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## Silvicultural Management Strategies: A Determinant for a Successful NGP Plantation in Northern Isabela, Philippines

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### ABSTRACT

The National Greening Program is the most extensive reforestation program in the Philippines. It aimed for climate change mitigation, biodiversity conservation, and food security. This paper provides initial information on the performance of NGP in Northern Isabela, focusing on the general information of the plantation site, the participation of stakeholders, and the implementation of selected forestry management strategies. Three sites were considered, which are located in Delfin Albano, Cabagan, and San Pablo, Isabela. Findings revealed that the plantation sites were grasslands and previously were of corn plantations. Yemane is the common species planted in the three study sites because it is less susceptible to the effects of drought, fire, pests, diseases, and typhoons, according to the implementers. Other tree species planted in Delfin Albano are teak, kadamba, acacia, and mahogany. It was further validated during the field site visit and inspection that the above-mentioned tree species have 100% survival because the implementers were equipped with knowledge on some silvicultural strategies for maintaining the plantation. Implementers considered the period of planting, the ideal size of seedlings, the proper spacing, fertilization requirements, and intermediate treatments for sanitation. Nevertheless, it is recommended to all plantations that the implementers should integrate agroforestry crops in collaboration with the Department of Agriculture. Finally, since the DENR was tasked with the monitoring and validation of the performance of the program, the DENR should also partner with various research institutions, including academic institutions, to assess the progress of the NGP for enhancement.

### INTRODUCTION

The Philippines is one of the most biodiversity-rich countries, with rainforests covering 90% of the country's total area; yet, however, forest cover has been reduced to fewer than 10% of its original, Perez, G. J., *et al* (2020). With the increasing population in the Philippines, the demand for forest ecosystems goods and services is expected to increase. As climate change intensifies, there will be increasing pressures from different clients and customers of the forestry sector to *meet all* or most of the domestic needs for wood, fuel wood, major and minor forest products, and other forest ecosystem-related goods and services. Natural hazards like landslides and floods brought about by typhoons have sounded alarms and intensified advocacy to rehabilitate and reforest denuded watersheds and conserve remaining forests. Chokkalingam states that U. (Ed.). (2006), tropical countries experienced economic progress at the expense of converting their forests and eventually realised the value of the forest, thus restoration has become a priority. The increase in fuel prices has forced many households to shift towards the use of fuel wood for cooking and other domestic activities. All these recent events and trends point to an urgent need for the forestry sector to be a major player not just as a direct source of wood and fuel wood but more importantly as a major provider of indirect ecosystems' goods and services.

According to Gunatilleke, N., *et al.* (2023), forest

restorations focused on ecological restoration and lower mountain forest are feasible with the assistance of local populations' economic and conservation values. Reforestation effort in the Philippines in the past three decades can be traced from the huge funding which came in 1987 after the National Forestation Program (NFP) was launched in 1986. The Forest Sector Program (FSP) was funded by loans of the Asian Development Bank (ADB) and Overseas Economic Cooperation Fund (OECF) of Japan. FSP I and FSP II were implemented for 14 years from 1988-2003, with total expenditure of US\$363 million, covering 576,320 ha of the 1.4 million ha targeted, i.e. 1.3 million ha for FSP I and 460,000 ha for FSP II. The aforementioned projects were done through contract reforestation and Community-Based Forest Management (CBFM) approach. Apparently, the output of the two FSPs does not meet the set targets, for FSP I, it only totaled to an output of 0.68 million hectares (DENR, 2015). While there is no explicit accounted output for FSP II, Israel and Lintag (2013) reported that the achievement of FSP II was only at 75%.

From 2000 to 2010, the average rate of growth of wood consumption in the Philippines (both for domestic use and export market) grew by at least 8%. If this trend continues, even at 5% per annum of growth, the total future supply requirement in cubic meters of Round Wood Equivalent to meet the total (domestic and export needs) requirement is almost 10 million cubic meters

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per year in 2028. The total annual projected demand will require a total harvesting area of forest plantations from more than 40,000 hectares in 2011 to about 94,000 hectares in 2028. This is assuming that the harvestable volume of cubic meters per ha will average at 100 cubic meters. The total harvestable area of forest plantations to meet domestic demand (55% of the total demand) will be more than 22,000 hectares and will almost be 52,000 hectares in 2028. This means that at the minimum, the annual target planting area of forest plantations to supply domestic consumption will be at least 27,000 hectares in 2015 and gradually increasing in area by at least 5% per annum, (Jam, A. 2011) According to Domingo, S. N., & Manejar, A. J. A. (2018), the implementation of EO 23 is the moratorium of logging while the EO 26, is the implementation of the National Greening Program to improve the forest cover.

In February 24, 2011, Executive Order No. 26, s. 2011 was signed by then President Benigno S. Aquino declaring an interdepartmental convergence initiative for a National Greening Program (NGP). The priority mandate of the said executive order is for poverty reduction, resource conservation and protection, productivity enhancement, and climate change mitigation and adaptation, which are among the priority programs of the government. The need for interdepartmental convergence initiative for the national greening program. In fact, there were government agencies that were specifically assigned to spearhead the national greening program which were Department Agriculture (DA), Department of Agrarian Reform (DAR) and Department of Environment and Natural Resources (DENR) in cooperation with the Department of Education (DepEd), Commission on Higher Education (CHED), Department of Social Welfare and Development (DSWD), Department of Budget and Management (DBM), private sector and concerned agencies and institutions. Hence, the National Greening Program shall plant some 1.5 Billion trees covering about 1.5 million hectares for a period of six (6) years from 2011 to 2016, in the following lands of public domain: forestlands; mangrove and protected areas; ancestral domains; civil and military reservations; urban areas under the greening plan of the LGUs; inactive and abandoned mine sites; and other suitable lands (Dulin, A. T., Guadamor, et. al. 2018).

In support to E.O. 26, Executive Order No. 193 was signed on November 12, 2015 to expand the national greening program will rehabilitate all the remaining unproductive denuded and degraded forestlands estimated at 7.1 million hectares from 2016 to 2028. The National Greening Program (NGP) is by far the largest and widest reforestation effort in the country fully funded by the Philippine Government (Vista *et al.*, 2016).

### Objectives

The research aims to provide information on the status of the NGP sites in the Northern Isabela to find ways that further improve the decision-making and implementation

mechanism of the program so that its performance will have better and significant gains in the end. Specifically,

1. To establish baseline profile of the National Greening Program (NGP) in Northern Isabela;
2. To identify and differentiate the silvicultural strategies applied for the success of NGP
3. To describe and compare the management strategies in NGP implementation
4. To summarize and synthesize the NGP success story in Northern Isabela.

### Limitation of the Study

The conduct of this study conformed with research ethical standards and protocols. The researchers wrote a letter of permission to conduct research and personally handed to the concerned authorities in the regional office of the Department of Environment and Natural Resources Cagayan Valley. Hence, the National Greening Program Division in the DENR Regional Office identified the NGP sites for the study.

This paper focuses on the experiences of the NGP implementers in the Isabela Province by considering three sites. These three sites present distinct characteristics (previous land use, key implementers, species of trees planted, plantation strategies, stakeholders involved, and management) that enabled comparison and analysis of factors affecting the performance of NGP in Northern Isabela. The study was limited to three sites namely, Delfin Albano, Cabagan, and San Pablo mainly due to financial limitations given varying accessibility and locations of NGP sites.

### METHODOLOGY

#### Sampling Technique

Initial idea of selecting study sites were based from the different performance in the implementation of the National Greening Program (NGP) in the Cagayan Valley Region. However, with limited schedules, the researchers sought the assistance of the Department of Environment and Natural Resources of Cagayan Valley Region. Purposive sampling was used in selecting the NGP sites, wherein, at least one site in the Municipality of Delfin Albano, Cabagan, and San Pablo in the which are all located in the Northern Isabela, Philippines.

#### Study Location

Figure 1 highlights the location of the three NGP sites being considered in this paper. The NGP site in the Municipality of Delfin Albano is being managed by their Local Government Unit (LGU) while the NGP sites in the Municipalities of Cabagan and San Pablo are being managed by Peoples' Organizations (PO's). Greater area was allocated by the MLGU of Delfin Albano being their proposed ecopark and watershed while the sites of POs in Cabagan and San Pablo are privately owned.

#### Respondents of the Study

The respondents or Key Informants (KIs) in every

NGP study site were those who implement and directly involved in the NGP plantation having signed contract and agreement with DENR and those who have direct supervisory designation pertinent to NGP activities. In the case of NGP study site 1 located in the Municipality of Delfin Albano that is also being managed by their LGU, the KIs include the two staff from the Municipal NGP unit, two KIs from CENRO being the immediate supervisory agency, and one community leader who is also contributing in NGP activities on-site. In the municipalities of Cabagan and San Pablo where two NGP study sites are located and being managed by POs, there were three PO leaders in each study sites as KIs and two CENRO staff as KIs being the immediate supervisory agency of NGP plantation in the area.

The fourth group KIs were from the NGP Division of the DENR Regional Office located in Carig, Tuguegarao City. They were considered as KIs since they are also involved in the monitoring and evaluation of the NGP performance in the region. It was assumed that they can validate the answers of the KIs from Delfin Albano, Cabagan, and San Pablo in the province of Isabela.

**Data Gathering Procedure and Instrumentation**

Interview schedule and field site visit were properly arranged and coordinated with CENRO, LGU, and POs. Focus Group Discussion (FGD) and Face to Face Interview (FFI) were conducted in order to gather relevant information that address the objectives of this research. A prepared interview questionnaire was used during the FGD and FFI. The interview guide questions focused on silvicultural management strategies they implemented in their NGP plantation.

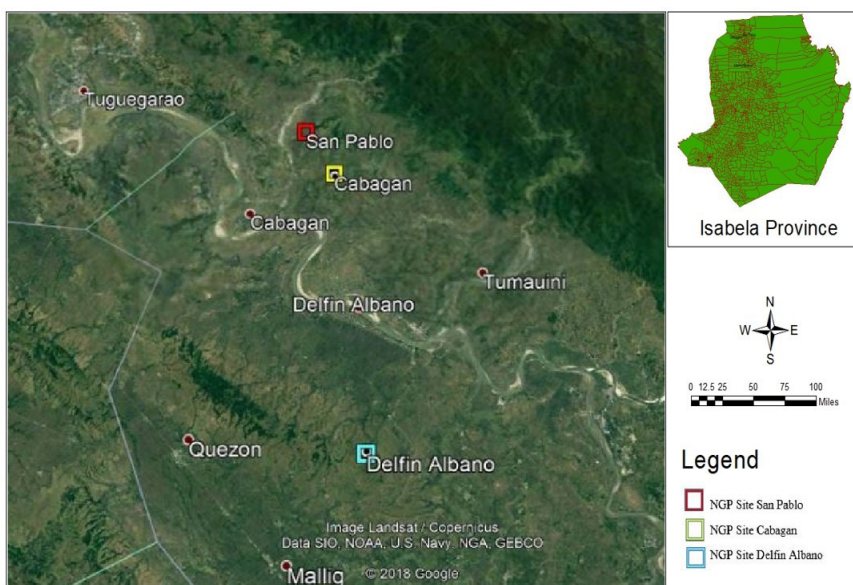
**Analysis of Data Gathered**

The KIs’ perceptions were determined through a prepared interview guide questions according to Likert-type scale response anchors. The results were further analyzed using

simple arithmetic mean. Observations during the actual site visit were noted to support the KIs perceptions in the results and discussion.

**RESULTS AND DISCUSSIONS**

The National Greening Program is highly expected to lead for the achievement of the Master Plan for Forestry Development (2016-2028) hence, the interest of this paper. There were three (3) NGP sites identified by the National Greening Program Division in the Regional Office of the Department of Environment and Natural Resources (DENR) of Cagayan Valley that were subjected in this study. These NGP study sites are found in the Municipalities of Delfin Albano, Cabagan, and San Pablo (Fig. 1). General information pertinent to the NGP is presented in Table 1. The key implementer of the NGP study site 1 that is found in the Municipality of Delfin Albano is its own Municipal Local Government Unit (MLGU). The key implementer of NGP study site 2 found in the Municipality of Cabagan is a Peoples’ Organization (PO) known as the Angancasilian Upland Planters Association. Likewise, the key implementer of NGP study site 3 found in the Municipality of San Pablo is also a PO known as San Pablo Agroforestry Multi-Purpose Organization. Concomitantly, these three study sites are being technically assisted by the DENR-Community Environment and Natural Resources Office (CENRO) that is based in the Municipality of Cabagan, Isabela. It was highlighted in the DENR-Department Administrative Order (DAO) Number 2016-20 that sustainable NGP plantations maybe enhanced and enriched in partnership with CBFM PO and the private sector while the Local Government Units may also opt to avail of any appropriate management arrangement to sustainably manage the NGP plantations they established after the duration of the development contract. In the management agreement, the LGUs shall not be allowed to sublease the area to a third party.



**Figure 1:** National Greening Program (NGP) study sites and location in the Municipalities of Delfin Albano, Cabagan, and San Pablo, Northern Isabela, Philippines

During the conducted interviews, with the on-site project coordinator of Delfin Albano, the adopted strategies in the implementation of NGP includes: social mobilization, harmonization of initiatives, provision of incentives, and monitoring and management of database. Social mobilization strategies involve the participation of the academe (Department of Education), government employees (Philippine National Police and Philippine Army), private sectors and civil society groups for the planting activity under NGP while the maintenance and production activities are given under the responsibility of POs and LGUs. The second strategy is to harmonize all the planting initiatives of the government, private sector, LGUs and CSOs and name it all under NGP. The provision of incentives intends to give all the proceeds of agroforestry plantations to NGP beneficiary communities to address food security and poverty reduction.

There were respondents interviewed in the NGP Division of DENR Cagayan Valley Regional Office who were considered as KIs since they were tasked as the prime monitoring team of all NGP plantations in the region. Face to Face interviews with KIs were conducted to validate the information given by the CENRO officials. The NGP study site 1 in Delfin Albano was previously as pasture land and have a land area of 168 hectares with 1,006 seedlings planted per hectare. The NGP study site 2 in Cabagan was previously an agricultural land of corn plantation and have a land area of 5 hectares with 500 seedlings planted per hectare. The NGP study site 3 in San Pablo was previously a pasture land and have a land area of 4.3 hectares with 500 seedlings planted per hectare. All of the key informants from the three study sites claimed that 100% of the planted seedlings survived because of sufficient water supply for irrigation and the species of trees chosen for the NGP are highly adaptable to drought and other climate related factors.

**National Greening Program (NGP) Management Responsibility and Silvicultural Strategies in Northern Isabela, Philippines**

**Site Identification, Evaluation, Delineation, and Planning for the National Greening Program (NGP)**

The Key Informants (KIs) were asked to identify the stakeholders who possesses management responsibility and direct involvement in the implementation of NGP. The KIs of NGP study site 1 (Delfin Albano) identified the following stakeholders: DENR-Central Office; DENR-Regional Office; DENR-CENRO Cabagan; Provincial Local Government Unit (PLGU); Municipal Local Government Unit (MLGU); and Peoples’ Organization (POs). The KIs of NGP study site 2 (Cabagan) and NGP study site 3 (San Pablo) identified the same stakeholders as identified by the KIs of NGP study site 1 (Delfin Albano) but they however included the participation of private individual. The fourth group of KIs were from the NGP Division of DENR-Regional Office and they agreed to those identified by the KIs from the three NGP study sites as stakeholders in the implementation of NGP however, they also included other stakeholders as follows: Non-government Organizations (NGOs); Academic Institutions (DepEd and CHED); and the Department of National Defense (DND) which includes the PNP, Philippine Army, BGMP, and the like. The level of responsibility of the identified stakeholders above were rated by the KIs in terms of their responsibility in the identification, evaluation, and delineation of sites for NGP forest plantation/agroforestry plantation. The KIs from NGP study site 1 (Delfin Albano) claimed that DENR-CENRO Cabagan, PLGU, MLGU, and POs were completely responsible; the DENR-Regional Office was mostly responsible; the DENR-Central Office was somewhat responsible; and the NGOs, Private Individuals, Academic Institutions, and DND were not at all responsible.

**Table 1:** General information pertinent to the National Greening Program in the Municipalities of Delfin Albano, Cabagan, and San Pablo, Northern Isabela

General Information	Study Sites		
	Site 1	Site 2	Site 3
NGP Location	Carmencita, Delfin Albano	Cabagan	San Pablo
Partner Agency/ Peoples’ Organization	DSWD DND DepEd	DENR-CENRO	DENR-CENRO
Area of the NGP Site	168 Hectares	5 Hectares	4.3 Hectares
Previous Land Use of the Site	Pasture Land	Corn Plantation	Pasture Land
Source of Water for Irrigation	Water pump	Stream	Water pump
Schedule of Tree Planting	Between July to December	Between July to December	Between July to December
Number of Seedlings Planted per Hectare	1006 seedlings	500 seedlings	500 seedlings
Size of Seedlings	At least Pencil Size Diameter	At least Pencil Size Diameter	At least Pencil Size Diameter
Year of Establishment	2015	2014	2014
Percent Survival of Seedlings Planted	100%	100%	100%

The KIs from the study sites 2 (Cabagan) and 3 (San Pablo) have the same observations whereas, DENR-CENRO Cabagan, PLGU, MLGU, and POs were completely responsible; the DENR-Regional Office and Private Individuals were mostly responsible; the DENR-Central Office was somewhat responsible; and the NGOs, Academic Institutions, and DND were not at all responsible. The observations of the KIs from the three study sites were further validated by the KIs from the DENR-Regional Office whereas, they claimed that DENR-Regional Office, DENR-CENRO, PLGU, MLGU, and POs were completely responsible; the Private Individuals were mostly responsible; and the DENR-Central Office, NGOs, Academic Institutions, and DND were somewhat responsible. It was learned that the central and regional offices of DENR cascaded complete responsibility to the CENRO offices in terms of NGP implementation and monitoring in their respective jurisdiction. This is for distribution of management functions since the central and regional offices can not accommodate various programs at once, they are more on financial management and program supervision.

The findings on the involvement of various stakeholders and their level of responsibility in the implementation of NGP in Northern Isabela showed clear manifestations that every citizen are now becoming highly responsible on what they can impart in order to help combat the problems on forest degradation and climate change. It can be recalled from the KIs interviews in the NGP study site 2 (Cabagan) and 3 (San Pablo) that there was increasing involvement of Private Individuals to join the POs as Key Implementers of NGP particularly in the aim to alleviate poverty. This was further emphasized through the issuance of Executive Order No. 193 in November 2015. Hence, the said involvement was motivated by their full understanding of NGP contract. Whereas, the DENR paid for the seedlings and labor of POs in planting the seedlings however, the POs shall shoulder the maintenance of their plantation. In the due time of harvest, particularly for commercial plantation, 100% of sales or gain will be owned by the POs.

According to the personnel of DENR-CENRO Cabagan, the POs may renew their contract depending on their performance and depending on the allocated budget. Nevertheless, it is expected that the POs already have and revolving fund to sustain their plantations.

The KIs were asked to determine the level of participation of those they identified as NGP stakeholders on the planning activities prior to forest plantation/agroforestry plantation under NGP. The KIs of NGP study site 1 (Delfin Albano) claimed that of the ten groups of NGP stakeholders, eight groups were considered and have participated in their NGP planning activities. Nevertheless, the DND were considered but did not participate while the DENR Central Office were not considered hence, they did not participate in the planning maybe because they cascaded this responsibility to the DENR Regional Office and CENRO Cabagan.

The KIs of NGP study site 2 (Cabagan) claimed that of the ten groups of NGP stakeholders, eight groups were considered and have participated in the NGP planning activities. The DENR Central Office were considered but they did not participate since they have entrusted the responsibility to the DENR Central Office and CENRO Cabagan. The DND were not considered in the NGP planning activities of the POs in the Municipality of Cabagan hence, they did not participate.

The KIs of NGP study site 3 (San Pablo) claimed that of the ten groups of NGP stakeholders, six groups were considered and have participated in the NGP planning activities. However, the DENR Central Office and Academic Institutions were considered but they did not participate. The NGOs and DND were not considered therefore they did not participate.

The KIs from the NGP Division in the DENR Regional Office asserted that all of the ten groups of stakeholders were considered and they as well participated in the NGP planning activities.

#### **Source and Quality of Seedlings for the National Greening Program (NGP)**

The KIs of NGP study site 1 (Delfin Albano) claimed that the following completely participated on the productions of seedlings: DENR-CENRO Cabagan, PLGU, MLGU, POs, NGOs, and Private Individuals. The DENR-Regional Office, Academic Institutions, and DND were considered as possible partners in the production of seedlings but they did not participate. The DENR-Central Office was not considered as possible source of seedlings hence no seedlings were provided by them.

The KIs of NGP study site 2 (Cabagan) claimed that the following completely participated on the productions of seedlings: DENR-CENRO Cabagan, PLGU, MLGU, POs, and Academic Institutions. The DENR-Regional Office, NGOs, Private Individuals, Academic Institutions, and DND were considered as possible partners in the production of seedlings but they did not participate. The DENR-Central Office was not considered as possible source of seedlings hence no seedlings were provided by them.

The KIs of NGP study site 3 (San Pablo) claimed that the following completely participated on the productions of seedlings: DENR-CENRO Cabagan, PLGU, MLGU, POs, and Academic Institutions. The DENR-Central Office, DENR-Regional Office, NGOs, Academic Institutions, and DND were considered as possible partners in the production of seedlings but they did not participate. The DENR-Central Office was not considered as possible source of seedlings hence no seedlings were provided by them.

The KIs from NGP Division of the DENR-Regional Office claimed that the following completely participated on the productions of seedlings: DENR-CENRO Cabagan, PLGU, MLGU, POs, NGOs, Private Individuals, and Academic Institutions. The DENR-Regional Office and DND were considered as possible partners in the

production of seedlings but they did not participate. The DENR-Central Office was not considered as possible source of seedlings hence no seedlings were provided by them.

Findings revealed that the stakeholders were mostly involved in the production of seedlings for the NGP plantations. It is expected that DENR-Central Office will not provide seedlings since these directives were already entrusted to the Regional Offices and CENRO. Whereas, NGP implementers may also buy from those produced by Private Individuals.

The species of trees and the quality of seedlings planted in the NGP study sites were determined from the KIs. *Gmelina arborea* Roxb. (Yemane) is common to the study sites and the KIs claimed that the seedlings of Yemane that they planted are of excellent quality. Yemane was the only species of trees planted by the NGP implementers in both NGP study sites 1 (Cabagan) and 2 (San Pablo) which were further observed during the field visits. The choice of species among the NGP implementers in NGP study sites 1 and 2 were according to the adaptive capacity of Yemane on the physical attributes of the planting sites and climate change.

Interestingly, NGP study site 1 (Delfin Albano) has planted other species of trees besides Yemane. These are *Tectonia grandis* L.f., Suppl. (Teak tree), *Anthocephalus cadamba* (Roxb.) Miq. (Kadamba), *Acacia mangium* Willd. (Acacia), and *Swietenia macrophylla* King (Mahogany). The KIs from Delfin Albano claimed that the seedlings of these species that they planted are of excellent quality. Unfortunately, these tree species are all exotic. It should be noted that among the priority forest tree species identified for the National Greening Program (NGP) is Philippine teak (*Tectonia philippinensis*) and yemane (*Gmelina arborea*) which is an introduced species were included in order to cater the needs of the Philippine wood-based industries (ERDB, 2014).

The KIs from the NGP Division in the DENR Regional Office confirmed that during their validation, the quality of seedlings that were planted in the three NGP study sites were of excellent quality. It should be noted that the NGP Division are in charge in the validation of the quality and quantity of seedlings prior to planting.

#### **Plantation Preparation and Establishment for the National Greening Program (NGP)**

NGP study site 1 plantation in the Municipality of Delfin Albano is being implemented by the Municipal Local Government Unit but in collaboration with various sectors through voluntary service on site preparation such as weeding and holing prior to the planting of seedlings. The DENR-CENRO Cabagan, MLGU, POs, Academic Institutions, and DND voluntarily participated during the plantation site preparation. During the field visit in their NGP plantation, the beneficiaries of the Pamilyang Pantawid Pilipino Program (4Ps) were tapped by the MLGU of Delfin Albano in the implementation and establishment of their NGP plantation. Other groups

of stakeholders were considered to join in plantation site preparation but they did not participate while the DENR Central Office were not considered hence, they did not participate.

In the NGP study sites 2 and 3 that are located in the Municipalities of Cabagan and San Pablo and are being implemented by POs through contract and MOA with DENR, the plantation site preparations were mainly by them as POs and as Private Individuals. Other groups of stakeholders were considered in the site preparations but they did not participate since the POs were paid to do so. In general, NGP site preparation as determined by the KIs from the NGP Division in DENR Regional Office was tasked to the DENR-CENRO Cabagan, PLGU, MLGU, POs, NGO, Private Individuals, Academic Institutions, and DND. However, for those contracted POs, they can strategize for their activities since they're being paid.

It should be noted that the implementation of NGP as per E.O. 26 still carried out the Community-Based Forestry Management (CBFM) program depending on the purpose of the establishment which is in accordance with DENR Memorandum Circular 1998-08 wherein, the private sector may enter into an agreement with beneficiaries. For untenured areas, private entities may develop the area under the Enhanced National Greening Program (ENGP) through a memorandum of agreement (MOA) entered with DENR. The duration of contracts with DENR partner-organizations was lengthened to five years from the original three years. This is to ensure high survival rates of tree planted in the previous years and increases the benefits of ENGP partners. The ENGP is the extension of the National Greening Program, which was created by virtue of E.O. 26 and implemented from 2011 to 2016. During its six-year implementation, the program posted an accomplishment of 1.3 billion seedlings planted in 1.7 million hectares. It also generated over four million jobs, benefiting around 558,000 individuals, through partnership with various People's Organizations (POs), particularly under the DENR's CBFM program. The Duterte Administration, meanwhile, targets to reforest some 1.2 million hectares from 2017 to 2022 in accordance with the Philippine Development Plan. From 2017 to 2018, ENGP covered areas reached 335,185 hectares, which were planted with some 299.2 million seedlings and generated a total of 715,118 jobs, benefiting some 112,166 individuals. For long term development, the private sector may invest in either establishment if new plantation and/or maintenance and protection of existing NGP plantations through appropriate management arrangement. Another innovation in the ENGP guidelines is a new mode of engagement called Reforestation by Administration (RA), which involves hiring of individuals not belonging to any POs, but have access to areas where there are no POs. The RA scheme is to be implemented in proclaimed areas and critical watersheds not covered by any tenurial instrument. DENR-Forest Management Bureau director Nonito Tamayo said the new guidelines were an offshoot

of Cimatu's order for an audit to all ENGP sites that required ground validation to determine which areas needing replanting and closer maintenance and protection efforts. The Reforestation by Administration (RA) for example is seen to address the gap in many reforestation schemes that seedlings die within the immediate period because they were planted in areas where there are no organized stakeholders engaged. The new guidelines, he added, promote planting indigenous species, especially within protected and watershed areas as well as high-value crops and fast-growing trees in production forests (Villanueva, 2019).

Participation of stakeholders in the tree planting activities as determined by the KIs, revealed that in the NGP study site 1 (Delfin Albano), those stakeholder groups who participated in the tree planting activities were the following: DENR-CENRO Cabagan, PLGU, MLGU, POs, Private Individuals, Academic Institutions, and DND. However, in the NGP study sites 2 (Cabagan) and 3 (San Pablo) being implemented by POs, other groups of stakeholders were considered to join the tree planting activities but only the POs and Private Individuals participated in the actual tree planting activities.

During the field visit, there were delineated areas for the different sectors as stakeholders and partners in the the NGP study site 1 located in Delfin Albano. It was observed that the area delineated for the PNP, Philippine Army, and BJMP which are all under the DND have a well-maintained NGP plantation. Such observations include uniform growth of trees, zero mortality, and uniform spacing of trees. It can also be observed that there is a regular weeding in order to prevent further competition of nutrients and to maintain the growth of trees. Unfortunately, there were areas burnt destroyed the NGP plantation that occurred during the long dry season in April 2019 after five years of plantation establishment. This challenged the implementers to establish fire lines and green belts such as banana.

The KIs from the NGP Division in the DENR Regional Office stressed that tree planting will benefit everybody which should be a voluntary service among all Filipino citizen hence, all of the stakeholders should participate in the tree planting activities either they're paid or not.

The main objective of plantation establishment is to produce high quality timber in trees with good or acceptable growth rates. As such, proper seedling's spacing shall be strictly observed but with consideration to the topographical location and physicochemical characteristics of soils. Three main factors affect growth and quality of the plantation site quality, seed supply and silvicultural management. Seedlings' spacing for every tree species has been established depending on site quality, seed supply, and silvicultural management. For instance, the success of teak plantation establishment depends largely in silvicultural management. The common management includes spacing, weeding, fire protection, insect and disease protection and thinning (Kaosa-ard, 2019).

The spacing of seedlings planted and the level of affect to the growth and survival of trees in the NGP study sites were also investigated. The *Gmelina arborea* Roxb. (Yemane) in all of the study sites were of pencil size seedlings when planted with 2m x 3m spacing. The KIs claimed that this spacing is of major effect to the growth and survival of trees in the NGP plantation. Their previous experiences were successful with this spacing which served as their basis.

In the NGP study site 1 (Delfin Albano), aside from *Gmelina arborea* Roxb. (Yemane), they also planted other exotic species of trees which are *Tectonia grandis* L.f., Suppl. (Teak tree), *Anthocephalus cadamba* (Roxb.) Miq. (Kadamba), *Acacia mangium* Willd. (Acacia), and *Swietenia macrophylla* King (Mahogany). The size of seedlings of these four other exotic species were more three times greater than the pencil size hence, greater spacing was applied which was 3m x 4m. The KIs claimed that this greater sizes of seedlings were to ensure the survival of species. KIs from Delfin Albano and from the NGP Division of DENR Regional Office attested that the said spacing has affected the growth and survival of trees in the NGP plantations. Whereas, there was 100% survival of trees from about three years since planted.

#### **Species Survival and Adaptation to Pests, Diseases, and Climate Change**

Pests and diseases has been always mentioned by the KIs as their challenge in their established NGP plantation. The KIs were further asked on the level of susceptibility of tree species on the problems pertinent to pests, diseases, and climate change. For *Gmelina arborea* Roxb. (Yemane), the KIs of NGP study site 1 (Delfin Albano) and 2 (Cabagan) observed that these are moderately susceptible to wood borer, defoliators, aphids, locust, and caterpillar while the KIs of NGP study site 3 (San Pablo) and the KIs from the NGP Division of DENR Regional Office observed as less susceptible to those pests and diseases. The other species of trees that were planted in NGP study site 1 (Delfin Albano) particularly *Acacia mangium* Willd. (Acacia) and *Swietenia macrophylla* King (Mahogany) were rated as somewhat susceptible while *Tectonia grandis* L.f., Suppl. (Teak tree) and *Anthocephalus cadamba* (Roxb.) Miq. (Kadamba) were rated as slightly susceptible to the abovementioned pests and diseases by the KIs in Delfin Albano.

The level of susceptibility of these tree species to pests and diseases were further determined from the perceptions and observations of KIs from the NGP Division of DENR Regional Office with high regards that they are highly aware being tasked on the validation and monitoring of NGP plantation in the region. They asserted that Yemane is slightly susceptible to the above mentioned pests and diseases while Teak, Kadamba, Acacia and Mahogany are somewhat susceptible. The perceptions and observations of KIs can be further validated in the field. Fortunately, such field observations showed no serious problems on the effects of pests and diseases.

Plantation forests are normally dominated by only one or few tree species with limited genetic diversity, which may render them more susceptible to the consequences of climate change, such as changing pest dynamics. Pest and disease organisms are influenced by climate change, and this is likely to affect plantation forest in a number of ways, both directly and indirectly. This was observed in the study sites whereas, only few species of trees were planted. According to the KIs, the choice of species was particularly with consideration to susceptibility to pest and diseases and more importantly to climate change (Pawson *et al.*, 2013).

The level of susceptibility of the trees species brought by climate change such as in periods of long drought, heavy rains or typhoons and even fires were investigated. The KIs from the three study sites (Delfin Albano, Cabagan, and San Pablo) claimed that Yemane is slightly susceptible. Since other tree species (Teak, Kadamba, Acacia, and Mahogany) were propagated in NGP study site 1 (Delfin Albano), the KIs claimed that these are moderately susceptible to climate change. Again, when the KIs from the NGP Division in DENR Regional Office were also asked on their perception of the level of susceptibility of the above mentioned species, they claimed that these are all somewhat susceptible. A spotted species of Yemane during the field visit has died due to extreme heat.

#### **Silvicultural Management for the Maintenance and Sustainability of Plantation under the National Greening Program (NGP)**

During the conducted separate face to face interviews with the KIs from the three study sites, they were able to mention some silvicultural management strategies that they applied and/or currently applying in the maintenance of NGP plantation as follows: regular irrigation for drought management; organic fertilizers are regularly applied; inorganic fertilizers are regularly applied; pesticides are regularly applied for pest and disease control and management; greenbelts for fire management were installed/ established; fire line for fire control were established and regularly maintained; sanitation cutting for disease-infested trees; and salvage cutting for dead trees. KIs asserted that these silvicultural management strategies are important in maintaining their NGP plantation.

In the NGP study site 1 (Delfin Albano), the KIs claimed that it is extremely important to regularly water their plantation for drought management, to establish greenbelts for fire management, and to establish fire lines for fire control. It was observed during the field visits that there were volunteers conducting tree planting activity in the site damaged by fire which challenges them to be more supportive to techniques that mitigate the spread of fire such as the establishment of greenbelts and fire lines. The KIs of NGP study site 1 also stressed that it is very important to conduct sanitation and salvage cutting to trees that are infested by diseases and to dead trees. Nevertheless, application of organic fertilizers, inorganic

fertilizers, and pesticides were rated by the KIs as slightly important.

During the conducted face to face interview with the KIs of NGP study site 2 (Cabagan), they affirmed that greenbelts for fire management, fire line for fire control, sanitation cutting for disease-infested trees, and salvage cutting for dead trees are extremely important in maintaining the NGP plantation. The same claims were expressed by the KIs from NGP study site 3 (San Pablo) and KIs from the NGP Division in the DENR Regional Office. Other silvicultural management strategies such as regular irrigation for drought management, organic and inorganic fertilizers and pesticides application were also claimed by the KIs from NGP study site 2 (Cabagan) as very important but were claimed to be moderately important by the KIs of NGP study site 3 (San Pablo) and KIs from the NGP Division in the DENR Regional Office.

#### **Stakeholder's Counterpart on Silvicultural Management for the Maintenance and Sustainability of Plantation under the National Greening Program (NGP)**

Of the identified silvicultural management strategies by the KIs that are important in the maintenance and sustainability of forest plantation/agroforestry plantation under the National Greening Program (NGP), they were further asked in terms of stakeholders' responsibility pertinent to these silvicultural management strategies.

In terms of irrigation and drought management, the KIs recognized this to be always the responsibility of the POs; sometimes could be the responsibility of DENR-CENRO Cabagan as technical stakeholders and the private individuals who entered contract with the POs and who also are voluntary citizens; and rarely are the academic institutions and DND helped in drought management.

Organic fertilizer applications will always be the responsibility of MLGU, particularly in NGP study site 1 (Delfin Albano) and sometimes are the POs (Cabagan and San Pablo). In terms of inorganic fertilizer and pesticides application, the KIs claimed that these are sometimes the responsibility of the MLGU (Delfin Albano) and POs (Cabagan and San Pablo). In general, KIs observed that fertilizers and pesticides are rarely applied in the NGP plantation since the species of trees could survive in any soil type while observed pests and diseases is very infrequent and is not seen as a major problem at present.

#### **Monitoring and Evaluation of Forest Plantation/ Agroforestry Plantation under the National Greening Program (NGP)**

In order to ensure the progress and sustainability of the NGP plantation, regular monitoring, evaluation, and validation is being conducted. The DENR-CENRO Cabagan is the prime stakeholder that conduct the monitoring, evaluation, and validation of NGP plantations with quarterly supervisory visits from the DENR Regional and Central Offices. Hence, the researchers further investigated the factors being considered in the

monitoring and evaluation of the NGP plantations. These are as follows: percent (%) survival; percent (%) mortality; damaged brought by pests and diseases; damaged brought by natural calamities and climate change (typhoon, landslides, drought, lightning, natural fire from lightning etc.); damaged brought by human-caused fires; illegal cutting of trees; damaged brought by other animals such as intrusion of ruminants; and damaged brought by anti-government group (e.g. NPA). These factors are always monitored by DENR-CENRO Cabagan and with the participation and reports from the MLGU and POs. The researchers were very fortunate that during the field site visit in NGP study site 1 plantation located in the Municipality of Delfin Albano, it was also the schedule of the team from DENR-CENRO Cabagan to monitor the plantation. A tree planting activity was being undertaken during the field visit which also allowed the researchers to witness and participate in the activity.

### CONCLUSION

Partnership initiative of Delfin Albano LGU such as collaboration with the DSWD, DepEd, and DND as their partners in the planting and maintenance of their NGP plantation was observed as a best practice for the success of the program while provision of incentives is worth it such as tapping the 4Ps to join in the tree planting activities. This is realizing the main objective of the plantation in Delfin Albano which is to develop a forest park and rehabilitate the denuded forest as their watershed thereby having greater land area owned by the government. The NGP practice and strategy in Delfin Albano is considered successful but needing further enhancement such as greater integration of endemic species of trees and agroforestry crops since the purpose is to become a forest park and watershed cover. On the other hand, the NGP plantations of POs in the Municipalities of Cabagan and San Pablo can be further enhanced by integrating other annual agroforestry crops as source of food and income while waiting for the cutting period of yemane. Integration of agroforestry crops can be a collaborative effort between DENR and DA.

### Ethical Consideration

The researches asked permission from the DENR Regional Office before proceeding with the research since they are the lead agency in the implementation of NGP in the region. The DENR Regional Office of Cagayan Valley directed the researchers to consider those NGP plantations being managed by a certain Community Environment and Natural Resources Office (CENRO). Therefore, the researchers were directed to DENR-CENRO Cabagan.

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