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Bamboos for environmental protection, eco-tourism and livelihood: The case of bamboo hub and eco-park in Lubao and bamboo sanctuary in Baguio city

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Abstract

This study focuses on two notable projects led by Philippine Bamboo Foundation Inc based in Makati, Philippines, namely: the transformation of bamboo cultivation in Lubao, Pampanga into a thriving Bamboo Hub and Eco-Park, and the establishment of the Bamboo Sanctuary in Baguio City. The Foundation actively advocates for the many versatile uses of bamboo and continuously collaborates with government agencies, non-governmental organizations, and local communities to promote the bamboo industry in the Philippines. The Lubao Bamboo Hub and Eco-Park was originally intended for the restoration of riverbanks through bamboo plantation. Subsequently, it evolved into a multifunctional facility: as a training center for propagation, farm development, processing of bamboo and a popular destination for eco-tourism in the region. The remarkable success of the Bamboo Hub and Eco-Park has attracted company's financial support through its Corporate Social Responsibility initiatives. This financial assistance has facilitated expansion of the area and a further promotion of eco-tourism. Production of bamboo raw materials for industries has also increased resulting in generation of additional employment opportunities for local communities. The Bamboo Sanctuary in Baguio City, on the other hand, was established to address environmental challenges faced by the city and Benguet Province, including pollution, deforestation, and recurring landslides. Acknowledging bamboo's potential to provide crucial ecosystem services such as carbon dioxide absorption and remediation of soil and water pollution, the sanctuary aims to showcase the benefits of fast-growing bamboo species in mountainous regions prone to erosion and landslides. The sanctuary operates as an educational hub for students and the public, highlighting bamboo's role in environmental protection through carbon sequestration, erosion control, and soil improvement. Additionally, the sanctuary serves as a benchmarking site for Local Government Units and other government agencies, private institutions and enthusiasts, as tourist destination featuring informative displays that emphasize bamboo's unique contribution to the environment.

Key Words: Bamboo, hub, eco-park, sanctuary, environmental protection, tourism, livelihood

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1. Introduction

The Philippines, renowned for its captivating natural beauty and vibrant culture, has been a trailblazer in championing environmental conservation, sustainable tourism and socio-economic development. Bamboo-related projects have emerged as powerful catalysts for promoting resilience, tourism, and economic opportunities. Bamboo's importance in the Philippines transcends its role as a plant representing a way of life that harmonizes with nature. It has become an integral part of the Filipino culture as manifested by a lot of traditional practices in the country that have become source of subsistence, livelihood and at the same time attractions to tourists. Prominent among these are the use of bamboo shoot for delicacies, bamboo poles for weapons, basketry and containers for transport of goods, cooking, musical instruments agricultural implements and others (Baja-Lapis et al 2016). For instance, *Bahay kubo*, a common local shelter and resting place for many Filipinos has become a unique component of many resort and tourist destinations and is now a million-dollar local and export industry and the *Tinikling*, a native dance using bamboo poles to provide tempo and steps for dancers which is usually presented in national and international events. Other very significant attractions that made the country very popular as tourist destinations are the *Pangkat Kawayan*, a world acclaimed musical orchestra which plays musical instruments that are entirely made of bamboo uniquely crafted for individual keys and the Bamboo Organ in a St. Joseph Parish Church in Las Pinas, National Capital Region that was built by Fray Diego Cera de la Virgen del Carmen in 1816. The Bamboo Organ Festival in the Philippines is being held to celebrate the versatility of the plant through bamboo pipes, reflecting the nation's cultural connection with bamboo. On Philippine waters, floating bamboo restaurants and bamboo tourist boats offer travelers the chance to savor local cuisine while embarking on picturesque adventures. Moreover, some regions and provinces hold a *Kawayanan* (Bamboo) Festival featuring various traditional and modern bamboo products that promotes the sustainable use of bamboo in small, medium and large-scale industries. More importantly, Philippines participates in International Trade Fairs and in the celebration of the World Bamboo Month to promote sustainable development of the bamboo industry. All these encapsulate the essence of ecotourism, environmental conservation and socio-economic development in the country.

Being one of the countries adversely affected by the loss of natural forests, the country tried to look for alternative approaches in restoring degraded ecosystem. As a result, bamboo has been found to be one of the best options because of its fast regenerative growth, high adaptability to marginal and degraded soil conditions, its remarkable ability to stabilize, hold and bind the soil due to its expansive rhizome and root system (Zhou et al 2005). These make

bamboo very much effective in preventing and controlling soil erosion and landslide. Moreover, bamboo has very high litterfall that serve as mantle in preventing splash erosion, conserving soil moisture and enriching the soil once the litter has decomposed. Thus, bamboo is now widely used in the country and is now an important component of the natural and agricultural ecological system that provides not only environmental services but also socio-economic development since it is an excellent substitute for wood as raw material for various industries. Among the many projects pertaining on the use of bamboo in protecting river banks, hillsides, lakeshore and rehabilitation of marginal and degraded lands, climate change mitigation and in providing livelihood are: *Bambulina* in Laguna, Cagayan Valley Bamboo Development Program in Cagayan Province, National Greening Program and Build Back Better program of the Department of Environment and Natural Resources (DENR) and the government requirement of 20% of the mined out areas for planting bamboo as embodied in the law. The sustainability of the bamboo industry in the country is be achieved due to the formation of the Philippines Bamboo Industry Development Council (PBIDC) at the national and local levels and a law on the creation of the Bamboo Development Center that will be passed expectedly this year 2024.

This paper delves on the stories of two exceptional bamboo initiatives: the Lubao Bamboo Hub and Eco-Park and the Bamboo Sanctuary and their significant roles within the broader context of the Philippines' bamboo-centered ecotourism landscape.

2. Materials and methods

A. The transformation of mere bamboo planting into a Lubao Bamboo Hub and Eco-Park.

The 17 hectares Lubao Bamboo Hub and Eco-Park is located at Barangay Sta Catalina, Lubao, Pampanga and is being managed specifically by the Municipal Environment and Natural Resources Office of the Local Government Unit (Fig. 1 1).



Fig. 1 1. Lubao Bamboo Hub and Eco-Park

The technical assistance of Ecosystems Research and Development Bureau of the Department of Environment and Natural Resources (ERDB-DENR) gave rise to the plan of the government for planting bamboo along the river bank with the initial primary objective of protecting the river bank from erosion and collapse. The bamboo planting using mainly kawayantinik (*Bambusa spinosa* Roxb.) commenced on July 2010. Other bamboo species that was later used for planting include Bayog (*Dendrocalamus merrilianus* (Elmer) Elmer) and yellow bamboo *Bambusa vulgaris* var. *striata* (Lodd. ex Lindl.) Gamble. The planting materials, accordingly, were donated by ERDB. Afterward the requirements for planting materials were and still are being produced in the nursery built inside the compound of the hub and eco-park by the workers of the said facility. Subsequently, a bamboo processing plant housed near the Material Recovery Facility was introduced with complete *e-bamboo* processing equipment given by the Department of Trade Industry through its Shared Service Facility Program. The bamboos planted particularly those of kawayantinik (*Bambusa spinosa* Roxb.) became sources of poles for the processing of engineered bamboos which were made into novelty items, handicraft and furniture. The processing of engineered bamboo into chairs was in support of the Department of Education's program on the use of chairs in schools.

The Philippine Bamboo Foundation Inc being a conduit player advocated the expansion of the area into a multi-functional facility. Thus, it provided technical guidance on how the mere bamboo planting for river bank rehabilitation and as source of raw materials for the bamboo processing to be transformed into a hub and eco-park. This was because of the realization of the potential of the area for environmental, social and economic benefits. To accomplish the task, the process underwent a comprehensive process. This involved collaborations with Local Government Units primarily the municipality of Lubao and Barangay Sta Catalina, educational and research institutions and private enterprises. A phased approach was adopted encompassing the following steps:

a. Assessment and planning

Detailed evaluation of the land's suitability for continued bamboo cultivation, taking into account soil quality, topography, and climate conditions. A master plan was drafted to integrate bamboo propagation, processing, and eco-tourism activities.

b. Community engagement and training

Local communities were engaged through workshops, training sessions, and capacity-building programs. Training covered bamboo propagation techniques, sustainable harvesting, and bamboo craft production. Many of the trained workers were employed in the hub and eco-park.

c. Building of infrastructure and amenities

Aside from improvement of bamboo processing, and preservation treatment facilities, other essential infrastructure were built such as event, exhibit and training center, eco-friendly accommodations and cottages made of bamboo, pergolas, comfort rooms and routes for guided tour. These were designed properly to maximize the beauty and environmental enhancement roles of bamboos and showcase bamboo's versatility.

d. Bambusetum as additional feature

Living collection of variety of commercial and ornamental bamboo species was added in order to make the area truly a bamboo hub that can enhance not only eco-tourism but more importantly research and educational purposes. Currently, it housed about 42 species of bamboos mostly sympodial or clump-forming (Annual Report, LGU Lubao 2020). These include exotic species like Timor Black Bamboo (*Bambusalako* Widjaja), Hedge Bamboo or commercially known as Chinese dwarf bamboo (*Bambusa multiplex* (Lour.) Raeusch. ex Schult. f.), Blowpipe Bamboo or known in ornamental gardens as Thai bamboo (*Bambusa dolichomerithalla* Havata renamed *Bambusa multiplex* (Lour.) Raeusch. ex Schult. f.) as per Vorontsova et al (2016). Pole Bamboo or Monastery bamboo (*Thyrsostachys siamensis* Gamble), Yellow Buho (*Schzostachyum brachycladum*(Kurz ex Munro) Kurz), and Striated Bamboo or Kawayan Dilaw (*Bambusa vulgaris* var. *striata* a variety of *Bambusa vulgaris*Schrad. ex J.C.Wendl(Vorontsova et al 2016), Native bamboo species such as Kawayan Kiling (*Bambusa vulgaris* Schrad. ex J.C. Wendl.) Bayog (*Dendrocalamus merrilianus* (Elmer) Elmer s), and Giant Bamboo (*Dendrocalamus asper* (Schult.f.) Backer). Collections of other bamboo species for this bambusetum is on-going.

e. Eco-Tourism integration

Interpretive signage, guided tours, and workshops were introduced to educate visitors about bamboo's significance. The site's transformation into an eco-park was pivotal in attracting tourists interested in sustainable practices. Promotion of the hub and eco-park as tourist destination is through its facebook page.

B. The Establishment of the Bamboo Sanctuary in Baguio City

The Philippine Bamboo Foundation Inc. strived to acquire various bamboo species numbering to about 22 from Zhejiang, China in 2008. These include monopodial bamboos namely *Chinomono bambusa neopurpurea* Hsueh &T.P.Yi, *Indosasa gigantea* (T.H.Wen) T.H.Wen, *Indocalamus decorus* Q.H.Dai, *Phyllostachys reticulate* (Rupr.) K.Koch, *Phyllostachys dulcis* McClure, *Phyllostachys edulis* (Carrière) J.Houz, *Phyllostachys nigra* var *nigra*, *Phyllostachys vivax* McClure, *Pleiolblastus gramineus*(Bean) Nakai, *Pleiolblastus argenteo striatus* (Regel) Nakai, *Pseudosasa amabilis* (McClure) Keng f., *Pseudosasa*

japonica (Siebold & Zucc. ex Steud.) Makino ex Nakai, *Pleioblastus viridistriatus* (Regel) Makino, *Pleioblastusfortunei* (Van Houtte) Nakai, *Pleioblastus distichus*(Mitford) Nakai, *Shibatea chinensis* Nakai and some sympodial bamboos like *Bambusa oldhamii* Munro and 3 varieties of *Bambusa multiplex* (Lour.) Raeusch. ex Schult. f.).

Initially, the collection was consigned at one of the Universities in Baguio specifically as living collection for research and educational purposes. Subsequently, these bamboo species were transferred to St Francis Seminary in Pacdal, Liteng, Baguio City in 2011 since it has enough space for the establishment of bamboo nursery for propagation and a sanctuary for the living collection of the bamboo. It was then Bishop Carlito Cenzone who accommodated the PBF's proposition to use the area within the compound of the seminary (Baguio Midland Courier, 2022). A Memorandum of Agreement (MOA) between the PBF and the Diocese of Baguio was signed. This MOA was renewed in 2019 with the Diocese of Baguio represented by Archbishop Bendico that manages the Seminary (2022 PBF's Compiled Documentation).



Fig. 1 2. Bamboo Sanctuary in Baguio City

As a bamboo sanctuary, the initial purpose was to feature mostly monopodial bamboo species mainly for taxonomic, silvicultural and ecological research. Subsequently, the objectives were later expanded to address the pressing environmental challenges in Baguio City in particular and Benguet Province in general such soil erosion, landslide and climate change. The process encompassed the following key elements:

a. Site assessment, species selection and development of plantation

Bio-physical site conditions like soil, climate, character and degree of slope and the existing vegetation were assessed. The monopodial bamboo species that have rapid growth and extensive root systems were selected for the plantation establishment specifically aimed at investigating the adaptability and capacity of the species in preventing and controlling erosion and in sequestering CO₂. Techniques in plantation development were tailored with those adopted for the hilly terrain incorporating contour planting and soil erosion measures.

An exotic bamboo species, *Phyllostachys aurea* (André) Rivière & C. Rivière locally known as Benguet Bamboo that has naturalized or has fully adapted to Benguet's environmental conditions was included in the selection of species for erosion prevention and control.

b. Setting-up of educational center

The sanctuary featuring the 22 bamboo species from China including the locally available *Phyllostachys aurea* (André) Rivière & C. Rivière and the existing sympodial bamboo species such as Giant Bamboo (*Dendrocalamus asper* (Schult.f.) Backer) and *Bambusa balcooa* Roxb. were designed as an educational hub. Each of these species was provided with tag/label bearing the name distribution and uses. It houses interactive exhibits and informative displays and regularly conducts workshops with lectures and hands-on to educate students and the public about bamboo's ecological, social and economic contributions.

c. Collaboration with government and other stakeholders

Partnerships were forged with local government unit of Baguio City and nearby municipalities, environmental organizations, and educational institutions and the private sectors in order to further promote the use of bamboo in environmental enhancement, eco-tourism and socio-economic development.

3. Results and discussion

A. The Lubao Bamboo Hub and Eco-Park.

The transformation of the mere bamboo planting into Lubao Bamboo Hub and Eco-Park, as perceived, had achieved not only the original objective of river bank protection and rehabilitation but more importantly the following:

a. Impact on eco-tourism and education

Statistical data reveals a steady increase in number and diversity of visitors after the area was transformed into a hub and eco-park. Visitors include eco-tourists from various research, academic, local government units, private agencies, individuals and groups, non-government organizations not only from the municipalities of the province of Pampanga but also from other provinces and regions of the Philippines. Eco-tourism activities include guided tours, photoshoot, social events like wedding, birthday, anniversaries, fish spa, swan boating, boating and fishing and biking.

The hub and eco-park became a popular venue for ecology training highlighting the environmental, social and economic benefits of bamboo and Technical Education and Skills Development Authority National Certification (NC) II training on bamboo production. In addition, it became a regular benchmarking venue for many local government units, non-government organizations, people's organization and others with the objective of seeing, appreciating the wonders of bamboo and how they can duplicate the hub and eco-park in their

respective communities. At first, no fees were collected but since the care, maintenance and protection of the hub and eco-park need funds to sustain and expand the operations, it was inevitable for the Municipal Council of Lubao to formulate a resolution regarding collection of entrance fees and use of activity centers and other facilities. The gate receipts and other fees, though minimal, have greatly helped in the sustenance of the hub and eco-park operations. The hub and eco-park have contributed to local and national tourism that generate additional income for the local communities. Now the hub and eco-park has become very popular as a tourist destination and is one of the many tourist attractions not only in the region but also in the Philippines. It is perceived to become not only national but also international tourist destinations.

b. Corporate support

The successful operations and management of the hub and eco-park have attracted the interest of corporations to support its expansion and sustainability not only as eco-tourism site but also for environmental enhancement by protecting and rehabilitating the river banks, minimizing the effects of climate change since bamboos have very high CO₂ sequestration capacity and as continuing source of raw materials for the bamboo industry. For example, in 2019, in collaboration with Philippine Bamboo Foundation Inc., the Insular Foundation through its Corporate Social Responsibility initiatives entered a Memorandum of Agreement with Local Government Unit of Lubao for the implementation of *Kawayanihan: Protecting the Environment and Lives through Community Work and Cooperation project* (Insular Foundation 2019). This Kawayanihan Project is specifically a response to the needs of the residents of Sta. Catalina, Lubao, Pampanga for additional source of livelihood and for environmental enhancement. The expansion of the hub heightened eco-tourism offerings that encourages businesses to be alive. Because of the Kawayanihan Project and other Corporate Social Responsibility programs, the Insular Foundation garnered the Asia Corporate Executive Officer (CEO) Award and the 2020 World Vision Corporate Social Responsibility (CSR) Company of the Year (Insular Foundation Report, 2020)

c. Livelihood generation

The hub and eco-park with various facilities and amenities, the nursery, bamboo processing, material recovery facility, bambusetum and others require a number of staff and workers for its efficient and sustained operations to an acceptable standard. The operations of the hub and eco-park provided decent and sustainable livelihood for local residents of the nearby communities.

B. The Baguio Bamboo Sanctuary

The establishment of Bamboo Sanctuary in Baguio has significantly achieved the following:

a. Environmental Impact:

The planting of monopodial bamboos on the slope of the seminary resulted in the prevention and control of soil erosion and landslide. Among the species that showed best results is the *Phyllostachys aurea* which is the locally available monopodial bamboo species. It grows quickly and has very high regenerative ability thus can cover the area and hold the soil efficiently. Because of its amazing growth, its CO₂ capacity is comparatively higher than the other monopodial bamboo species. Because of the sanctuary's demonstration of the bamboo's role with regard to enhancement of the environment, LGUs and other government agencies, nearby communities and even private agencies, individuals and groups are encouraged to adopt the planting of bamboo specifically *Phyllostachys aurea*(André) Rivière & C. Rivière which is fully well adapted and naturalized in Benguet Province.

b. Educational Value:

The numerous educational programs tailored for specific clients, like those from the academic (students, faculty and staff) and research institutions, non-government organizations, private agencies and the general public have made them informed/educated about bamboo's ecological, social and economic roles that are essential for healthy and sustainable living. The information displays and interactive exhibits have been instrumental in dispelling misconceptions about bamboo's roles and uses. Furthermore, the sanctuary similarly served as a benchmarking site for LGUs and other government agencies, non-government organizations, private and public research and academic institutions, People's Organization and as a platform for knowledge exchange.

c. Tourism and advocacy:

The sanctuary's unique positioning as an eco-educational site has attracted local and international tourists. It was surprising that after provisions of some amenities like comfort rooms, promenade, resting area and others and posting information in social media, the sanctuary becomes one of the most sought tourist destinations in Baguio. It is listed as one of Tourism Baguio City's must-see eco-tourist spots.

d. Livelihood generation:

The bamboo sanctuary does not collect entrance fees but encourages the visitors to donate whatever amount they can spare. Amazingly, there are visitors who are generous enough to shell out their pennies because of the happiness, wellness and knowledge they got from their visit to the sanctuary. The donations are collected by the Seminary and part of it is shared in the operations and management of the sanctuary. The influx of visitors from all walks of life

has encouraged some residents of the local communities to earn some income from selling food stuff, drinks and souvenir items.

Conclusions

The Lubao Bamboo Hub and Eco- Park and the Bamboo Sanctuary in Baguio City have underscored the bamboo's pivotal role in promoting a resilient environment, fostering tourism, and generating livelihood. The evolution of the Lubao Bamboo Hub and Eco-Park from a simple plantation to a multifunctional center exemplifies the social, economic and ecological potentials of bamboo. The Bamboo Sanctuary in Baguio City, on the other hand, serves as a testament to bamboo's ability to address pressing environmental challenges while providing educational value, tourism attraction and livelihood generation. These projects collectively showcase bamboo's versatility as a catalyst for sustainable development.

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Conflict of Interest

The authors declare there is no conflict of interest.

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