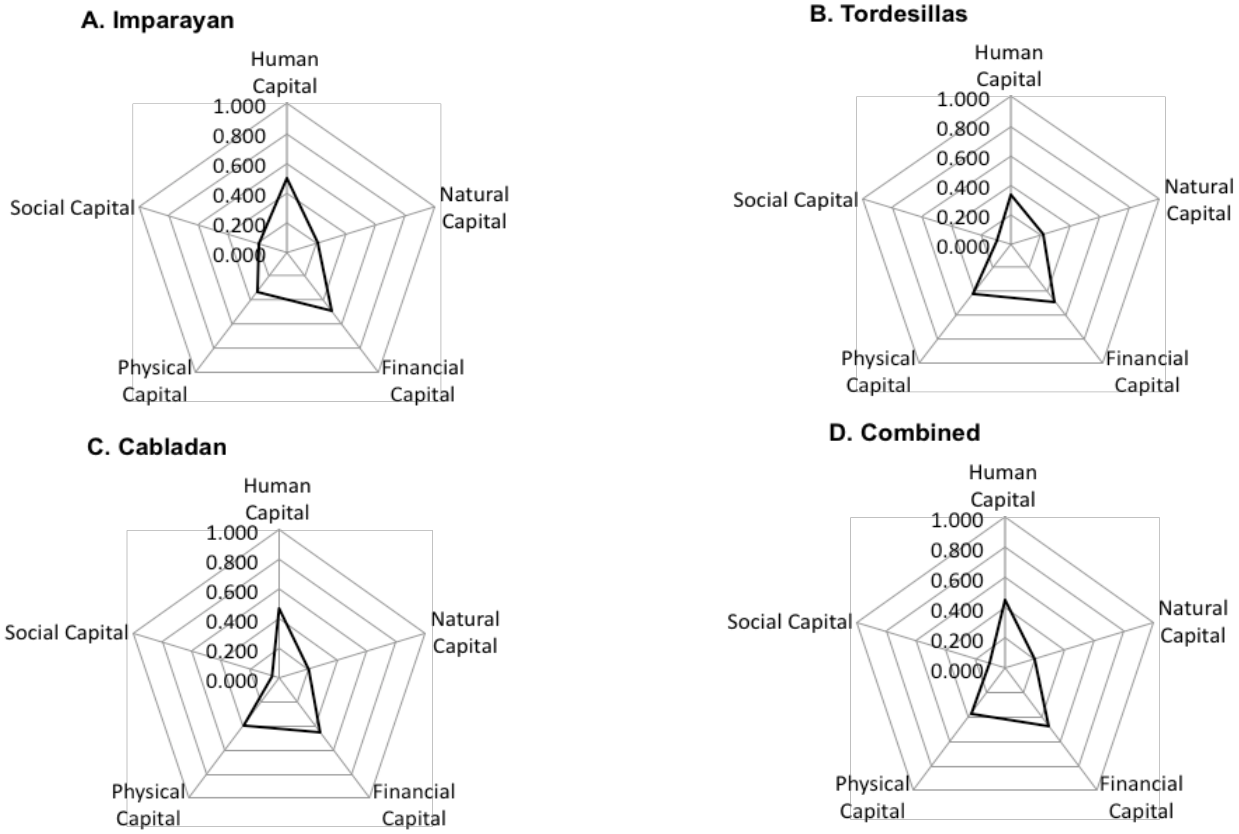

Figure 2. Spider diagram of the five capital assets for Imparayan (A), Tordesillas (B), Cabladan (C) and the combined barangays (D).

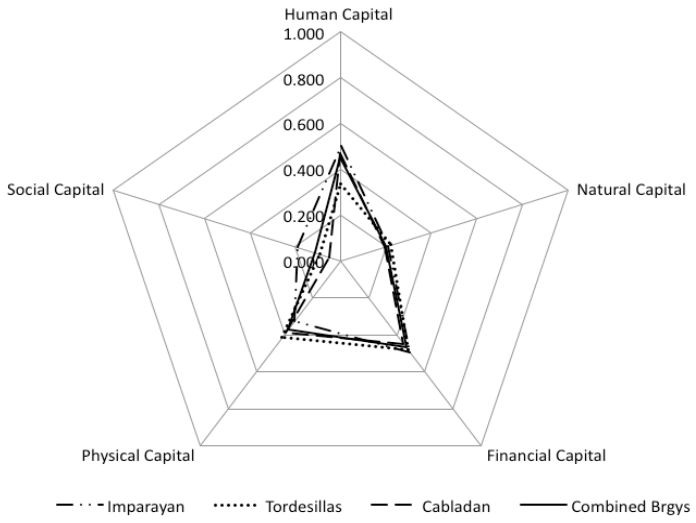

Figure 3. A comparative spider diagram of the five capital assets for the three communities and the combined barangays in Sibalom Natural Park, Antique.

(classified as Intermediate Zones), all of which within close proximity to the Colombo Metropolitan Region (CMR). The five capitals were also used in evaluating the communities, focusing on the following indicators: savings (seven sub-indicators), credits (six sub-indicators), and income sources (13 sub-indicators) for the financial capital; education, vocational training, extension services, health and labor for the human capital; road/transport, water supply, energy, house/toilets, agricultural machinery, government building and market for the physical capital; land, water streams and forest for the natural capital; and relatives, labor neighbors, and membership in identified organizations, and aid and livelihood societies for the social capital. These indicators were given a different percentage weight in each village. Kobawaka was better endowed with financial, human, and physical assets compared with the other communities. This was explained by the location of Kobawaka, where it can be found within the CMR where industry and infrastructure are generally well-developed (*Wanasinghe 2001 as cited by Thennakoon 2004*). This condition was similar to Imparayan, thus, improved human, financial and physical assets could be attributed partly to proximity to town centers.

On the other hand, the high vulnerability of Cabladan could have been a factor of and compounded by the exposure of the community to risks and natural hazards as related by barangay leaders. In an assessment of vulnerability of rural livelihoods to climate change among the Pacific islands, sustainable livelihood analysis (SLA) workshop output suggested that high vulnerability was associated with heavy reliance on degraded natural resources in which these livelihoods are based (*Park et al. 2009*). The high frequency and magnitude of risks experienced in Cabladan affected their asset base as financial capital was regularly focused in restoring losses in the natural capital that impedes investments in other livelihood strategies.

CONCLUSIONS AND RECOMMENDATIONS

The average human, financial, and physical capitals of the households allocated for additional manpower and increased skills, wealth for livelihoods investment, and tools for adapting to stresses in their livelihoods through diversification. This offset the limitations of the natural and social capitals. In-migration and out-migration for wage labor provided for the increased wealth, thereby supporting livelihood capital assets (human, social, physical, and financial) and strategies (diversification and intensification to some extent).

As this was an initial assessment of the current socio-economic strength as well as deficiencies of the upland communities in the study area, the recommendations presented here were prospective. While the five capitals showed and emphasized the weak household asset base, even stronger capital asset should not be disregarded. The target for strengthening the assets must focus on individual sub-component regarded as important building block of livelihoods.

For the human capital, interventions should focus on education. Higher educational attainment of household heads definitely increases skill and widens opportunities for livelihood strategies. The accessibility to education facilities is important but the quality of instruction must also be ensured.

On social capital, the quality and benefits derived from livelihood organization, network or accessibility to government support groups, and market for agricultural commodities should be strengthened. A market mechanism to regulate price fluctuations and promote access of smallholder producers should be explored. Social capital plays a critical role in the household's livelihood strategies as it widens opportunities and shortens the gap between external groups or aid and internal linkages.

The yield and diversity of crops and animals must be boosted for the natural capital. The low crop yield in a farming household will limit them in sustaining their food requirements for the duration of the cropping cycle. Natural processes also contribute to the shocks in the natural capital, such as erosion and siltation which are observed to be predominant in the communities. Thus, soil and water conservation methods should be carried out to avoid increasing resource depletion or shrinking of the resource base in affected areas. It will also help in reducing soil erosion of rice paddies that eventually descends into the river system contributing to siltation. On forest restoration and conservation, government support programs should be continued and sustained, and must also be worked out vis-à-vis climate adaptation and mitigation initiatives. This will ensure continued ecosystem services, foremost is water,

which is essential in initiating and sustaining farm production activities. Additionally, locally abundant non-timber forest product such as punaw (*Schizostachyum* sp.) should be promoted and propagated as it can contribute to household food requirements and income diversification to fill the seasonal gap in farm production.

For the financial capital, the focus must be on regularity, level, and diversity of income. Diversification, first among agricultural livelihoods and eventually into off-farm and non-farm livelihoods, will pool cash income or wealth, allowing engagement or investment in other livelihood activities and capital assets such as the human capital. Increased human capital through skills and education will eventually lead to livelihood specialization which was found to be higher-earning and more stable.

Lastly, for the physical capital, infrastructure such as roads, bridges, power and communication must be improved; and access to agricultural equipment facilitated. Infrastructure transforms communities by facilitating access to resources and linkages such as goods and services from market to households and vice versa. Basic infrastructure are considered determinant of an improved well-being. Limited physical capital puts the households at a disadvantage as costs of foregone opportunities are higher. On the other hand, flood and landslide signals are best early warning system mechanisms in affected communities.

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ACKNOWLEDGMENT

We are grateful for the support of DOST-PCAARRD for the financial grant. We would also like to thank SNP PASu Russel Rizardo for providing relevant information. The same is also extended to the former and current community heads of Brgys. Imparayan, Tordesillas and Cabladan, namely Brgy. Capt. Tito Paduganao and former Brgy. Capt. Mary Paduganao; Capt. Rudy Abanto Jr.; and former Brgy. Capt Porficio Cabigunda and Brgy. Capt. Leonardo Fortin; to the study enumerator, Lumen Tiongco; and Ruth Condeno-Martinez, Jennifer Dimas-Edrial, and Prosperidad Abonete for field assistance.