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The Socio-Political Structure that regulates the Ifugao Forest Maintenance

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Abstract. As many farmlands, urban regions and villages around the world confront the shortage of water supply due to the drastic climate and environmental changes during the last decade, it has become imperative to look elsewhere for efficient and sustainable water conservation model. The Ifugao socio-political structure *Muyong* that regulate the maintenance and the communal use of the land, and the *Muyong* forest itself bring forward a model for a sustainable utilization of farmlands without causing excessive damage to the land. This system of water utilization and recycling in effect produces potable fresh water and water for irrigation. The socio-political model includes several methods of maintenance contributed by all the members of the society and a customary law that ensures environmental sustainability and water accessibility for all. This paper shall outline the indigenous culture that embodies this socio-political structure, the hydrological system built as a result and in turn will emphasize the importance of collective responsibility and communal ownership as a mode of ensuring environmental sustainability and water conservation. It shall also propose a possible replication of this model in other areas around the world.

Keywords: water, *Muyong*, watershed, sustainability, Ifugao, replication.

1. Introduction

The Ifugao Province lies at the center of North Luzon Philippines in the mountain range of the Cordillera region whose traditional mode of agriculture is noted for its sustainability. However, the hydrological system and the water conveyance network that snake sinuously downhill remain inconspicuous - and unknown to many, this system sustained the community for thousands of years.

The Philippines and the world grapple with the problem of lack of water resource. The International Water Management Institute predicts that this problem will worsen by 2020 even in regions such as central China and India Punjab in which the dearth of water supply has never occurred (Seckler 1998). This dilemma brings forth, the need to look for time-tested solutions that modern technology could not provide.

The Ifugao solution to the problem of water and resource management is intricately woven in its socio-political structure brought about by its religion and a philosophy that encourage the veneration of nature and the environment. These in turn promote collective responsibility and cooperation among community members (Barton 1922).

The results of these interweavings are ecological and engineering feats: the Muyong forest as a watershed as well as a communal resource and a hydrological system that provides water for all purposes which all the community members can enjoy. These systems are worthy of emulation and a close scrutiny - and if these are to be replicated in areas in which hills and highlands abound, they can ensure environmental and water sustainability anywhere else in highlands and hilly areas of the world.

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This paper proposes that the *Muyong* forest management can be emulated in other upland areas and even in the lowland areas. It shall focus on the general factors and conditions that allowed the Ifugao people to ensure clean and sustainable water supply for several centuries and how this can possibly be replicated. The research aims to set precedence for other specialists in the field of hydrology, ecology, biodiversity, botany and forestry to delve into the scientific construct of the Ifugao *Muyong* system.

2. The Muyong Forest and the Muyong System

The Ifugao province belongs to the Cordillera Region, which is known for its effective watershed system. In this region, water stems from the high mountains and flow down the gradient to the lowland. The entire region stores more than 150 million cubic meters of water as more than 15 major rivers slides down to the major dams of northern Luzon (Environmental Science for Social Change 2012). In the Ifugao, the Muyong is a privately owned woodlot situated at the top of the 700-1500 meter high mountains (United Nations Educational, Scientific and Cultural Organization 2013). The Ifugao people primarily use the Muyong forest as a source of firewood, wood as housing material, herbal medicine, food and most importantly, water (Jang, 2012). Since every farmer needs to use the privately owned Muyong to make a living, the Ifugao community has developed a socio-political structure the *Muyong system* to ensure the use of the woodlot for all residents (Butic and Ngidlo 2003).

Thus, the *Muyong* denotes many separate meaning: 1). A privately owned woodlot in an elevated area that is managed by the indigenous people. 2). A socio-political structure of collective management, 3). water rehabilitation technique 4). assisted natural regeneration strategies for the forest.

The social organization of the Ifugaos can only be understood by looking at how their communities and the environment closely interact. As the socio-political system involves the management of land and the irrigation systems, the Ifugaos delineate the importance of cooperation in the sharing and distribution of land and water as well as the endowment of inheritance. Hence, religion and social structure regulate the Ifugao politics which is in a sense, decentralized, and one which enjoyed a high degree of freedom and autonomy (Acabado 2003).

Recognized worldwide as an ideal strategy for forest management, the *Muyong System* profoundly intersects with the Ifugao traditional culture and functions as a watershed and forestry management. (Butic and Ngidlo 2003) assert that the *Muyong* functions beyond that as it can be a strategy for assisted natural regeneration (ANR) or a farming method (Butic and Ngildo 2003). The role of culture and religion, however, is significant in the *Muyong's* perpetuity (Jang 2012). The Ifugao traditions and laws are dependent upon her physical world, her nature and environment and these are reflected in her taboos and customs which guide her interaction with the natural resources and the environment (Barton 1919).

Although the *Muyong*, which spans about five-hectare maximum, is privately owned, as it is usually an inherited property, the forest subsists for communal use. The *Muyong* can harbor hundreds of traditional species, both flora and fauna, depending on the size of the forest. For the appeasement of their gods, the one who inherits the *Muyong* holds the primary responsibility to manage its utilization as well as to care for her less wealthy siblings and neighbors by giving them free access to the forest. Community members especially those who have less in life are bestowed freedom to take resources from the *Muyong*. Those who have no source of timber materials for the construction of a house are encouraged to harvest one or two trees. The only requirement for the villagers who use the *Muyong* is to care for it and to ensure diversity of reforestation of species and other fruit trees. The Ifugaos as a community foster cooperation by working together to protect hillside areas and the *Muyong* from intrusion through activities within it which involve pruning, thinning areas of the forest and salvage cutting in order to improve plant growth. Cutting trees without permission, in the past, carried severe punishment of death if fine were not paid but these days, an individual caught with felled log is required to pay the amount that corresponds to the value of the felled tree. (Butic and Ngidlo 2003).

The *Muyong* is also a hydrological system, an irrigation and a forestry management in the traditional culture. The importance of the *Muyong* system for water resource sustainability can be understood by considering first the components of the Ifugao agro-ecological zones. These zones consist of the micro forest

(*muyong orpinugo*), swidden fields (*habal*), terraced paddies (*payo*), settlement districts (*boble*) and braided riverbeds (*wangwang*). As the Ifugao economy is dependent on rice production which traditionally not only intended for mere consumption but also for the production of rice wines used for rituals to appease the gods, the terraced paddies must be managed efficiently through proper utilization of water. The *Muyong* is a major component in that the springs beneath it collect the water that flows from the highlands for household uses. It also functions as a recharge zone that provides water for the stabilization of the other constituents of the agro-ecological zones. The efficiency and vigor of the rice terraces can therefore be measured through the water that emanates from the *Muyong* located at the periphery of a highland and the verges of hills. Apart from maintaining the supply of water on irrigation and on the surface, the woodlot also provides protection to low-lying fields which are prone to erosions and run-offs, thereby improving nutrients in the soil as well as its chemical and physical composition. (Conklin 1980).

As a major constituent of the Ifugao religious life, thanksgiving rituals are done within it in order to highlight the importance of the forest as a provider of air and water. The *Muyong* also functions as the center of tribal culture with residents settling amidst its clusters, apart from being a burial site for the local population's forefathers and ancestors. Hence, the Ifugaos view the woodlot as the abode of the spirits - both of their ancestors and of the spirits that are present in nature worthy of their veneration. Under the forest canopy, the Ifugaos perform their rituals and feasts for bountiful harvest and good fortune in which pigs are butchered as offering and rice wine (tapuy) is shared for the appeasement of the gods. (Serrano and Cadaweng 2006).

3. The Ifugao Rice Terraces Hydrological system and water sustainability

The Ifugao culture is ingrained in rice cultivation as prosperity is often measured not through the area of land a clan holds but more through the amount of rice harvested every year. Therefore, this culture brought about the necessity for the Ifugao to design an efficient and a sustainable irrigation system that could transport water from the Muyong to the rice terraces and the households that require it (Acabado 2003). The hydrological system of the *Muyong* is fascinating and is the by-product of the socio-political structure that embodies the forest management system.

The water from the *Muyong* travels down the terrace ponds or fields using two modes. First, water can run down as surface run offs using the bamboo conveyance network to siphon downhill through the terraces. The terrace ponds are carved with strong ridges whose acclivities are measured precisely to fit the bamboo-made conveyance network for water to run through safely, preventing the water from eroding the soil and stripping it off of minerals in the low farmlands and irrigation canals. These steep and elevated ridges minimize the damage upon the soil that is frequented by run-offs and floods (Domoguen 2007). The water is then transported through the water conveyance network that usher the water downstream from the highland *Muyong* to each of the terrace ponds below. Another method is for the water to seep in the ground to go through a subsurface flowdown. At the bottom of each layer of terrace pond, the water is filtered as it runs through layers of stone, pebbles and porous soils built at the base of each terrace ponds. These act as the foundation for water filter system. In Ifugao culture the terrace ponds symbolize purity in that water is purified as it slides from each layer down the terrace pond. Various sizes of stones and pebbles are located at the bottom of the rice terraces soil profile (subsoil) filter water which in turn maintain enough moisture in the soil which is important not only to ensure the nutrient in the soil but also to allow enough evaporation to occur in order for precipitation to take place, thus contributing to the environmental balance. (Concepcion 2013) The system likewise prevents water from eroding the soil and replenishes soil in the terraces when the silts are extracted during the purification process. Therefore water is purified while replenishing the soil for another round of harvest.

The filtered and the recycled water then reach natural springs for individual households to collect as the natural spring accumulates purified water for consumption. Consequently, water on the surface is distributed for irrigation. Through proper management of the conveyance network, excess water does not bring damage on the soil. Therefore, when the monsoon season begins in the Ifugao, excess water snakes through the lower terrace pond via the conveyance network or otherwise known as the spillways (*guhing*) (Ananayo 2007). The process is gradual as water needs to cascade down layers and layers of terrace pond to reach the homes. This

basic structure of the Ifugao terrace fields ensures that rice and other farm crops receive no tainted water that could potentially erode the land and cause harm to the crops and to the people. There are spillways at each terrace pond that allows for excessive water to cascade down each layer while the horizontal subsurface flow purified for drinking, takes place in the natural drainage conduits inside the terrace ponds (Ananayao 2007).

It is important to note that the tools and implements which the Ifugaos use to design the irrigation system are strictly organic materials found in nature - bamboo pipes, pebbles and myriad of plants to ensure the sustainability of water and soil.

4. Replicating the Ifugao Water Resource Management and Sustainability

It is significant to look at the Ifugao sustainable water resource management practice as a kind of innovation notwithstanding its longevity and efficiency. Although the current most common definition of innovation signifies novelty, an introduction of a new idea or method, it is significant to consider that the indigenous system of terracing and water management falls within the bounds of the definition of innovation as it is environmentally efficient and sustainable as well as time-tested. The idea therefore that a system is sustainable parallels the notion of innovation as the rate of efficiency is a measurable and necessary factor in the innovation process. Thus, in order to emulate the *Muyong* system model, it is significant to look at some of the factors that contribute to its success.

5. Watershed Biodiversity Management and Assisted Natural Regeneration

The management of species diversity for a watershed is significant in ensuring the continuous and sustainable supply of water. The Ifugaos have perfected the skills of managing a diverse watershed forest. There exists more than 170 documented tree species in the Muyong, 45 medicinal plants of which 20 are used for ethno-pesticides and 49 recorded indigenous animals in the *Muyong* area (Food and Agriculture Organization of United Nations 2013). A study has indicated that plant diversity in particular improves protection against soil-borne pathogens, enhancing the health and the nutrients of the soil (Latz et al. 2011). The *Muyong* system is well managed not only because of the culture of collective responsibility but also because people have the incentive to take advantage of the plants' use. For example, among 171 tree species, 112 species have their own distinct uses and among 45 medicinal plants, more than 20 are utilized as ethno-pesticides, one of the most vital resources needed to harvest the food (Food and Agricultural Organization of United Nations N.d.): rice. Around 50% of the flora in the *Muyong* is effectively used. This likewise counts as incentive for the community members.

Although some plants have apparent use, they primarily build and add nitrogen to the soil. These are considered nitrogen-fixing plants, a necessary constituent for healthy soils (Formerly the Watershed Management Council 2013). The *Finus minahasse* and *Ficus nota*, which both belong to the one of the top three most prolific plants in the *Muyong* called the *Moraceae* tree family, have been nurtured near coffee trees and abound in all areas in order to conserve water and rehabilitate the watershed. *Lithocarpus ilanosis* trees are good watershed species while both *Trema orientalis* charcoal trees (Food and Agricultural Organization of the United Nations N.d) and *Wrightia pubescens* coral swirl trees, which both are categorized as nitrogen fixing plants, are used for reforestation and watershed rehabilitation (Lee et al. 2011). The *Muyong* is also known as the *Coniferous* forest, implicating that more water is going to be conserved by the *conifer* leaves (Provincial Government of Benguet N.d.). Many other shrubs and trees likewise function to prevent soil erosion and other damage to the area; thus, *Muyong* has maintained its biodiversity which in turn has ensured sustainability (Magcale- Macandog 2012).

However, biodiversity is successfully nurtured only after a prolonged period of time. Rogelio C. Serrano and Ernesto A. Cadaweg claim that the indigenous people understand that the full development of the *Muyong* forest requires at least twenty years: for swidden lands (*uma*) to grow into grassy cogon (*Imperata cylindrical*) and into large areas of talahib (*Saccharum spontaneum*). This is followed by the emergence of ferns, shrubs and mid-sized trees which later succeeds into larger and taller vegetation called the dipterocarp tree species whose include lauan (*Shorea*), bagtikan (*Parashorea malaanonan*) and guijo (Shorea guiso) plant (Serrano and Cadaweng 2006). The Leguminous tree, the *Albiza Procera*, for example is planted in the Muyong forest for the purpose of afforestation. The *Bambusa Blumena* is also nurtured for afforestation

activity, as a source to stabilize the unstable slopes and banks of the terraces and the canals while Tithonia diversifolia, sunflower, is cultivated and used as organic fertilizer. (Concepcion 2013).

While the growth of the larger trees takes place, the Ifugao people actively plant fast-growing Benguet pine and Indian rosewood which are grown commercially but also, perhaps unintentionally, to restore the nutrients of soil. The varieties of plant species as well as an adequate presence of large trees improve soil fertility, create a more auspicious microclimate and allow the deeply entrenched roots to consolidate a healthy soil, preventing any major soil erosion and stabilizing the pH acidity levels of the flowing water (Serrano and Cadaweng 2006). Furthermore, the Ifugao people are patient and do not resort to foreign species of plants for quick revegetation; when the government had implemented the golden apple snail to supplement protein requirement of the Ifugao people, the indigenous farmers were quick to notice the destruction that invasive species could inflict upon the endemic crops (Joshi 2002). Thus, introducing exotic species may lead to the deterioration of the ecosystem, severely threatening the quality of water and the ecological balance of the *Muyong*.

Stable precipitation and water quality from the *Muyong* relies on four main factors: 1). a diversified group of endemic plants and animals 2). A balance between the presence of large and slow-growing trees like *dipterocarps, coniferous* or *angiospermophytes* and the plantation of smaller, fast growing vegetation to allow the soil to nourish at a short term basis. 3). the plantation of diffuse fibrous rooted from deep-rooted perennial species for sustainable maintenance. 4). the plantation of indigenous species or non-native naturalized species but not exotic invasive species as these could bring about adverse consequences. 5). the plantation of nitrogen-fixing species.

By pinpointing which plant species would be most appropriate is conditional, a healthy watershed teems with diverse vegetation and its system based on traditional modes. Ecological balance and biodiversity are maintained through simple technology and the problems are dealt with by vegetation to prevent further damage to the soil and landscape.

6. Water Supply Management

The Muyong remains as an effective model of proper utilization and management of water. As it is located above the terrace ponds, maintenance and management is necessary for the proper utilization of water for irrigation, home use and drinking.

Although the Muyong watershed is elevated and elevation is significant in that at high altitudes, mountains create a barrier to the incoming body of air, forcing the air to rise and cool it enough to trigger precipitation, the existence and maintenance of forests, woodlot and watersheds in diverse conditions are important in ensuring water sustainability. In the Muyong, however, it is noted that rainfall increases by an estimate of 1000 mm over the first 1000 meters and any land area above that elevation will play a major role in generating water. Since the *Muyong* lies at the tip of the 1000 meter high mountains, allowing for moisture and precipitation to flow down the mountain and terrace gradient for purification (Walpole 2010), the Ifugao watershed has a rainfall level that exceeds 3,000 mm. The altitude therefore is conducive for water generation from rainfall. In a mossy forest over the very highlands of the mountain region, a 40 meter thick atmospheric blanket of moisture envelops the forest, allowing for an increasingly fast rate of evapotranspiration to occur. Therefore, any high-elevated forest can harness water even from mists and air moisture. In lowlands and hills, the introduction of species diversity in forests and assisted natural regeneration (ANR), may increase infiltration and reduce sedimentation, run-offs, pollution, flood and erosion. Reduction of these factors will ensure clean water source and can resupply water in aquifers underground which up to this day are the main source of drinking water in many rural areas.

7. Water Balance and Terrace Pond Maintenance

The management of water supply in terrace ponds and proper knowledge of water balance contributes to the resiliency of the terraces. Equation below shows the water balance equation as applied to a single terrace pond (Soriano & Castro 2012).

$$I + P = ET + RO + DP \pm \Delta SF$$

I = water supply for irrigation
P = Precipitation
ET = crop evapotranspiration
RO = surface runoff
DP = Deep percolations
ΔSF = horizontal subsurface flow (that flows downhills)

The understanding the water balance equation is significant in replicating the pond management model of the Ifugao irrigation requirements and water supply to enhance water balance and to increase resilience of the terrace ponds. The water balance equation represents the water cycle, the means which water is transported and transformed into one form to the other. If the volume of precipitation changes, so does the amount of surface runoff and water supply for irrigation. The research corroborates how the Ifugao people had already adopted a traditional forest and terrace management system that suits the different seasons which affects one or more of the factors that affect the water balance equation.

In a graph published under Soriano and Castro's work, the data indicates that Ifugao is most humid during the Septembers and most dry during the early months of the year. In order to adjust to the changes in the water supply which arise from the shift in seasons, the Ifugao people employ some strategic practices. During the wet and cold seasons of August, September and October in which the amount of precipitation hits all time high, the indigenous people heed much attention in rehabilitating the forests and replanting variety of plants by conducting *Ahilamun* which involves the removal and plucking of dead relics and other wastes to improve the content of the soil (Ananayo 2012). During the dry seasons from February to June, farmers devote their time maintaining rice crops, irrigation channels and limiting the consumption of aquatic food to adjust the use of water supply as a means to achieve equilibrium with the water balance equation.

Simulations showed that irrigation requirement was highest from March to April and lowest from August to September. Excess in precipitation may occur during wet years or extreme rainfall events. This emphasizes the importance of proper control of drainage canals and spillways to minimize runoff in the dry season and prevent oversupply in the wet season. Therefore, the Ifugao people emphasize the importance of adopting certain maintenance strategies that suits the seasonal shifts and the geographic location of the region.

8. Communal Involvement and Collective Responsibility

However, what sets the *Muyong* system apart from other mossy and more water-producing watershed in the Cordillera is its sustainability as a consequence of its socio-political structure: It allows every farmer to use the *Muyong* provided that he holds responsibility of the forest's maintenance. As the Ifugao culture revolves around agriculture, everyone has a sense of attachment to the *Muyong* as Muyong forest is a necessity for agricultural practice. Thus, as the socio-political structure is designed to promote communal use of the woodlot watershed, people can feel inclusive and responsible in the need to maintain the forest regularly. Since everyone has a stake in the forest, the community is motivated to care and tend for it. It is recommended that a successful replication and a continuous maintenance of a watershed seem most plausible if the forest is situated near an agrarian community or farmlands.

Since the sediments of the water replenishes the soil while it passes through the stone-layered bed of the soil for purification, the watershed will be beneficial in both the agricultural and the hydrological aspects. A Muyong can be opened for communal use but in return it requires maintenance such as: pruning, swidden farming and removing dead relics of wood and leaves. As based on the contentions above, *Muyong* can be successfully replicated in elevated forest areas and in regions that are near agricultural-based communities to give the local people the incentive to care and tend for the forest. The *Muyong* forest management should be run as a local and communal-based effort.

9. Recommendations and Implications

Macandog et al (2008) assert that the water and forest management system of the Cordillera in general have sustained indigenous species diversity and have in turn improved the lives of the community members.

Thus, it is imperative that policy makers, scholars, local communities, NGO's and legislators must find a way to impart to other communities this system for them to adopt this time-tested indigenous knowledge and practices not just to preserve it but also to test its efficacy in other localities. (Macandog 2012).

As countries around the world do not suffer from a dearth of mountains and hills, the introduction of the forest watershed system in upland areas can easily be accomplished. Lowlands can also benefit from careful management of forests in which species diversity is introduced. The Philippines alone counts major mountain ranges in its composition with Luzon having three major mountain ranges, and Mindanao five both of which supply water for urban demands. In the Philippines' Luzon, the Cordillera and the Sierra Madre mountain ranges count as sources of water supply.

The replication of the Cordillera's watershed and its management system, specifically the Ifugao *Muyong* system of forest watershed management and water resource, irrigation, recycling and filtration method for sustainable and enduring water resource, can only be realized through the cooperation of the community members. The allotment of an upland area for forest watershed management can also prove a hurdle since land ownership has been privatized in many countries and in developing countries there is a lack of government initiative on issues relating to environment and sustainability. It is imperative therefore for governments to look at legislative measures it can take so as to ensure and secure water resource and sustainability for the growing population and the demands that spring from economic development and modernization.

Communities must also do their part by either contributing a portion of unused upland area to the forest watershed initiative or by taking part in maintaining the land allotted for it. Since the resources are communal, local populations will be able to readily value the importance of cooperation, altruism and environmental management.

Any mountainous or sloped forest areas should resort to the Muyong system as its land management to develop an irrigation that optimally suits its geography. The importance of geographical relativity of reforesting plants is that the soil and the indigenous plants rely on nutrients and minerals endemic to the soil and location. Otherwise, unforeseen contingencies may arise from introducing foreign invasive species in the Cordillera region.

Although reforestation is recognized as the most efficient mode of water management sustainability, the Muyong system should not be identically replicated into other regions as to cultivate diverse plants that only ensure optimal growth.

As these recommendations adumbrate the prospects of water management in other mountainous regions, in order to ensure the continuation of this knowledge, policy makers must heed efforts to disseminate information of indigenous knowledge (IK) and emphasize the significance of learning an efficient model of sustainability from indigenous societies as those traditional systems have withstood the test of time. By understanding Ifugao culture and the population's concern for the environment and their fellowmen, policymakers shall also encourage collective responsibility and communal cooperation. The management of the *Muyong* forest shall require not only full participation of the community but also the management of proper endemic vegetation that can improve soil quality and increase evapotranspiration and evaporation for the water supply. The ample combination of large and small, long rooted and short rooted, slow growing and fast growing, nitrogen fixing trees and other native shrubs and plants can surely enhance the quality of the environment, enabling water which is produced in places that lie in elevated regions. The Muyong system might be a traditional and indigenous knowledge, but it is a scientific knowledge that sustained communities for hundreds if not thousands of years. It is time the rest of the world learns of it too.

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