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Working Paper

Impact Assessment of the National Greening Program of the
Department of Environment and Natural Resources: Scoping or Process
Evaluation Phase (Economic Component)

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Philippine Institute for Development Studies
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Impact Assessment of the National Greening
Program of the DENR: Scoping or Process
Evaluation Phase (Economic Component)

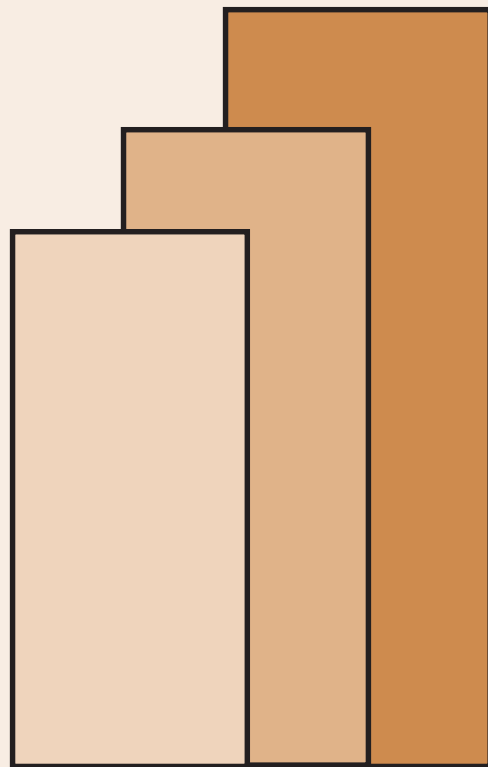
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**Impact Assessment of the National Greening Program of
the Department of Environment and Natural Resources:
Scoping or Process Evaluation Phase
ECONOMIC COMPONENT**

FINAL DRAFT REPORT



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LIST OF ACRONYMS

ADB	Asian Development Bank
AEZ	Agro-Ecological Zone
AR-TM	Afforestation-Reforestation and Timber Management
ATT	Average Treatment Effects on the Treated
BAU	Business as Usual
BFI	Bukidnon Forests Incorporated
BFP	Barangay Forest Program
BOP	Balance of Payments
BOT	Bureau of Treasury
BSP	Bangko Sentral ng Pilipinas
BUB	Bottom-Up Budgeting
CBA	Cost Benefit Analysis
CBEP	Community-Based Employment Program
CBFM	Community-Based Forest Management
CDD	Community Driven Development
CENRO	City/Community Environment and Natural Resources Office
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium
CSD	Comprehensive Site Development
CSO	Civil Society Organization
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DENR	Department of Environment and Natural Resources
DOH	Department of Health
DOLE	Department of Labor and Employment
ENVISAGE	Environmental Impacts and Sustainability Applied General Equilibrium
ESSC	Environmental Science for Social Change
EU27	Europe-27
FAO	Food and Agriculture Organization
FDC	Forestry Development Council
FGD	Focus Group Discussion
FGT	Foster-Greer-Thorbecke
FIES	Family Income and Expenditure Survey
FLONAS	National Forests
FMB	Forest Management Bureau
FSP	Forestry Sector Project
GAA	General Appropriations Act

GDP	Gross Domestic Product
GE	Green Economy
GHG	Greenhouse Gas
GIDD	Global Income Distribution Dynamics
GIS	Geographic Information System
GIZ	German Agency for International Cooperation
GMT	Global Mean Temperature
IAC	Inspection and Acceptance Committee
IAM	Integrated Assessment Model
ICES	Inter-temporal Computable Equilibrium System
IEC	Information, Education and Communication
IPCC	Intergovernmental Panel on Climate Change
IST	Impact Study Team
KII	Key Informant Interview
LBP	Land Bank of the Philippines
LES	Linear Expenditure System
LFS	Labor Force Survey
LGU	Local Government Unit
LOI	Letter of Instruction / Letter of Intent
LULUCF	Land Use, Land Use Change and Forestry
M&P	Maintenance and Protection
MOA	Memorandum of Agreement
MPFD	Master Plan for Forestry Development
NAMRIA	National Mapping and Resource Information Authority
NAPC	National Anti-Poverty Commission
NDRRMC	National Disaster Coordinating Council
NGO	Non-Governmental Organization
NFP	National Forestation Program
NGP	National Greening Program
OECD	Overseas Economic Cooperation Fund
PA	Protected Area
PBAC	Prequalification, Bids and Awards Committee
PD	Presidential Decree
PENRO	Provincial Environment and Natural Resources Office
PhilGEPS	Philippine Government Electronic Procurement System
PIDS	Philippine Institute for Development Studies
PO	People's Organization
PSM	Propensity Score Matching
REDD	Reduced Emissions from Deforestation and Forest Degradation
RF	Rainforestation Farming
SAM	Social Accounting Matrix

SB	Sangguniang Bayan
SEC	Securities and Exchange Commission
SMP	Survey, Mapping and Planning
TLA	Timber License Agreement
TWG	Technical Working Group
UNEP	United Nations Environmental Programme
UPLB	University of the Philippines Los Baños

EXECUTIVE SUMMARY

Over the years, deforestation in the Philippines resulted in significant reduction in forest cover. Between 1990 and 2013, the Philippines has lost 3.8 million hectares of its forest. The trend points to a continued deterioration in forest if no intervention is implemented. Declining forest will have negative consequences on the environment which can affect human health, agricultural productivity, climate change, etc. The Philippine Government's rehabilitation efforts during the past three decades showed that reforestation projects may have enhanced biodiversity through the planting of many tree species per site, including native species and have neutral to positive effects on soil and water properties, including peak flood levels and landslide frequency. However, these projects have contributed little to meeting the national timber needs plus it came with high economic costs and cannot be replicated at the local level (Chokkalingam *et al.*, 2006).

In 2011, the Aquino III administration executed the National Greening Program (NGP) through Executive Order 26 as the reforestation initiative of the government. Through the NGP, the government hopes to address other related problems on poverty, food security, environmental stability and biodiversity conservation, and climate change. NGP is by far the largest and widest reforestation effort in the country fully funded by the Philippine government. Compared to past reforestation efforts under MPFD, the NGP has a large target of 1.5 million hectares reforested in a span of only six years (2011-2016), almost twice shorter than the usual period of reforestation program in the country.

This report focuses on the scoping and process evaluation of the NGP economic component. There are two parts of the report: (1) economic impact assessment of the NGP using household survey data gathered from the three sites; and (2) quantifying the potential economic and poverty effects of the NGP impact assessment using Computable General Equilibrium (CGE) model. The three study sites were randomly chosen for this phase and these were Zambales, Negros Occidental and Dinagat Islands. These three sites present distinct characteristics (natural environment, reforestation strategy and communities involved) that enabled comparison and analysis of factors affecting the performance of NGP. The study was limited to three sites mentioned above mainly due to financial limitations given varying accessibility and locations of NGP sites.

This NGP economic impact assessment centered on the process evaluation of the different NGP interventions. Economic impact indicators include marginal change in income, income distribution, additional employment generated, and efficiency measure. Data from household surveys (483 NGP respondents, 444 non-NGP respondents) were supplemented with information gathered from focus group discussions and key informant interviews in the Provinces of Zambales, Negros Occidental and Dinagat Islands. In

determining the economic impacts of NGP on the condition of people in the three selected sites, propensity-score matching (PSM) procedure was employed. PSM is useful in evaluating the causal effect of *treatment* (here referring to *NGP interventions*) on some outcome variable (e.g. change in income) experienced by individuals or household members in the three sites selected for the study. PSM uses a probit model in the estimation of propensity scores to ensure verifiable and unbiased findings on the impacts of NGP on the socio-economic condition of the locals in the three sites selected. This propensity score will produce valid matches for estimating the impact of an NGP intervention.

The second part of this study presents preliminary results of the quantitative assessment of the potential economic and poverty effects of the NGP using a CGE model. In the assessment, a CGE model was specified, calibrated and used to simulate two broad scenarios: (1) a baseline or a business-as-usual scenario that incorporates the current forest deterioration in the Philippines; and (2) a NGP scenario which implements a reforestation program that reverses the continued reduction in the country's forest cover. The CGE model was calibrated to a social accounting matrix of the Philippine economy in 2012. The CGE model incorporates a land-use module which is critical in the assessment. The model also incorporates factor efficiency parameters in production to accommodate the health effects of changes in the environment on labor, and the climate change effects on the productivity of agricultural land.

Key Results

NGP is being implemented through social mobilization and contract reforestation: Community Driven Development (CDD), Comprehensive Site Development (CSD) and individual contract. On the implementation approach, we can glean that there was no "one-size fits all" NGP strategy that would increase the likelihood of success. In terms of NGP strategy, social mobilization was common among the three sites, except in Dinagat Islands where it focused only on planting. In terms of NGP strategy, social mobilization was common among the three sites, except in Dinagat Islands where it focused only on planting. In particular, social mobilization was not that effective in Zambales and Negros Occidental. CDD was employed in Sta. Cruz, Zambales and Hinoba-an, Negros Occidental whereas contract reforestation was employed in Dinagat Islands. Pakyaw system for monitoring and protection was employed in Dinagat Islands while hired labor was employed for site preparations. Community Driven Development (CDD) was employed in Sta. Cruz, Zambales and Hinoba-an, Negros Occidental whereas contract reforestation was employed in Dinagat Islands. Pakyaw system for monitoring and protection was employed in Dinagat Islands while hired labor was employed for site preparations. Agricultural farming and fishing is common among the three sites, except in

Dinagat Islands where household members are also obtaining their income from mining aggregates.

Communities were generally grateful for the additional income provided by NGP and were able to manage their time between farm work and NGP activities. The household survey results show some increase in income for households from Sta. Cruz, Zambales and Hinoba-an, Negros Occidental, except in Dinagat Islands, but the increase is not statistically significant. The average real household income of the NGP recipients before the NGP (2010) and during the NGP (2014) is seen to be statistically the same). The case of Dinagat is somehow different because the average real household income has decreased in hundreds during the NGP, though it is not statistically significant.

The 2014 average real monthly household income of the NGP household recipients and non-NGP households was also seen to be statistically the same. Except for Dinagat Islands, NGP household beneficiaries has much higher average real household monthly income of PhP 7,341 compared to the average real household monthly income of non-NGP households of only PhP 4,988, which was statistically different.

For the household monthly real expenses of the NGP beneficiaries, the top three expenses for 2010 are food, tertiary education and loan. While for year 2014, top three were food, tertiary education and secondary education. Comparing other values in 2010 and 2014, the expenditures for health, electricity, leisure and transportation have increased in 2014 while expenditures for primary education, water, communication, church activities, credits, tax and clothes have decreased in 2014.

Jobs generated in NGP are accounted under the Community-Based Employment Program (CBEP) of the Department of Labor and Employment (DOLE). In 2014, Negros Occidental has the most number and with increasing trend of jobs generated from 2012-2014 under CBEP. It is followed by Zambales and the least of the three is Dinagat, mainly because Dinagat adopted social mobilization for planting and only contracting individuals for maintenance and protection activities.

Although the analysis did not indicate whether local people in the NGP sites get richer or poorer, due to disqualification of household income from PSM, the effects of NGP on the local people have evidently induced bigger household size, higher number of working household members, and positive perception on NGP activities. This is expected since most of the NGP activities entail manual labor employing local farmers in the three sites from seedling production, land preparation and planting, and up to maintenance and protection activities. An extra hand would be a handy contribution in the attainment of targets set forth in the MOA or contract. Moreover, respondents perceived that NGP has made a significant impact in their community given their positive perception or knowledge of NGP in their area. This may indicate a feeling of contentment with

participating in the NGP activities since it provides extra income during the lean months of rainy season. In general, the community has a positive perception on the possible economic effects of NGP. Majority of households interviewed from the three sites perceived that there was a significant increase in income due to NGP (74%), an increase in household assets (44%), increase in household capability to send children to school (60%), increase availability of food (76%), and increase capacity to participate in NGP activities.

The NGP implementation cost is relatively low compared with actual cost because the NGP recipients are assumed to cover the protection and maintenance cost after year 3. Based on FMB-DENR Technical Bulletin 10 (2014), the NGP average cost per hectare is PhP 21,421. About PhP 16,421 of it is allotted for the establishment activities which include seedling production; survey, mapping and planning (SMP); site preparation; information, education, communication (IEC); transportation; and mobilization. The remaining PhP 6,000 maintenance and protection costs is divided into PhP1,000 for first year, PhP3,000 for second year, and PhP 2,000 for third year. The budgeted maintenance and protection accounts for 28% of the total NGP cost, which is way lower than the suggested 50%. Furthermore, the NGP average cost of PhP 21,421/ha is relatively low compared with PhP 40,000/ha budget for PICOP Resources; PhP 78,000/ha budget for ABS-CBN Bantay Kalikasan Foundation; and PhP 75,000/ha for UP Land Grant (Carandang and Carandang, 2009). Accounting the true survival rate¹ provided by the environment component, the computed output (area planted with surviving seedlings) per cost ratio shows that the program is not so efficient. Israel and Lintag (2013) reported an average output/cost ratio of 0.1225 from 1994-2009 data which is higher than the estimated average (0.03) from the three sites for 2011-2014 of NGP implementation.

For 2015, NGP has a budget of PhP 7 billion compared with PhP 500 million enforcement/forest protection budget. If we look at the NGP budget per region, it was observed that the NGP further distributed its budget to the regions where there is a lower percentage of forest cover, may be suggesting that the DENR's strategy is more inclined to forest development than that of forest protection.

On a macro perspective, CGE assessment indicates that the NGP will result in an improvement in the overall output of the economy. The production of agricultural crops (palay, coconut, sugar and other agriculture) improves, as well as the processing of these crops into food. The production of non-manufacturing sector improves, but the increase is lower than the improvement in agricultural output. This higher agricultural growth is

¹ Energy Development Corporation's (EDC) survival rate was 40-60%. EDC does not experience an 85% survival rate, they are lucky once the computed survival rate is 70%.

due to the improvement in agricultural land productivity and the improvement in labor efficiency under the NGP scenario relative to the baseline. Output of dwellings and other services increases, but the improvement is relatively lower than the overall output growth of the economy. The forestry sector benefits the most under the NGP scenario. Public administration (which includes public health, education, and other general government services) increases as the overall economy improves with higher government revenue and spending. Likewise, reforestation increases the overall supply of productive land in the country. It increases the utilization of land as forest. In particular, the factors markets for labor, capital and land are affected favorably as the overall output of the economy improves. As a result factor income increases. Households are therefore positively affected by higher factor incomes. This is evident in higher average household income of NGP recipients vs. non-NGP recipients. The improvement in factor efficiency decreases the cost of production, which lowers the consumer price of commodities. Food prices decline as agricultural production improves. Households in the lower income groups benefit from lower consumer food prices as their food consumption share in their total expenditure is larger compared to those households in the higher income groups. Finally, higher household incomes and lower consumer prices lead to lower poverty. All poverty indicators drop. Furthermore, those in extreme poverty benefit the most. Income distribution also improves over time as indicated by a declining GINI coefficient.

Recommended Strategic Actions

1. The next program on Natural Forest and Landscape Restoration Program should at least double the allocated budget for forest development per hectare. The suggested total cost per hectare of forest plantation development, considering spacing and peculiarities of labor cost in different areas, should be from PhP 44,180/ha (2014 real value) for the first three years of operations under 4x4 m spacing up to PhP 88,983/ha (2014 real value) for the first three years of operations under a 2x3 m spacing.
2. There is a need to audit all NGP activities. Hence, a sequential implementation of activities should be followed and for every contracted NGP activity, corresponding audit should be done. For example, an audit is needed to assess the forest restorability cum quality of the stand/sites identified in the SMP. Likewise, the assessment should look into the financial, economic, and social viability of the proposed reforestation in the area (provincial or regional level).
3. Outcome-based monitoring and evaluation by a third-party technical working group(s) based on the following expanded criteria: quality of seedlings, canopy closure and microclimate, biodiversity condition and true survival rate of seedlings.

4. There is a need to revise the incentives appropriate in a given reforestation site. In particular, harvesting incentive in contracts should be clearly indicated in the contract or MOA. For example, planted fast growing tree species may be harvested (with proper control mechanisms or safety nets to avoid abuse) to meet the national timber requirement of the country.
5. To sustain the gains of reforestation and attain the intended long-term outcomes, future program should increase support to forest protection of existing forests. This can be coupled with improving community organizing that delivers true local people empowerment and inclusive participation, organizational development and capacity building of partner POs. The expected net-benefits that can be gained from protecting existing forests and those planted through NGP from 2011-2016 may outweigh the expected net benefits from the implementation of Natural Forest and Landscape Restoration Program.
6. Some results still need to be validated in Phase II. A more detailed economic impact can be estimated through the conduct of an extended benefit-cost analysis, which will provide estimates of benefit cost ratio (BCR), net present value (NPV) and internal rate of return (IRR). Likewise,

**Impact Assessment of the National Greening Program (NGP) of the
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Scoping or Process Evaluation Phase
[PIDS-IE/14-2015/33]
Economic Component– Final Draft of Process Evaluation Report²**

PART I: ECONOMIC ASSESSMENT OF THE NGP

I. INTRODUCTION

This Impact Assessment Project aims to assess the impacts of the NGP to food security, poverty alleviation, environmental stability, biodiversity conservation, and climate change mitigation and adaptation goals of the government. Through this project, the multi-faceted factors that led to the present NGP outcomes will be uncovered in the field focusing on the factors that contributed to such state of the NGP forest plantations and on its present and future potential impacts. In general, the project aims to find ways to further improve the decisions-making and implementation mechanisms of the program so that its performance will have better and significant gains in the end. In addition, this project will serve as basis for the succeeding forestation programs of the government based from the lessons and experience in the NGP. The impact assessment project is guided by the conceptual framework based on the concept of “*Theory of Change*.” It is divided into four major components: 1) Terrestrial and Mangrove Ecosystem Situation; 2) NGP Intervention; 3) NGP Impact Assessment and 4) NGP Result. The impact assessment will cover the understanding of the NGP interventions, how it will reduce the current state of the upland and coastal environment as well as the social and economic situation of the people in upland and coastal communities, and how it will contribute to the attainment of its goals. The impacts will be categorized into four sectors – environment, economic, social and institutional. This report focuses on the economic component only.

The primary objective of the project is to assess the impacts of the NGP to food security, poverty alleviation, environmental stability, biodiversity conservation, and climate change mitigation and adaptation goals of the government. The project’s specific objectives of the economic component are to:

1. Estimate NGP’s economic impacts to project beneficiaries in terms of building up capital for improved livelihood for sustained increased income and in terms of the potential benefits it will contribute to the economic growth of the communities in the short term, municipality in the mid-term and province/region in the long-term;

² Prepared by Arvin B. Vista, Principal Investigator

2. Conduct an extended-Cost-Benefit Analysis (extended-CBA) taking into account all costs and benefits that are quantifiable in this project; and
3. Simulate potential long run economy-wide impact of NGP on the economy, incomes through the employment/livelihood component and poverty and the environment using Computable General Equilibrium (CGE) model to derive policy options that will optimize NGP performance.

In this Scoping or Process Evaluation Phase, this Report highlights the situationer cum baseline conditions, methodology, other scoping and process evaluation results from three sites selected addressing specific objectives 1 and 3. The CGE simulation presents the baseline scenario, i.e. business as usual, and an NGP scenario (Specific Objective 3). Objective 2 will be addressed in the second phase of the Impact Assessment of NGP.

II. PHILIPPINE FORESTRY

The country has had a century of reforestation efforts starting in 1910 initiated by the silvicultural class of the Forestry School in University of the Philippines Los Baños (UPLB). In 1916, Philippine Legislature Act 2649 appropriated PhP 10,000 for the reforestation of Talisay-Minglanila Friar Estate Cebu covering 4,095 hectares (ha). Between 1919-1940, several reforestation projects were completed such as the Magsaysay Reforestation Project in Arayat, Ilocos and Zambales; Cincona Plantation in Bukidnon, etc. At the outbreak of World War II in 1941, 35 reforestation projects were in operations covering 535,000 ha mostly in Luzon. Between 1946 to mid-1970's, 29 of the 35 reforestation projects operating before the war were reopened. In 1960, the Reforestation Administration was created under Republic Act 2706. In 1972, about 91 reforestation projects were being implemented. Letter of Instruction (LOI) No. 3 integrated reforestation activities into the mandate of the then Bureau of Forest Development. With the enactment of Presidential Decree (PD) 75 in 1975, all reforestation activities are required to have participation of the private sector. By 1976, all holders of Timber License Agreements (TLAs) were required to reforest inadequately stocked forestlands within their forest concessions as requisite in their operation plans. The following year (1977), PD 1153 required all able-bodied citizen 10 years and above to plant 12 seedlings annually for five consecutive years. In 1979, LOI 818 compelled all holders of existing TLAs, leases and permits to reforest one ha of denuded land for every ha logged. Most of these reforestation efforts (1900s to 1941, and martial law years) were undertaken at little cost to the government.

Huge funding 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 (Figure P1.1³). 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%.

Moving forward in terms of strategy, Executive Order 725 issued in 1981 provided incentives to private sector involved in reforestation through industrial tree plantations, tree farms, and agroforestry farms. From 1980s-1990s, participatory approaches to forest conservation were employed as the main strategy for forest conservation, such as the Integrated Social Forestry Program and Community Forestry Program. By 1987, there was a shift in strategy from regular reforestation projects to contract reforestation by corporate groups, families, local government units (LGUs), non-governmental organizations (NGOs) and communities under the NFP. In 1995, Phase II of the NFP was implemented through the Community-Based Forest Management (CBFM).

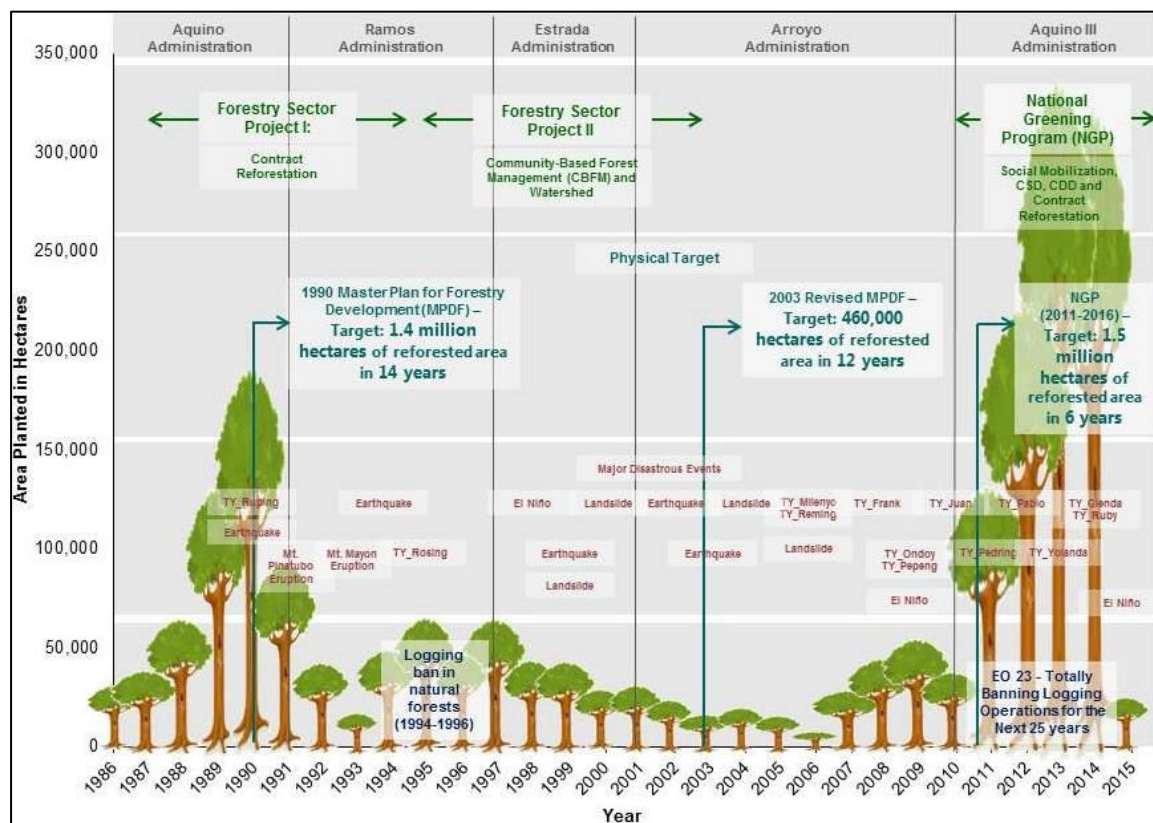


Figure P1.1. Three decades (1986-2015) of reforestation in the Philippines. (Source: DENR, 2015)

³ Data on NGP area planted 2015 is as of June 2015. Record of disasters was based from NDRRMC (2015) and Orallo (2015).

At present, the Aquino III administration executed the National Greening Program (NGP) in 2011 through Executive Order 26 as the reforestation initiative of the government. Compared to FSP, the NGP has a large target of 1.5 million hectares reforested in a span of only six year (2011-2016), almost twice shorter than the usual period of reforestation program in the country. The NGP is being implemented through social mobilization and contract reforestation: Community Driven Development (CDD), Comprehensive Site Development (CSD) and individual contract. So far, considering the area planted and despite the disastrous events that have occurred during the implementation years, NGP has been effective as a reforestation program. Comparing FSP and NGP, the latter had achieved higher output in terms of actual area planted.

A. Economic Situationer

Among the three main sectors of the Philippine economy, the agriculture, hunting, fishery and forestry (AHFF) sector ranks the lowest in terms of share to gross domestic product (GDP). Over the last 23 years, the share of the AHFF in the country's GDP decreased relative to the contribution of the industry and service sectors. Other than that, the increase in popularity of the industrial and services sectors resulted into capturing the larger share and contribution to the country's GDP. In 2014, AHFF accounted for 10% of the Philippine economy, a 42% decline from its 1986 level (17% share of GDP) (Figure P1.2).

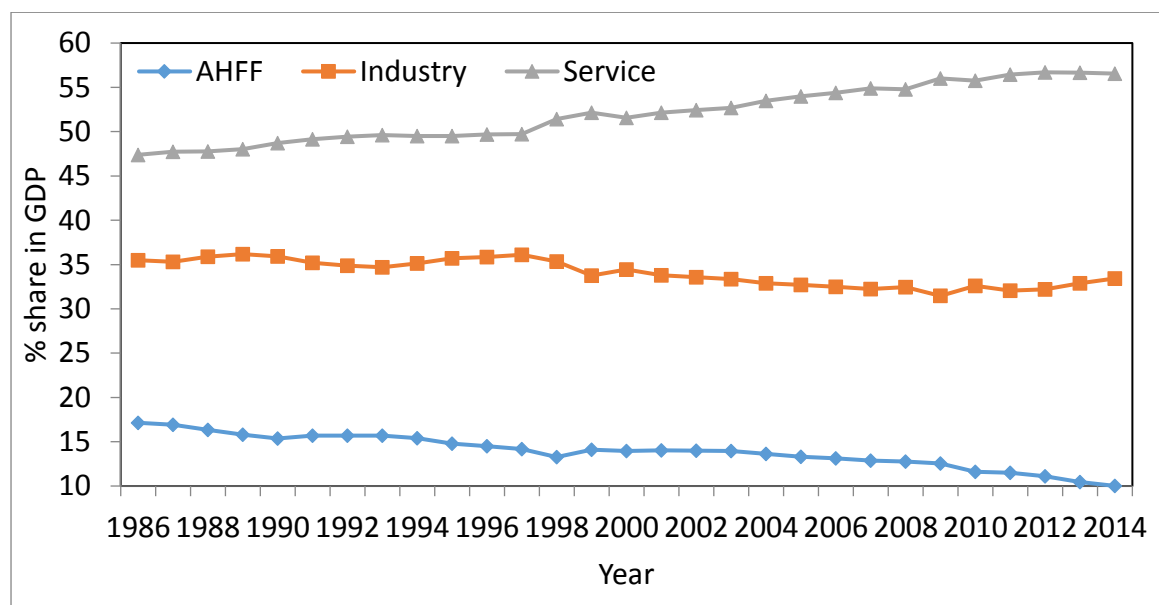


Figure P1.2. Shares of the Agriculture, Hunting, Fishery and Forestry (AHFF), Industry and Service Sectors in Philippine Gross Domestic Product, 1986-2014 (Source: NSCB, 2015).

The decreasing share of the AHFF output relative to its contribution to the country's GDP was manifested in the slow and declining annual growth rate in the production of agricultural commodities (Figure P1.3). From 1986 to 2014, the AHFF sector posted an average annual growth rate of only 2.33%, partly due to damages caused by severe typhoons and natural disasters, along with other unfavorable weather conditions brought about by climate change. In 1998, AHFF output fell due to severe El Niño, resulting in a 6.97% contraction. The following year (1999), the sector recovered with a growth of 9.65%.

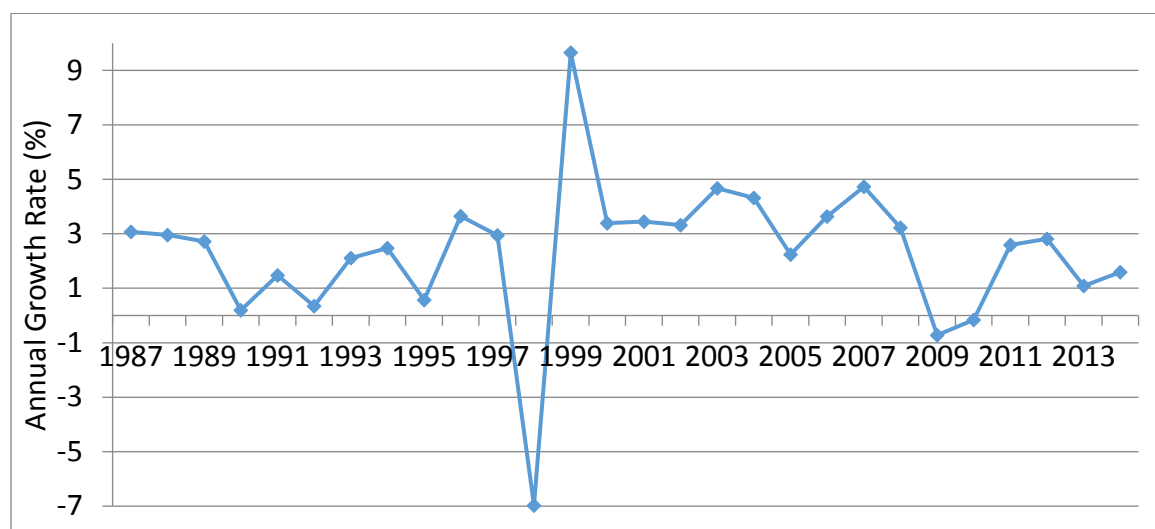


Figure P1.3. Annual growth rates of the agriculture, hunting, fishery and forestry sector in terms of its contribution to the gross domestic product (Source: NSCB, 2015).

As depicted in Figure P1.2, the annual share of the forestry sub-sector to the GDP was declining. From 0.83% GDP contribution of the Philippine forestry sub-sector in 1990, it fell to 0.04% in 2013 (Figure P1.4). Philippine forests alleviate the impacts of poverty since it absorbs most of the poor households by providing venues for both formal and informal settlements as well as livelihood for most of them. In areas where forests are still substantial and forest resources abound, poverty incidence tends to be higher. For example in 2012, the regions of ARMM (48.7%) and CARAGA (31.9%) experienced high poverty incidence. Caraga and ARMM consistently posted the highest poverty incidence among families in 2006, 2009 and 2012 (NSCB, 2013).

In 1960s, logs from Philippine forests were aggressively promoted internationally under the trade name "Philippine mahogany." In 1970s, logs, lumber and plywood produced locally were promoted internationally. But in 1986, there was an export ban of logs from natural forests. Then in 1989, there was an export ban on lumber processed from logs from natural forests. In 1990s started liberalization in the entry of imported wood

products in the country. Hence, from a log exporter in the 1960s to early 1980s, the country now was changed to exporter of skilled workers (OFW).

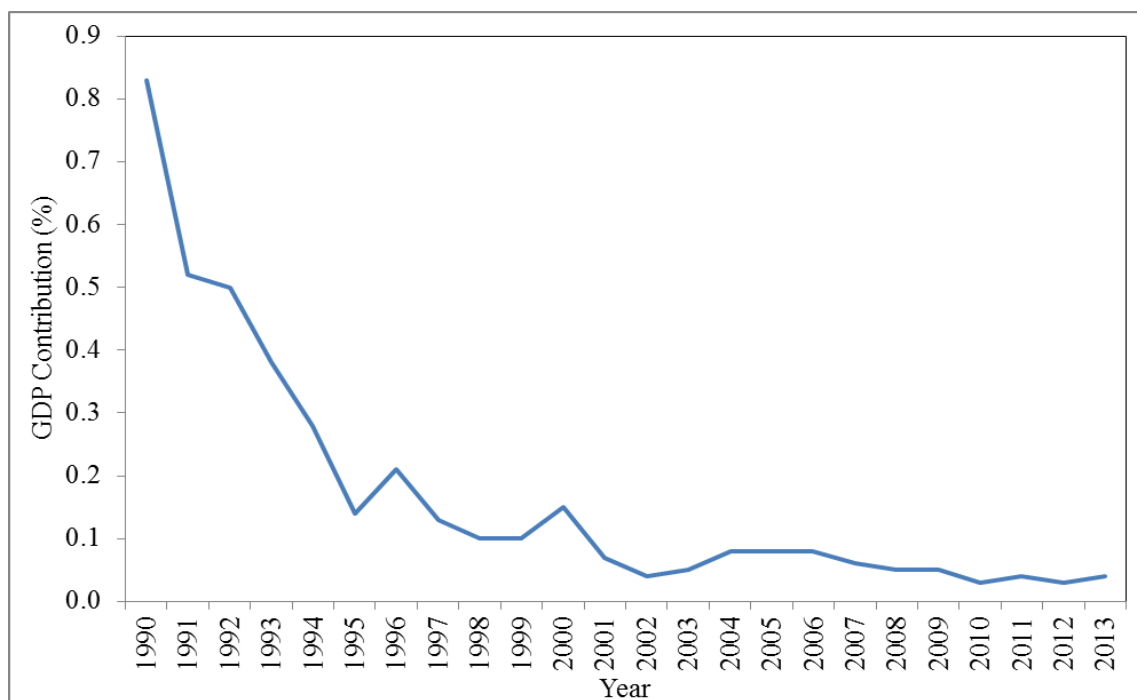


Figure P1.4. Gross domestic product contribution of the Philippine Forestry Sector, 1990-2013 (Source: NSCB, 2015).

Although the AHFF sector accounts for the lowest share to the Philippine economy, it employs about 35% of the country's 33.7 million labor force (2008 Labor Force Survey, Figure P1.5). Hence, a large part of the population relies heavily on agriculture, hunting, fishery and forestry for employment and income, particularly in rural areas. Since about three-fourths of the country's poor live in rural areas, AHFF is considered important elements in Philippine economic development and poverty reduction. Employment in the AHFF sector grew slowly at a rate of 0.53% compared to total employment (2.35%) from 1990 to 2014. Furthermore, the share of AHFF to total employment declined from 44% in 1990 to 27% in 2014.

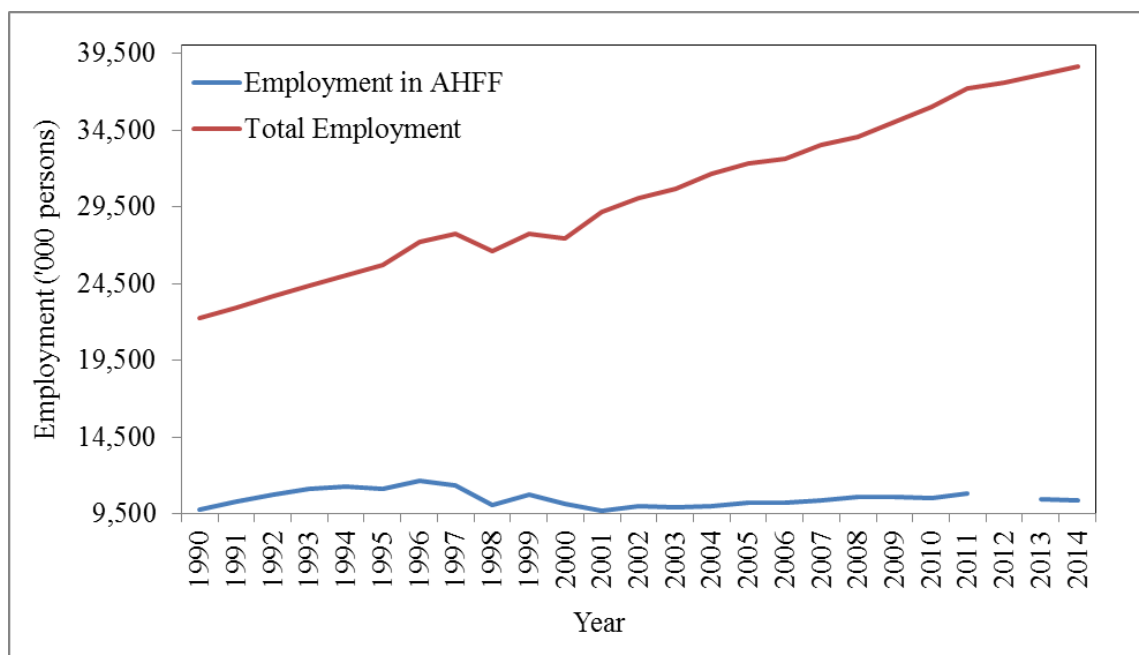


Figure P1.5. Total employment and agriculture, hunting, fishery and forestry employment, 1990-2014 (Source: NSCB, 2015).

B. Forest Cover: 2003 vs 2010

In 2003, about 7,168,400 ha of the 29,554,156 ha total land of the Philippines is forested (Table P1.1). About 6,431,630 ha are within forestlands and 736,770 ha are within alienable and disposable lands. The total forest cover is classified as closed, open, and mangrove forests. Half of the total forested area is open forest with an area of 3,515,645 ha. This is followed by closed forest at 2,761,092 ha of the total forest cover; and mangrove forest at 154,893 ha (FMB-DENR, 2003). The closed forests in the forestlands include areas that have not been logged and logged-over areas whose vegetation have reached the closed canopy stage while a major portion of the open forests in the forest zone falls within areas logged by TLA holders including those portions affected by timber poaching, areas destroyed by fire and other forest disturbances. The mangrove areas within the forest zone are those that have remained intact as a result of the ban on the cutting of mangrove species with the forest zone pursuant to Republic Act No. 7161⁴.

⁴ R.A. 7161 (1991) Ban on cutting of all mangrove species.

Table P1.1. Philippine 2003 and 2010 Forest Cover in hectares.

Region/ Philippines	Within A&D		Within Forestlands		Total	
	2003	2010	2003	2010	2003	2010
CAR	32,924	27,702	639,396	745,489	672,320	773,191
Region 1	34,316	9,190	155,485	115,287	189,801	124,477
Region 2	95,068	24,443	1,054,777	1,020,065	1,149,845	1,044,508
Region 3	76,617	34,942	512,878	485,656	589,495	520,598
NCR	763	2,214	2,057		2,820	2,214
Region 4-A	65,046	57,312	224,627	212,344	289,673	269,656
Region 4-B	126,729	59,290	1,068,415	856,374	1,195,144	915,664
Region 5	46,052	56,881	110,424	151,134	156,476	208,015
Region 6	50,222	18,510	214,292	168,809	264,514	187,319
Region 7	23,268	9,790	51,601	52,275	74,869	62,065
Region 8	38,695	31,963	481,153	482,502	519,848	514,465
Region 9	14,164	12,234	168,031	164,684	182,195	176,918
Region 10	23,800	19,896	313,693	357,962	337,493	377,858
Region 11	4,740	6,731	416,295	421,985	421,035	428,716
Region 12	19,653	5,668	329,581	243,361	349,234	249,029
CARAGA	43,459	48,427	479,833	634,685	523,292	683,112
ARMM	41,254	52,753	209,092	249,141	250,346	301,894
PHILIPPINES	736,770	477,944	6,431,630	6,361,774	7,168,400	6,839,718

(Source: FMB, 2003, 2013)

In 2010, the total forest area was further reduced to 6,839,718 ha, or a loss of 328,683 ha of forest cover in only a span of seven years (FMB, 2013). The difference was most significant in Regions IV-B, Region 2 and Region 12. In 2010, a different definition of land cover was adopted by National Mapping and Resource Information Authority (NAMRIA). In terms of forest cover by type, closed forest decreased by 24.5% in 2010 relative to 2003 while open forest increase by 14% (Table P1.2). On the other hand, mangrove forest increased by 25.5% in 2010 relative to 2003 level.

Table P1.2. Philippine forest cover change by type, 2003 vs. 2010.

Forest Type	2003 (ha)	2010 (ha)	Change	
			ha	%
Closed forest	2,560,872	1,934,032	-626,840	-24.5
Open forest	4,030,588	4,595,154	564,566	14.0
Plantation	329,578			
Mangrove	247,362	310,531	63,169	25.5
Total	7,168,400	6,839,718	-328,682	-4.6

(Source: FMB, 2003, 2013)

Out of the 29,554,156 ha land area of the country, there are about 8,720,119 ha of forestlands considered to be marginal and grassland/degraded areas (fallow, shrubs, wooded grasslands, grasslands, and open barren) (Figure P1.6, FMB, 2013). These areas are mostly unproductive, open, denuded or degraded needing reforestation and rehabilitation.

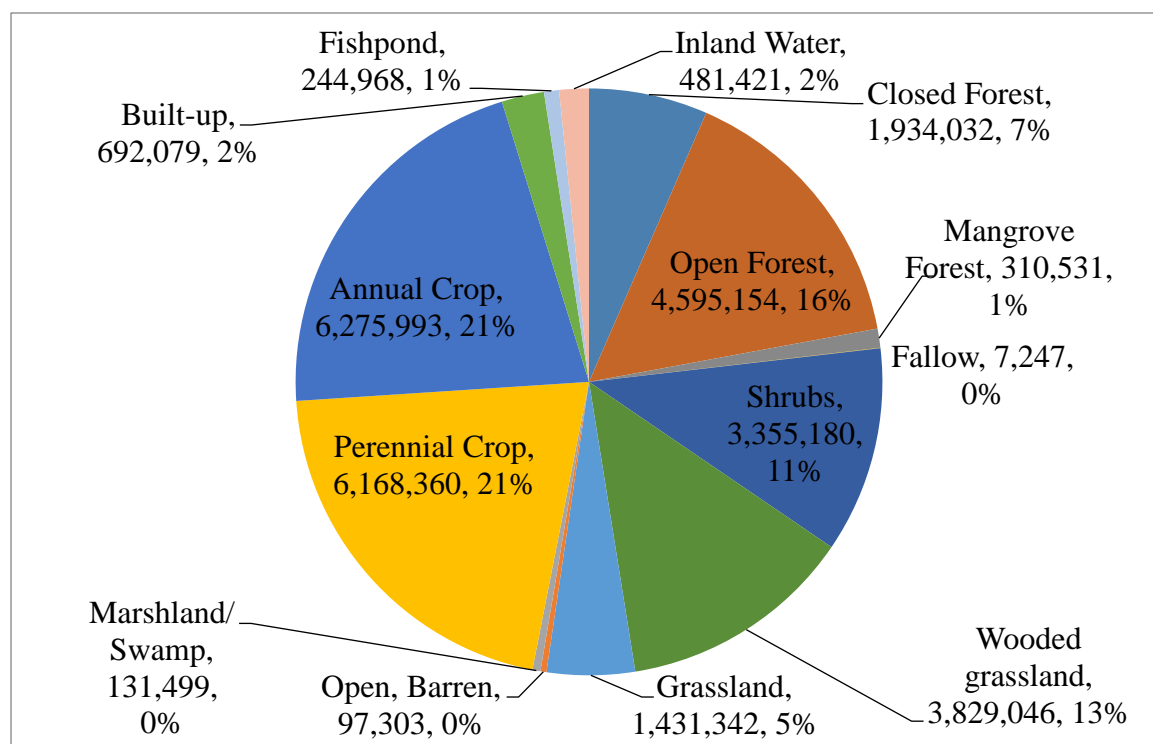


Figure P1.6. Land use and forest cover of the Philippines, 2010 (Source: FMB, 2013).

C. Forest Development

The effort of DENR on forest development caters reforestation activities on degraded and denuded public domain lands such as forestlands, mangrove and protected areas (PAs), ancestral domains and other suitable lands. Forest development is continually being part of the DENR initiative to increase the current forest cover of the country as well as to improve the productive capacity of the degraded and generating forestland through different appropriate strategies (FMB, 2003). Through the years, forest development initiatives of the department involves the participation of fellow government agencies, people’s organizations (POs), CBFM communities, academe, NGOs, private sector and other civil society organizations. For the year 2011-2016, the flagship program of the government for forest development is the NGP.

Like the forest protection, forest development initiative also falls under the forest management budget section of the DENR. As reflected in the Department's General Appropriations Act (GAA) document from 2010 to 2012, forest development has much higher budget allocation compared to forest protection. The budget was also observed to be in an increasing trend for the said duration. For 2010, PhP 1.2 billion is allocated for forest development and it rose to PhP 1.4 billion in 2011. Much higher budget was allocated in 2012 with a value of PhP 2.2 billion (DENR, 2015). With the continuing effort on NGP, the budget for forest development is expected to rise until it reaches its target by the year 2016.

D. Assessment of Government Reforestation Projects

Between 1960s to 1980s, the Philippine Government used the forest as the main driver for economic development with the issuance of TLAs that is largely blamed for the decimation of the Philippine forest. Its forest cover declined from 70% of the country's total land area of 30 million has in 1900 to about 18.3% in 1999 (ESSC, 1999), but bounced back to around 26% or 7.6 million has in 2010 (FAO, 2011). The increase in forest cover is a clear indication that the reforestation program of the government and tree planting efforts of the private sectors have finally paid off. From 2000-2010, FMB-DENR (2012) revealed that about 306,958 has have been reforested but mainly using exotic species such as Mahogany, *Gmelina arborea*, *Acacia mangium*, *Paraserianthes falcataria* and Eucalyptus spp. The Government still accounts for the biggest share in this effort, reforesting around 79% (212,857 ha) followed by the private sector at 21% (57,224 ha).

This is by far a positive accomplishment for the government amidst the failure of rehabilitation effort beginning in the 1970s. These include the FSP I and FSP II funded by loans from ADB with dismal results. The problems were mainly social, institutional and financial rather than technical. It failed to address the key underlying cost of degradation, which is the absence of livelihood options for those living in the uplands. It merely considered the upland communities as laborers during reforestation projects without the much-needed benefits for sustainability (Chokkalingam, et al., 2006).

On a positive note, Philippine Government's rehabilitation efforts during the past three decades showed that reforestation projects may have enhanced biodiversity through the planting of many tree species per site, including native species and have neutral to positive effects on soil and water properties, including peak flood levels and landslide frequency. However, these projects have contributed little to meeting the national timber needs plus it came with high economic costs and cannot be replicated at the local level (Chokkalingam et al., 2006). According to the preliminary assessment of Guiang et al. (2001) on the CBFM, the observed major economic incentives of CBFM are employment opportunities, income from sales of forest products, share in profits and dividends, provision of farm inputs, income-generating projects, increased farm production,

community organizing, participation in planning and development contracts. However, these incentives were largely dependent on the DENR's approval of the application resource use rights.

The CBFM in Nueva Vizcaya has been a medium towards the implementation of a "more environment-conscious livelihood strategies" (Carig, 2012). The Philippines is one of the countries in Southeast Asia which incorporated new approach to reforestation named as rainforestation or rainforestation farming (RF). This approach was developed by Visayas State University and the German Agency for International Cooperation (GIZ). It is basically an agroforestry system which involves planting of both economically and ecologically beneficial species (crops, fruit trees, native trees, etc.). It is seen that this approach will gain several economic benefits to stakeholders especially to local communities (Reforestation and Afforestation, 2012).

Initial assessments of the NGP are generally encouraging. According to DENR Secretary Ramon Paje, the Program was able to plant 90 million trees in 128,000 hectares in 2011, surpassing its goal of rehabilitating 100,000 ha for the same year. From 2011-2013, it has already generated 1,172,160 jobs and employed 168,212 individuals. These results, however, need to be validated through scientific methods covering biophysical indicators such as actual number of planted seedlings, health and quality of plantations established and managed, and survival rates as well as socio-economic indicators such as the benefits that accrued to the beneficiaries of the Program.

The most recent assessment of the Program was written by Israel and Lintag (2013). Their study aimed to evaluate whether 1) the Program was able to achieve its objectives of forest ecosystem conservation in its 20 years of implementation, identify the causes of delays in its implementation of projects or programs including its collaboration with other national and local government units; 2) assess the effectiveness and efficiency of its implementation; 3) determine if the coverage, annual targets, and modes and costs of implementation of the NGP are responsive towards the issues and problems of the program; and 4) recommend improvement measures based on the existing implementation plans and arrangements. In achieving these objectives, primary and secondary data were collected. Focus group discussions and key informant interviews were conducted in selected NGP sites in the Caraga region. These were supplemented with secondary data obtained from institutional sources.

At the national level, they found that the NGP "has only partially attained its replanting targets," and that it has "become relatively inefficient in its conduct of replanting activities over the years." On the other hand, down at the area level, the effectiveness of NGP was manifested in the growth of income and livelihood opportunities, and in the improvement on the overall condition of the environment and natural resources in the areas. In conclusion, Israel and Lintag (2013) stressed that the key elements to a

successful reforestation program include not only sufficient financial and manpower resources, but also more importantly, effective monitoring and implementation of operational improvements.

E. National Greening Program

The current reforestation program under the administration of President Benigno S. Aquino III is called the National Greening Program. The NGP, through the issuance of Executive Order 26, signed on February 24, 2011, is the response of the Philippine Government towards reforestation. The guidelines for NGP were released on March 8, 2011 and the program was formally launched on May 13, 2011 (DENR/DAR/DA, 2012).

NGP is led by the DENR and follows the convergence approach where 13 government agencies are putting up their efforts and resources to plant 1.5 billion trees in around 1.5 million hectares by 2016 in partnership with the LGUs, civil society organizations (CSOs), POs, the academe and the private sector. The involvement of CSOs, NGOs and local communities representatives are integral part of the devolution of forest measures (Magno, 2001). This signifies strong state-society relationship through participatory planning to achieve social capital. Human resources are important assets because they are the primary implementers of every program in a state. NGP is mainly funded through government coffers with a budget of around PhP30 billion over the course of six years (2011-2016) of project implementation. Trees are to be planted in areas for development such as forestlands, mangrove and PAs, ancestral domains, civil and military reservations, urban areas under the greening plan of the LGUs, inactive and abandoned mined sites, and other suitable lands, all are of the public domain.

NGP is a reforestation program that has a diverse set of goals, which are poverty reduction, sustainable management of natural resources, provision of ecosystem services, and promotion of public awareness. In particular, the specific goals of the NGP are as follows:

1. to contribute in reducing poverty among upland and lowland poor households, indigenous people, and in coastal and urban areas;
2. to implement sustainable management of natural resources through resource conservation, production and productivity enhancement;
3. to provide food, goods and services such as timber, fiber, non-timber forest products, aesthetic values, air enhancement values, water regulation values and mitigate climate change by expanding forest cover that serve as carbon sink;
4. to promote public awareness as well as instill social and environmental consciousness on the value of forests and watersheds;
5. to enhance the formation of positive values among the youth and other partners through shared responsibilities in sustainable management of tree plantation and forest resources; and

6. to consolidate and harmonize all greening efforts of the government, civil society and the private sector.

According to an interview with Director Calderon of FMB-DENR, with the implementation of NGP, we can expect a 12% increase in the country's forest cover relative to the 2003 forest cover of 7.2 million hectares and assuming an 85% survival rate. Moreover, the NGP is expected to raise the carbon sequestered level by an additional 8% to the average 36 million tons carbon sequestered annually (Teves, 2012).

The following strategies were adopted in the implementation of NGP (FDC, CFNR, UPLB/DENR, 2014):

- 1) social mobilization;
- 2) harmonization of initiatives;
- 3) provision of incentives; and
- 4) monitoring and management of database.

Social mobilization strategy involves the participation of the academe, government employees, private sectors and civil society groups for the planting activity under NGP while the maintenance and protection activities are given under the responsibility of the POs. 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. Lastly, a centralized database was developed to provide regular monitoring and timely report on the progress of NGP. This strategy also promotes the involvement of the private sector, civil society and academe in the monitoring and evaluation of NGP. Mapping through Geographic Information System (GIS) and geotagging were also introduced.

The DENR has likewise established NGP commodity roadmap for 2013-2016 and adopted several agroforestry species for planting almost 70% of the 1.5 million hectares target land. The commodities are identified as timber, fuelwood, coffee, cacao, rubber, bamboo, rattan and other fruit trees. These commodities were seen as the ones which will contribute best to the national economic growth. The road map also promotes the adoption of indigenous species for protection forests and PAs. Moreover, it supports the planting of appropriate mangrove species within and outside PAs (Teves, 2013).

Table P1.3 shows the quantitative targets of the NGP from 2011-2016. The potential benefits from the NGP are as follows: improvement in land productivity, increase in labor supply, health improvement, climate change mitigation, job generation, and alternative livelihood/livelihood opportunities.

Table P1.3. National Greening Program area/seedlings targets and actual seedlings planted.

Year of Implementation	Target Area (ha)	Total Area Planted (ha)	Target No. of Seedlings (million)	Actual Seedlings Planted (million)
1 (2011)	100,000	128,558	100	89.624
2 (2012)	200,000	221,763	200	125.596
3 (2013)	300,000	333,160	300	182.548
4 (2014)	300,000	321,532	300	195.069
5 (2015) ^a	300,000	9,904	300	9.889
6 (2016)	300,000	No data	300	No data
Total	1,500,000		1,500	

(Source: FMB, 2012) Note: ^a1st quarter only

The NGP cost is relatively low compared with actual cost because the NGP recipients are assumed to cover the cost after year 3. From 2011 to 2014, we can see an increasing trend in the budget allocation for and area planted through NGP (Figure P1.7). The reported area planted was even higher than the set area targets given in Table P1.3. On the other hand, actual seedlings planted were below the targeted number of seedlings to be planted for years 2011 to 2014.

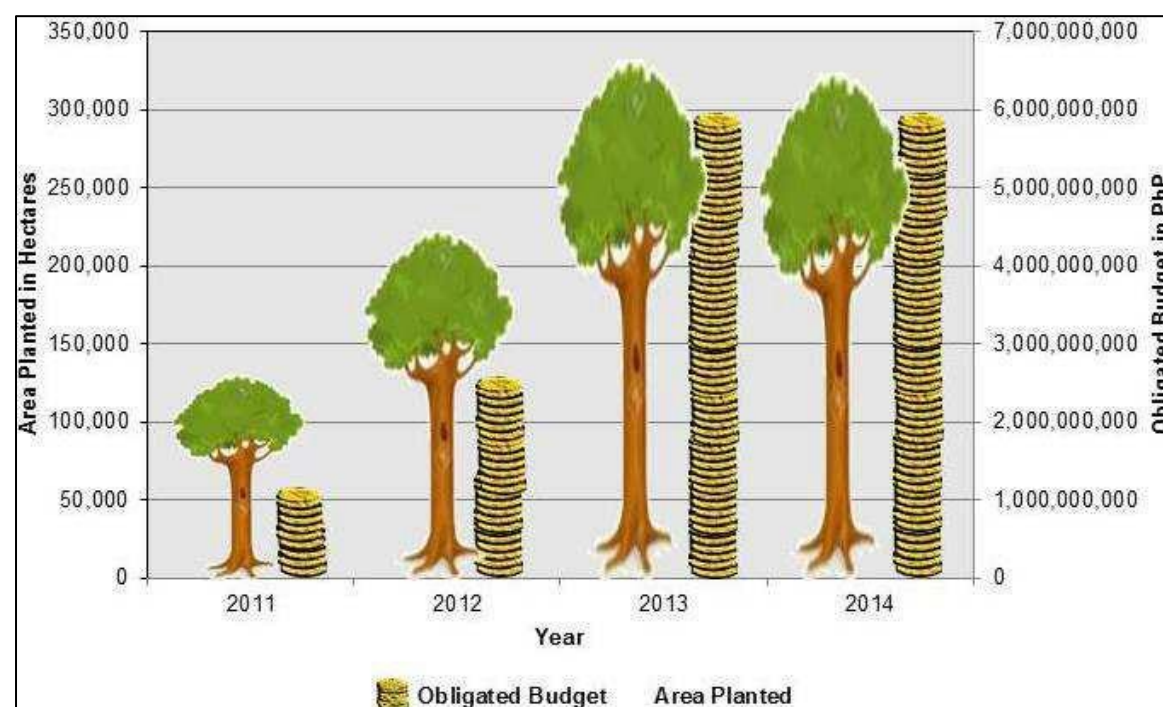


Figure P1.7. NGP Obligated budget and area planted from 2011-2014 (Source: DENR, 2015).

Looking further into the NGP average percent obligated budget for 2011-2013, we can see that CAR, Regions 3, 4A, 8 and 7 were the top five regions (Figure P1.8) while in terms of forest area cover, the top five were Regions 2, 4B, CAR, 13, and 8. Forest or canopy cover, together with species diversity and ecosystem functions are good indicators for measuring environmental success, which is a long-term goal of reforestation (Le et al, 2011). On the other hand, degraded sites, those with less forest cover, in most cases are difficult sites to reforest and will entail higher costs to attain establishment success (Lamb and Tomlinson, 1994). Hence, it is possible reforestation in sites adjacent to existing forest stands or cover may increase the establishment success compared with reforestation in grassland sites, assuming all other things being the same.

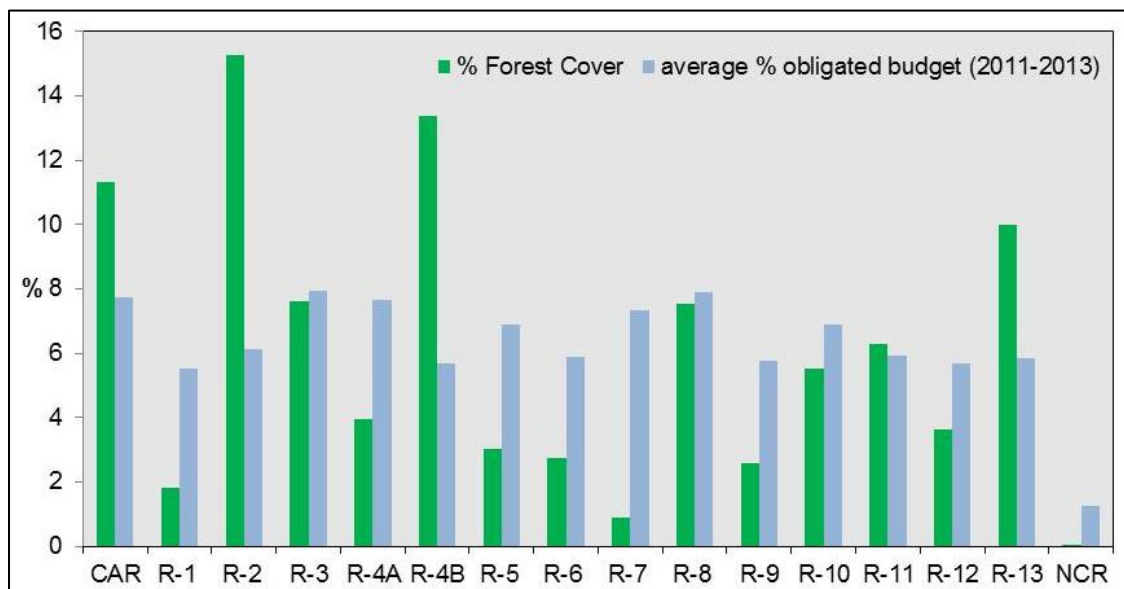


Figure P1.8. NGP average percent obligated budget for 2011-2013 and percent forest cover per region (Source: DENR, 2015).

III.METHODOLOGY

Figure P1.9 illustrates the implementation framework that was employed in the impact assessment study. It shows aspects of the interventions and where they come into the impact assessment process. The figure also shows the key indicators and data collection methods employed. The impact assessment for this component of NGP focused on the economic aspect.

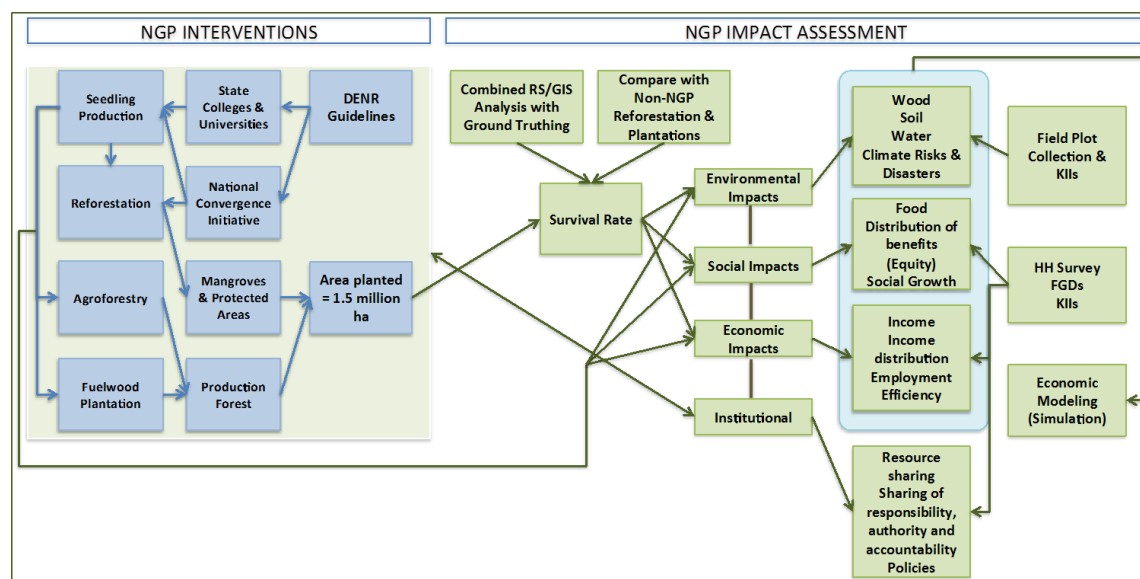


Figure P1.9. Implementation framework employed in the impact assessment of the National Greening Program.

Using the DENR NGP central database, a random selection was done with DENR NGP Central Office to choose three sites based on the following criteria:

- One province from each major island groups: Luzon, Visayas and Mindanao
- Minimum size of a NGP parcel: 10 hectares and in contiguous areas; with large NGP area
- Diversity of species planted; excluded urban greening sites planted with non-tree species
- “Representativeness” of the commodities or plant species
- Number of years under NGP

The selected sites were Sta. Cruz, Zambales (Figure P1.10), Hinoba-an, Negros Occidental (Figure P1.11) and Basilisa, Dinagat Islands (Figure P1.12).

Luzon	Visayas	Mindanao
<ul style="list-style-type: none"> • Zambales • Sta. Cruz (1,055) 	<ul style="list-style-type: none"> • Negros Occidental • Hinoba-an (1,244) 	<ul style="list-style-type: none"> • Whole of Dinagat Islands (774)

Note: Number in parenthesis () are NGP area in hectares.

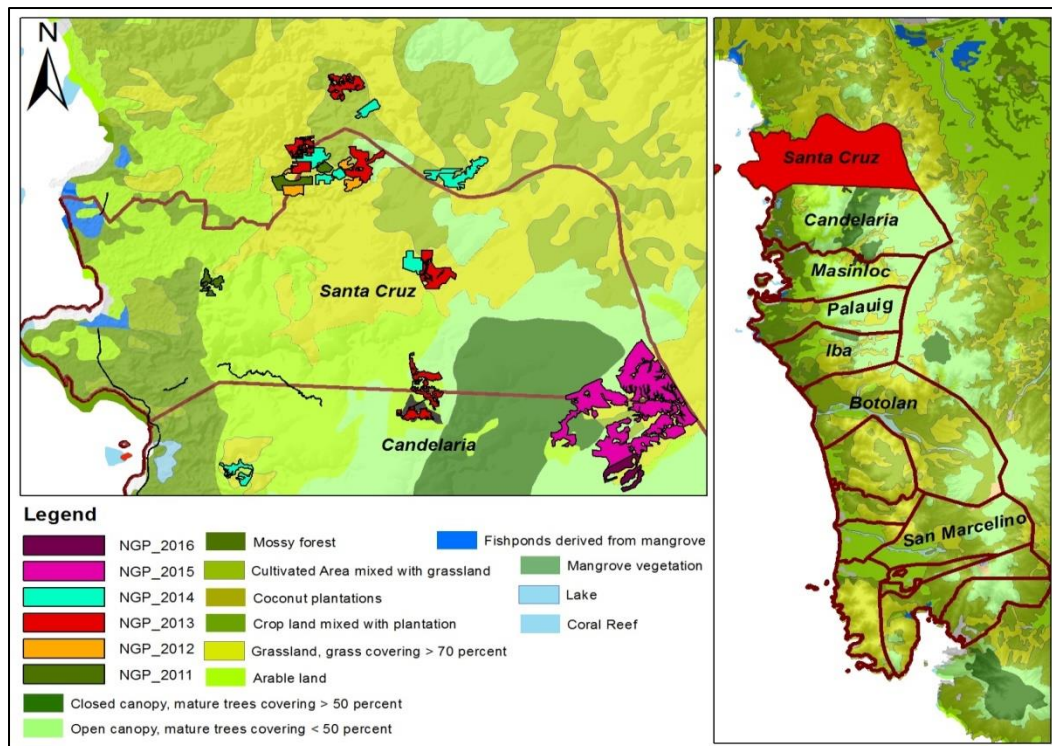


Figure P1.10. Sta. Cruz, Zambales.

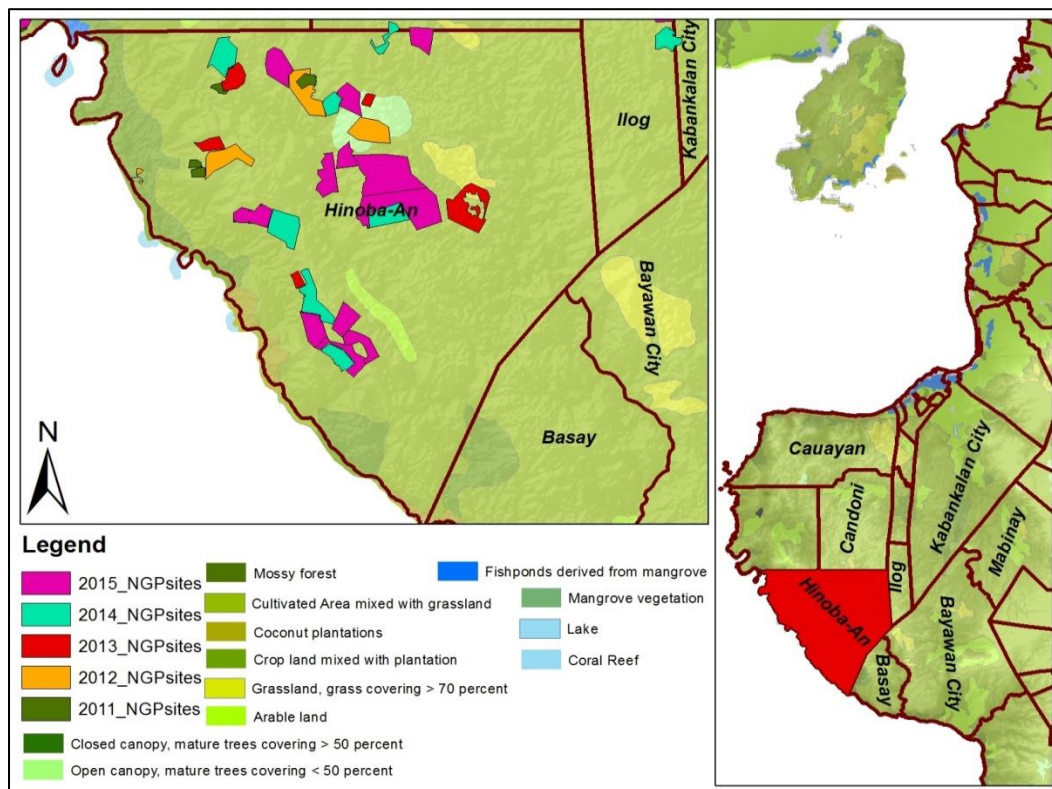


Figure P1.11. Hinoba-an, Negros Occidental.

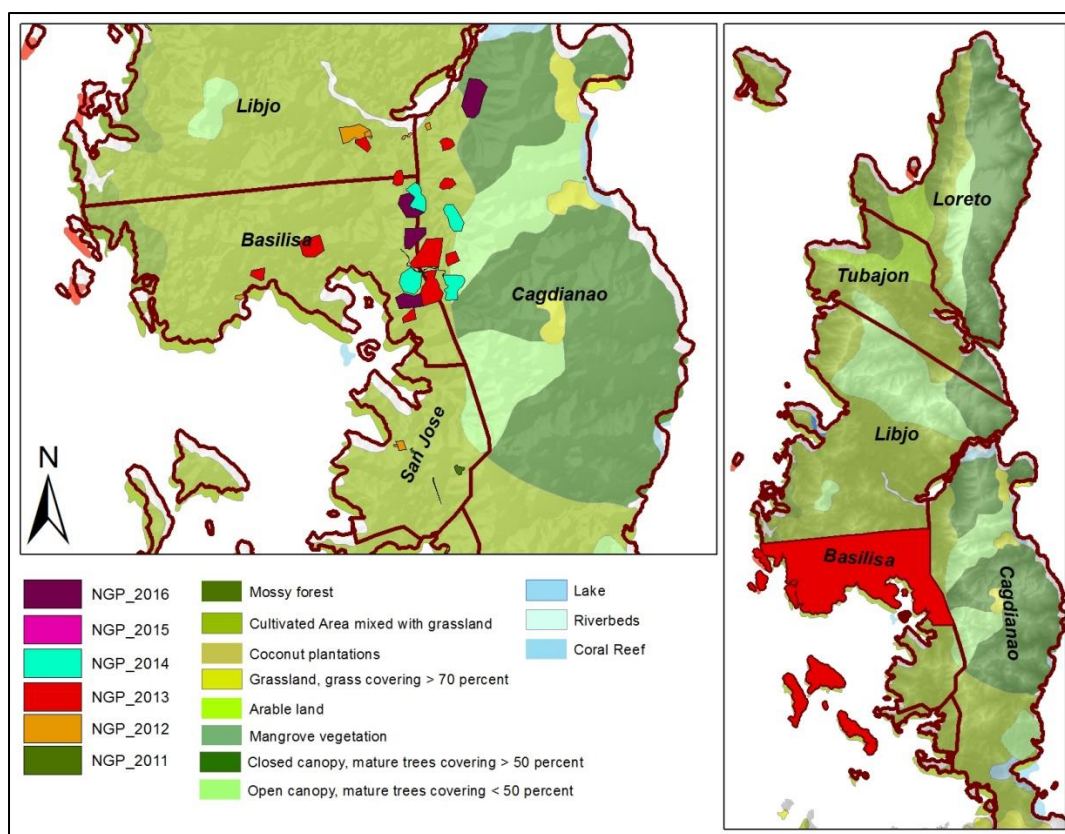


Figure P1.12. Basilisa, Dinagat Islands.

To evaluate the subsequent economic impact of NGP, household surveys using field interview questionnaire was conducted. Appendix Tables P1.1a-P1.1c provides the details of household sample per sites. Aside from household surveys, focus group discussions and key informant interviews were also conducted. Appendix Tables P1.2a-P1.2c shows the documentation of actual field activities of the NGP Impact Assessment Study Team at the three sites. Appendix P1.4 shows the questionnaire for NGP respondents while Appendix P1.5 shows the questionnaire for non-NGP respondents. The household survey sample size for the three sites selected is given in Table P1.4. Appendix P1.6 shows the list of key informants and focus group discussion participants and their particulars.

Table P1.4. Household survey sample size for the three sites selected.

Site	No. of NGP Beneficiaries (HH Population)	Computed Sample Size	No. of Respondents NGP ^a	No. of Respondents Non-NGP ^b
Sta. Cruz, Zambales (3 barangays)	182 (964)	145 (90% CI; 3% SE)	118	146
Hinobaan, Neg. Occ.	356 (2,891)	150 (75% CI; 3% SE)	136	134
Dinagat (3 municipalities)	210 (2,012)	195 (85% CI; 3% SE)	229	164
Total		490	483	444

^aComplete enumeration, ^b Sample

A. Pre-Testing of Survey Questionnaires

Pre-testing of questionnaire and training of enumerators were conducted in Zambales and was replicated in Hinoba-an, Negros Occidental and Dinagat Islands. The training of enumerators was conducted in order to level off the basic knowledge of enumerators in conducting the elicitation methods.

Two types of questionnaire were formulated in eliciting the impacts of NGP, particularly intended for respondents who were engaged in the NGP activities and respondents who were not involved in the NGP activities. Both questionnaires were divided in different sections: 11 sections for NGP-respondent questionnaire and seven sections for the non-NGP-respondent questionnaire. Each section of the questionnaire have indicator questions which aims to measure the impacts of NGP objectives as stated in DENR Memorandum Circular No. 1 dated March 8, 2010.

1. NGP-Respondent Questionnaire

The NGP-respondent questionnaire consists of 11 sections. Sections A to E aims to capture indicator variables for Objective 1 which focuses on poverty reduction among different communities. These sections will elicit data on economic and socio-demographic status of the respondents. Sections F to H focuses on the specific knowledge of the respondent pertaining to the NGP. Section H, in particular, will elicit technical know-how of respondents with regards to the actual implementation. These particular section aims to validate the specific procedures applied by the respondents vis-à-vis the recommended procedures in tree planting and management. These sections of the questionnaire aim to account for Objective 2 of NGP. The succeeding section I, particularly focuses on Objective 3 of the NGP. Questions in this section pertain to perception and awareness of respondents on the different ecosystem services that they currently enjoy; and if there had been any changes in these ecosystem services during or after the implementation of NGP. Finally, section J elicits question that is attributable to NGP's Objective 4. This section focuses on the overall awareness and understanding of the community towards the environment and the importance of the role of forests and watershed management. There had been no separate sections pertaining to Objectives 5 and 6 since these could already be covered in other sections.

The questionnaire in Appendix P1.4 is the final version used in Sta. Cruz Zambales and Hinoba-an, Negros Occidental. In Sta. Cruz, Zambales, a Tagalog version was prepared and administered while an English version was utilized for Hinoba-an, Negros Occidental. This English version will also be employed in the Dinagat Islands.

2. Non-NGP respondent Questionnaire

A separate set of questionnaire was prepared for non-NGP household respondents. Although, the questionnaire was intended for non-NGP respondents, the set of questions were still based from indicator questions to satisfy the NGP objectives. In general, this set of questionnaire aims to provide comparable information between non-NGP and NGP household recipients' welfare. The questionnaire is still divided into different sections which correspond to the sections of the NGP questionnaire. Similar with the NGP-household respondent questionnaire, Sections A to D pertains to economic and socio-demographic profile. Furthermore, Section E pertains to awareness of the respondent on the NGP activities. Finally, sections F and G are also similar to NGP-respondent questionnaire sections I and J which focuses on ecosystem services, awareness and perception on the role of forests and watershed management.

B. Enumerator's Training and Pre-Testing Activity

In order to have a standard basis in the elicitation of information, an enumerators' training was conducted on February 5, 2015 at Sta. Cruz, Zambales. The training focuses on the overall context of the study, a crash course on ecosystem and ecosystem services, background of NGP, "Do's and Don'ts" of enumeration, and finally a detailed training on how to elicit the required information based from the two types of questionnaire. A representative of DENR Region 3 NGP coordinator and representatives from CENRO of Masinloc was also present during the training. All DENR personnel assisted the team in the discussion on how to ask the necessary questions, particularly on the technical parts of the questionnaire. A mock interview was also conducted after the training wherein the DENR personnel took the role of respondents while the enumerators ask the questions. This exercise served as the practice ground of enumerators for the upcoming pre-testing activity.

Following the enumerator's training, a pre-testing activity was conducted on February 6, 2015. The objective of the activity is to check whether all the necessary information is being captured in the initial questionnaire. This exercise also aims to expose the strong and weak points of the questionnaire, as well as the challenges of the enumerators in eliciting the information. Seven NGP household recipients and three non-NGP household were selected following convenience sampling in Barangay Guinabon, Sta. Cruz, Zambales for the pre-testing activity. The actual survey employed a simple random sampling methodology for selecting the respondents.

In addition, a cheat sheet of lectures was prepared as guide for enumerators in terms of technical details in the questionnaire. With the refinements of the questionnaire, the actual interview time averaged about one hour per household respondent.

C. Focus Group Discussions and Key Informant Interviews

Focus group discussions (FGDs) and key informant interviews (KIIs) were conducted alongside the household surveys in the three selected sites to have a more intimate probing of information needed for NGP assessment. The objective of the FGD and KII is to plot and map the entire process flow of the NGP from the planning the targets up to the implementation in the ground. The overall target outcome is a schematic diagram of the entire process of the program.

The different levels of the program is represented by different stakeholders, beginning from the DENR-NGP central office, to the regional level, to the provincial level, to the community, and finally to the recipients of the program. A detailed process flow could be conducted in each group of stakeholders to have a more in-depth analysis on each level. In every level of analysis, the pre-requisites or inputs and the results or output were identified. Mapping of the entire process flow provided a visual representation of the standard procedures and the identification of primary and secondary impacts to the stakeholders involved. In each level, specific questions for the Social, Economic, and Institutional component of the study were asked to elicit the required information.

For the economic component, the questions will focus mainly on the costs and benefits of the program to the recipients and to the community as a whole. The costs and benefits analysis could include monetary and non-monetary values in each stages of the process. The economic component could also look at other economic activities that are affected. Similar with the economic component, the social component looks at the welfare impact of the program specifically in terms of household status, quality of life, cultural impacts, and gender-based distribution of roles, responsibilities, and participation to the program. Since each level of the process involve different stakeholders, the social impact could look at the dynamics of the stakeholders in each level. Similarly, the institutional component of the study will look at the interrelationship of different stakeholders in the program as well as within the different stages. The effect of policy outcomes in the program will also be analyzed in each level of the process.

The FGDs will invite different stakeholders which had been involved in the NGP program. Each type of stakeholder will explain in detail the process on how they were able to take part in the NGP program planning and implementation. During the FGD program, an introductory plenary session will be conducted. This session would orient the participants on the background of the study, objectives, and the mechanics of the activities. Following the plenary will be a breakout session. The bigger group will be

divided into small sub-groups in order to have a more intimate probing session with the stakeholders. The mapping of the process flow per stakeholder will be conducted during the break-out group. Each sub-group is a representation of the specific process flow intended for a particular type of stakeholder. For instance, the process flow for PO's implementation is different with the process flow for other organizations implementation. At the end of the FGD, the participants will be asked to present their process flow in the plenary to compare and contrast their processes with other stakeholders. A similar process will also be conducted with the NGP coordinator's office in the region, PENRO, and CENRO through the key informant interviews. Eventually, the process flows in different levels will be matched in order to come up with the complete picture of the entire program.

D. Analyzing the Economic Impacts of NGP with Propensity Score Matching (PSM)

In determining the economic impacts of NGP on the condition of people in the three selected sites, propensity-score matching⁵ procedure was employed. Employing PSM in this study serves the concern in ensuring the proper impact evaluation of NGP since this study is not experimental. PSM is useful in evaluating the causal effect of *treatment* (here referring to *NGP*) on some outcome variable experienced by individuals or household members in the three sites selected for the study. PSM provides the right counterfactuals for the determination of economic impacts since it “can control selection bias based on observable characteristics by finding a control observations having as similar as possible to the treatment group, to serve as surrogates for the missing counterfactuals” (Rejesus et al. 2011). Hence, an unbiased study would facilitate the identification of measures that would strengthen the economic underpinnings of implementing post-NGP in the country.

The NGP exposure serves as the causal agent of the outcomes represented by *NGP*, which is associated with the respondents as either an NGP recipients or non-NGP recipients with binary equivalent of 1 and 0 in the model. Three matching methods (radius matching, kernel and nearest neighbor) were employed to come up with implications on the economic underpinnings of NGP in the three sites. The three methods of matching, namely: radius matching with default radius of 0.1, kernel matching with epanovich bandwidth of 0.06 and nearest neighbor matching procedures were performed to check for consistency of findings. The impacts of NGP on the household members in the three sites were examined on the basis of the outcome variables given in Table P1.5 and the impacts are indicated in the values of the significant average treatment effects on the treated (ATTs) for each outcome variable. PSM will drop the variable that does not meet the balancing property criterion inherent in the estimation, hence 3 out of 14 outcome

⁵ Rosenbaum and Rubin (1983) provides a theoretical explanation of PSM.

variables were dropped in the specification model in the estimation of propensity scores. Household real expenses in 2014, gender and knowledge of tree roles were dropped because of failure to meet the balancing property requisite for estimation. Thus, no generalization could be made with these variables in this study on the basis of NGP impacts since PSM fails to find the required matches for proper comparison.

The ATT would indicate the effect of NGP on certain outcome variables purporting the economic condition of the locals in the three sites selected, which would imply as “the average change of an outcome variable for treated sites due to NGP, whose functional form is given below:

$$ATT = E(Y_i^1 - Y_i^0 / D = 1) = E(Y_i^1 / D = 1) - E(Y_i^0 / D = 1)$$

where *ATT* is the measure of the change cause by NGP on an outcome

Y_i^1 is the estimate of an outcome value of site *i* if it is treated (NGP recipients)

Y_i^0 is the estimate of an outcome value of site *i* if it is not treated (non-NGP)

$D=1$ the participation status in case of treatment. The participation status where the treatment is zero is $D=0$.

Each *I* will have only one outcome and $E(Y_i^0 / D = 1)$ to be not observable, which would create “the problem of causal inference. Hence, we need information from the control group or respondents from the non-NGP sites to replace the missing counterfactual data for the treatment. To control bias and ensure robustness of results, the characteristics of NGP and non-NGP sites of the study from which the respondents are selected had been chosen based on similar attributes or profile, besides the bootstrapping of errors, the establishment of the ideal bandwidth and the imposition of common support restriction in the estimation process.

Table P1.5. Definition of variables for the economic impact evaluation.

Variable name	Definition
NGP	1= NGP respondents; 0=Non-NGP respondents
Household real income in 2014	PhP, household income, in real 2014 values, with 2010 base year
Household real expenses in 2014 ^a	PhP, household expenses, in real 2014 values, with 2010 base year
Age	Age of head of the household, years
Gender ^a	1=Male; 0=Female
Years of education	Number of years of education
Years of residency	Number of years of residency
Membership in organization	1=Yes; 0=No
Involvement in training/seminar	1=Yes; 0=No
Household size	Number of household members
Number of working HH members in 2014	Number of household members on active employment
Awareness of NGP	1=Respondent is aware of the National Greening Program; 0=otherwise
Awareness of ES	1=Respondent is aware of the ecosystem goods and services; 0=otherwise
Knowledge of watershed	1=Respondent is knowledgeable of watershed and the services/functions it provides; 0=otherwise
Knowledge of tree roles ^a	1=Respondent is knowledgeable of the role of trees; 0=otherwise

^a indicate the variables that are dropped from the model specification for the estimation of propensity scores based on the balancing property test results

IV. SCOPING OR PROCESS EVALUATION RESULTS

In terms of NGP strategy, social mobilization was common among the three sites, except in Dinagat Islands where it focused only on planting. Community Driven Development (CDD) was employed in Sta. Cruz, Zambales and Hinoba-an, Negros Occidental whereas contract reforestation was employed in Dinagat Islands. Pakyaw system for monitoring and protection was employed in Dinagat Islands while hired labor was employed for site preparations. Agricultural farming and fishing is common among the three sites, except in Dinagat Islands where household members are also obtaining their income from mining aggregates (Table P1.6).

Table P1.6. Comparison of three sites in terms of NGP implementation strategy, NGP involvement and major income source.

Item	Zambales	Hinoba-an	Dinagat
NGP Implementation strategy	Social mobilization; CDD Comprehensive Site Development (CSD)	Social mobilization CDD	Contract reforestation “Pakyaw” system for M&P Social mobilization for planting
NGP involvement	Seedlings production Planting Maintenance & protection (M&P)	Seedlings production Planting M&P	Hired labor during land preparation; Contractors for M&P
Major income source	Farming (agriculture)	Agriculture	Farming & fishing Mining (aggregates)

A. NGP Implementation Strategies

1. Zambales

The Province of Zambales adopted the CDD and CSD schemes in the conduct of NGP. The CDD generally involves PO as the beneficiary. The DENR has the task to conduct target setting and survey, mapping and planning (SMP) to determine NGP sites and programs on information, education and communication (IEC) and to identify partnership with POs. If a PO is interested, they are required to submit a Letter of Intent (LOI) and pertinent documents to PENRO. To be qualified, the PO must be a registered organization under the Securities and Exchange Commission (SEC) and is financially stable. Once the LOI is accepted, the PENRO and CENRO will prepare the MOA and both parties, together with the PO, will affix their signature. The MOA include activities on seedling production,

site preparation and plantation establishment, and maintenance and protection. Each activity is set to have individual and unique MOA.

Though there is an individual MOA for each activity, the process for request for site validation and payment concerning NGP is set to be generic. After the accomplishment of a specific NGP activity, the PO or contractor will send request for inspection/evaluation and payment to CENRO and upon receipt, CENRO will conduct a pre-evaluation. After the pre-evaluation, CENRO will endorse the request to PENRO, attention to the Inspection and Acceptance Committee (IAC). IAC is responsible for the evaluation and preparation of report of the NGP activities. Upon receipt of request and documents, the records' section will forward it to the PENR officer for attachment of routing slip. The documents will then be submitted to the NGP focal person and advises the IAC to set schedule for inspection of the activities and prepare inspection report. After which, the report will be reviewed by the NGP focal person, affix initials and submit to PENR officer for signing. All the documents and vouchers will then be submitted to planning section for record purposes and directed to accounting section for review of the documents for release of payment. Once IAC endorsed the report for payment, the CENRO will prepare voucher with complete attachments of PO request for evaluation, accomplishment report, IAC report, digitized map, geotagged photos and copy of contract. Voucher will be directed to PENRO for review of the NGP focal person, PENR officer, accounting and cashier. Upon approval and signature of the accountant, the voucher and check will also be for approval of the PENR officer. The processing of voucher in PENRO usually takes a week. The voucher will then be endorsed to the cashier section for the preparation of checks and go back to PENR officer for signature. Once documents are reviewed and approved, the check will be signed by the PENR officer and a certificate of completion and acceptance of the total project will be awarded by the DENR to the PO. The cashier section will also prepare advice for PENR officer's signature and advice for release to the Land Bank of the Philippines (LBP). After which, the checks will be ready for release to the concerned PO or contractor. Lastly, the PO will issue official receipt to the DENR upon every release of payment (Figure P1.13).

For every activity, different schedule of releases are set. For seedling production (the activity usually last for 2-6 months of implementation), aside from the advance payment of 15% mobilization fund which will be released upon the signing and approval of MOA, three releases were set as per agreed on the MOA. The first release caters 75% of the contract price with recoupment of the 15% advance payment and requires 75% output of the total number of target seedlings. Second release is 15% of the contract price, also with recoupment and having the remaining 25% number of target seedlings as output. Lastly, the third release is

the 10% retention fee which requires the 100% accomplishment of the target number of production.

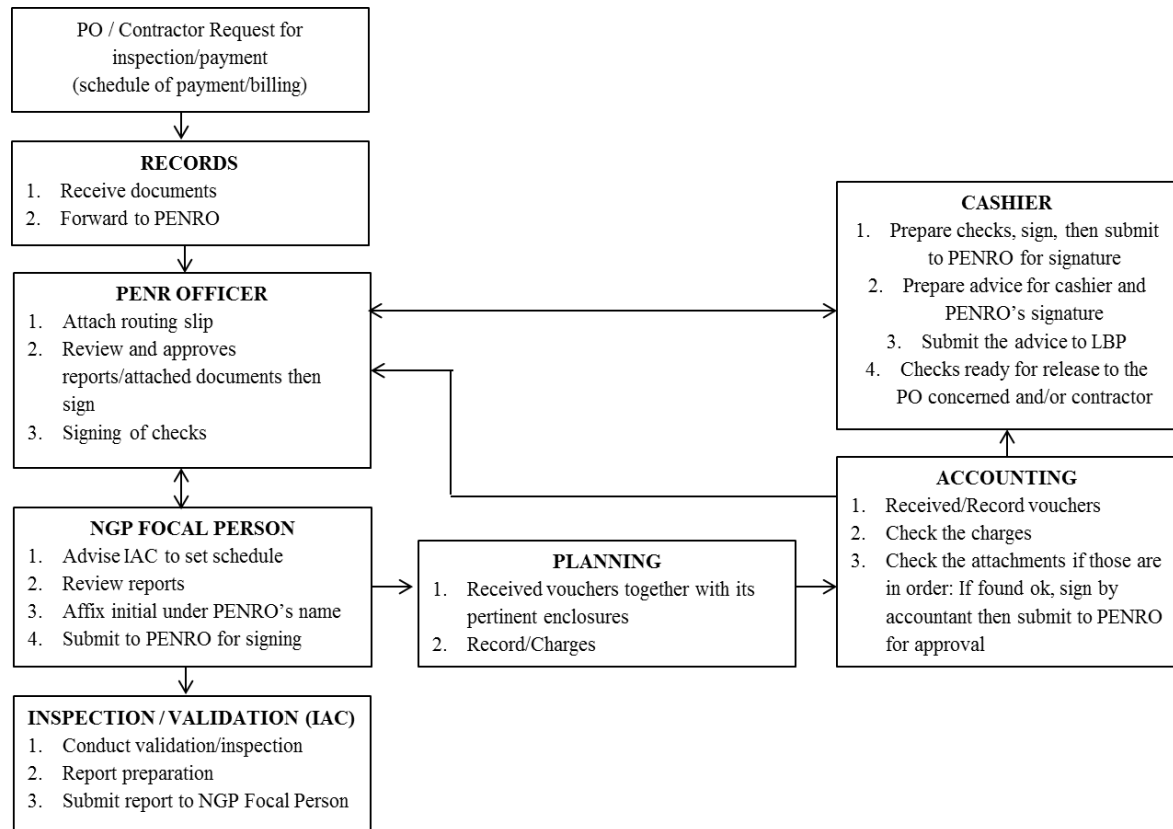


Figure P1.13. General flow chart of site validation and processing of payment for CDD and CSD in Sta. Cruz, Zambales.

For the site preparation and plantation establishment, which usually takes off June-September or June-December including construction of fire lines, the releases are also set to three excluding the advance payment of 15% as mobilization fund. The first release is set at 50% of the contract price with recoupment upon site clearing, site preparation, hauling of seedlings, hole digging, staking and 60% planted area out of the set target. For the second release, 40% of the contract price with recoupment and the same output with the first release and upon planting of the remaining 40% targeted area. Lastly, 10% of the contract price will serve as the retention fee and will be released upon 100% accomplishment of the set targets.

The maintenance and protection activities are set to be implemented for three years and contract is renewed every year. The first year contract has the price of PhP 1,000 per hectare, second year with PhP 3,000 per hectare and third year with PhP 2,000 per hectare. All those three years have the same set of activities. For the

first release, the requirement is 100% completion of ring weeding or strip brushing, patrol works and establishment of fire lines. Second release is set to be for the 100% completion of fertilizer application, maintenance of fire lines and conduct of regular patrol works. For the third and last release, 10% retention fee which will be released upon the accomplishment of total target under the maintenance and protection activities. Breakdown of releases for the three years maintenance and protection activities are shown in Figure P1.14.

The other NGP scheme in Zambales is the CSD. CSD involves private contractors who are interested to be part of NGP (Figure P1.15). The DENR will do the target setting for NGP under CSD and convene the Prequalification, Bids and Awards Committee (PBAC) and Technical Working Group (TWG) for the preparation of bidding documents and posting to Philippine Government Electronic Procurement System (PhilGEPS). If interested, a contractor must acquire bidding documents from DENR and attend the pre-bid conference and bidding process. The DENR will have post qualification of winning bidder and prepare the three year contract. Upon approval and signature of the contract by both parties, it will be submitted to PENRO-Accounting together with the approved work and financial plan including list of manpower for the request and release of the 15% mobilization fund. After the release of the advance payment of 15% of the contract price, the implementation of NGP activities will follow.

Like in the CDD, there is also a generic process flow for the request for site validation and payment in CSD. After each of the activity, the contractor will request for evaluation to the DENR. The IAC will evaluate and prepare report and if qualified, it will be endorsed for payment. Once endorsed, the billing will be processed in PENRO together with attachment of contractor's request, accomplishment report, IAC report, digitized map, geotagged photos, copy of contract and annual audited financial report. The voucher for endorse payment will be prepared by PENRO and will be checked and approved by the NGP focal person, PENR officer, accounting and cashier. Once approved, the check will be signed by the PENR officer and advice to cashier and LBP for release of the payment. Different releases are set for each year. For the first year, five releases were set upon agreement in the contract. The first release is 25% of the contract price with recoupment of the advance payment and upon the production of at least 50% number of seedling requirement. Second payment is 20% of contract price with recoupment upon the attainment of another 50% seedling production. Third payment is for site preparation and completion of 100% planting (30% of contract price with recoupment). Fourth payment is 25% of the contract price with recoupment and to be released upon the conduct of ring weeding and fertilizer application. Lastly, for the fifth release, 10% retention fee with recoupment upon attainment of total target in maintenance and attain at least 90% survival rate.

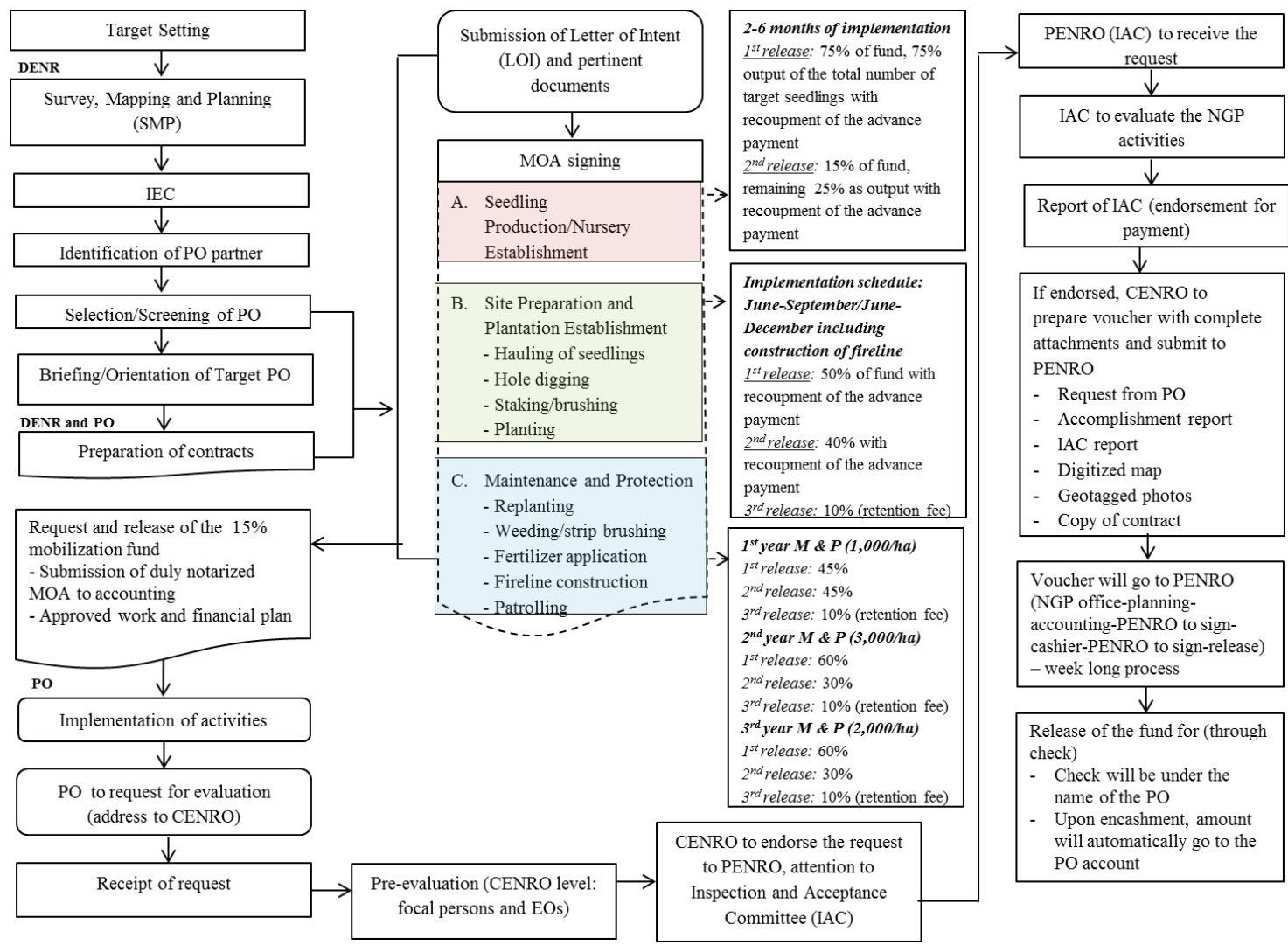


Figure P1.14. Process flow of Community Driven Development in Sta. Cruz, Zambales.

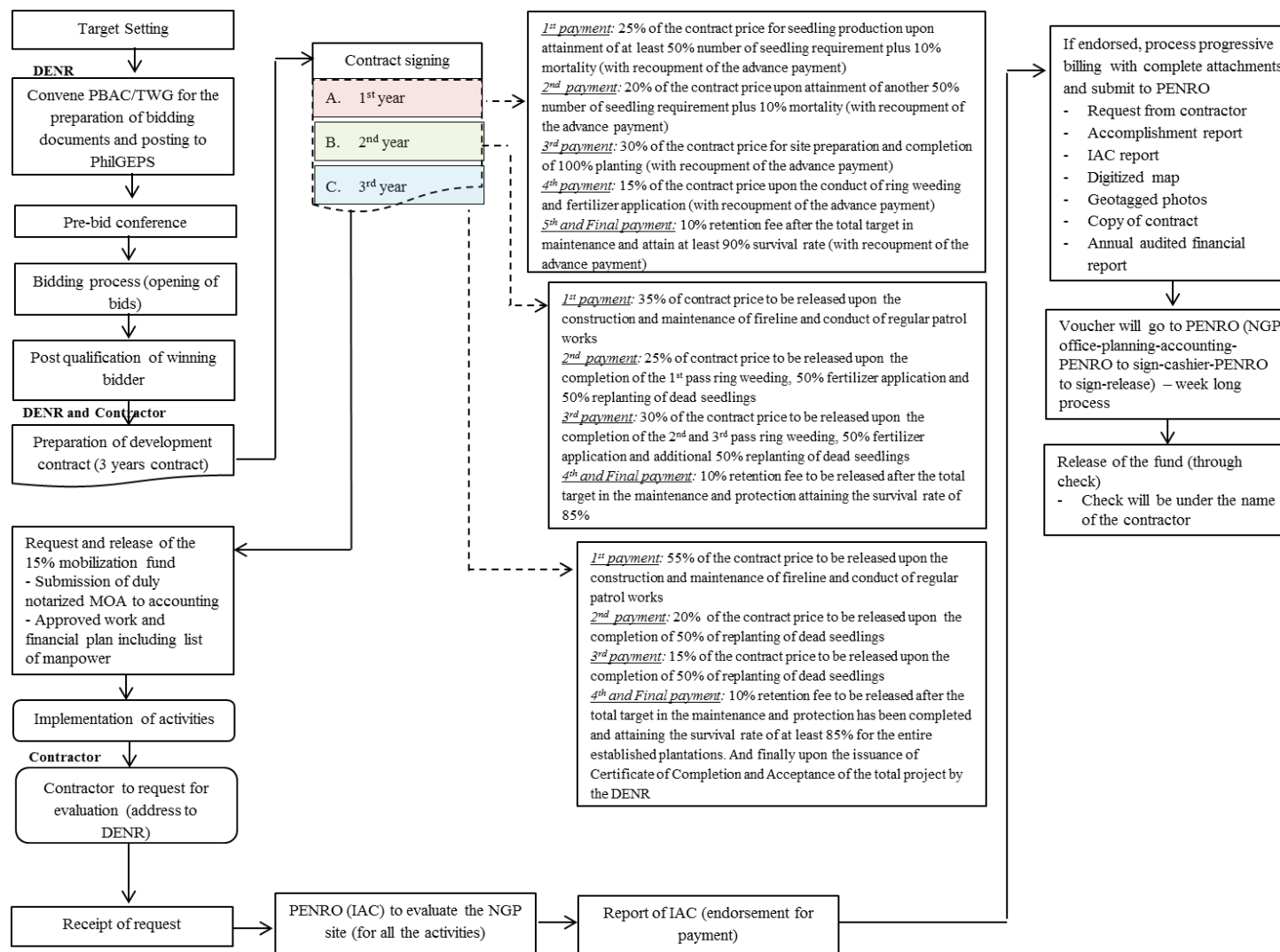


Figure P1.15. Process flow of Comprehensive Site Development in Sta. Cruz, Zambales.

For the second year, only four releases are set. First release would be 35% of the contract price which is set for the construction and maintenance of fire lines and conduct of regular patrol works. Twenty five percent (25%) for the second payment upon the completion of the first pass ring weeding, 50% fertilizer application and 50% replanting of dead seedlings. The third payment, 30% of the contract price involves the completion of the second and third pass ring weeding, 50% fertilizer application and remaining 50% replanting of dead seedlings. For the fourth and final payment, the 10% retention fee will be released upon the attainment of the total target in the maintenance and protection attaining the survival rate of 85%.

For the last year, the number of releases is also four. First payment of 55% is upon the construction and maintenance of fire lines and conduct of regular patrol works. The second payment, 20% of the contract price to be released upon the completion of 50% of replanting of dead seedlings. Fifteen percent (15%) of the contract price which is under the third payment will be released upon the completion of the remaining 50% of replanting of dead seedlings. Lastly for the fourth and final payment, 10% retention fee to be released after the total target in the maintenance and protection has been completed and attaining the survival rate of at least 85% for the entire established plantations. And finally upon the issuance of Certificate of Completion and Acceptance of the total project by the DENR.

2. Hinoba-an, Negros Occidental

In 2011, the NGP scheme in the Municipality of Hinoba-an was done through procurement (bidding), at least for seedling production. From 2011, until the 2013, NGP in the municipality was also implemented through individual contracts and CDD approach. The individuals were sending LOI to be able to become part of NGP and the agreement is set to be in a per activity or per year basis. Beginning 2014, the municipality adopted the CSD scheme for the implementation of the NGP. The CSD scheme was stated in every contract but the actual approach in the ground involves PO which was contracted for three years to conduct NGP activities from seedling production up to maintenance and protection.

Before the start of the activities for the first year, 15% mobilization fund will be released to the PO upon the submission of the duly notarized LOA and approved work and financial plan (Figure P1.16). And for the succeeding billings, a generic billing process for all the activities which starts from POs request for evaluation of their work was set. The request will be addressed to CENRO and CENRO to conduct an evaluation of the activity. Once it passed the evaluation, CENRO will endorse the request to PENRO for follow-up evaluation.

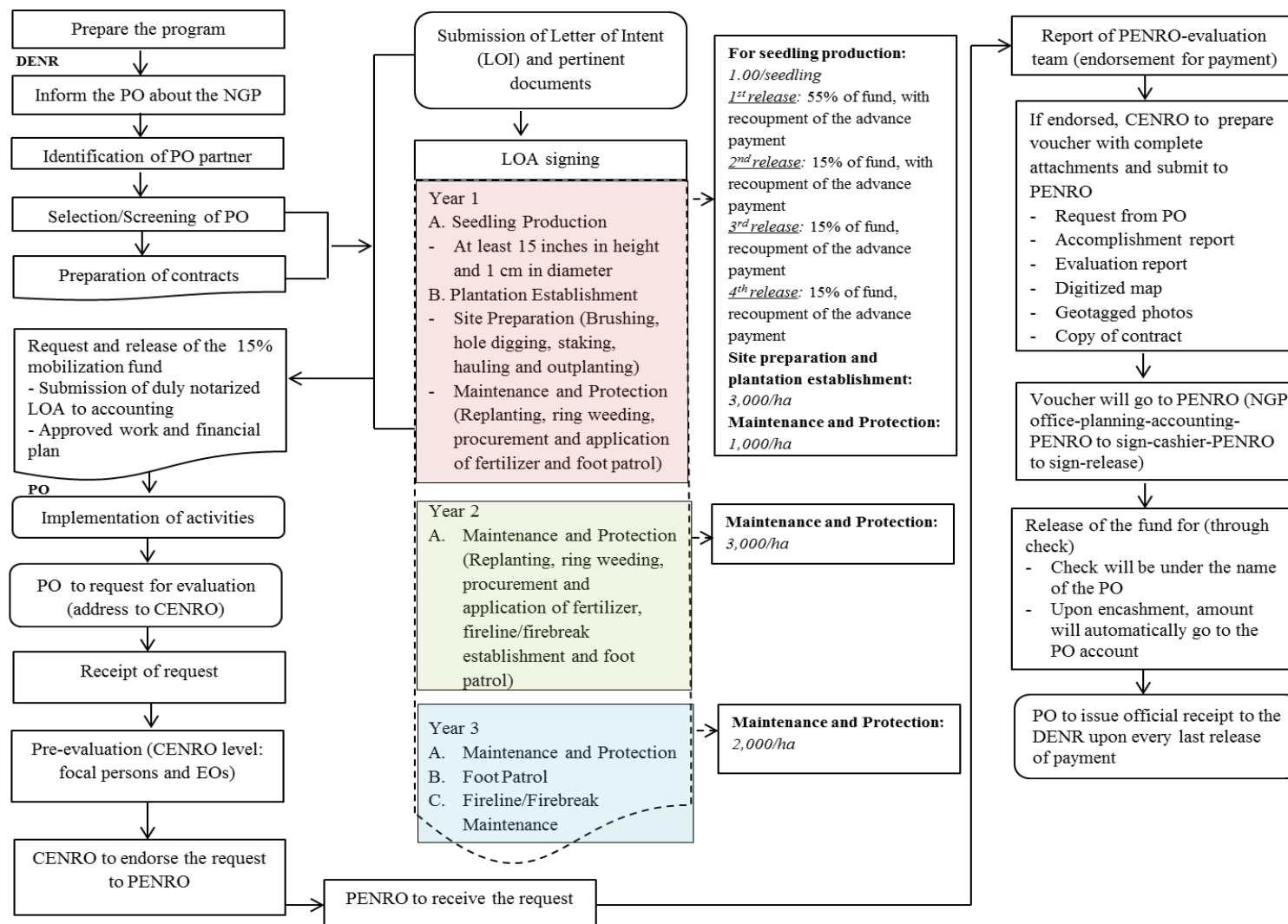


Figure P1.16. Process flow of Comprehensive Site Development in Hinoba-an, Negros Occidental.

If passed, PENRO will endorse the evaluation report to accounting for payment and the CENRO will prepare voucher with complete attachments of PO request for evaluation, accomplishment report, evaluation report, digitized map, geotagged photos and copy of contract. Voucher will be directed to PENRO-accounting for review and approval. Once documents are reviewed and approved, the check will be signed by the PENR officer and a certificate of completion and acceptance of the total project will be awarded by the DENR to the PO. After which, the check will be signed by the PENR officer and advice to cashier for release of the payment to the concerned PO. Lastly, the PO will issue official receipt to the DENR upon every release of payment.

The LOA in Hinoba-an has three components which indicates specific NGP activities for every year. For the first year of conduct, activities are set to be seedling production, plantation establishment and the first year of maintenance and protection. The payment for seedling production is PhP 1.00 per seedling and has four releases for the whole payment. First release is set to be 55% of the fund and the second up to the fourth payment is set to be 15% each, all with recoupment of the advance payment. Alongside with seedling production, the first year of implementation also caters plantation establishment which cost PhP 3,000 per hectare and first year of maintenance and protection which cost PhP 1,000 per hectare.

For the second year, the activity is maintenance and protection which includes replanting, ring weeding, procurement and application of fertilizer, fire lines/fire break establishment and foot patrol. The costing for the second year of maintenance and protection is PhP 3,000 per hectare. Lastly, for the third year of the contract, the third year of maintenance and protection was implemented with the specific activities of foot patrol and fire lines/fire break maintenance. The activities for this last third year have a budget cost of PhP 2,000 per hectare.

The general flow of disbursement for the municipality of Hinoba-an would start from the CENRO, followed by the document review and approval of PENRO and sectoral approval as well (Figure P1.17). The disbursement documents will then go to the planning office of PENRO for documentation and be directed to accounting for the process of payment. Once all of the necessary attachments were reviewed, the PENR will be required to sign the check and direct the cashier for the releasing of the check.

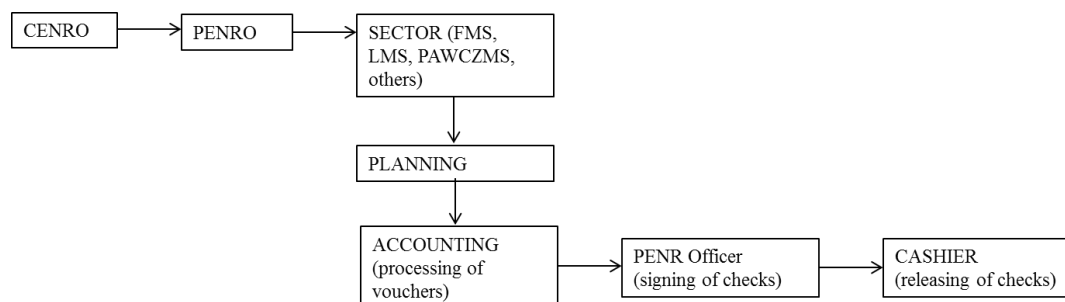


Figure P1.17. Disbursement flow in Hinoba-an, Negros Occidental.

3. Dinagat Islands

Since there are no established POs in Dinagat, PENRO-Dinagat have innovated the Pakyaw system for the implementation of the maintenance and protection activities of the NGP where it is to be noted that the plantation establishment is being done through social mobilization. The process is somehow similar to CDD, just that the agreement is solely between an individual, named as Pakyaw leader and the DENR (Figure P1.18).

The PENRO through the Punong Barangays invite the Pakyaw group and group leaders to participate in NGP (i.e. maintenance and protection activities). If the group is interested, they are required to submit LOI address to PENRO. Upon the receipt of the LOI, PENRO will then prepare the Pakyaw Agreement and will be reviewed by both parties. Upon approval, the agreement will be signed by representatives from both parties, notarized and submitted to the Accounting Department of PENRO along with the approved work and financial plan, schedule of work and schedule of payment. This is intended for the release of the 15% mobilization fund, usually takes 4-6 months to process. The 15% portion of the whole fund will be allotted for production/procurement of planting materials. The fund will be available through check under LBP and release to the Pakyaw leader in coordination with PENRO. Encashment will be done through LBP by the Pakyaw leader. Requirement for claiming the check is cedula and government ID. After the release of the 15% fund, the maintenance and protection activities are expected to start. Notice of Award and Notice to Proceed from PENRO will then be issued to the Pakyaw group and upon the start of the maintenance and protection activities, briefing on the conduct of NGP will first be directed. The Pakyaw group will commence within seven days upon the issuance of Notice to Proceed.

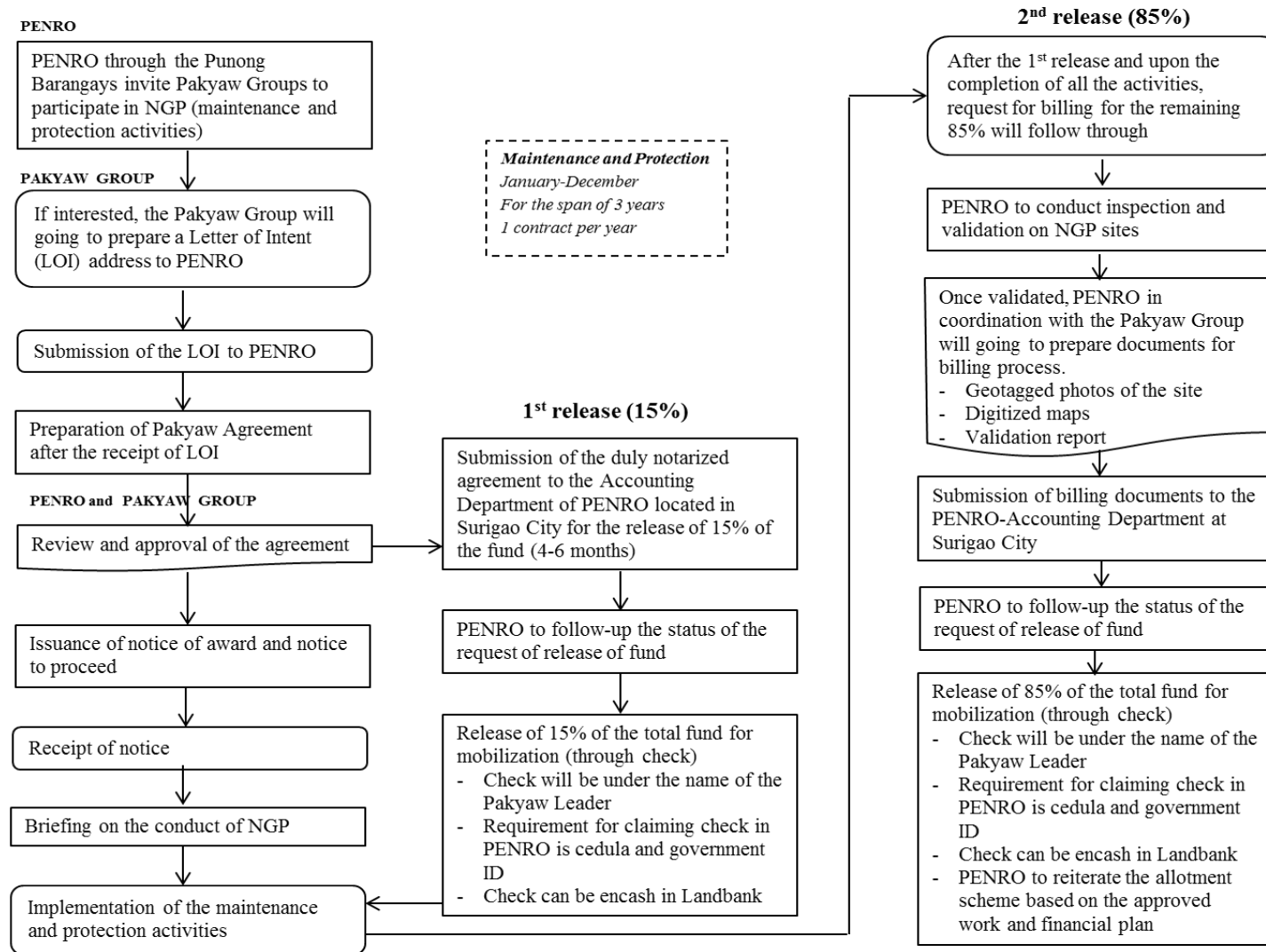


Figure P1.18. Disbursement flow of Pakyaw Scheme in Dinagat Islands.

The specifics of the maintenance and protection activities are seedling production, procurement and application of organic fertilizer (vermicast), strip-brushing, ring-weeding, staking and replanting. The usual duration of the contract is 11 months.

On the other hand, the second and final release (remaining 85% of the fund) will be after the completion of the replanting and application of organic fertilizer. Eighty five percent (85%) of the fund is allotted for site preparation, replanting and completion of organic fertilizer application. For the release of the remaining 85%, the Pakyaw group will request for inspection and billing to PENRO. Once validated, PENRO staff in coordination with the Pakyaw group will going to prepare documents for billing process, most important are the geotagged photos and validation report. Billing documents will then be submitted to the Accounting Department of PENRO and will be processed for another 4-6 months. Upon availability, the check will be released under the name of the Pakyaw leader. PENRO has the task to reiterate to the leader the allocation of the fund based on the approved work and financial plan and remind the proper disbursement to the involved persons in the activity.

Bottom-Up Budgeting (BUB) is another approach adopted by PENRO-Dinagat for the conduct of NGP (Figure P1.19). This approach entails full NGP activities from seedling production up to maintenance and protection. The LGUs are the main actors in BUB, who then submits a proposal regarding reforestation and rehabilitation to PENRO. Included in the proposal are the identified sites and portions regarding seed production, site preparation and development, and maintenance and protection for the sites. PENRO then review and approve or disapprove the proposal. Once approved, the LGU, through its Mayor will enter into a MOA with the PENRO for the proposed reforestation and rehabilitation activity which shall be counted under NGP. A Sangguniang Bayan (SB) resolution authorizing the Mayor to transact business will be prepared by the LGU in coordination with PENRO and then be submitted to the PENRO-Accounting Department for the first release of fund (15% for mobilization).

After which, NGP activities will be conducted. Inspection and validation activity will be directed by PENRO upon the request of the LGU. The second release (25%) will be available upon the attainment of the agreed number of seedlings with 10% allowance for mortality and at least three months after potting or the attainment of 50% of the height and diameter of the target species. Same billing process with the first release will be conducted for the succeeding releases with additional submission of digitized maps, geotagged photos and validation report from PENRO. The third release (25%) is set upon delivery by the CSOs and inspection by DENR at the planting site and the seedlings meeting agreed number and standards.

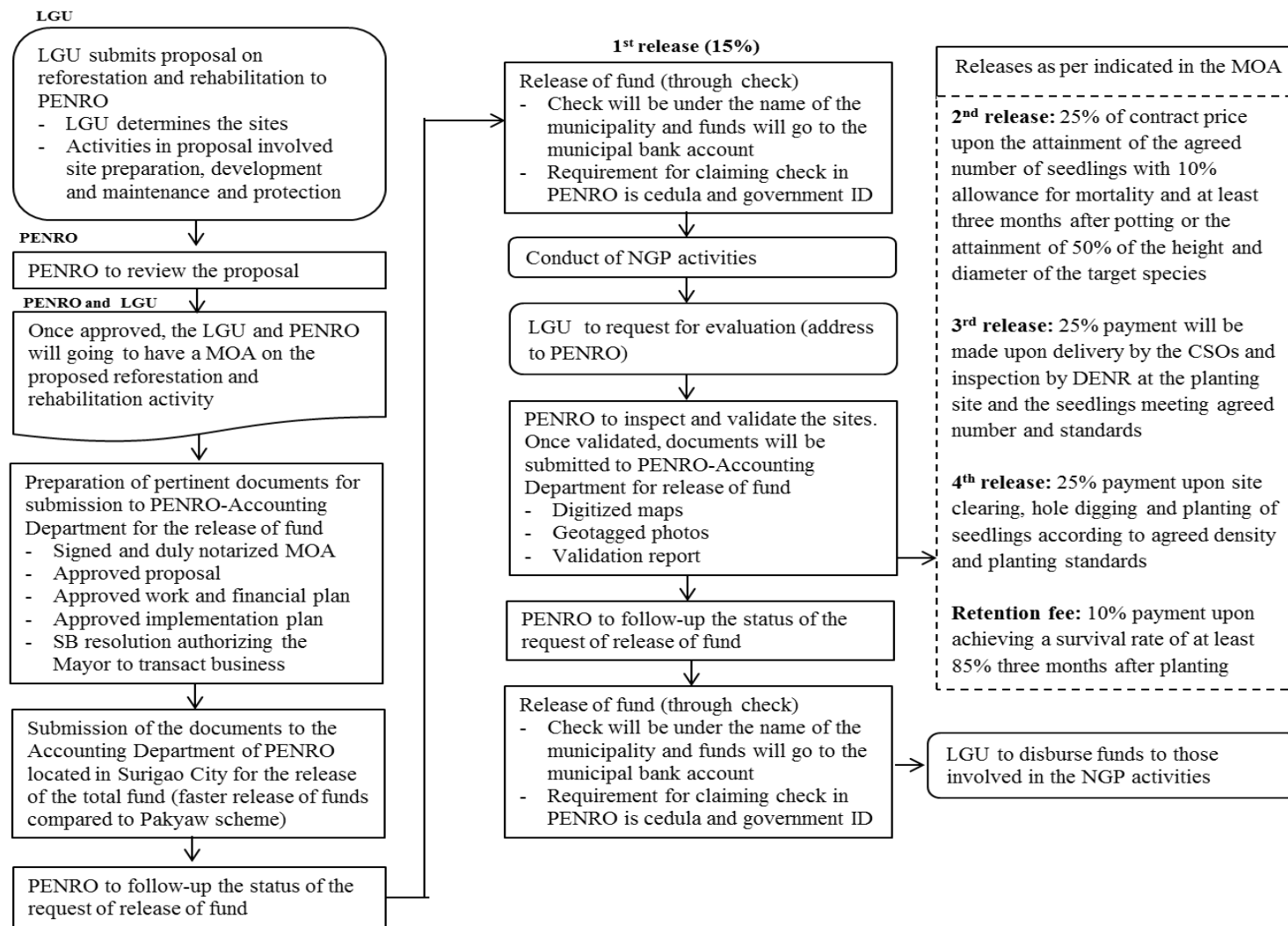


Figure P1.19. Disbursement flow of Bottom-Up Budgeting in Dinagat Islands.

The fourth release (another 25%), upon site clearing, hole digging and planting of seedlings according to agreed density and planting standards. Last will be the release of the 10% retention fee upon achieving a survival rate of at least 85% three months after planting. Following every release is the payment to the involved workers in NGP which will be led by the LGU. BUB contract will last for a year.

Barangay Forest Program (BFP) is also adopted in Dinagat as one of the NGP approaches (Figure P1.20). The objective of the BFP is to produce and plant tree seedlings in upland barangays within the 609 focused municipalities identified by the National Anti-Poverty Commission (NAPC) and within priority critical watershed areas as well as those affected by the recent calamities to support the NGP.

PENRO is the responsible party for the identification of barangays which will be included in the program. The selection will be based on the barangay classification (third class and below) and the potential sites for reforestation and rehabilitation. In Dinagat, three barangays in Hibosong, one barangay in Libjo and five barangays in Basilisa are currently involved in the program. Upon identification and finalization of the list of barangays, there will be a MOA between the barangay (represented by the Punong Barangay) and PENRO stating the specifics of the activity. The duly notarized MOA along with the approved work and financial plan, implementation plan and resolution authorizing the Barangay Chairman to transact business will be submitted to the PENRO-Accounting Department for the release of the 15% fund for mobilization (first release).

NGP activities will follow through upon the first release, which includes seedling production up to maintenance and protection. Inspection and validation after each activity will be conducted by PENRO upon the request of the LGU in order to release the remaining funds. Once approved, the validation report with digitized map and geotagged photos will be submitted to PENRO-Accounting Department for billing process. The second release (50%) will require the attainment of 100% nursery established and developed and 100% seedling production of 10,000 native species plus 20% mortality allowance. Another 25% of the project cost is allocated for the third release which has the requirement of 100% site preparation of 20 hectares and 100% plantation establishment. Lastly, for the release of the 10% retention fee, 85% survival rate of the 20 hectares established plantation three months after planting is required.

Following every release is the payment to the involved workers in NGP which will be led by the BLGU. The duration of the BFP contract is three years.

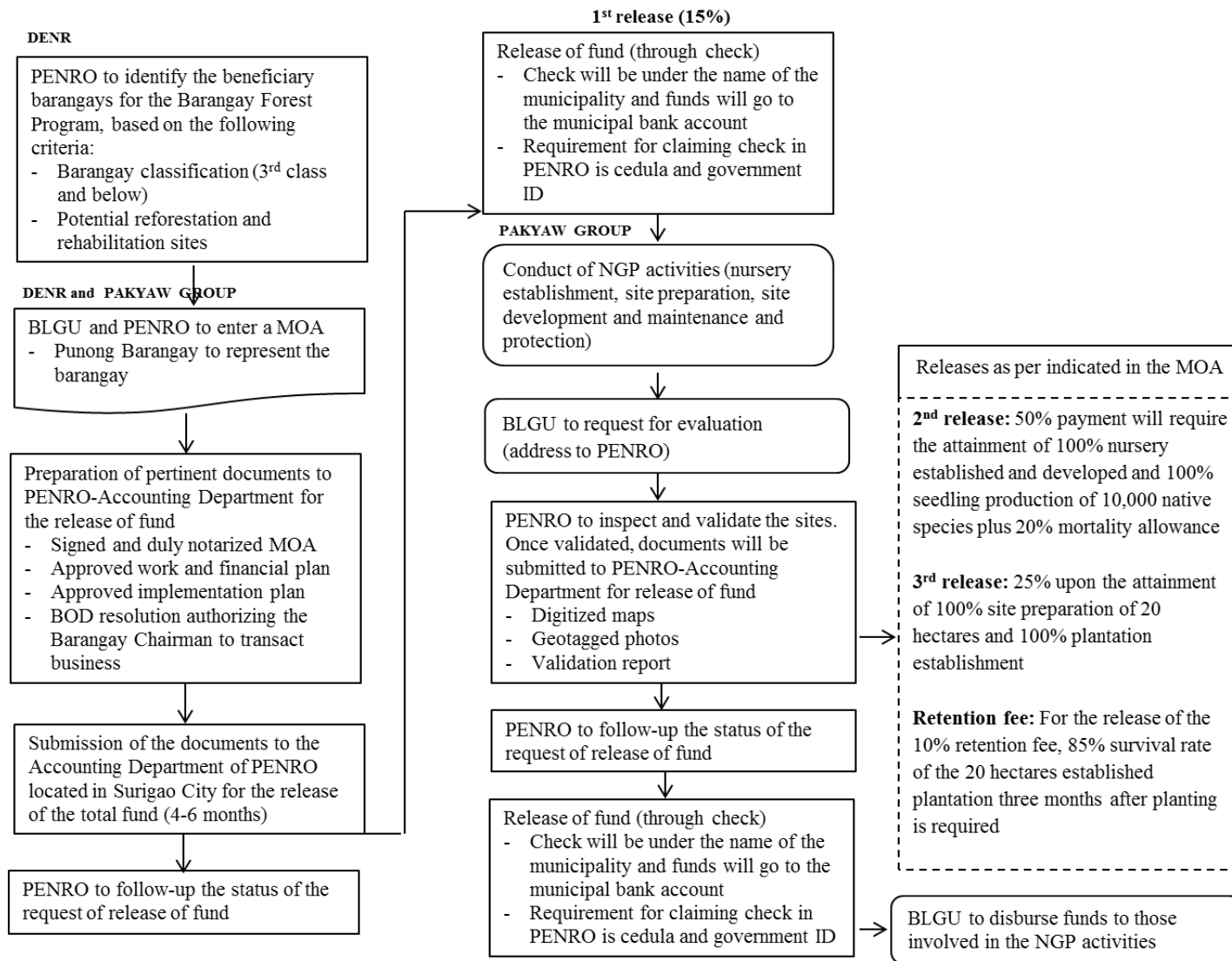


Figure P1.20. Disbursement flow of Barangay Forest Program in Dinagat Islands.

B. Economic Impacts of NGP with Propensity Score Matching

The probit⁶ estimation of propensity scores for each observation to be matched using all the matching processes (radius, kernel and nearest neighbor) has yielded both the economic correlates of NGP and the economic variables that have complied with the balancing requirement of PSM. Table P1.7 shows the simpler version of the original list of economic variables used in PSM. The variables with superscript a shown in Table P1.5 are the ones discarded for the subsequent matching procedures based on propensity scores. Of the variables in Table P1.7, age, years of education, membership on organization, household size, and awareness of NGP are considered correlates of NGP intervention based on their significant coefficients. Of these five variables, membership in organization, household size and awareness of NGP are the economic correlates that have a positive relationship with NGP. Based on their estimates, they are likely to increase with the increasing probability that the sites of the household residents is within the NGP implementation.

The significance of the average treatment effects on the treated (ATT) is used as the basis in determining the impacts of NGP on the economic condition of the people in the selected three sites. The estimation of ATT values has applied the three matching procedures mentioned for robustness and consistency check. The matching procedures have observed common support constraints, bootstrapping of errors and replications of 100, besides the epanovich bandwidth set at 0.06 for kernel and the default radius at 0.1 for radius matching. The results of the analysis demonstrate the stringency of the kernel matching procedure which shows no significant impact from NGP intervention.

PSM dropped the variable in the specification model that does not meet the balancing property criterion inherent in the estimation of propensity scores. Household real expenses in 2014, gender and knowledge of tree roles were dropped. Hence, no generalization could be made with these variables on the basis of NGP impacts since PSM fails to find the required matches for proper comparison (Table P1.8).

⁶ The impacts of NGP intervention on the economic correlates have been examined using propensity score matching, which uses a probit model in the estimation of propensity scores to ensure verifiable and unbiased findings on the impacts of NGP on the socio-economic condition of the locals in the tree sites selected. Probit analysis is a binary choice model that was estimated using Stata software. The probit command in Stata assumes that the response variable is coded with zeros indicating a negative outcome and a positive, non-missing value corresponding to a positive outcome (e.g. increased household income after NGP intervention).

The use of probit and logit models will result in the same statistical conclusion, even if the underlying assumptions regarding the distribution of the cases and the error term differ. Probit is commonly used in economics rather than logit because economists generally favor the normality assumption of this model. The assumption of normality makes specification problems associated with statistical analysis easier to analyze and interpret than with the standard logistic distribution (Wooldridge, 2010).

Table P1.7. Probit estimates on the economic correlates of NGP.

Variable	Coefficient	P-value
Intercept	-0.608	0.02
Household real income in 2014	0.000	0.62
Age	-0.008**	0.03
Years of education	-0.065***	0.00
Years of residency	0.005	0.15
Membership in organization	0.527***	0.00
Involvement in training/seminar	-0.048	0.65
Household size	0.046*	0.06
Number of working HH members in 2014	-0.010	0.89
Awareness of NGP	1.312***	0.00
Awareness of ES	-0.131	0.21
Knowledge of watershed	0.145	0.18
Log likelihood	-460.205	
Number of observations	855	
LR Chi ² (11)	261.830	
Prob>chi ²	0.000	
Pseudo R ²	0.222	

*** Significant at 1% level of significance, ** Significant at 5% level of significance, * Significant at 10% level of significance

Table P1.8. ATT Estimates of the economic variables for NGP impacts

Variable	Radius matching		Kernel matching		Nearest neighbor	
	ATT	t-stat	ATT	t-stat	ATT	t-stat
age	-0.385	-0.33	-0.416	-0.28	0.247	0.135
years of education	-0.368	-1.21	-0.263	-1.01	0.013	0.04
years of residency	1.440	0.94	1.029	0.69	2.446	1.26
membership in organization	0.017	0.51	-0.010	-0.33	-0.004	-0.13
involvement in training	0.003	0.07	-0.005	-0.12	0.051	1.181
household size	0.287*	1.64	0.254	1.41	0.157	0.667
household income real 2014	264.826	0.51	297.504	0.58	962.682	1.513
number of working household member	0.014	0.26	0.026	0.42	0.113*	1.666
awareness of NGP	0.042*	1.84	0.000	0.00	-0.009	-0.82
awareness of ES	0.003	0.07	-0.005	-0.10	0.013	0.243
knowledge of watershed	0.001	0.01	-0.016	-0.43	0.013	0.245

* Significant at 10% level of significance

For the radius matching procedure, *household size* and *awareness of NGP* shows the ATT estimates were positive and significant at 10% level. NGP has a positive significant contribution to the household size in the three sites. This is expected since most of the NGP activities entail manual labor from seedling production, land preparation and planting, and up to maintenance and protection activities. An extra hand would be a handy contribution in the attainment of targets set forth in the MOA or contract. Moreover, respondents perceived that NGP has made a significant impact in their community given their positive perception or knowledge of NGP in their area. This may indicate a feeling of contentment with participating in the NGP activities since it provides extra income during the lean months of rainy season. Communities were generally grateful for the additional income provided by NGP and they were able to manage their time between farm work and NGP activities. The household survey shows some increase in income but the increase was not statistically significant. Household income in real 2014 values was only significant at about 12% level. Hence, for the respondents from the three sites included in the study, we cannot see significant impact of NGP at 10% level. House income, being an important economic parameter would have to be analyzed with the use of other analytical methods such as instrumental variables to check NGP's influence on it and to elicit insights from these alternative analyses.

The ATT estimates of the *number of working household member* was also positive and significant at 10% level based on nearest neighbor matching procedure, which may imply that NGP has made significant improvement in the employment of the locals in the three sites selected. This is somewhat supported by the ATT result on the number of working household members where NGP intervention is implied to have done a slight service to the people in the three sites.

C. Income, Income Distribution and Job Generation

Communities were generally grateful for the additional income provided by NGP and were able to manage their time between farm work and NGP activities. The household survey results show some increase in income for households from Sta. Cruz, Zambales and Hinoba-an, Negros Occidental, except in Dinagat Islands, but the increase is not statistically significant. The average real household income of the NGP recipients before the NGP (2010) and during the NGP (2014) is seen to be statistically the same (Table P1.9). It is also to be noted from these results that the case of Dinagat is somehow different because the average real household income has decreased in hundreds during the NGP, though it is not statistically significant. This result mirrors the PSM's outcome, which was discussed above.

Just like the average real monthly household income of NGP recipients for 2010 and 2014, the 2014 average real monthly household income of the NGP recipients and non-

NGP households was also seen to be statistically the same (Table P1.10). Again except for Dinagat Islands, NGP household beneficiaries has much higher average real household monthly income of PhP 7,341 compared to the average real household monthly income of non-NGP households of only PhP 4,988, which was statistically different.

Table P1.9. Average real monthly household income of NGP recipients in Zambales, Negros Occidental and Dinagat Islands, 2010 vs. 2014.

	2010 HH Real Income				2014 HH Real Income			
	Zambales	Negros Occidental	Dinagat	Pooled	Zambales	Negros Occidental	Dinagat	Pooled
Average total household income	9,978	6,443	6,921	7,510	10,777	6,503	6,098	7,341
SE total household income	909	553	375	328	954	461	292	312

2010 base year, SE is standard error

Table P1.10. Average real monthly household income in Zambales, Negros Occidental and Dinagat Islands: NGP vs. Non-NGP.

	2014, NGP				2014, Non-NGP			
	Zambales	Negros Occidental	Dinagat	Pooled	Zambales	Negros Occidental	Dinagat	Pooled
Average total household income	10,777	6,503	6,098	7,341	10,179	6,197	4,988	7,045
SE total household income	954	461	292	312	132	193	339	191

2010 base year, SE is standard error

For the household monthly real expenses (real value) of the NGP beneficiaries, the top three expenses for 2010 are food, tertiary education and loan. While for the year 2014, top three were food, tertiary education and secondary education. Food being the top expense for 2010 and 2014 has the household spending value of around PhP 2,000 plus and the expense for food for both years is statistically the same. There is a change in the third top expense in 2010 and 2014. For 2010 the third most expense is the loan accounting to an average expense value of PhP 1,131 and has decreased to PhP 648 in 2014. While for 2014, the third top expense is seen to be secondary education having an average expense value of PhP 800 as compared to the value of PhP 657 in 2010.

For the comparison of other values in 2010 and 2014, the expenditures for health, electricity, leisure and transportation have increased in 2014. While the aforementioned expenditures have increased, the following have decreased in 2014: primary education, water, communication, church activities, credits, tax and clothes. Of which, church activities incurred a significant change from PhP 415 in 2010 to PhP 108 in 2014. For both years 2010 and 2014, the category with least expense value is water with an average expense value of PhP 70 in 2010 and a lesser value of PhP 57 in 2014. Other expense categories such as insurance and annual celebrations expense were also accounted and were seen to be statistically the same for both 2010 and 2014 (Table P1.11).

Table P1.11. Distribution of monthly household real expenses, 2010 vs. 2014 for the three sites.

Expenditure Item	2010 Real		2014 Real		% Increase or Decrease	Rank
	PhP	%	PhP ^a	%		
Leisure/vices	220	2%	445	4%	51%	1
Electricity	239	2%	271	3%	12%	2
Health	557	5%	614	6%	9%	3
Secondary education	737	6%	800	8%	8%	4
Transportation	383	3%	385	4%	1%	5
Tax	421	4%	417	4%	-1%	6
Food	2,470	22%	2,378	24%	-4%	7
Others	690	6%	626	6%	-10%	8
Clothes	498	4%	437	4%	-14%	9
Primary education	658	6%	548	5%	-20%	10
Communication	220	2%	182	2%	-21%	11
Tertiary education	2,271	20%	1,848	18%	-23%	12
Water	70	1%	57	1%	-23%	13
Credits	498	4%	326	3%	-53%	14
Loan	1,132	10%	648	6%	-75%	15
Church activities	415	4%	108	1%	-284%	16
Total	11,479	100%	10,092	100%		

2010 base year

Jobs generated are also monitored under the NGP. Jobs generated in NGP are accounted under the Community-Based Employment Program (CBEP) of the Department of Labor and Employment (DOLE). Jobs generated is measured for CBEP monitoring as counts of jobs filled, wherein “a person is counted every time his/her name appears on one payroll because he/she holds more than one job or changes jobs during the reference period (DOLE, 2013, p10).” This is not a good indicator of real employment since it is possible that a person may be counted twice or more in a year since NGP contracts are prepared

per activity and not per year. Hence, a true measure of employment may have to be studied in further detail to better analyze the possible impacts of NGP on local employment.

In 2014, based from the on-site data, Negros Occidental has the most number of jobs generated under CBEP (Table P1.12). Increasing trend on jobs generated in Negros Occidental was also observed from 2012-2014. It is followed by Zambales and the least of the three is Dinagat, mainly because Dinagat is adopting social mobilization for planting and only contracting individuals for maintenance and protection activities.

Table P1.12. NGP list of jobs generated based on Community Based Employment Program.

Province	Number of Jobs Generated based on CBEP		
	2012	2013	2014
Zambales			866
CENRO Botolan			412
CENRO Masinloc			165
CENRO Olongapo			289
Negros Occidental	6,061	8,558	13,601
CENRO Bacolod City	2,014	2,000	6,720
CENRO Cadiz City	2,859	4,864	4,204
CENRO Kabankalan City	514	466	779
CENRO Sibalay City	504	476	1,470
Mt. Kanlaon Natural Park	170	752	428
Dinagat Islands			120
Municipality of Basilisa			72
Municipality of San Jose			21
Municipality of Loreto			9
Municipality of Dinagat			14
Municipality of Libjo			3
Municipality of Tubajon			1

(Sources: PENRO-DENR, Province of Zambales; PENRO-DENR, Province of Negros Occidental and PENRO-DENR, Province of Dinagat Islands)

In general, the community has a positive perception on the possible effects of NGP, especially in economic terms. Majority of households interviewed from the three sites perceived that there was a significant increase in income due to NGP (74%), an increase in household assets (44%), increase in household capability to send children to school (60%), increase availability of food (76%), and increase capacity to participate in NGP activities (Table P1.13). While there was no statistical difference in the real income of

households before and after NGP and comparing NGP-household recipients vs. non-NGP household recipients, any additional income received by locals is crucial to their daily needs. In reality, income is a real issue among these locals. A difference of P1,000 additional income per hectare would matter a lot to these locals.

Table P1.13. Perception of household respondents on the effect of NGP, in %.

Perception on the effect of NGP	YES(%)			
	Dinagat	Negros Occidental	Zambales	All
Significant increase income	64	75	92	74
Increase in household assets	34	29	80	44
Increase in household capability to send children to school	48	63	83	60
Increase availability of food	66	82	86	76
Increase capacity to participate in NGP activities	37	56	76	52

D. NGP Implementation Cost and Efficiency

The NGP implementation cost is relatively low compared with actual cost because the NGP recipients are assumed to cover the protection and maintenance cost after year 3. Based on FMB-DENR Technical Bulletin 10 (2014), the NGP average cost per hectare is PhP 21,421 (Table P1.14). About PhP 16,421 of it is allotted for the establishment activities which include seedling production, SMP, site preparation, IEC, transportation and mobilization. The remaining PhP 6,000 maintenance and protection costs is divided into PhP1,000 for first year, PhP3,000 for second year, and PhP 2,000 for third year. The NGP's maintenance and protection cost is relatively low compared with existing cost standards for Philippine Forest development and rehabilitation. The NGP cost for maintenance and protection for three years is only PhP 6,000 compared with the DENR MC 2000-19 wherein a 4x4 spacing has a budget of PhP 21,596; a 5x2 spacing has a budget of PhP 34,222; and a 2x3 spacing has a budget of PhP 40,346, all values in 2014 real terms. As per Carandang and Carandang (2009), the maintenance and protection cost of a reforestation activity in the Philippines should be 50% of the total reforestation cost. Computing its percentage, it only accounts for 28% of the total NGP cost, which is way lower than the suggested 50%.

The NGP average cost of PhP 21,421/ha is relatively low compared with PhP 40,000/ha budget for PICOP Resources; PhP 78,000/ha budget for ABS-CBN Bantay Kalikasan Foundation; and PhP 75,000/ha for UP Land Grant (Carandang and Carandang, 2009).

Table P1.14. Cost of National Greening Program implementation.

Species/Commodity	Seedlings			SMP	Social Mobilization		First Year Maintenance and Protection	First Year Total	Maintenance and Protection		Total Cost Per Ha
	Density (per ha)	Unit Cost	Cost PerHa		Site Preparation	IEC, Transportation, & Mobilization			Second Year	Third Year	
Indigenous	500	12	6,000	450	3,000	1,000	1,000	11,450	3,000	2,000	16,450
Fast growing (R)	500	10	5,000	450	3,000	1,000	1,000	10,450	3,000	2,000	15,450
Fast growing (R)	1,000	10	10,000	450	3,000	1,000	1,000	15,450	3,000	2,000	20,450
Fuelwood	1,000	6	6,000	450	3,000	1,000	1,000	11,450	3,000	2,000	16,450
Coffee (from seeds)	500	12	6,000	450	3,000	1,000	1,000	11,450	3,000	2,000	16,450
Coffee (Luzon) - Clonal Propagation ^a	500	20	10,000	450	3,000	1,000	1,000	15,450	3,000	2,000	20,450
Coffee (Visayas) - Clonal Propagation ^a	500	18	9,000	450	3,000	1,000	1,000	14,450	3,000	2,000	19,450
Coffee (Mindanao) - Clonal Propagation ^a	500	15	7,500	450	3,000	1,000	1,000	12,950	3,000	2,000	17,950
Cacao (budded)	500	25	12,500	450	3,000	1,000	1,000	17,950	3,000	2,000	22,950
Rubber (from seeds)	500	15	7,500	450	3,000	1,000	1,000	12,950	3,000	2,000	17,950
Rubber (budded)	500	35	17,500	450	3,000	1,000	1,000	22,950	3,000	2,000	27,950
Bamboo	500	35	7,000	450	3,000	1,000	1,000	12,450	3,000	2,000	17,450
Rattan	500	20	10,000	450	3,000	1,000	1,000	15,450	3,000	2,000	20,450
Mangrove (Propagule)	2,500	3	7,500	450	3,000	1,000	1,000	12,950	3,000	2,000	17,950
Mangrove (Potted)	2,000	15	30,000	450	3,000	1,000	1,000	35,450	3,000	2,000	40,450
Other fruit trees (grafted)	200	25	5,000	450	3,000	1,000	1,000	10,450	3,000	2,000	15,450
Urban greening (saplings) ^b	400/ha or km	75	3,000	450	3,000	1,000	1,000	35,450	3,000	2,000	40,450
Average			9,382	450	3,000	1,000	Average cost per ha	16,421	3,000	2,000	21,421

^aincludes cost for protection, ^bonly for key cities; (Source: FMB Technical Bulletin 10, 2014)

Accounting the true survival rate⁷ estimated by the environment component (Appendix Table P1.3), the computed output (area planted with surviving seedlings) per cost ratio shows that the program is not so efficient. Israel and Lintag (2013) reported an average output/cost ratio of 0.1225 from 1994-2009 data which is much higher than the estimated average (0.03) from the three sites for 2011-2014 of NGP implementation (Table P1.15).

On efficiency aspect, the NGP staff at the PENRO and CENRO levels claim that the targets are unrealistic. The Commodity Road Map for 2013, crafted due to the low survival rates from 2011-2012, was a welcome opportunity for the local DENR to re-plan more realistically and prepare catch-up plans that would ensure that previous targets missed are still reached within the term of the program. However, the targets for the region remained the same and as such, the ever-increasing number of hectares raises the bar year after year.

Table P1.15. Area planted, obligated budget and area planted/obligated budget ratio, Regions 3, 7 and 13, 2011-2014.

		Total area planted (ha)	% survival ^a	Area with surviving seedlings (ha)	Obligated budget '000	Output/Cost Ratio
Region III	2011	5,556	100.00	5,556	82,000	0.07
	2012	12,601	66.67	8,401	216,991	0.04
	2013	21,079	77.79	16,397	410,525	0.04
	2014	22,338	56.59	12,642	431,441	0.03
Region VI	2011	5,450			65,932	
	2012	11,052			170,989	
	2013	26,982	97.10	21,167	501,665	0.04
	2014	21,046	70.76	16,511	387,020	0.04
Region XIII	2011	5,082			62,387	
	2012	8,085			155,716	
	2013	5,056	59.00	2,983	303,070	0.01
	2014	34,723	26.89	9,338	376,042	0.02
					Average	0.03

^a See Appendix Table P1.3. (^bSource: DENR, 2015)

⁷ EDC's survival rate was 40-60%. EDC does not experience an 85% survival rate, they are lucky once the computed survival rate is 70%.

For 2015, NGP has a budget of PhP 7 billion compared with a meial PhP 500 million enforcement/forest protection budget. If we look at the NGP budget per region (Figure P1.8), it was observed that the NGP further distributed its budget to the regions where there is a lower percentage of forest cover, may be suggesting that the DENR's strategy is more inclined to forest development than that of forest protection.

E. Other Findings

1. Survival rate of seedlings is high on initial years but declining through time

The current practice of computing for the survival rate is based on the number of planted seedling that survived at the time of validation divided by the number of seedlings planted based on the contract for a given area. Using this formula, the measured survival rate in the three sites as of 2014 is given in Table P1.15. For example in Region III, the survival rate in 2011 was 100% and it declined to 56.59% in 2014.

After planting, maintenance and protection is contracted out to POs for CDD. This contract is performance-based and specifies 85% survival rate before the final 10% of the contract amount is paid. This assures DENR of high survival rate at no additional cost, the cost being born by the contracted POs or households/invididuals. The study found that the number of seedlings used in replanting to attain at least 85% survival rate can be as high as 160% more than the original number planted. For this reason, the project provided an alternative computation based on the number of planted seedlings that survived divided by the total number of seedlings planted that includes both initially planted based on the contact and the number replanted. The survival rates dropped by 20% to 50% from the initial computations.

2. There are observed and perceived positive effects of NGP implementation on the environment

Communities in the NGP sites in Zambales observed an increase in stream flow in areas planted in 2011. The laboratory results of samples taken by the team seem to validate the observation. Laboratory results show that soil moisture has increased and on site measurement shows that temperature is lower in the NGP sites compared to bare areas. Survey shows that the respondent's perceived significant climate changes after the implementation of NGP in their areas.

3. Community perceptions on NGP are generally positive

There is high awareness on the positive effects of forests in maintaining ecological integrity. They regard forests as defense against severe flooding and in maintaining water levels in rivers, streams and irrigation canals. The respondents also acknowledge that their involvement in NGP augmented their income albeit only in the short term. This mirrors the results of PSM, a procedure employed to analyze the economic impacts of NGP on the three sites selected.

4. Delays in the payments made by DENR put POs in a difficult financial situation

The delays, as explained by DENR, were due to delays in the release of fund from the DBM. Regardless of reason, the delays in payment forced POs to take loans with very high interest rates (as high as 15% every 15 days) just to pay the services of members involved in NGP. It also encouraged the practice of cashing Land Bank checks at grocery stores and other “agents” for a fee of 2%-5% of the amount. It reinforced the members’ doubts of corruption and collusion between DENR and PO leaders.

5. Promised of incentives for communities not enough in current instruments (MOA) to sustain the positive impacts of NGP

The current NGP program is not clear on the direct benefits on the communities, except on the short-term contracts, especially in untenured areas. To encourage communities to protect the plantations, future NGP interventions should include in its design socio-economic incentives to ensure the sustainability of reforested areas. Incentives can take the form of harvesting rights, livelihood support in the interim (e.g., marketing and product development support, capacity building and organization development support), mechanisms for long term financing such as payments for ecosystem services schemes, and addressing tenure issues by continuing CBFM in a sustained but judicious manner. In particular, harvesting incentive in contracts or MOAs should be clearly indicated.

Moreover, the “social mobilization” strategy in Zambales and Negros Occidental failed because it only considered DENR’s objectives and not the community goals, needs, aspirations, and capacities. The social mobilization activity focused on-one-time only tree planting activity of various groups – government agencies, students, private businesses as part of the corporate social responsibility activity, and civic groups.

V. SUMMARY AND CONCLUSIONS

NGP is by far the largest and widest reforestation effort in the country fully funded by the Philippine government. This study, focus on economic component is concerned with scoping and process evaluation. Three study sites were randomly chosen for this phase and these are Zambales, Negros Occidental and Dinagat Islands. These three sites present distinct characteristics (natural environment, reforestation strategy and communities involved) that will enable comparison and analysis of factors affecting the performance of NGP.

On the implementation approach, we can glean that there is no “one-size fits all” NGP strategy that would increase the likelihood of success. Social mobilization was not that effective in Zambales and Negros Occidental since some of the participants in the tree planting activities does not have the capacity and technical experience to be effective. By nature, NGP activities are very labor-intensive and is set to be community driven, provided that enough support funding were provided by the government through the DENR field offices. However, the program may be a disservice to the local when they are the one who carry the actual cost of replanting. This is problematic when survival rates are declining and efficiency is very dismal. With increasing targets of area planted, efficiency measured in terms of survival rate over actual seedlings planted declined over the years, i.e. from 2011 to 2014. This was evident in Zambales.

In terms of average income, NGP household recipients experienced some marginal increase, though it was not statistically significant. The same is true when comparing NGP household recipients vs. non-NGP household recipients. Changes was more obvious in average household monthly real expenses wherein the expenditures for health, electricity, leisure and transportation have increased in 2014 while expenditures for primary education, water, communication, church activities, credits, tax and clothes have decreased in 2014. Employment was generated from the labor intensive NGP activities, specifically during the plantation establishment such as seedling production, site preparation, transportation, and actual planting in the NGP sites.

Furthermore, this study has employed PSM in order to get rid of selection bias and endogeneity in the estimation process of evaluating the economic impacts of NGP in the three sites selected. This study has accounted the influences of NGP on the parameters of the economic condition of people in the selected sites. Although the analysis did not indicate whether local people in the NGP sites get richer or poorer, due to disqualification of household income from PSM, the effects of NGP on the local people have evidently induced bigger household size, higher number of working household members, and positive perception on NGP activities. These are all positive short term gains that would benefit the community as a whole with the NGP implementation until 2016. There is

more to do with further increasing the positive perception on NGP so that implementation pitfalls will not be repeated again in future implementation of post-NGP.

VI. RECOMMENDATIONS

1. There is a need to review the costings of reforestation activities and allocate more funds for maintenance and protection beyond the usual three years. The budget should be commensurate with realistic targets on the ground and availability of personnel. Following Carandang and Carandang (2009), the suggested total cost per hectare of forest plantation development, considering spacing and peculiarities of labor cost in different areas, should be from PhP 44,180/ha (2014 real value) for the first three years of operations under 4x4 m spacing up to PhP 88,983/ha (2014 real value) for the first three years of operations under a 2x3 m spacing. From this total cost, the suggested budget for maintenance and protection of reforestation projects should be 50% of the total cost of forest development, i.e. PhP 22,090/ha to PhP 44,491/ha (2014 real value). The suggested distribution of costs for the first three years of operations would be: 55% of the total cost for the 1st year (i.e. PhP 24,299/ha to PhP 48,941/ha); 26% of the total cost for the 2nd year (i.e. PhP 11,487/ha to PhP 23,136/ha); and 19% of the total cost for the 3rd year (i.e. PhP 8,394/ha to PhP 16,907/ha). The bulk of forest development activities is heavy in costs during the first year, hence it was allocated the most budget for the three years of operations.
2. There is a need to audit all NGP activities. Hence, a sequential implementation of activities should be followed and for every contracted NGP activity, corresponding audit should be done. For example, an audit is needed to assess the forest restorability cum quality of the stand/sites identified in the SMP. Likewise, the assessment should look into the financial, economic, and social viability of the proposed reforestation in the area (provincial or regional level).
3. Outcome-based monitoring and evaluation by a third-party technical working group(s) based on the following expanded criteria: quality of seedlings, canopy closure and microclimate, biodiversity condition and true survival rate of seedlings.
4. There is a need to revise the incentives appropriate in a given reforestation site. In particular, harvesting incentive in contracts should be clearly indicated in the contract or MOA. For example, planted fast growing tree species may be harvested (with proper control mechanisms or safety nets to avoid abuse) to meet the national timber requirement of the country.

5. To sustain the gains of reforestation and attain the intended long-term outcomes, future program should increase support to forest protection of existing forests. This can be coupled with improving community organizing that delivers true local people empowerment and inclusive participation, organizational development and capacity building of partner POs. The expected net-benefits that can be gained from protecting existing forests and those planted through NGP from 2011-2016 may outweigh the expected net benefits from the implementation of Natural Forest and Landscape Restoration Program.
6. Some results still need to be validated in Phase II. A more detailed economic impact can be estimated through the conduct of an extended benefit-cost analysis, which will provide estimates of BCR, NPV and IRR.

PART II: QUANTIFYING THE POTENTIAL ECONOMIC AND POVERTY EFFECTS OF THE NATIONAL GREENING PROGRAM⁸

I. INTRODUCTION

Between 1990 and 2013, the Philippines has lost 3.8 million hectares of forest, which represents 36% of its 1990 forest cover. If no intervention is implemented, its forest cover will continue to deteriorate to 6 million hectares by 2050. This continued deforestation have negative effects on the environment, health, agricultural productivity. The National Greening Programing (NGP) which was implemented in 2011 through the Executive Order 26 was designed to increase reforestation. Through the reforestation program, the government hopes to address other related problems on poverty, food securing, environmental stability and biodiversity conversation, and climate change.

The NGP can potentially result in large scale environmental changes that have economy-wide effects. However, to date most valuation methods used to analyze these changes employ partial equilibrium models, which are limited in their consideration of economic and ecological spillovers effects. So for Phase I of this NGA Assessment Project, a computable general equilibrium (CGE) model is used to quantitatively assess the potential economic and poverty effects of the NGP. In the assessment, a CGE model was specified, calibrated and used to simulate two broad scenarios: (i) a baseline or a business-as-usual scenario that incorporates the current forest deterioration in the Philippines, and (ii) a NGP scenario which implements a reforestation program that reverses the continued reduction in the country's forest cover. The CGE model was calibrated to a social accounting matrix of the Philippine economy in 2012. The CGE model incorporates a land-use module which is critical in the assessment. The model also incorporates factor efficiency parameters in production to accommodate the health effects of changes in the environment on labor, and the climate change effects on the productivity of agricultural land.

The results of the CGE simulation were utilized in a poverty microsimulation model to quantify the economy-wide effects on poverty and income distribution poverty and income distribution effect of the NGP. The poverty microsimulation was calibrated to the 2012 Family Income and Expenditure Survey. Figure P2.1 shows how the models are used in the analysis.

⁸ Prepared by Caesar B. Cororaton, Arlene Inocencio, Marites Tiongco and Anna Bella Manalang

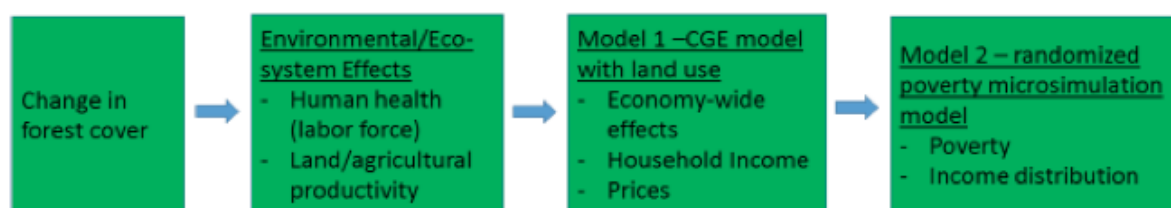


Figure P2.1. Framework of analysis.

The next sections of the report includes the literature review, description of the CGE model and its assumptions, and simulation results on sectoral output, land utilization, factor markets (factor prices and demand), product markets (production, consumption and commodity prices), household income across decile, poverty and income distribution.

II. LITERATURE REVIEW

A. CGE Applications in Forestry

One way of measuring the economy-wide effects of forestry policies and programs such as forest rehabilitation, reforestation, and afforestation is through the use of CGE models. CGE models are useful in simulating the effects of macroeconomic policies and external shocks because it is based on a flow matrix where different sectors in the economy interact according to a predetermined set of rules and equilibrium conditions (UNEP, 2011), including even social and environmental indicators (Bussolo and Medvedev, 2007). Several studies conducted in foreign countries have employed CGE in assessing the diverse impacts of forestry policies.

Dee (1991) studied the distributional impacts of numerous forest protection and industry policies in Indonesia using a multi-sectoral CGE model. The model accounted for both forest and non-forest sectors where the former was represented by a steady state solution to an intertemporal harvesting problem, and the latter was reflected by conventional single-period production functions. There were a total of seven policy instruments used, four of which concerned forests while the remaining three were industry related. The forest policy instruments were: (a) an increase in the minimum size of trees that can be harvested; (b) the creation of a national park; (c) an increase in the length of forest leases to concessionaires; and (d) a Pigouvian tax on forest output. On the other hand, the industry policy instruments were: (a) removal of a log export ban; (b) removal of agricultural and processing assistance; and (c) removal of assistance to all industries. Two alternative treatments of land mobility were carried out. The first scenario treated land use in all industries as fixed. The second dealt with land as mobile between agriculture and forestry with the economy moving towards the use where there are greater discounted returns.

The results indicate that the impact of both forest protection and industry policies depend on the flexibility of land-use patterns. The simulations show that if land is mobile between agriculture and forestry, the following effects take place - *First*, all policies except the Pigouvian tax increases the amount of land converted to forestry; *Second*, removing assistance from agriculture increases the volume of standing timber; and *Third*, the burden of a decrease in real GDP caused by forest protection need not fall on the rural poor. Notwithstanding the foregoing, all forest policies were found to reduce annual forestry output and cause an increase in log prices.

Studies below reflect the general equilibrium effects of forest rehabilitation programs in the form of afforestation and reforestation.

Afforestation consists of planting trees on land previously used for other purposes. The existing literature lacks studies on the economic implications of converting agricultural land into forest land, and setting it aside as carbon graveyards. Monge et al. (2012) addressed this gap by using a static regional CGE model in assessing the long-run impacts of a government-funded afforestation-based carbon sequestration program in the United States on the following: (a) the annual carbon removal contributions by set-asides, privately owned timberland and harvested wood products; (b) land-use change in different major land resource areas; and (c) the production and prices of related commodities. The afforestation activities targeted were afforested set-asides and an expanding commercial forestry industry under different management intensities and a 5-year rotation age extension.

The CGE model used took into account the economic shocks affecting land allocation between agriculture and forestry, as well as the dynamic nature of forest-based carbon sequestration. Four types of nesting structure were employed - a productions nest, a land market nest, an afforestation activity nest, and a nest for carbon dioxide offsets generated by the commercial logging industry. These structures were based on constant return to scale and nested constant elasticity of substitution functions.

The results show that for a carbon offset price of \$10 per metric ton carbon dioxide (MTCO₂), 76 million acres of agricultural land were afforested and set aside for sequestration purposes from North Dakota to Northern Texas. The commercial forestry industry also expanded in the regions adjacent to the Mississippi River and Ozark Mountains. When it comes to the production and prices of related industries, the beef cattle industry was negatively affected with a decrease in production by 4%, an increase in price by 7%, and the highest consumption reduction across all households. On the other hand, basic crops such as oilseeds and grains were not severely impacted by the afforestation program with a price increment of only 1%.

The study of Monge, et al. (2012) focused only on the primary impacts of afforestation in the economy. On the contrary, Michetti and Rosa (2012) examined both the primary and secondary costs and benefits of afforestation-reforestation and timber management (AR-TM) in European climate policy. The research looks at the changes in the carbon stabilization costs, amount of carbon sequestered given a carbon price, land use, and land and timber market prices, as well as the magnitude of leakage of afforestation-reforestation.

The Inter-temporal Computable Equilibrium System (ICES) model was used; it is a multi-country and multi-sector global CGE model. It is recursive-dynamic, developing a sequence of static equilibria, linked by an endogenous process of capital and debt accumulation. Nevertheless, in this case, only a simplified structure of the economy with only one-time jump from 2001 to 2020 was utilized. It also availed of a nested structure for its production process and final demand. It assumed that the total amount of carbon stored by forests is 34% to 40% via AR and 54% to 63% via change in TM. It is also assumed that TM does not impact land use change but only timber supply, while AR activities affect land use change.

The economy starts from a business-as-usual scenario where climate policy or the AR-TM opportunities are disregarded. Two policy scenarios were then simulated. The first is where Europe-27 (EU27) countries unilaterally commit to a 20% GHGs emission reduction below 1990 values by 2020. The results imply a reduction in the EU27 GDP of 1% compared with the baseline. The prices of agricultural goods decreased by 0.6%, and the price of land went down by 1.6%. The leakage effect in the form of fossil fuels use increase in the regions outside the policy boundaries is +1%. Still, this leads to a positive net global CO₂ emission reduction at a reduced policy cost. The second scenario requires a 30% reduction of emission from EU27. In this context, there is a reduction in GDP by almost 2%, prices of agricultural goods by 1%, and prices of land by 2.3%. The leakage effect is +1.5%.

Michetti and Rosa (2012) were able to demonstrate the pivotal role of AR-TM activities. Although AR only comprises 20% of the EU27 emissions mitigation efforts, it allows the achievement of the 30% emission reduction target with only 0.2% GDP cost compared to a 20% emission reduction without AR. Also, the use of AR-TM decreases the following: policy costs through a savings of 28% on average for both targets, carbon price by 27% and 30% for the 20% and 30% emission reduction targets respectively, and the leakage effect by around 0.2% for both emissions reduction cases.

Yet, Monge, et al. (2012) and Michetti and Rosa (2012) centered only on the climate change effects of afforestation. Bassi (2013) looked into how reforestation will affect the

entire social, economic, and environmental structure using system dynamic modeling. The direct, indirect, and induced impacts of reforestation, such as but not limited to avoided expenditure and additional benefits, to the economy were measured. These effects were projected from 2013 to 2015, and analyzed over the short, medium, and longer term. This sector specific evaluation was complemented with a macroeconomic analysis carried out using the CGE model.

Two scenarios were simulated using CGE. The first one was a business as usual (BAU) case. This presumes the continuation of historical trends and the existing policy framework. The second one was a green economy (GE) scenario. This supposes that there are investments in reforestation programs with the goal of stopping deforestation by investing in planted forests for productive purposes. The assumptions in the model include the presence of five types of forests, a deforestation rate of 0.7% to 1.5%, and carbon emissions between 1,100 and 9,133 tons CO₂. The last two are dependent on the type of forest. Furthermore, the reforestation policy starting 2014 is that the planted forest area matches the total forest area cleared from primary and secondary forests, and rainforests. The reforestation investment is 1.96 million pesos per km² of planted forest based on the 2011 United Nations Environmental Programme estimate.

Projections from 2020 to 2035 were made on the following: total forest area, the total amount of carbon stored in forest land, the annual CO₂ emissions from forests, forestry production, forestry value added, forestry employment, and forestry income. The values from 2020 to 2035 for both BAU and GE scenarios were decreasing. Nonetheless, the results show that the GE scenario is better because it gives a higher projection compared to the BAU scenario for all areas.

These studies show the importance of being able to comprehensively measure the contribution of forest rehabilitation programs to the economy.

Brazil has implemented a similar program, which is called the National Forests (FLONAS), with the goal of expanding the Brazilian forest by 50 million hectares (ha). The paper of Pattanayak et al. (2009) looked at the health and wealth impact of the FLONAS using a CGE model. The main idea of the paper was to understand how the changes in the ecosystem (environmental changes) affect human health and wealth. There are at least three pathways human health are affected by changes in the ecosystem: (a) *direct* – floods, heat waves, or drought; (b) *ecosystem-mediated* – altered infectious disease risk and reduced food yields (malnutrition, stunning); (c) *indirect-displaced-deferred* – varied health consequences of livelihood loss, population displacement (e.g, dwelling in slums), and conflict. The link between changes in the ecosystem and human health is complex, but the paper focused on pathway (b), the ecosystem-mediated, particularly the regulation of infectious diseases. In many tropical settings, changes in

climate and land uses (particularly deforestation) represent a potent environmental disease risks. The paper looked at how the expansion of the Brazilian forest by 50 million hectares under the FLONAS can mitigate these environmental disease risks. The paper adopted a CGE in the analysis. In their model they incorporated several equations that represent land use. In particular, the land use representation in the model is shown below (Figure P2.2).

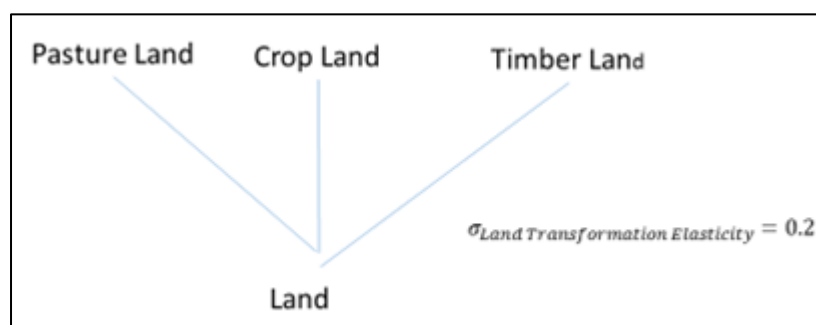


Figure P2. 2. Land movements and transformation in the CGE model.

The specification above is generally similar to the land use representation in the Philippine CGE model that will be used to analyze the poverty impacts of NGP, except for two items. The Philippine CGE: (a) includes land use for residential/commercial; and (b) disaggregates crop land into major crops using another nested CET function. Residential/commercial land use is included because the high population growth in the Philippines resulted in fast conversion of land into uses for dwellings. Disaggregation of land into major crops is important in understanding how agriculture is affected by the NGP and how agricultural farm households and other households in rural areas are impacted.

Another important feature of the CGE model in Pattanayak et al. (2009) is the specification of the labor supply. The labor supply function provides a link between the impact of diseases on labor supply and the rest of the economy. In the model labor supply was specified as

$$\bar{L} = f(H_t) = \Phi(L_t + l_t), \text{ where } \Phi = f(\text{Disease, etc})$$

\bar{L} is labor endowment (time available in a day, which is divided into labor time (L) and leisure time (l_t)). The health impacts associated with diseases effectively enter as a scale factor (Φ) on the amount of labor available.

In the Philippine CGE, labor supply is fixed, but it grows annually based on population growth. Thus, there is no equation that specifies labor supply. This is because the objective in the NGP is to evaluate the poverty effects. As stated at the outset, poverty is affected by changes in household income or commodity prices or both. Thus the link such

as (9) may not be necessary in the analysis of the poverty effects. What is critical is the poverty microsimulation model that translates the CGE effects into household income and expenditure and poverty effects.

The Pattanayak et al. (2009) paper developed several scenarios, but the three important ones were: (a) a baseline scenario that incorporated the Intergovernmental Panel on Climate Change's (IPCC) moderate projection of higher temperature by 2°C that would cause fluctuations in rainfall of $\pm 15\%$; (b) Climate Change Plus Deforestation; and (c) the FLONAS where forest in Brazil increased by 50 million hectares. Their major findings indicated that climate change and deforestation lead to higher incidence of infectious diseases in humans and therefore decreases labor supply. The decrease in labor supply is higher in rural areas than in urban areas. Overall, welfare declined as a result. The increase in forest by 50 million hectares under the FLONAS program decreases the incidence of infectious diseases and therefore increases labor supply. Overall welfare improved as a result.

B. Climate Change, Land Use and Forestation/Reforestation Programs

It is difficult to quantify the effects of agriculture activities and changes in land use which includes conversion of crop lands into forest or agroforest. Forestation has been closely related to climate change through its mitigation effects. There are a few methods and models that have recently been developed to study effect of changes in land use on climate change (Turner II et al., 2007). Models which build scenarios that involve both the impact and contribution of agriculture to climate change are among the next-generation scenarios that challenge climate change research (Moss et al., 2010). These models combine an understanding of the variability in earth's climate system, its response to human and natural influences and the effect of changes on the populations.

The modeling framework of Wang et al. (2011) incorporates both the biophysical and socioeconomic drivers for land use into a regional climate system model. In particular, the model focuses on the impact of land use and the natural vegetation dynamics, i.e., the response of natural vegetation to predicted climate changes and the resulting climate feedback.

The study of Michetti (2012) examined various models on land-use, land-use change and forestry (LULUCF). It was pointed in the study in order to cater global dimensions of land-use system and a realistic representation of LULUCF, there should be a use of a spatial and global framework, which integrates the environment, economics and biophysics. Among all methods the integrated assessment model (IAM) represents the most advanced modeling strategy to deal with the complexity of the land-use system. It employ both geographic and economic models while including biophysical considerations, but despite this progress IAMs it should render more transparency of the

interactive spheres and to allow for the inclusion of more feedback effects. New generation IAMs models would enhance future land demand and supply projection under baseline or under climate stabilization scenarios.

In the literature, several CGE models are linked with partial equilibrium models to better capture the climate change-agriculture and land use dynamics. The IAM is an example where a CGE model is linked with a partial equilibrium-agricultural model for land-use (Palatnik and Roson 2009). The IAM model contains detailed representation of the different economic processes. However, one drawback of IAM is that the integration of the CGE in model is not consistent with the partial equilibrium, thus convergence of the two is not always assured. The CGE and the partial equilibrium models use different assumptions, data sources, data, and units of measurements.

Applying the necessary adjustments in the CGE parameters, Ronneberger, et al. (2009) show that changes in emissions and crop production move in the same direction as changes in GDP and welfare. Changes in trade balance and crop prices move in the opposite direction. The simulations demonstrate that crop production adjusts according to the pattern of induced yield changes brought about by climate change. Higher yield increases crop production while lower yield decreases production. Any yield losses are compensated by increasing the area used for production which increases prices, negatively affects the balance of trade, and decreases GDP and welfare. Furthermore, the model simulation shows that climate change has a negative impact on GDP and welfare for most regions except for Central America and South Asia, and sub-Saharan Africa, Canada and Western Europe; the former group with stronger gains and the latter group with smaller gains.

Lin and Byambadorj (2009) assessed the long-term impacts of climate change on agricultural production and trade in China using a global CGE. They found that climate change results in a 1.3% decline in GDP and a welfare loss of 1.1% in 2080. China's agricultural productivity declines, which increases the country's dependence on world agricultural markets. This effect leads to additional losses in welfare and output through unfavorable terms-of-trade effects. China's food processing sectors are negatively affected by the decline in agricultural productivity as well as the decline in global agricultural productivity as a result of climate change.

Zhai and Zhuang (2009) employed a CGE model to assess the economic effects of climate change for Southeast Asian countries through 2080. The simulation results suggest that global crop production decreases by 7.4%. There is uneven distribution of productivity losses across the different regions, with higher decline in developing countries. A reduction in global agricultural productivity has non-negligible negative impacts on Southeast Asia. With lower agricultural productivity, the dependence of

Southeast Asia on crop imports increases, causing welfare losses. The negative effects are lower in Singapore and Malaysia, but higher in Indonesia, Thailand, Vietnam, and the Philippines. GDP in the last three countries contracts by 1.7% to 2.4%.

Michetti and Parrado (2012) presented a CGE model to analyze the potential role of the European forestry sector within climate mitigation. The paper has extended the traditional ICES CGE model and the new version accounts for land heterogeneity across and within regions and even land mobility. This included endogenous agent's decisions on land allocation between agriculture and forestry, and forest-sector characteristics. The model addresses one of the main conceptual challenges of modeling terrestrial mitigation options, which is simulating competition for land between different land-use activities. Results showed that the slowdown of the European economy follows to the inclusion of emission quotas, where European regions experience a GDP reduction of 2.4% and 3.9 % in 2020. It was further suggested in the study that other European regions must also take part in a climate stabilization agreement. Indeed, in terms of forest carbon mitigation, regions detaining old-growth forests would have necessarily a higher mitigation potential compared with the regions characterized by temperate forests.

Golub et al. (2009) divide the earth into agroecological zone (AEZ) and employ a global model with land allocation mechanism to study the effects of land use change on greenhouse gas emissions. AEZ is a land resource mapping unit, defined in terms of climate, landform, and soils and has a specific range of potentials and constraints for cropping (FAO, 1996). The study demonstrates that as population and per capita income increase and consumption patterns change, the strongest growth in consumer demand is predicted in the forestry sector due to the increased demand for furniture, housing, and paper products. At the same time, unmanaged forest lands are converted to production lands in all regions except in places where no unmanaged forests are available. In Australia, New Zealand, North America, Latin America and Western Europe, land used in forestry production declines while that for agriculture expands. Within the agricultural sector in these regions, more land is used for crops while less is used for livestock production. In the rest of the regions, including Southeast Asia and South Asia, land employed in commercial forestry expands while that for agriculture contracts as a response to increased demands for forest-based products worldwide.

Pant (2010), incorporated land use change and forestry in a dynamic CGE model. It splits the forestry activity into three parts- planting, holding and harvesting. The framework of the study can be used in a CGE model to support implementation of the proposed reduced emissions from deforestation and forest degradation (REDD) scheme. The model can be used also to project the effects on food production and prices of an increase in bio-fuel subsidies.

In Ethiopia, climate change was assessed in terms of its effect on crop and livestock farming and how these effects extend throughout the country, in terms of economic growth and poverty reduction. Gebreegziabher et al. (2011) simulated the impacts of climate change induced variations in land productivity in the Ethiopian economy in the 2010-2060 period by using a dynamic CGE model with a social accounting matrix (SAM) that depicts production by sector in detail, including agriculture and manufacturing. It also employed the Ricardian model from to simulate the impacts of the changes in temperature and precipitation indicated by the climate projections from the Intergovernmental Panel on Climate Change. Results demonstrate that there is a dramatic impact of climate change even in the high-growth scenarios, especially that agriculture dominates Ethiopia's economy completely and any climate-change impacts on agriculture will be considerable in the coming decades.

C. CGE Models and Poverty Microsimulations

Research that looks at the effects of climate change on poverty supplements the CGE model with poverty microsimulation models that use detailed household data from household surveys. The CGE model accounts for the impact of climate change on macro variables such as agricultural productivity and production, commodity demand and prices factor demand and factor returns, and household income. This set of information is used to change the distribution of household income in household surveys. There are several poverty simulation models available in the literature such as the Global Income Distribution Dynamics (GIDD) of the World Bank (de Hoyos 2008), Estrades (2013), Cockburn (2001), Cororaton and Corong (2009).

van der Mensbrugghe and Medvedev (2010) produced simulations of their paper with the World Bank's Environmental Impacts and Sustainability Applied General Equilibrium (ENVISAGE). ENVISAGE is a relatively standard CGE model, with a specific focus on the energy side of the global economy, it also contains a simple climate module that makes it suitable for integrated assessment analysis. The model is global, recursive dynamic CGE with 2004 base year. While the distributional analysis is carried out with the World Bank's Global Income Distribution Dynamics (GIDD) model, which applies the existing CGE-microsimulation methodologies. Result shows that climate change damage increases poverty in 2030 with the poverty headcount rising by 0.2 and 1.2 percentage points at the extreme and moderate poverty lines, respectively. The adverse effects of climate change vary significantly by the main source of household earnings. Although climate-change damage is concentrated in agriculture, the agricultural households are not necessarily the most affected. The ultimate impact of climate-change damage on agricultural households depends on whether the increase in the output price is sufficient to compensate for the welfare loss due to the higher cost of feeding the family. Mitigating the negative effects of climate change is always pro-poor in Latin America,

but the efficient strategy reduces the losses significantly and may even benefit the poorest households.

Buddelmeyer et al. (2012) considered a specific approach of disaggregating output from a dynamic computable general equilibrium (CGE) model into impacts at the household and individual level. They linked a CGE model and an MS model in a sequential way. The approach allows the computation of the potential distributional effects of the policy changes simulated in the model. The approach is applied to assess the impacts on household income of two climate-change mitigation policies compared to a reference case without mitigation. The simulations are carried out for the period from 2005 to 2030 in Australia. Results show that these two mitigation policies are likely to have positive distributional effects despite a slightly negative effect on average real income. To a large extent, this is due to the redistribution of carbon permit revenues to households on a per capita basis through lump sum transfers.

D. CGE Applications in Philippine Forestry

The earliest CGE models of the Philippines were done by Clarete (1984) on trade policy and Habito (1984) on fiscal policy and income distribution. Since then, quite a number of models have been constructed that evaluated the impacts on welfare, poverty, outputs, prices, international trade, consumption, employment, pollution emissions, income distribution, food security, forestry, and agriculture, among others. For Philippine forestry, CGE model was employed to assess the effects of commercial logging ban on equity, efficiency and the environment (Rodriguez, 2003). Other studies have been conducted using CGE in assessing the diverse impacts of forestry policies in the country.

Dufornaud et al. (2003) concentrated on quantifying the costs arising from a moratorium on commercial logging in the Philippines. The costs measured included (1) welfare losses to domestic consumers, (2) decrease in employment, and (3) foreign exchange requirements in the importation of the logs to meet domestic needs. Using a CGE model, two different scenarios were simulated under two policy regimes. The scenarios included full employment, and less than full employment. The policy regimes were a total ban on commercial logging, and a total ban on commercial logging accompanied by an across-the-board reduction of import tariffs. For both scenarios of full and less than full employment, the results showed that the reduction in welfare is greater under a ban compared to a ban with a tariff reduction. Under full employment, the decrease in welfare is PhP 15.3 billion and PhP 8.6 billion respectively, while with less than full employment, the reduction is PhP 15.8 billion and PhP 8.9 billion, respectively. The decline in total employment was measured only for the less than full employment scenario. Total employment declines by 1.77% when there is a total ban and by 1.11% with a total ban and tariff reduction. Lastly, the impact on foreign exchange requirements was quantified only for the policy regime of total ban with tariff reduction. Here, foreign

exchange requirements would increase as the value of imported forestry products is shown to increase. This, in effect, would sequentially lead to a decline in the value of the peso, cheaper exports, an increase in demand for Philippine goods, and the necessary foreign exchange needed to import more logs. These results support a total ban on commercial logging in the Philippines for at least a cycle as there are more benefits to society from halting the harvest than from allowing it to continue.

Based on extensive review of CGE applications in forestry, the impacts of reforestation program can be assessed on a regional and national level. CGE is a useful tool for assessing possible changes in macroeconomic variables and induced impacts on the other sectors of the Philippine economy. While CGE has been used in many national and regional assessments, it will be the first application in assessing the nationwide reforestation effort of the DENR in terms of scale and components (economy, incomes through the employment/livelihood component and poverty and the environment).

III. CGE MODEL

The CGE used in the analysis is a sequential dynamic model calibrated to a 2012 social accounting matrix (SAM) of the Philippine economy. Appendix A presents the complete specification of the model, the macro SAM used in the calibration and the elasticities in the model. The simulation results from the CGE are utilized in a poverty microsimulation model to quantify the poverty and income distribution effects of the NGP.

In the CGE model, sectoral output is the sum of value added and intermediate inputs, where value added is a fixed Leontief ratio of intermediate inputs in every sector (Figure P2.3). The determination of the sectoral value added is in two stages. In each stage, a constant elasticity of substitution (CES) structure is used. In each sector in the first stage, skilled and unskilled labor are aggregated into total labor, and capital and land into total capital. In the second stage, labor and capital in each sector are aggregated into value added. Sectoral output is sold to the domestic market as domestic sales and to the rest of the world as exports. Product differentiation (price difference) between domestic sales and exports is formulated using a constant elasticity of transformation (CET) function. Sectoral imports and domestically produced goods sold to the domestic market determine sectoral consumption (the Armington composite good). Product differentiation (price difference) between imports and domestically produced goods is formulated using a constant of elasticity of substitution (CES) function. This Armington composite good is used as intermediate inputs, as well as final demand which is composed of household consumption, government consumption, and investment.

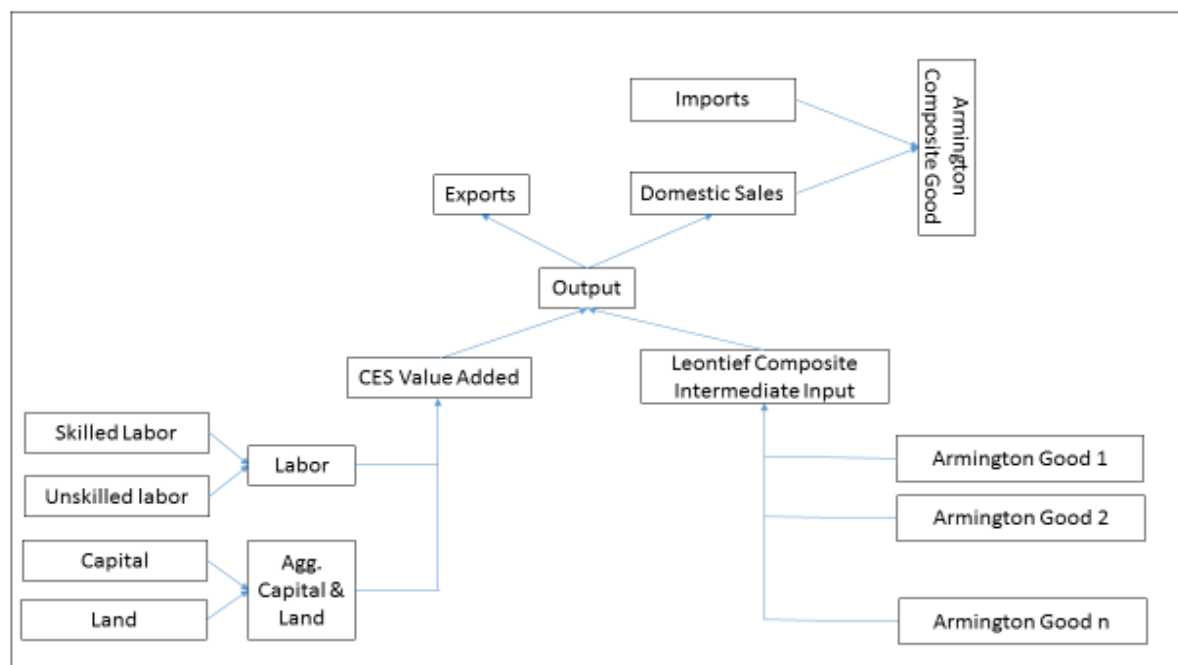


Figure P2.3. CGE structure.

Figure P2.4 shows the structure of income and consumption of households and enterprises. Households are grouped in decile. The sources of household income are factor payments (from labor, capital and land) and other sources which include dividend payments, government transfers and foreign remittances. Disposable income of households, net of direct tax payments, is allocated to household consumption and savings. Household consumption/demand is specified using a linear expenditure system (LES).

The source of income of enterprises is capital. After paying direct income tax, enterprises allocated income to domestic household dividends, rest of the world dividends, and savings.

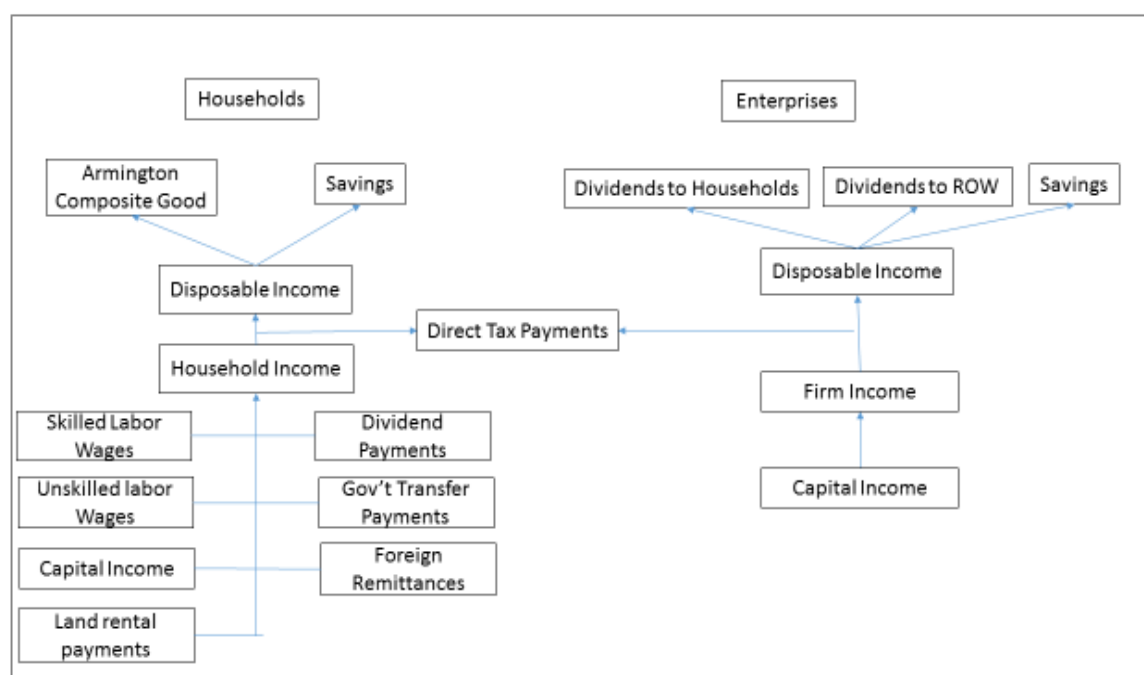


Figure P2.4. Income and consumption structure of households and enterprises.

Figure P2.5 shows the structure of government income and expenditure, and the balance of payments. The sources of government income are direct and indirect tax revenues, import tariff revenue, and foreign transfers to the government. There are four uses of government income in the model: spending, transfers to households, public transfer to the rest of the world and government savings⁹. In the balance of payments, the outflows include payments for imports, dividends to the rest of the world, capital income payments, and government transfers to the rest of the world. The inflows include income from foreign remittances, export receipts, rest of the world transfer to the government, and foreign savings.

⁹ Negative government savings refers to budget deficit.

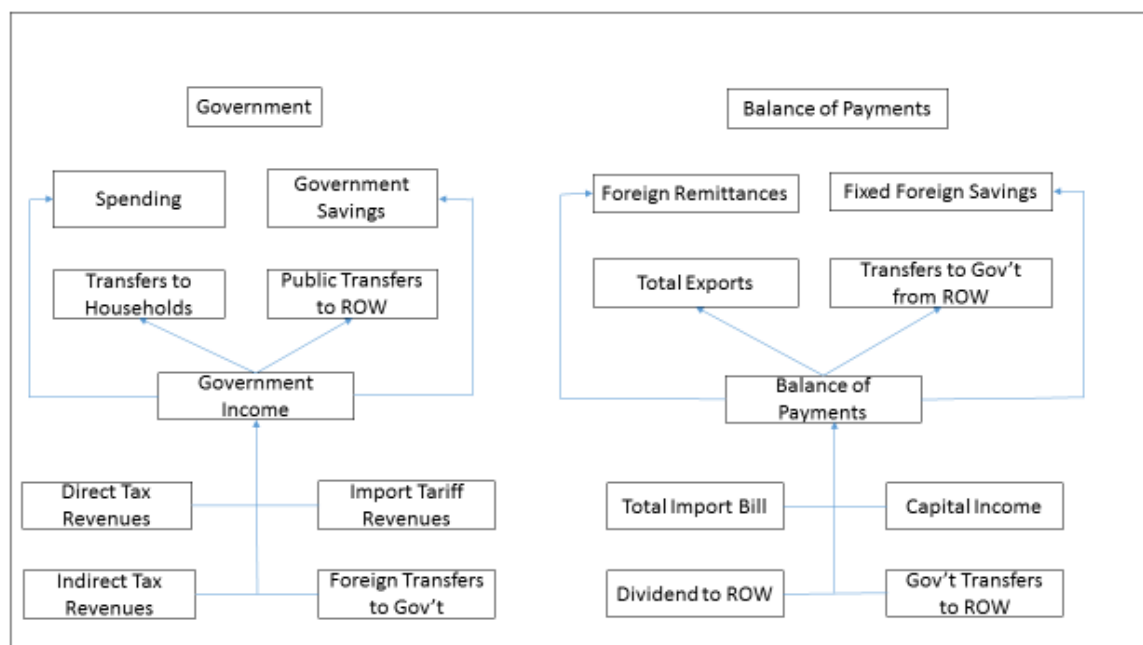


Figure P2.5. Government income and expenditure and balance of payments.

To analyze the economic effects of NGP, the model needs to be modified so as to allow for a system that allocates land to various uses. The allocation of land in the model is done in two stages (Figure P2.6). In the first stage, using a CET function, land is allocated to four uses: crops, forest, pasture land, and dwellings (residential and commercial). The allocation of land across these uses depends upon the elasticity of transformation in the first stage (σ^{CET1}) and the relative price of each of these uses. In the second stage, using another CET function, land used for crop production is allocated to key crops: rice, sugar, coconut, and all other crops. The allocation of crop land to various crops depends upon the elasticity of transformation in the second stage (σ^{CET2}) and the relative price of each of the crops.

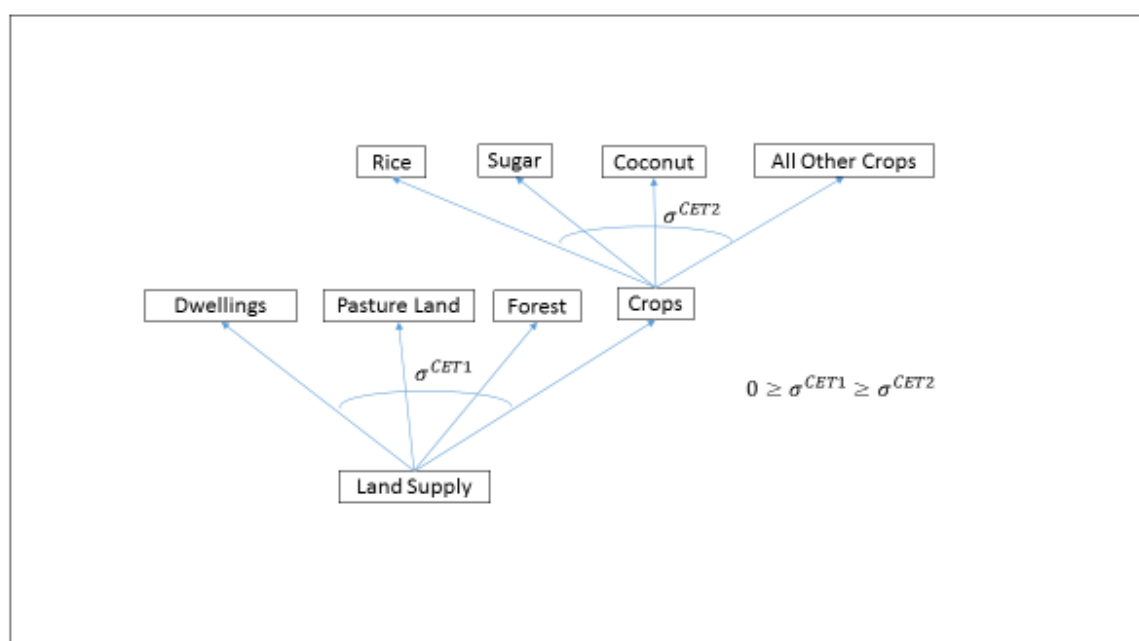


Figure P2.6. Land allocation in the model.

The sum of savings of households, enterprises, government and foreign savings flows back into system as total investment. Government savings and foreign savings are fixed. The nominal exchange rate is the numeraire. The external account is cleared by changes in the real exchange rate, which is the ratio between the nominal exchange rate and endogenous prices in Philippine markets. The CGE model is marketing clearing. Prices, which include prices in factor markets (labor, capital, and land) and product markets, adjust in order to clear/equilibrate all markets in the model.

Changes in factor prices and factor demand determine factor incomes. Changes in factor incomes, together with factor endowments of households, determine changes in income at the decile level. Changes in commodity prices drive the reallocation of resources across sectors. Changes in the sectoral output prices affect the consumer price of commodities, which is the composite price of the Armington good.

The model is sequential dynamic. Sectoral capital stock which is fixed in the current period is updated endogenously in the next period using a capital accumulation equation that depends on the current level of sectoral investment. Following Jung and Thorbecke (2001), sectoral investment is specified as Tobin's q. Labor is updated exogenously using the growth of population.

A policy shock introduced into the CGE model generates general equilibrium effects on sectoral output, demand, commodity and factor prices, factor use (labor, capital and land) and household income. These information are utilized in a poverty microsimulation model to quantify the effects on poverty and income distribution. The poverty

microsimulation model was calibrated to the 2012 Family Income and Expenditure Survey (FIES) and is discussed in detailed in the appendix.

The model was calibrated using a SAM of the Philippine economy in 2012. The SAM used to calibrate the model was aggregated to 14 sectors from an original 241-sector SAM. Table P2.1 presents the structure on the economy based on the SAM.

Table P2.1. Structure of the Philippine Economy Based on SAM (%).

	Factor Payments							Trade					
	X Share	VA/X	SKL	USKL	K	LND	Total	D/Q	M/Q	M Share	D/X	E/X	E Share
Palay	1.7	67.8	1.2	52.0	34.2	12.7	100.0	99.9	0.1	0.0	100.0	0.0	0.0
Coconut	0.4	89.6	1.0	42.7	41.1	15.2	100.0	99.4	0.6	0.0	99.9	0.1	0.0
Sugar	0.3	56.4	0.8	36.0	46.1	17.1	100.0	100.0	0.0	0.0	100.0	0.0	0.0
Other agriculture	6.8	65.5	1.8	36.7	49.1	12.4	100.0	97.2	2.8	1.0	96.1	3.9	1.7
Forestry	0.1	84.4	0.4	15.9	44.3	39.3	100.0	85.4	14.6	0.1	99.6	0.4	0.0
Rice	2.2	33.0	4.0	15.0	81.0	0.0	100.0	89.2	10.8	1.5	100.0	0.0	0.0
Coconut processing	1.1	42.2	4.0	14.9	81.1	0.0	100.0	68.1	31.9	1.5	49.4	50.6	3.7
Sugar processing	0.8	35.3	9.2	34.3	56.5	0.0	100.0	90.1	9.9	0.4	80.3	19.7	1.0
Other food	10.1	26.7	5.9	21.6	72.5	0.0	100.0	90.6	9.4	5.3	88.9	11.1	7.1
All other mfg	26.0	24.8	9.1	21.9	69.0	0.0	100.0	56.4	43.6	67.1	58.9	41.1	68.0
Other industry	8.8	60.8	5.3	24.6	69.9	0.2	100.0	84.5	15.5	9.0	98.0	2.0	1.1
Dwellings	4.1	81.3	3.1	1.4	85.9	9.5	100.0	100.0	0.0	0.0	99.6	0.4	0.1
Other service	32.3	60.2	12.7	17.9	69.4	0.0	100.0	92.2	7.8	14.1	91.5	8.5	17.4
Public admin.	5.4	77.9	57.3	42.7	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	0.0
Total	100.0									100.0			100.0

Source: 2012 SAM

X = output

VA = value added

SKL = skilled labor (with at least high school diploma)

K = capital

USKL = unskilled labor

LND = land

M = imports

Q = Armington composite good

D = domestic sales of X

E = exports

Relative to the total output of the economy, the share of agricultural crops is small (X Share). Production is dominated by other service, all other manufacturing, other food, and other industry. However, in terms of value added contribution (VA/X), agriculture and service sectors have significantly larger shares than manufacturing.

Factor payments vary across sectors. For palay and coconut, the share of payments to unskilled labor (USKL) is larger than the share of payments to capital (K) and land (LND). For sugar and other agriculture, the share of payments to capital is larger than the share of payments to unskilled labor and land. The share of payments to capital is larger than the share of payments to the other factors for the rest of the sectors. Except for dwellings and public administration, the share of payments to unskilled labor is higher than the share of payments to skilled labor (SKL). Forestry, which is a key sector in the NGP analysis, has about 40% payments to land and 44% payment to capital.

The sector with the highest import-competing goods (represented by an import ratio of 43.6% under M/Q) is all other manufacturing, which include the electronics. This is followed by coconut processing (31.9%), other industry (15.5%), and forestry (14.6%). In terms of the overall country's imports (M Share), all other manufacturing accounts for the bulk of imports with 67.1% share.

Domestic production caters largely the domestic market (E/X), except for coconut processing and to some extent all other manufacturing. Agricultural production, including rice, is sold practically to the local market. In terms of the overall country's exports (E Share), all other manufacturing has accounts for 68%.

Table P2.2 presents the sources of household income. Factor incomes (payments to labor, capital and land) are the major sources of income across household groups. Capital, which includes operating surplus, is a key income source, followed by income from unskilled labor. Land, which is critical in the NGP analysis, has contributed significantly less to income than labor and capital but households in the lowest income bracket has a larger share from land income compared to households in the highest income bracket.

Table P2.2. Sources of household income (%).

Decile	SKL	USKL	K	LND	DIV	REM	OTHERS	Total
H1 (decile)	0.67	23.50	71.28	3.48	0.07	0.47	0.53	100.00
H2	1.30	25.73	68.02	3.32	0.03	0.94	0.66	100.00
H3	1.68	27.28	66.10	3.23	0.04	0.84	0.83	100.00
H4	2.64	28.78	62.97	3.08	0.06	1.30	1.17	100.00
H5	2.92	32.77	58.37	2.85	0.04	1.73	1.32	100.00
H6	4.40	34.23	55.11	2.69	0.05	2.37	1.15	100.00
H7	7.06	34.76	50.51	2.47	0.08	3.59	1.53	100.00
H8	12.71	32.81	45.92	2.24	0.10	4.57	1.65	100.00
H9	16.72	30.21	42.70	2.09	0.10	6.35	1.83	100.00
H10	23.28	14.39	47.97	2.34	1.49	7.43	3.10	100.00

Source: 2012 SAM

SKL = skilled labor (with at least high school diploma)

K = capital, includes operating surplus

USKL = unskilled labor

OTHERS = include rice quota rent (for H7, H8, H9, and H10)
and government transfers

LND = land

DIV = dividend income

REM = foreign remittances

Table P2.3 shows the structure of consumption of households. The share of food consumption, particularly rice, is higher in lower income than in higher income groups. In contrast, the share of consumption of commodities produced in all other manufacturing sectors is higher in richer households than in poorer groups. Similar trend is observed in the consumption share of dwellings.

Table P2.3. Household consumption share (%).

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	All
Palay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut	0.33	0.34	0.34	0.33	0.33	0.31	0.31	0.29	0.28	0.23	0.28
Sugar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other agriculture	6.06	6.44	6.30	5.92	5.64	5.06	4.67	4.14	3.52	2.46	3.94
Forestry	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rice milling	17.61	16.44	14.44	12.32	10.09	8.35	6.86	5.40	4.00	2.03	5.89
Coconut processing	0.76	0.87	0.86	0.83	0.78	0.72	0.66	0.56	0.46	0.30	0.53
Sugar processing	0.50	0.71	0.83	0.86	0.88	0.91	0.89	0.79	0.71	0.54	0.71
Other food	17.12	20.11	21.17	21.84	22.45	22.72	21.94	20.48	18.26	13.03	18.00
All other manufacturing	6.64	7.70	9.08	9.83	10.70	11.04	11.71	12.32	13.13	15.26	12.73
Other industry	0.67	0.93	1.15	1.41	1.84	2.24	2.54	2.72	2.72	2.60	2.36
Dwellings	4.29	4.64	5.07	5.39	6.05	6.71	7.28	7.73	7.80	9.21	7.66
Other service sector	46.00	41.81	40.75	41.27	41.23	41.94	43.12	45.55	49.12	54.33	47.90
Public administration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: 2012 SAM

A. Definition of Scenarios

There are three sets of scenarios analyzed in the paper: (i) baseline or business-as-usual (BaU) scenario; (ii) full NGP scenario; and (iii) partial NGP scenario.

BaU Scenario. There are three elements in the baseline scenario: (a) the forest cover projection of the Department of Environment and Natural Resources (DENR) without NGP; (b) the increasing incidences of infectious diseases as a result of declining forest cover which negatively affects labor supply; and (c) the declining agricultural land productivity because of climate change.

Based on DENR’s projection, Table P2.4 shows that without NGP the total forest cover in the country will decline from 6.4 million hectares in 2010 to 4.5 million hectares in 2050. This is a major feature of the BaU scenario. The other element in this scenario is the impact of climate change on agricultural productivity. Based on Cline’s (2007) climate model, the projected CO₂ atmospheric concentration will increase to 735 parts per million (ppm) in 2080 from the current level of 380 parts ppm. The global mean temperature (GMT) will increase by 3.3°C. The average surface temperature of land areas, which will warm more than the oceans, are projected to rise by 5.3°C, weighted by land area, and 4.4°C, weighted by farm area.

Table P2.4. Projected forest cover without NGP (‘000 hectares).

	2010 ^{/1/}	2015	2020	2025	2030	2040	2050
Forest lands - closed canopy	1,868	1,494	1,300	1,381	1,264	1,264	1,264
Forest lands - open canopy	4,291	3,847	3,849	3,044	3,002	2,856	2,828
Forestlands – mangroves	203	244	281	309	340	374	411
Total	6,362	5,585	5,430	4,734	4,606	4,494	4,503

Source: DENR

^{/1/} Baseline

In Cline’s analysis, there are two cases that examine the impact of climate change agricultural productivity: with carbon fertilization effect and without carbon fertilization effect¹⁰. His results indicate that when carbon fertilization effect is included, global agricultural productivity by 2080 is projected to decline by 3%; but without the said

¹⁰ The rising carbon dioxide gas in the atmosphere as a result of human fossil fuel burning should in principle “fertilize” plant growth through the process of photosynthesis (this is also called the “carbon fertilization” effect”), but research evidence indicates that the effects are insignificant and short-lived. Thus, the carbon fertilization effect is unlikely to offset a significant fraction of projected increases in atmospheric CO₂ concentration over the next century.

effect, the agricultural productivity is seen to drop by 16% (Table P2.5). The effects across regions vary significantly; those located in lower latitudes would tend to experience larger losses because they are already close to or beyond the thresholds at which further warming will reduce agricultural productivity. The results indicate that developing countries tend to have larger negative effects compared to developed countries. In particular, Philippine agricultural productivity in 2080 is projected to decline by 23.4% in the case without carbon fertilization effect and 11.9% in the case with carbon fertilization effect. In the analysis, agricultural productivity declines by 14%.

Table P2.5. Projected climate change and impacts on agricultural productivity.

Climate Variables	Land Area	Farm Area
Base levels		
Temperature (°C)	13.15	16.20
Precipitation (mm per day)	2.20	2.44
By 2080		
Temperature (°C)	18.10	20.63
Precipitation (mm per day)	2.33	2.51
Carbon Fertilization Effect		
Impacts on Agricultural Productivity (%)	Without	With
World (output weighted)	-15.90	-3.20
Industrialized countries	-6.30	7.70
Developing countries	-21.00	-9.10
Africa	-27.50	-16.60
Asia	-19.30	-7.20
Philippines	-23.4	-11.9
Middle East	-21.20	-9.40
Latin America	-24.30	-12.90

°C = degree Celsius; mm = millimeter

Source: Cline, 2007

The third element in this scenario includes the human health effects of deforestation. Changes in the environment affect health in three path ways: (a) direct – floods, heat waves, or droughts; (b) ecosystem-mediated – altered infectious disease risk and reduced food yields (malnutrition, stunting); and indirect-displaced-deferred – varied health consequences of livelihood loss, population displacement (e.g., dwelling in slums) and conflict. In Brazil, deforestation in the Amazon forest can reduce labor endowment/supply by 3% by 2050 base on the estimates of Pattanayak et al, 2009. Since the Amazon and the Philippines have similar tropical conditions, in the absence of a similar empirical estimate of the effects of environmental changes on human health in the

Philippines, the paper adopts the same 3% decline in labor endowment by 2050 in the BaU scenario.

Full NGP Scenario. The assumptions in this scenario address the three concerns in the baseline. The full implementation of NGP will increase the country's forest cover by 1.5 million hectares from 4.5 million in 2050 to 6 million. This will have favorable effects on health. There is no reduction in labor supply in this scenario as human health improves with increasing forest cover. Also, agricultural land productivity improves as a result of the reforestation activities in NGP.

Partial NGP Scenario. Past experience in the Philippines indicates that attaining the desired targets of a reforestation program may be difficult to attain. This scenario assumes that the country's forest cover will improve by 750 thousand hectares only as a result of NGP, which is 50% lower than the desired target. However, this will have favorable health impact. Labor supply will decline by only 2% in 2050, a slight improvement compared to the BaU scenario. Agricultural land productivity will decline by 10%, also an improvement than the 14% decline in the BaU scenario.

Model Implementation of Scenarios. How are these effects implemented and simulated in the CGE model? The reforestation in the NGP which maintains the current forest cover increases effectively forest land relative to the baseline where there is continued deforestation. In the land use framework shown in Figure P2.4, the increase in forest land under the NGP scenario relative to the baseline increases effectively the overall supply of productive land in the country.

The negative health effects on labor and the decline in agricultural land productivity are implemented in the model through changes in factor efficiency parameters in the production function. Consider a production with four inputs

$$Q = f(\delta_s \cdot L_s, \delta_u \cdot L_u, \delta_k \cdot k, \delta_{ld} \cdot Ld_{ld})$$

where Q is output, L_s is skilled labor, L_u is unskilled labor, L_k is capital, and Ld_{ld} is land. The respective factor efficiency parameters are δ_s for skilled labor, δ_u for unskilled labor, δ_k for capital and δ_{ld} for land¹¹. Table P2.6 presents the values of the factor efficiency parameters in the baseline. In the NGP scenario, the values of these parameters are all set to one in the simulation.

¹¹ These efficiency parameters appear in various equations of the model presented in Appendix A.

Table P2.6. Factor efficiency parameters.

Labor				
	Skilled	Unskilled	Land /b/	Capital
	δ_s	δ_u	δ_{ld}	δ_k
2012	1	1	1	1
...
2050 /a/	0.970	0.970	0.859	1

/a/ Straight line decline, except for capital

/b/ Average of Cline's projection. These are applied to agricultural crops only.

IV. SIMULATION RESULTS

The CGE model was solved annually and sequentially from 2012 to 2050. The assumptions under the BaU and the NGP scenarios were simulated separately. However, the discussion in this section focuses on the effects of the NGP scenario in 2020, 2030, and 2050 as indicated by the percent difference of the NGP scenario from the baseline.

Table P2.7 shows that relative to the baseline, overall output of the economy under the full NGP scenario improves by 0.3% in 2020, 0.9% in 2030 and 2.3% in 2050. Agricultural crop production of palay, coconut, sugar and other agriculture improves, as well as the processing of these crops into food. Non-manufacturing production improves also. The higher agricultural output growth is due to the improvement in agricultural land productivity and the improvement in labor efficiency under the NGP scenario relative to the baseline. Output of dwellings and other services increases, but the improvement is relatively lower than the overall output growth of the economy. The forestry sector benefits the most under the NGP scenario. Public administration (which includes public health, education, and other general government services) increases as the overall economy improves with higher government revenue and spending¹².

The sectoral effects are lower under the partial NGP scenario. Overall output of the economy improves by only 0.7% relative to the baseline in 2050. Agriculture and food processing sectors are also favorably affected.

¹² Government budget balance is held fixed in the simulation.

Table P2.7. Sectoral Effects of NGP (% change from the baseline)

	Full NGP Scenario			Partial NGP Scenario		
	2020	2030	2050	2020	2030	2050
Palay	0.490	1.310	3.126	0.131	0.338	0.798
Coconut	0.369	1.057	2.844	0.095	0.262	0.778
Sugar	0.483	1.289	3.221	0.128	0.330	0.889
Other agriculture	0.405	1.066	2.838	0.097	0.249	0.802
Forestry	0.750	1.978	9.533	0.286	0.730	5.650
Rice processing	0.501	1.335	3.167	0.133	0.343	0.801
Coconut processing	0.393	1.178	3.020	0.099	0.283	0.747
Sugar processing	0.485	1.293	3.231	0.128	0.330	0.893
Other food	0.449	1.219	2.980	0.121	0.319	0.794
All other manufacturing	0.414	1.183	2.883	0.121	0.341	0.820
Other industry	0.398	1.122	2.692	0.116	0.323	0.772
Dwellings	0.264	0.767	2.030	0.065	0.181	0.555
Other service	0.046	0.293	1.029	0.010	0.073	0.278
Public administration	1.064	2.237	4.441	0.326	0.689	1.347
Overall output	0.329	0.933	2.343	0.092	0.256	0.656

Source: Authors' calculation

V. SUMMARY AND CONCLUSION

Using a CGE model, this paper provides a quantitative assessment of the potential economic, poverty and income distribution effects of NGP in the Philippines. In the analysis, two scenarios were simulated and analyzed: (a) a baseline scenario that has the following features: declining forest cover; increasing incidences of infectious diseases that negatively affects labor endowment; and declining agricultural land productivity because of climate change; (b) a full NGP scenario that reverses these trends; and (c) a partial NGP scenario where only half of the 1.5 million hectares target reforestation is achieved.

The assessment indicates that the NGP will result in the following:

1. An improvement in the overall output of the economy. The production of agricultural crops (palay, coconut, sugar and other agriculture) improves, as well as the processing of these crops into food. The production of non-manufacturing sector improves, but the increase is lower than the improvement in agricultural output. The higher agricultural output growth is due to the improvement in agricultural land productivity and the improvement in labor efficiency under the NGP scenario relative to the baseline. Output of dwellings and other services increases, but the improvement is relatively lower than the overall output growth of the economy. The forestry sector benefits the most under the NGP scenario. Public administration (which includes public health, education, and other general government services) increases as the overall economy improves with higher government revenue and spending.
2. Reforestation increases the overall supply of productive land in the country. It increases the utilization of land as forest.
3. Factors markets for labor, capital and land are affected favorably as the overall output of the economy improves. As a result factor income increases. Households are therefore positively affected by higher factor incomes.
4. The improvement in factor efficiency decreases the cost of production, which lowers the consumer price of commodities. Food prices decline as agricultural production improves. Lower income groups benefit from declining consumer food prices as their food consumption share in total expenditure is larger compared to those households in the higher income groups.
5. Higher household incomes and lower consumer prices lead to lower poverty. All poverty indicators decline. Those in the extreme poverty benefit the most. Income distribution also improves over time as indicated by a declining GINI coefficient.
6. The results of the full NGP and the partial NGP scenarios indicate that the potential impact on the economy and households greatly depends on the full and successful implementation of NGP.

REFERENCES

- Annabi, N., B. Khondler, S. Raihan, J. Cockburn, and B. Decaluwe. 2006. "Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short-versus Long Run Impacts" in *Poverty and the WTO: Impacts of the Doha Development Agenda*. (Thomas Hertel and L. Alan Winters, editors). New York: Palgrave Macmillan, and Washington, D.C.: The World Bank. pp. 429-466.
- Carandang, A.P. and M.G. Carandang. 2009. Activity and Cost Standards for Forest Development and Rehabilitation. *Journal of Environmental Science and Management*. Vol 12. No.1. 42-67.
- Carig ET. (2012). Impact Assessment of Community-Based Forest Management in the Philippines: A Case Study of CBFM Sites in Nueva Vizcaya. *International Conference on Management and Social Sciences 2012*, (pp. 17-21). Penang, Malaysia.
- Chokkalingam U, AP Carandang, JM Pulhin, RD Lasco, RJJ Peras & T Toma (Eds.). (2006). *One Century of Forest Rehabilitation in the Philippines: Approaches, Outcomes and Lessons*. Bogor, Indonesia: Center for International Forestry Research (CIFOR).
- Cline, 2007. *Global Warming and Agriculture: Impact Estimates by Country*. Center for Global Development and Peterson Institute for International Economics, Washington DC.
- Cockburn, J. 2001. Trade Liberalization and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis, mimeo, Department of Economics, Laval University.
- Cororaton, C.B. 2013. "Economic Impact Analysis of the Reduction in Sugar Tariffs under the ASEAN Trade in Goods Agreement: The Case of the Philippine Sugar Sector". GII Working Paper No. 2013-1.
- Cororaton, C. B., and E. Corong. 2009. *Philippine Agricultural and Food Policies: Implications on Poverty and Income Distribution*. International Food Policy Research Institute (IFPRI) Research Report No. 161. Washington DC: IFPRI.
- Cororaton, C.B., and J. Cockburn. 2007. "Trade reform and poverty - Lessons from the Philippines: A CGE-microsimulation analysis". *Journal of Policy Modeling* 29(1): 141-163.

Decaluwé, B., A. Patry, L. Savard and E. Thorbecke. 2000. "Poverty Analysis within General Equilibrium Framework", Working Paper 9909, Department of Economics, Laval University.

De Janvry, A., E. Sadoulet and A. Fargeix (1991), "Politically Feasible and Equitable Adjustment: Some Alternatives for Ecuador", World Development, 19(11): 1577-1594.

Department of Environment and Natural Resources (DENR), Department of Agrarian Reform (DAR) and Department of Agriculture (DAR). (2012). *National Greening Program: Implementation Manual for CY 2012*.

DOLE-Technical Working Group. 2013. Community-Based Employment Program (CBEP): Reference Manual Volume I. Department of Labor and Employment (DOLE).

ESSC. (1999). *Decline of the Philippine Forest* Environmental Science for Social Change, Inc.

FAO. (2011). State of the World's Forest 2011. Rome: Food and Agriculture Organization of the United Nations.

FMB-DENR. (2003). Philippines Forestry Statistics in 2003.

FMB-DENR. (2012). Philippine Forestry Statistics in 2012.

FMB-DENR. (2013). Philippines Forestry Statistics in 2013.

FMB-DENR. (2014). Technical Bulletin 10. NGP Central Office.

Fofana, I., Lemelin and J. Cockburn, 2005. "Balancing a Social Accounting Matrix: Theory and Application". (<http://www.pep-net.org/fileadmin/medias/pdf/sambal.pdf>).

Forestry Development Council (FDC), College of Forestry and Natural Resources, University of the Philippines Los Baños (UPLB) and Department of Environment and Natural Resources (DENR). (2014). *Bringing out the best of the National Greening Program: Success stories and best practices in the CALABARZON region*.

Foster, James; Joel Greer and Erik Thorbecke. 1984. "A class of decomposable poverty measures". Econometrica. 3 52: 761–766. doi:[10.2307/1913475](https://doi.org/10.2307/1913475).

- Fugazza, M., and J. Maur. 2008. Non-Tariff Barriers in Computable General Equilibrium Modeling. Policy Issues in International Trade and Commodities Study Series N. 38. United Nations Conference on Trade and Development.
- Ganuza, E., R. Barros, R., and R. Vos. 2002. Labor Market Adjustment, Poverty and Inequality During Liberalization. In *Economic Liberalization, Distribution and Poverty: Latin America in the 1990s*. (Rob Vos, Lance Taylor and Ricardo Paes de Barros, R., eds) Cheltenham (UK) and Northampton (US): Edward Elgar Publishing, pp. 54-88.
- Guiang ES, SB Borlagdan & JM Pulhin (2001). *Community-Based Forest Management in the Philippines: A Preliminary Assessment*.
- Israel, D.C. and J.H. Lintag. (2013). Assessment of the Efficiency and Effectiveness of the Reforestation Program of the Department of Environment and Natural Resources: Philippine Institute for Development Studies.
- Jung, H. and E. Thorbecke. 2001. "The Impact of Public Education Expenditure on Human Capital, Growth, and Poverty in Tanzania and Zambia: A General Equilibrium Approach". International Monetary Fund. IMF Working Paper WP/01/106. <http://www.worldbank.org/wbi/macroeconomics/modeling/IMMPA-html/Jung-Thorbecke01.pdf>.
- Magno F. (2001). Forest devolution and social capital: State-civil society relations in the Philippines. *Environmental History*, 264-286.
- National Disaster Coordinating Council (NDRRMC) – Office of Civil Defense. (2013, October 14). Destructive Typhoons (1970-2003). Philippines. Retrieved July 28, 2015, from <http://web.archive.org/web/20041109180046/http://baseportal.com/cgi-bin/baseportal.pl?htx=/miso/typhoons&range=200,20>
- Orallo, A.-L. D. (2011, August 16). Philippine Disaster Risk Management Systems: NDRRMC's Policies, Plans, and Programs. Philippines. Retrieved July 28, 2015, from Http://www.adrc.asia/aboutus/vrdata/countryreport/2011A_PHL_Anna_CP.pdf
- Pattanayak, S. K., M.R. Ross, B. M. Depro, S. C. Bauch, C. Tmmms, K. J. Wendland, and K. Alger. 2009. "Climate Change and Conversation in Brazil: CGE Evaluation of Health and Wealth Impacts". *The B.E. Journal of Economic Analysis and Policy*. Vol. 9 Issue 2, Article 6, page 28.

- Pulhin, J., Chokkalingam, U., Peras, R., Acosta, R., Carandang, A., Natividad, M., et al. (2006). Chapter II: Historical Overview. In U. Chokkalingam, A. Carandang, J. Pulhin, R. Lasco, R. Peras, & T. Toma (Eds.), *One Century of Forest Rehabilitation in the Philippines: Approaches, Outcomes and Lessons* (pp. 6-41). Jakarta, Indonesia: Center for International Forestry Research.
- Reforestation and Afforestation. (2012). *The Berkshire Encyclopedia of Sustainability: China, India, and East and Southeast Asia: Assessing Sustainability*, 312-315.
- Rejesus, R. M., Palis, F. G., Rodriguez, D. G. P., Lampayan, R. M., & Bouman, B. A. M. (2011). Impact of the alternate wetting and drying (AWD) water-saving irrigation technique: Evidence from rice producers in the Philippines. *Food Policy*, 36(2), 280-288.
- Rosebaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55
- Teves, C. 2012. *NGP targets fuelling 8% carbon sequestration rise*. Positive News Media. Retrieved from <http://positivenewsmedia.com/blog/2012/10/ngp-targets-fuelling-8-carbon-sequestration-rise/> Retrieved on June 13, 2015.
- Teves, C. 2013. *NGP commodity road map highlights agro-forestry*. Bayanihan. Retrieved from <http://bayanihan.org/2013/01/11/ngp-commodity-road-map-highlights-agro-forestry/> Retrieved on June 13, 2015.
- Vos, R. (2005). "Microsimulation Methodology: Technical Note". New York (unpublished manuscript).
- Wooldridge, J.M., 2010. *Econometric Analysis of Cross Section and Panel Data*, 2nd ed. MIT Press.