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Agro-Ecological Evolution in the Land use Systems in Ifugao, Philippines

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Abstract **– The evolution of land use system in the Province of Ifugao, Philippines is very evident, from a natural forest to different agricultural ecosystem. At present, there are four (4) existing complex land use system in the province namely: forest, kaingin, agroforestry and pasture/grass land. This study aimed to describe considerations in the agro-ecological evolution of land use resources in the Ifugao, Philippines. Qualitative method particularly case study was utilized to examine the major factors affecting the agro-ecological evolution in the land use system. Based on the result of the study there are five (5) general considerations of communities in the agro-ecological change in the land use system in Ifugao, Philippines: economic factor, physical factor, cultural importance, market opportunities and support system. The trend of Agro-ecological evolution is prompted to provide the immediate and basic needs of the communities in the upland. The clearing of portions of the forest land and convert to other land use system satisfies the needs of the community. However, it is alarming, natural resources particularly soil and water is becoming tainted most especially on steep slopes areas due to the result of combined anthropological and environmental activities exaggerated by climate change.**

Keywords **– Ecosystem Services, Social Importance, Natural Resources.**

I. INTRODUCTION

Philippines is about 30 million hectares, half of which is classified as forest land, 47 percent is classified as alienable and disposable land and the remaining three (3) percent is unclassified forestlands. Alienable and disposable (A&D) land refer to those areas which may be issued with permanent title and/or used for varying purposes such as for residential, agricultural, commercial and other uses. Of the country's' 14.19 million hectares of A&D land, 9.63 million hectares are already titled (DENR, 2015). On the other hand, forestland are land belongings to the state and cannot be alienated unless provided by law. Much of the forest land are hilly and mountainous with slope > 18 percent hence are deemed not suitable for agricultural purposes as legally defined by the Revised Forestry Code of 1975 (Esplana & Quizon, 2017).

The land use system is the result of complex interaction of different physical, biological and human interventions in the farm management attaining certain goal and objectives (Dethier & Effenberger, 2012). Several studies have reviewed and summarized the factor that influence the adoption in agriculture. Accordingly, some relevant factors that can influence the decision to convert from conventional to organic farming include: farmers characteristics, farm structure, farm management, exogenous factor, and attitudes and opinions (Kallas et.al, 2009).

The Ifugao province in particular is a landlocked watershed province bounded by a mountain range to the north and west that tempers into undulating hills towards the south and the east. The highest elevation is 2,523 meters above sea level (masl.) with the rice terraces lying above 500 masl. Ifugao province is located at the southern portion of the Cordillera Administrative Region (CAR) found at heart of Luzon Island of the

Philippines. It is home to the indigenous people who call themselves "Ifugaos" and is host to one of the world renowned rice terraces clusters that the UNESCO World Heritage List of cultural and natural properties considered to be of "understanding universal value" (Licnachan, 2009). In the land classification of the Philippines 2013 as published by the Forest Management Bureau of the Department of Environment and Natural Resources (FMB-DENR, 2014) Ifugao province has approximately 251,778 hectares and 90 % (226,369 has) of which is declared as forestland only 10 % (25,409 has.) is considered as Alienable and Disposable lands (A & D).

The major livelihood in the province is farming, wood carving and other works related to agriculture. Expansion of agricultural areas in many parts has changed the land cover to more agro-ecosystems and less cover of vegetation. It is important to consider the factors evolving the land use system and farming practices in the Ifugao, hence this study.

II. METHODOLOGY

The study considered existing data and available information from the Department of Environment and Natural Resources (DENR) and Department of Agriculture (DA) to identify the areas that were converted from forest to other land use system in the Province of Ifugao. It also involved the conduct of personal interviews to the selected upland farmers regarding history of the farm, planting structure, the choice of commodity, and land use design.

The study used the qualitative method of research. Specifically, this study employed the case study that examined the Agro-ecological evolution of land use system in the province of Ifugao considering the socio-economic and demographic factors, cultural attributes, political and policy interventions, climate change adaptation. Focus group discussion was also used to collect the qualitative data and validate information during the interview, a question guide was prepared to facilitate the discussion process and exchange of information efficiently. Group discussion was conducted to knowledgeable farmers and leaders from the different municipalities of Ifugao who experienced land use change representing different land use system to draw different informations on how Agro-ecological systems evolved.

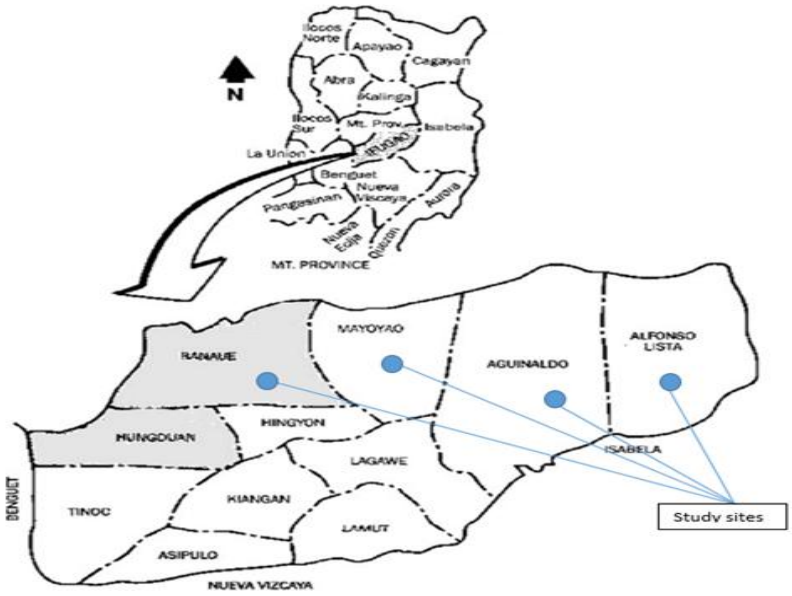

Fig. 1. Study Site.

Findings

The province of Ifugao in the Philippines is a mountainous area and majority of which is declared as forest zones. The province naturally possesses abundant natural resources such as timber, fruits, wild honey and wild animals that is used for food and commercial purposes. It is blessed with fertile soil, abundant water in most areas and good climatic condition favorable for agriculture and forestry purposes. The province is inhabited by the Indigenous Ifugao tribes such as Kalanguya, Tuwali and Ayangan that are engaged in vegetable farming, hunting, logging and wood carving, however, some portions of the province particularly in Alfonso Lista and Lamut is predominantly occupied by Ilocano community involved in rice and/or corn production as their main source of living. There exist a balance of socio-economic and ecological importance of natural resources in the agro-ecological system in the province as they practice fallow period in their farming, minimal utilization of chemicals in the control of pest and diseases in their farms and minimal application of synthetic fertilizers in their vegetable production to maintain the integrity of the environment particularly; soil fertility, water quality and quality of agricultural produce. Agro-ecological systems in Ifugao follow traditional farming systems and processes such as land preparation, sowing of seeds, fertilization, control of pest and diseases, harvesting and Marketing. This is the routine structure of agriculture in the area. Moreover, this is the usual engagement of communities that serves as source of income.

The agro-ecological systems in the province is comprised of different components because there exist a variety of land use systems such as forest land, kaingin or agricultural production area, open area, and pasture land. Forest areas dominate the land use system, comprising of different endemic and indigenous forest tree species with good quality for construction and furniture. Nevertheless, many portions are converted to kaingin, pasture land, agroforestry system, and widespread establishment of resettlement because of increasing population in the province.

III. Current Agro-Ecological Systems in Ifugao, Philippines

Forest

Forests are viewed, defined, assessed, and valued through different lenses. From different vantage points, forests can be seen as a source of timber products, an ecosystem composed of trees along with myriad forms of biological diversity, a home for indigenous people, a repository for carbon storage, a source of multiple ecosystem services, and as social-ecological systems, or as all of the above (Chazdon et.al, 2016). Forest is a natural and dominant ecosystem in Ifugao, Philippines. Certainly, it comprised of different level of canopy from the smallest (suppressed) up to the tallest (dominant) crown classification which is composed of endemic hardwood species belonging to the family Dipterocarpaceae, Fabaceae, Myrtaceae, Lamiaceae, Verbenaceae and a lot more. These species of hardwoods possess good quality performance as a construction materials, furniture, post, and other wood related uses. The forest is a source of livelihood for the indigenous communities, it is where they hunt wild animals, harvest fruits, edible vines and ferns. It is where a natural spring originated that is being used for domestic and to irrigate their agricultural crops. Forests resources in the province serve as a natural barrier to calamities like typhoon that will approach the area. These are some of the many benefits of forest, however the conservation value of natural forest is declining, more so it is alarming because of complementary effect of both anthropogenic and environmental problems. Nevertheless, the Philippine

government have initiative to protect remaining forest resources, restore and rehabilitate degraded resources. With the National Greening Program (NGP) of the Department of Environment and Natural Resources (DENR) it is expected to rehabilitate degraded forest in the province.

Fig. 2. Forest in Alfonso Lista, Ifugao.

Kaingin

Kaingin involves the cutting down and burning of plant growth, followed by the planting and harvesting of agricultural crops in forested areas in the Philippines. Kaingin in the Philippines is recognized and known by social scientist as "swidden farming", often used by social scientists that encompasses a variety of agricultural practices with differing environmental effects (Cuevas 1991, Kummer 1992a, Russell 1988). In general, slash and burn (kaingin) is evident and rampant in the Ifugao, Philippines, upland communities tend to clear forest areas and convert to agricultural production. A Forest land is considered a public land, that a public land is considered as a public domain which has not been subjected to the present system of classification for the determination of which lands are needed for forest purposes and which are not (PD 1559), however, there are occupants within the forest land that claims to be the owner of the land as they use, maintain and protect the forest resources since their time immemorial, majority of them are indigenous groups of Ifugao.

Kaingin areas in the province are planted with vegetables, upland rice, and other agricultural products. Some are engaged in wide scale corn production. The practice of kaingin in the province is recognized as one of the sustainable agroforestry systems in the Philippines because of employing soil and water conservation technologies like establishment of rock walls on steep slopes, use of endemic species, green mulching, use of organic fertilizer and natural control of pests and diseases. But, because of population pressure and the eagerness to produce harvest, the environment and ecological aspect is being sacrificed over the economic use.

Fig. 3. Kaingin in Aguinaldo, Ifugao.

Agroforestry System

Agroforestry system can be defined in different perspectives, according to Schroth & do Socorro (2014) Agroforestry system is a tree-dominated land use system with two or more strata of trees or shrubs and a substantial degree of structural complexity within at least one of the strata. Moreover, it is widely promoted as a sustainability-enhancing practice with great potential to increase crop yields, conserve soil and recycle nutrients whilst producing fuel wood, fodder, fruit and timber (Castro & Nunez, 2017). Typically, agroforestry systems in Ifugao is composed of complex, interrelated ecosystem of perennial that is naturally grown in the area like the *muyong* and/or an established tree plantation combined with agricultural cash crops simultaneously or sequentially in a parcel of land.

The establishment of agroforestry system in Ifugao, Philippines is a practice by the indigenous community long time ago and being strengthened as a climate change mitigation and adaptation strategy in the locality. It plays important role in food security as it provides basic services for domestic and commercial purposes. The establishment of agroforestry system at present is supported by government agencies particularly the Department of Agriculture, Department of Environment and Natural Resources and Local government units as they provide seedling of fruit trees, forest trees and seeds/planting materials for agricultural crops.

Fig. 4. Agroforestry System in Mayoyao, Ifugao.

Pasture Land/Grassland

Pasture lands are open grassland that are intended for grazing animals. Grasslands have many biodiversity values, including wildlife habitat, occurrence of rare species, intrinsic ecosystem properties of structure, function and composition, and ecosystem services such as watershed protection, grazing, and scenery (Faber-Langendoen and Josse, 2010). Grassland have a significant contribution to food security by providing most of the energy and proteins required by the ruminants used for meat and dairy production (Sevov et. al, 2018).

Many of the grasslands in Ifugao province were under Pasture Lease Agreement (PLA) of DENR issued to individuals to operate and manage portion of the Grassland to raise grazing animals particularly cattle. Grassland is dominated by cogon (*Emperata cylindrica*) and other species under the family *Poaceae*. Grazing has been reported to reduce the diversity of herbs and shrubs in the grassland. Due to overgrazing, the vegetation species composition, richness and productivity has changed over the past decades, some species have disappeared (Darau et al., 2005) while others have survived through the use of morphological or other

adaptations (Blench and Sommer, 1999, Ali-Shtayeh & Salahat, 2010). Because of decline of natural species in the area, rangeland managers tend to grow other species that will help supply forage needed by the animals that lead to species invasion (Del Pozo et. al., 2006).

Fig. 5. Grassland in Mayoyao, Ifugao.

At present there is a widespread conversion of forest land into agricultural purposes. Based on the results of the research conducted, there are five (5) major considerations in the agro-ecological evolution of land use system in the province of Ifugao particularly economic factors, physical factors, cultural importance, market opportunities and support system.

IV. Considerations in the Agro-Ecological Evolution in Ifugao, Philippines

Economic Factors

Economic factors play important role in the agro-ecological evolution in Ifugao. As families in the upland increase their number of household members, there is an increase also in the needs of domestic products such as food, medicine, and other essentials for the family. In addition, a conceivable increase in the expense for transportation, education and communication services for the family. With this pointed reason, families need continuous and stable job, and earn more money for them to provide the needs of the family instantaneously.

Families in the upland communities in Ifugao tend to clear portions of the forest to convert into kaingin. Accordingly, the rotation of agricultural crops planted in their farms is shorter that takes for only 3-6 months unlike for perennial crops like trees where the rotation is longer with a minimum of ten (10) years for the fast growing species. The return of investments and income therefore with agricultural crops in kaingin system is faster, consequently, upland farmers can provide their immediate needs stated above. The strong force of financial provision by the upland farmers have triggered them to cultivate even steep slope areas in the forest zones that seriously affecting the degradation of the physical condition of the area.

Physical Factors

Physical factors such as soil, water and climatic factor is also a consideration in the evolution of agro-ecological system from forest to other land use systems. The choice of upland farmers of what crops are to be planted in the area is dependent on the species site compatibility.

The province except the municipality of Alfonso Lista is type II general climatic condition under the Modified Corona's Classification of Climate (MCCC), describes as no dry season with a very pronounce

maximum rain period from December to February. The abundant supply of water due to the climatic condition is favourable in the production of vegetables and other high valued agricultural crops that encourage upland dwellers to convert forest areas into kaingin. Newly opened forest areas that is converted into kaingin has fertile soil embolden upland dwellers to widen their kaingin area for larger production and income more than enough to provide their basic needs.

Cultural Importance

Ifugao is a culturally motivated province, it is embodied in the system the different indigenous belief and practices related to resource management, food preparation, wedding, medicine and other ritual practices by the upland communities of Ifugao. These culture influence the agro-ecological components of the system. The practice of kaingin in the province is recorded long time ago and passed through generations even at present. However, due to different anthropogenic and environmental factors, the practice of kaingin worsens the current environment situation of the agro-ecological system in the province. Clearing steep portions of the forest and converted to kaingin exaggerates soil erosion and even land slide in the area that in the long run it will lower the production of the land. The crops being planted in their farm are also dependent in their long time practice wherein these species are being used for different occasions like wedding, birthdays and other cultural celebrations. On the other hand, portions of the forest are maintained as source of water for domestic and agricultural purposes. Moreover, the maintained forest is the source of indigenous foods like fruits, grains, vegetable, and medicinal plants for the community.

Market Opportunities

Market and trades of products for upland farmers is very important. The selection of agricultural products to be planted in their farm is a priority consideration for them to convert their products monetarily to finance their basic needs. Their products such as banana, rice, vegetables and different farm animals are being sold in the province for local consumption. However due to surplus of supply, volume of these commodity products is being traded to neighbouring provinces. Upland farmers in the low lying areas are producing corn and rice as their major products. A wide scale of corn production is observed in the municipality of Alfonso Lista and Aguinaldo in a monoculture cropping design. Their harvest is being traded to corn dealers that are supplying raw materials for feed manufacture in the country.

Moreover, the stability of price is always a challenge for the farmers because they cannot dictate the market particularly the price of products. In as much as the farmers are concerned, they should gain something from farming to provide their basic needs.

Support System

Support system is pertaining to different public and private institutions that helps in the establishment and maintenance of an agro-ecological system. In the Philippines, there are programs of the government deputized to different concerned agencies that support farmers all over the country. The Department of Agriculture (DA) is extending planting materials to upland farmers like corn, vegetables, rice, and farm animals while the Department of Environment and Natural Resources (DENR) is giving seedlings of forest trees and fruit trees through their different programs as mandated in their priority programs and projects. Moreover, they are also partners in establishing their farms by giving fertilizers and pesticides, allocating funds for maintenance, and

even extending technical advices. With this endeavour of the government, farmers are encouraged to adopt programs of the government by embracing the technology they introduce to include farming systems and designs, species to be planted and farming activities assuming that farmer co-operators will be earning income in the future to finance their essential needs. This scheme, encourage upland farmers to shift the ecological components of the Agro-ecological system from forest to other land use system.

Financial institutions on the other hand, help farmers decide in the design of agro-ecological systems in the province, the capacity of the famers to finance the farming cycle is a major consideration for them. In the case that the farmer encountered financial shortage due to unfavourable weather condition and other social challenges, lending institutions are available to mediate to provide financial assistance with acceptable interest to the farmers in order for them to provide maintenance in their farms and an immediate source of money to purchase their basic needs for survival.

V. CONCLUSION

The widespread conversion of forest land into other land use system is primarily driven by different factors. The economic aspect is the major reason of land conversion. Upland communities tend to widen the area for agricultural purposes to provide enough income that will satisfy their immediate needs for domestic, education, transportation and communication purposes. Physical factor is also considered in the maintenance and agro-ecological change to maintain high productivity as they designed their crops to be compatible with the physical condition of the area. Cultural importance on the other hand is also considered to maintain good agricultural practices in the province. Market opportunities and support system play important role in the establishment and success of land use design employed by the upland farmers to their farms.

Human interest is on top among reasons in land use change and design, however, there should always be a balance of importance among social, economic and environmental component in nature for sustainability.

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