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Landscape components of Aborlan Palawan Philippines: influence on the employment and income of its populace

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Abstract. Aborlan Palawan is known to be the sleeping town in the Southern part of Palawan Philippines As a municipality, its landscape is composed of several structures making it a municipality, home for its population. This study focuses on the use of landscape maps to describe its landscape components and how it influences the employment and income of its population. Descriptive research method and documentary analysis was used to describe the influence of landscape maps (road network, water catchment, Environmentally Critic Area Network (ECAN), soil map, land classification and land use) to the employment and income of the population Components of the landscape is described using Patch Mosaic Model Pattern Elements, specifically the patch, corridor and matrix. Result of this study revealed that the land scape of Aborlan Palawan which is composed of 57% ECAN considered as the major landscape matrix in Aborlan, influence the employment and income status of its population. The ECAN matrix, influence livelihood of its populace, since employment and income of population situated near ECAN, lag behind compared with the villages (*barangays*) in lower slopes. The employment rate and income is high in villages far from ECAN.

1. Introduction

The composition of a landscape is defined by the spatial elements that are distinguished in the map and believed to be relevant to the landscape function under consideration. Composition is mainly concerned with land cover types which are presented at courser scale [1]. Landscape ecology is a discipline that studies environmental complexity, concentrating mainly on an analysis of the importance of spatial relationships between the various components (individuals, populations, communities, and land mosaics) of the real world. When studying a landscape, it is important to be able to consider the components that are of immediate interest without losing sight of the whole [2]. In this study landscape component is define as the physical structures (land, water, roads) that composes the municipality of Aborlan Palawan Philippines. The biggest structure is express as matrix, patches as scattered mosaic of discrete structures, and corridors as linear landscape such as road networks and bodies of water. Aborlan Palawan is a first class municipality located in the Southern part of Palawan, Philippines. It is situated at the central portion of Palawan Island, 69 km southeast of Puerto Princesa City (Fig. 1). It is located at 118 °32' 53" North longitude and 9 °26' East latitude. It lies in a vast plain between the Sulu Sea and the mountains. Bounded on the east and west by rich and mighty bodies of water, the Sulu Sea and the West Philippine Sea facing South China Sea, and comprising part of Palawan Island's almost 2,000 kilometers of coastline. It has 19 villages/barangays including its Aborlan Poblacion. It has a population of 35,091 people. In 2014, there are also 7,310 total households with an average family size of 4 persons per household [3]. Generally, the soil of Aborlan can be classified into rough mountain soil type which is suitable for forest growth and preservation purposes

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comprising about 57% of its total land area, and clay loam which is suitable for agriculture comprising about 40%. The topography ranges from flat near the shore of the eastern and western part to rugged mountainous in the central and southwestern portion of the municipality. The total land area of 80,733 hectares is covered with different land use types, of which about, 54.8% is forest [4].



Figure 1a. Map of Philippines showing Aborlan Palawan Circled Black

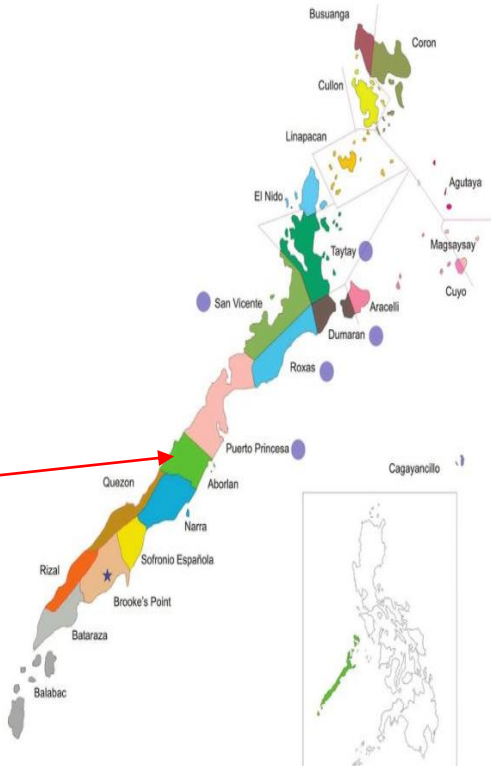


Figure 1b. Map of Palawan showing Aborlan Palawan in green patch

1.1. Objectives of the study

This study describes the following landscape components of the municipality (expressed in landscape maps-road network map, water catchment, environmentally critical Area Network, soil map, land classification and land use) and its influence on the employment and income of the population.

2. Methodology

A convenient and popular model for conceptualizing and representing the elements in a categorical map pattern is known as the *patch-corridor-matrix model* (PCMM). Under this model, three major landscape elements are typically recognized, and the extent and configuration of these elements defines the pattern of the landscape. The patch mosaic model is the dominant model of landscape structure in use today and Map of land cover types is an example of using this model in studying the landscape.

This study used descriptive research method to describe landscape maps and its influence on the livelihood of the population. Documentary analysis on landscape maps, employment, and income of the population supports the results and discussion. Data on landscape map, employment, and income, were gathered from the Municipal Planning and Development Office of Aborlan Palawan (MPDO) Philippines.

In this study, PCMM was used in which landscape maps are express in mosaic (biggest structure) linear (roads and bodies of water) and patches (mosaic with discrete land structure). The employment and income are express in magnitude, proportion, and total.

3. Results and discussion

3.1. Road network

Road network map (corridors-linear landscape elements) is shown in Figure 2 in different hues of brown. Darkest brown line denotes national highway from Puerto Princesa City to Narra Palawan, and is located close to villages facing the Sulu Sea. Provincial and municipal roads (dark brown lines), connects villages which is mostly prevalent in villages facing Sulu Sea. Municipal road, also connects 2 villages (Culandanum and Apurawan) facing South China Sea. To date no road traverses villages facing South China to villages facing Sulu Sea. Thus people of Culandanum and Apurawan, use pumpboat (motored banca) to Puerto Princesa City, then travel by land via public utility vehicle (PUV) to town proper of Aborlan. Examining the road network map shows that 57% of Aborlan is ECAN, characterize by forest growth. Villages that are closer to the forest from the North are Sagpangan,

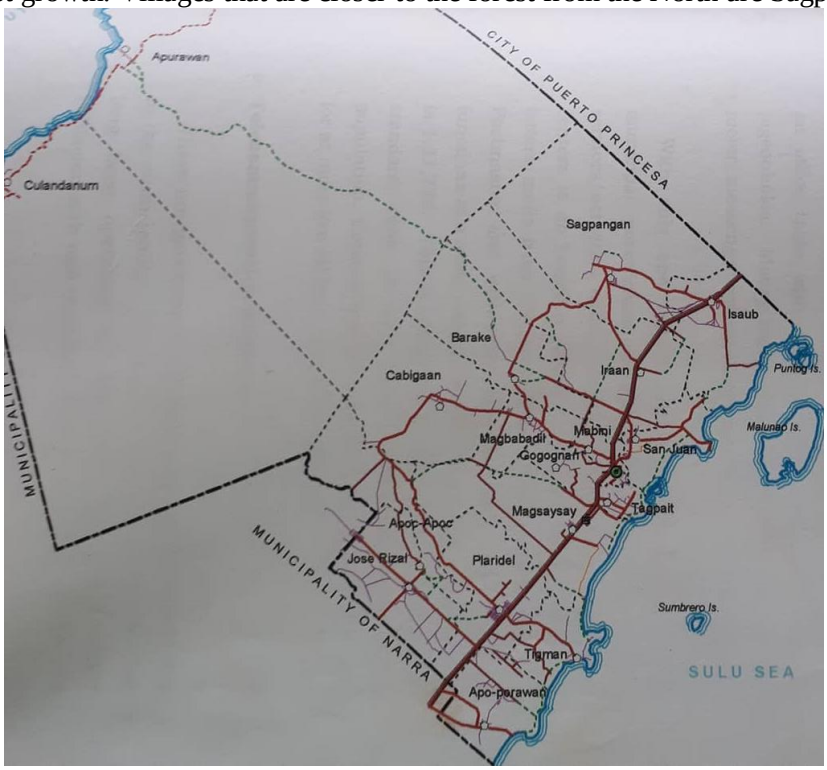


Figure 2. Road Network Map of Aborlan Palawan

Source: Aborlan MPDO Data Bank

Barake, Cabigaan and Apurawan and Culandanum facing the South China Sea Coastline is expressed in dark blue line while rivers and creeks are represented by light blue single lines which are distributed in interwoven manner, in villages facing the Sulu Sea. Most of the population inhabited areas, are in lower slopes and are accessible to road networks. Areas with higher slope are forests. However, one group of the Indigenous people in Palawan-the Tagbanuas inhabited areas near the forest such as Sagpangan, Barake and Barake facing Sulu Sea and Apurawan and Culandanum facing South China Sea [5].

3.2. Water catchment map

Water Catchment map (corridors-linear landscape elements) of Aborlan Palawan is posited in Figure 3.Water catchment is shown in 2 blue lines, which are connected to the main rivers (single blue line).Two villages facing South China Sea has more distinct and extended water catchment areas which are connected to the following rivers; Tigman, Talakaygan, Ibanu, Apurawan, Aborlan. Bubunaguan, Apurawan, Calategas and Culandanum. The rest of the vilages (facing Sulu Sea) has less extended water catchment which came from the following rivers; Isaub, Sagpangan Aborlan, Talakaygan, Tigman, Apo-Aporawan, Barake, Isaub, Aborlan and Mayligan. All of these water catchments areas terminated along the coastlines (3 blue lines) of the municipality. Villages facing South China Sea are bordered by the coastlines facing South China Sea. While villages facing Sulu Sea are bordered by coastlines facing Sulu Sea. The water catchment map influences the agricultural production in the municipality.



Figure 3. Water catchment Map of Aborlan Palawan

Source: Aborlan MPDO Data Bank

3.3, Environmentally critical area network map

Figure 4 shows the environmentally critical Area Network (ECAN**).** The **core** zone (red matrix) is the

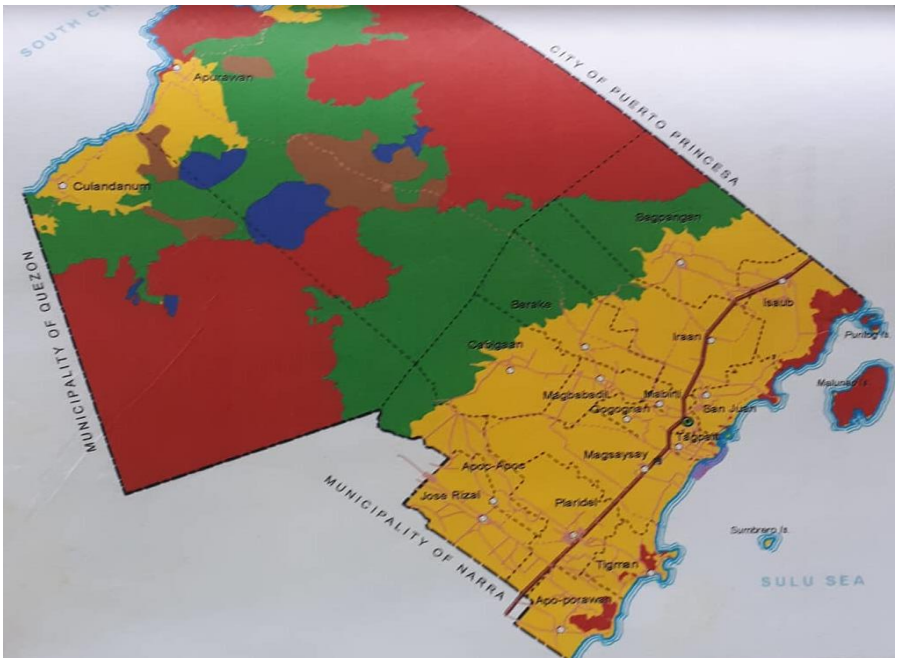


Figure 4. Environmentally Critic Area Network Map of Aborlan Palawan

Source: Aborlan MPDO Data Bank

ECAN, and are protected by Philippine Forestry Law from any human activity. It include sanctuaries of rare and endangered species in the villages of Apurawan and Culandanum. Selected coral reefs, seagrass and mangrove ecosystem reserves are found along the coastal areas in Apurawan, barangay Isaub and island Puntod facing Sulu Sea. Considering the distance of Aborlan (first town from Puerto Princesa City (going South). Cleopatras Needle in Puerto Princesa City serve as home for some endemic species of animals like the Palawan squirrel are also found in core zone in Aborlan. Restricted use zone are shown in blue patches and also found in the villages of Culandanum and Apurawan. These areas are inhabited by endemic and endangered species of flora and fauna like leopard cats. Spatial ecology study of Palawan leopard cats (*Prionailurus bengalensis heaneyi*) using live trapping, radio telemetry, and small mammal trapping from May 2013 to July 2014 in Aborlan, Palawan, Philippines, revealed the presence of the indigenous animal in the area [6]. Zone areas are posited in green patches found in villages of; Apurawan, Culandanum,Sagpangan, Barake and Cabigaan. Planting of crops are allowed for indigenous people that inhabited the areas, in order to sustain their lives. Multiple use areas are shown in yellow patches which are used for growing of agricultural crops. Most of the yellow patches are located in villages in lower slope and facing Sulu Sea. Minimal yellow patches are found in the villages facing South China Sea. Traditional use zone, (traditional agricultural practices) are presented in brown patches and also found in 2 villages facing South China Sea. Mangrove forest is displayed in purple small patch along the coastline of barangay Magsaysay facing Sulu Sea.

3.4. Soil map

Figure 5 posited the soil Map of Aborlan Palawan (patches of varying brown hues). Soil map of the municipality is described in varying hues of dark brown to light brown based on fertility of the, soil. Fertile areas facing Sulu Sea are found in villages of; San Juan, Mabini, Gogognan Magbabadel, Tigman, Apo-aporawan where main agricultural crops like rice corn, legumes are grown. Perennial crops like coconut, cashew, citrus family also thrive in these areas. Next on soil fertility are the vilages of; Isaub, Apoc-apoc, Magsaysay, Plaridel, Jose Rizal. Agricultural crops are also grown in these areas.

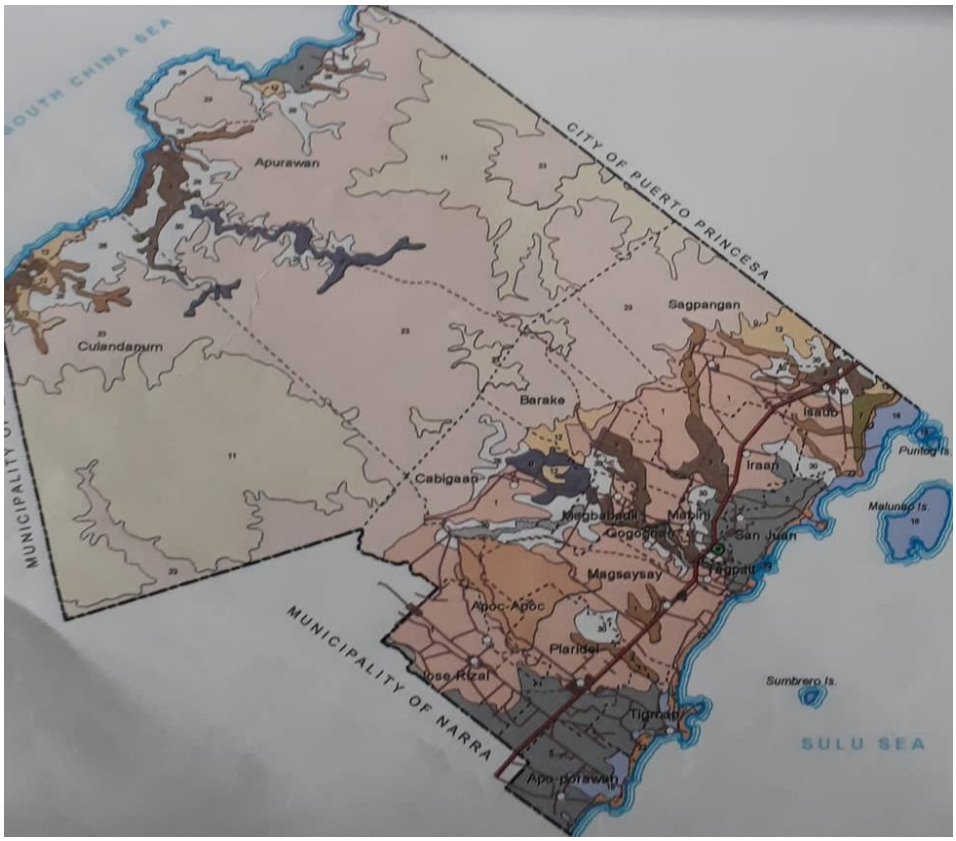


Figure 5. Soil Map of Aborlan Palawan

Source: Aborlan MPDO Data Bank

Villages facing South China is characterized by lighter color. Slope in this area is high compared with the villages facing Sulu Sea. Agricultural perennial crops like coconut thrive in dark brown to light brown patches near the coastlines, and near Apurawan river.Tigman, Apo-aporawan where main agricultural crops like rice corn, legumes are grown. Perennial crops like coconut, cashew, citrus family also thrive in these areas. Next on soil fertility are the vilages of; Isaub, Apoc-apoc, Magsaysay, Plaridel, Jose Rizal. Agricultural crops are also grown in these areas. Less fertile soils in villages facing Sulu in villages of: Sagpangan, Barake and Cabigaan,since these villages are found in higher slope. Less fertile soils in villages facing Sulu in villages of: Sagpangan, Barake and Cabigaan, since these villages are found in higher slope. Lowland crops are not suited to these villages, thus farmers in those areas, plant long variety of rice which has lower harvest than the lowland rice. Indigenous people (*Tagbanua*) mostly inhabited the three villages, where they rely much on plants in the forest like rattan gathering, honey gathering during summer months. Some species of orchids typically found in forest and some Indigenous People still sold it in lowlands.

3.5. Land classification map of Aborlan Palawan

Figure 6 shows the land classification map of Aborlan, Palawan. More than the majority (57%) of Aborlan is classified as protected land as shown in dark green matrix, where almost 60% of the villages facing South Sea China Sea and about 25 % of the land in barangays facing Sulu Sea. It covers approximately 80% of Sagpangan, 50% of Isaub, 40% of Iraan, 60% of Barake and 40% of Cabigaan These villages are inhabited by *Tagbanuas* and rely much of their livelihood on forest products. Large patch of timber/forest land, represented by light blue green patches, found mostly in villages of Culandanum and Apurawan. Small patches are found in Iraaan, Isaub and Magasaysay and Jose Rizal, where planted trees are owned by private farm owners. Large patches of arable land (light

pink) are mostly found in villages facing Sulu Sea and small patches near the coastal areas in Culandanum and Apurawan facing South China Sea

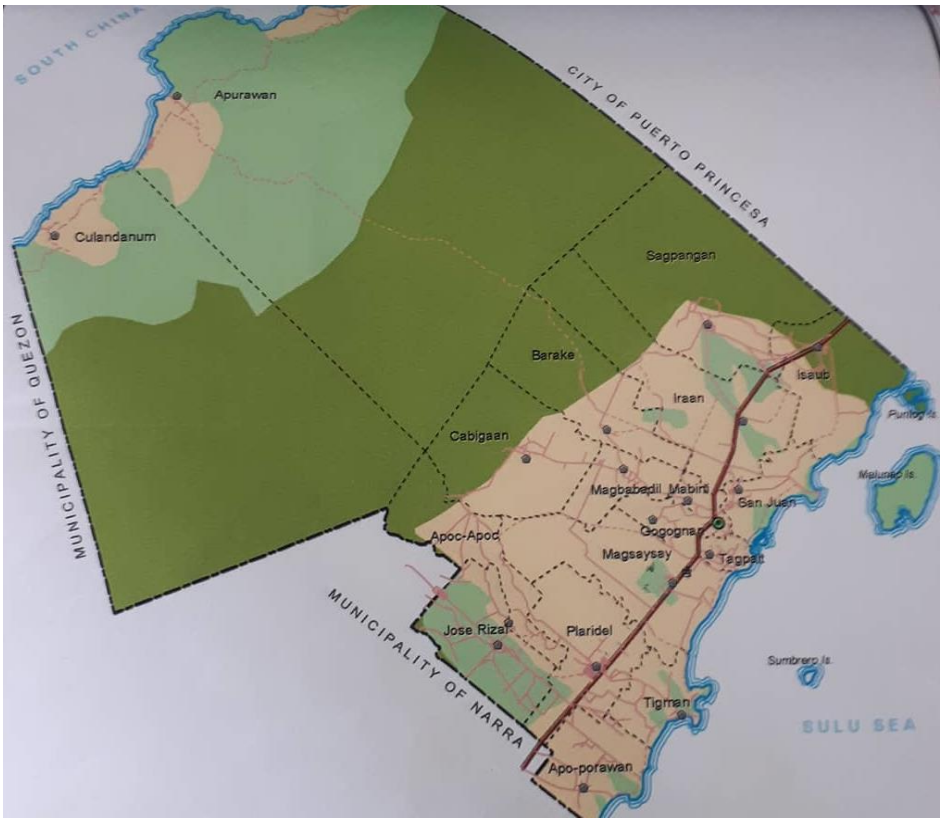


Figure 6. Land Classification Map of Aborlan Palawan
Source: Aborlan MPDO Data Bank

3.6. Existing land use map

Figure 7 illustrates the Existing general Land Use Map. Large dark green matrix is characterized by forest mostly found in 2 villages facing Sulu Sea. Light green patches characterize by grassland are mostly found in villages facing Sulu sea and small light green patches in 2 villages facing South China Sea. Agricultural lands are represented by light blue patches which are mostly found in villages facing Sulu Sea, and very small patches along the coastline of Culandanum facing South China Sea. Swamp areas (dark blue lines) are along the coastline of villages facing Sulu Sea and South China Sea. Mangroves are represented in pink patches near the coastline of barangays facing Sulu Sea and very small pink patch in barangay Culandanum. Although very minimal in Aborlan landscape, still contributed to the coastal area of the country. The coastal areas of the Philippines provide a continuous supply of goods—fish, oil, gas, minerals, salt, and construction materials— and services such as shoreline protection, sustaining biodiversity, maintaining water quality, transportation, and recreation. The direct benefits from mangroves have been estimated to be more than $600 per hectare per year in fish production and potential sustainable wood harvest. The annual direct benefits in the Philippines from mangroves are therefore at least $83 million per year [7].

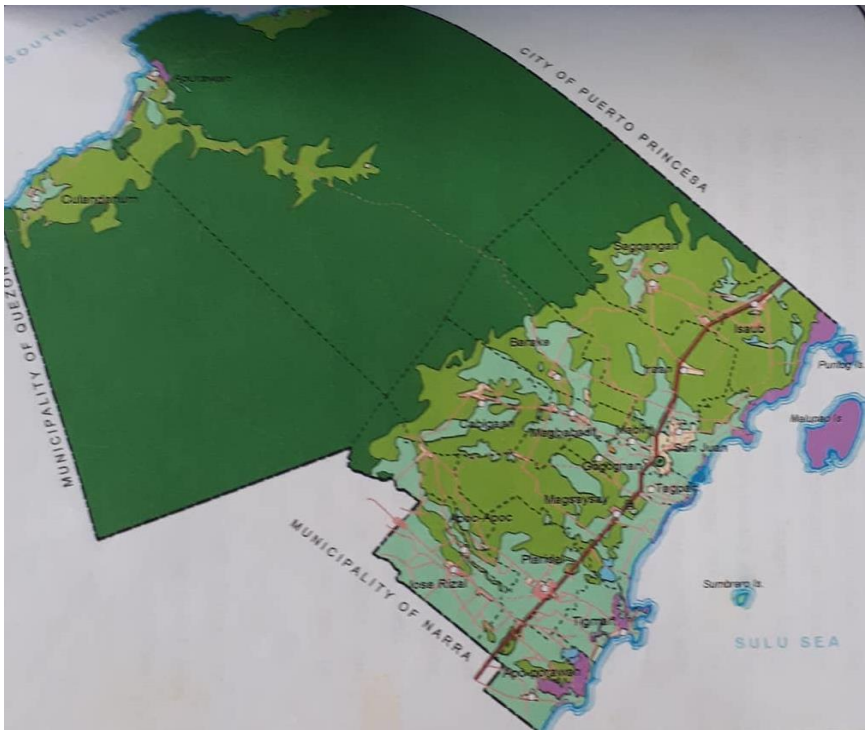


Figure 7. Existing General Land Use Map of Aborlan Palawan, Philippines
Source: Aborlan MPDO Data Bank

Table 1. Employment Rate (2014) in Aborlan Palawan

Barangay	Number of Households of the labor force	Employed members of the labor force	
		Magnitude	**Proportion**
1.Apo-Aporawan	315	293	93.02
2.Apoc-apoc	246	241	97.97
3.Apurawan	1357	1323	97.49
4.Barake	121	118	97.52
5. Cabigaan	750	727	96.93
6. Gogognan	229	220	95.07
7. Iraan	262	247	94.27
8.Isaub	333	310	93.09
9. Jose Rizal	309	297	98.12
10.Mabini	322	307	95.34
11. Magbabadil	396	377	95.2
12.Plaridel	952	899	94.43
13. Ramon Magsaysay	531	513	96.61
14. Sagpangan	481	469	97.51
15. San Juan	804	745	92.66
16. Tagpait	347	330	95.1
17. Tigman	579	557	96.2
18.Poblacion	681	651	95.59
19. Culandanum	374		
Total	9342	8942	96.72

Source: Aborlan MPDO Data Bank

3.7. Influence on employment rate

Employment rate as revealed in Table 1. Based on the report of MPDO (2014), there are 20,928 individuals with ages 10 years old and over were the source of data for employment in the

municipality. Out of this number, 9,342 belongs to the labor force and 8,942 were in the workforce either employed or self –employed. Highest employment was found in the villages of Jose Rizal and Apoc-apoc (facing Sulu Sea) wherein, these areas are located near road networks and agricultural production zones. No data on employment was reported in the village of Culandanum, due to the remoteness of the village. Local facilities and employment opportunities is critical during times of need, especially for health, employment and social reasons [8].The survival of small upland farmers depends on whether they would have more scientific knowledge about farming, favourable incentives to grow environment- friendly crops such as trees and other perennials, and access to nonfarm income sources [9].Employment conditions in Philippine rural labor markets and agriculture can be characterized as casual or informal, with low skill requirements, with low productivity and returns, and a greater concentration of poverty. This is consistent with a prominent strand of development literature that posits a traditional sector, mostly located in rural areas, and highly depending on agricultural livelihood.

3.8. Influence of land structures on the income of the population

How this land components influence the income of the population, data from Aborlan MPDO (2015) such as employment and income was gathered. There are 3,421 households with income below the

Table 2. Income of the Population

Barangay	Number of Households	Households with Income below Poverty Threshold	
		Magnitude	**Proportion**
1.Apo-Aporawan	220	66	30
2.Apoc-apoc	203	91	44.83
3.Apurawan	874	433	49.54
4.Barake	176	86	48.86
5. Cabigaan	504	344	68.25
6. Gogognan	150	101	67.33
7. Iraan	370	148	40
8.Isaub	462	234	50.65
9. Jose Rizal	238	109	45.8
10.Mabini	247	124	50.2
11. Magbabadil	284	154	54.23
12.Plaridel	591	240	40.61
13. Ramon Magsaysay	569	253	44.46
14. Sagpangan	359	237	66.02
15. San Juan	596	188	31.54
16. Tagpait	237	127	53.59
17. Tigman	390	95	24.36
18.Poblacion	519	149	28.71
19. Culandanum	321	242	75.39
Total	7310	3421	46.8

Source: Aborlan MPDO Data Bank

poverty threshold or about 46.8 % of the total Households (Table 2). At the village level, Culandanum registered the highest proportion with 75.39% of the total households fall below the poverty incidence, followed by Cabigaan with 68.25% and Gogognan at 67.33%. This can attest to the land components, where areas near the ECAN cannot fully utilize the land even though it is more fertile, since it is restricted and mostly composed of forest and timber land. Close to 1.6 billion people – more than 25% of the world's population – rely on forest resources for their livelihoods and most of them (1.2 billion) use trees on farms to generate food and cash. Food Agriculture Organization, promoted the concept of better forestry, less poverty which suggests ways to prevent, mitigate, and reduce poverty through forestry-based interventions in rural areas [10]. At present, the Philippine uplands are occupied and cultivated by roughly 24 million people—one-third of the country's

population—with their lives and general wellbeing intimately linked with the forest and its resources. On these lands, a large percentage of the population suffers from extreme poverty [11].

4. Conclusion

The use of landscape maps (road network, water catchment, ECAN, soil map, land classification and land use) to assess the employment and income of the population can provide environmentalist, policy makers, researchers and laymen baseline information on whatever projects, and development plans that will be implemented in the municipality. Result of this study revealed that the landscape components of Aborlan Palawan, Philippines influenced the employment and income status of its population. It is imperative that the 57% of its total land area is ECAN, had influenced the employment and income status of the population. The lay back employment and income status of the people near ECAN could be attributed to the protected areas in the said area.

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