ECOLOGICAL RESILIENCE AND IMPACT ASSESSMENT: APPLICATIONS AND CHALLENGES II

Conference Topic: **G10 Biodiversity and ecology**

TITLE: Using SEEA Ecosystem Accounting to conserve biodiversity as a common good

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The Philippine is one of thirty-four (34) countries that adopted the System of Environmental Economic Accounting (SEEA), a statistical system that looks at individual environmental assets (resources), such as water or energy resources. In addition, SEEA Ecosystem Accounting (SEEA EA) takes a spatial approach to accounting, as the benefits a society receives from ecosystems depend on where those assets are in the landscape in relation to the beneficiaries. It is a powerful methodology in organizing data around specific policy-relevant environmental themes, such as biodiversity, climate change, oceans, protected areas, wetlands and forests. The World Bank supported the Philippine Wealth Accounting and Valuation of Ecosystem Services (WAVES) project which produced the Philippine Natural Capital Accounting (NCA) Roadmap, policy and analytical reports on ecosystem services accounts and national environmental accounts. The project has helped the government, at multiple levels, dissect policy challenges of environmental issues affecting biodiversity in urban, suburban and rural areas.

This paper discusses three important analytical reports on ecosystem services accounts that are relevant to biodiversity conservation: 1) the importance of river water for irrigate crops, 2) land use conflicts and 3) quantifying and valuing forest carbon sequestration. The study area is in the south of Palawan, one of the world's most beautiful island provinces due to its rich biodiversity and pristine landscapes and seascapes. Considered as the 'last Ecological frontier of the Philippines', its complex ecosystems are home to several rare, threatened and endangered species, with new species till being discovered and recorded to date.

Our natural capital is an important factor in spurring the Philippine economy. Natural capital refers to the stock of renewable and non-renewable resources (e.g., plants, animals, air, water, soils, and minerals) that provide a flow of benefits to people. It also includes the ecosystem services that are often "invisible" to most people, such as air and water filtration, flood protection, carbon sequestration, pollination of crops, and habitats for wildlife. Central to economic growth is the capacity of the environment to sustain ecosystem services that provide the needed subsistence and livelihood for resource-dependent communities and capital for infrastructure, machineries, manufacturing, and production sectors. However, as our natural capital is exponentially extracted, the declining stocks and degrading environmental condition are inadvertently neglected. The value of these ecosystem services is not readily captured in the market, so their exact contribution to the economy is often unknown. Humans tend to forget that nature continuously provides the needed ecosystem services that benefit long-term income and growth and sustain a well-functioning economy.

System of Environmental Economic Accounting - Ecosystem Accounting (SEEA EA)

While the SEEA Central Framework looks at individual environmental assets (resources), such as water or energy resources, the SEEA EA takes a spatial approach to accounting, as the benefits a society receives from ecosystems depend on where those assets are in the landscape in relation to the beneficiaries. This spatial focus identifies the location and size of ecosystem assets, the ecosystem

services provided, and the location of beneficiaries (households, businesses and governments). For example, the beneficiaries of water filtration ecosystem services are likely located downstream of the ecosystem asset that provides that benefit. As a result, ecosystem accounts are commonly presented using maps, bringing together geographical, environmental, ecological, and economic information in one place, as well as tables. The SEEA EA can be compiled at different spatial scales, including the subnational (state, river basin, protected area, urban, etc.), or national level and across terrestrial, freshwater and marine areas. In general, in SEEA Ecosystem Accounting, biodiversity is considered as a characteristic of ecosystems rather than as an ecosystem service and hence is best accounted for as part of the assessment of ecosystem assets – in particular as part of the assessment of ecosystem condition. In this context, falling biodiversity (as measured for example by reductions in the number of species in a given area) will generally correspond to declining ecosystem condition." (UNSEEA EEA, 2012) *https://seea.un.org/ecosystem-accounting*

Definition of terms:

Ecosystem accounting is a coherent and integrated approach to the assessment of the environment through the measurement of ecosystems, and measurement of the flows of services from ecosystems into economic and other human activity. Ecosystem accounting aims to shed light on the non-market activity that relates to ecosystems and integrate this information with relevant market related data.
Ecosystem asset. Stocks in ecosystem accounting are represented by spatial areas each comprising an ecosystem asset. Each ecosystem asset has a range of ecosystem characteristics – such as land cover, biodiversity, soil type, altitude and slope, climate etc. – which describe the operation and location of the ecosystem. Some of these characteristics may be considered relatively fixed (e.g. slope and altitude) while others are more variable (e.g. rainfall, land cover and biodiversity).Example of Ecosystem Assets: forests, wetlands, coral reefs which are measured in terms of extent e.g. hectares.
Ecosystem flows. First, there are flows within and between ecosystem assets that reflect ongoing ecosystem processes – these are referred to as intra-ecosystem flows and inter-ecosystem flows. The recognition of inter-ecosystem flows highlights the dependencies between different ecosystem assets (e.g. wetlands are dependent on flows of water from further up the river basin). Second, there are flows reflecting that people, through economic and other human activity, take advantage of the multitude of resources and processes that are generated by ecosystem assets – collectively these flows are known as ecosystem services.
Ecosystem Services. Ecosystem services are generated through ecosystem processes that reflect the combination of ecosystem characteristics, intra-ecosystem flows and inter-ecosystem flows.
It is noted that flows of ecosystem services may relate to either:
(a) flows of inputs from the environment to the economy (e.g. from the logging of timber resources) or
(b) flows of residuals to the environment (e.g. emissions, waste) from economic and other human activity.

Flows of both inputs and residuals can impact on ecosystem assets including on their structure, composition, processes, functions and biodiversity: ecosystem services as "contributions" highlights that ecosystem services are only one part of a broader set of inputs that are combined to provide the benefits. For example, the benefit of clean drinking water is, most commonly, the end result of the water abstracted from an ecosystem and the use of human inputs of labour and produced assets (e.g.

pipes, wells, filtration equipment, etc.). ecosystem services do not result only from the harvesting or extraction of materials from ecosystems. They also result from the general functioning of the ecosystem

Under the Philippine WAVES, the following analytical reports were prepared based on the results of the Ecosystem Accounts prepared for Southern Palawan:

1. Using River Water to Irrigate Crops in Southern Palawan

In recent decades, forest loss in the upper parts of Pulot Watershed (municipality of Sofronio Espanola, Southern Palawan) have gradually changed the flood regime of the Pulot River. In general, the dry season flow has been reduced while there is an increase in runoff during the wet season. In addition, sedimentation has caused a decline in the storage capacity of the reservoir. Sediment loading is also influenced by deforestation upstream of the reservoir. The Pulot Municipal irrigation scheme which started in 1989, supplies irrigation water to around 500 hectares of rice paddies and domestic water into eight barangays. Out of 500 hectares of irrigated paddy in the municipality, half (250 hectares) is dependent upon Pulot River and the irrigation reservoir in the river. Due to water deficiencies in Pulot watershed, only part of the 250 hectares is irrigated. In addition, the Pulot River supplies domestic water to around 780 households and establishments in the two barangays of Pulot Center and Pulot Shore.

For the ecosystem accounts, a detailed hydrological model was developed for Pulot Watershed. The model served to analyze the water regulation service provided by forests in the upper watershed, which is essential in providing water to irrigated rice paddies in the lowlands. In general, vegetation, in particular forests, enhance the water supply to the Pulot irrigation scheme by absorbing water during periods with high rainfall and gradually releasing this water during the dry season when the need for irrigation water is highest. In line with the general approaches in compiling ecosystem accounts, the hydrological service was modelled by comparing current water regulation exerted by the vegetation to a non-forested scenario. This approach facilitates understanding of how forests contribute to maintaining dry season water flows, and, subsequently, irrigated paddy production. The Ecosystem Account on River Water for Irrigation demonstrates that the oil palm plantations need to consider the availability and sustainable use of resources such as water which through the years has been observed to have created negative societal effects especially on the biodiversity and productivity of the land. Issues include (i) a low return on investment due to low yields; (ii) reduced opportunities to use land for more productive uses; (iii) negative externalities resulting from use of river water for irrigation and indirect land conversion because farmers are forced to convert upland use for crop cultivation to compensate for loss of land to oil palm plantation. In turn, upland forest conversion has exacerbated negative effects on river hydrology including reduced dry season streamflow and increased sedimentation affecting paddy production in Pulot irrigation scheme as well as generating more sedimentation in coastal zones.

2. Natural resources in Southern Palawan are under increasing pressure from competing demands, from mining, monocrop plantations, upland farming, infrastructure expansion and eco-tourism. Dealing with conflicting land use claims requires coordinated efforts by the responsible government agencies in order to zone activities while ensuring that applicable laws and regulations are enforced. In the case of Southern Palawan, there are several government agencies involved in land use planning. These include line bureaus, field offices and attached agencies of the Department of Environment and Natural Resources (DENR) i.e. Forest Management Bureau (FMB), Land Management Bureau (LMB), Community Environment and Natural Resources Office (CENRO), the Palawan Council for Sustainable Development

(PCSD) and the National Commission on Indigenous Peoples (NCIP). In addition, the municipal level Local Government Units (LGUs) are responsible for the implementation of land use policies. The mandates of these agencies with regards to land use planning are overlapping and at times conflicting, which increases the risk of land use conflicts that can ultimately lead to further degradation of the natural ecosystems and the ecosystem services they provide. This situation is further compounded by the fact that the agencies do not share a common database for monitoring of land use and are thus not always sufficiently aware of information in other departments or agencies. To help address this issue, an integrated approach is needed to harmonize and address the competing use of lands and achieve the sustainability of natural resources.

Major conversions of land within the 'Core Zone' of the Environmentally Critical Areas Network (ECAN), which should be strictly protected and maintained free of human disruption based on Republic Act (RA) 7611. Yet, spatial analysis revealed that as of 2014, 4,061 hectares (ha) (3%) of land within the Core Zone has also been classified as Alienable and Disposable (A&D) – i.e. land that can be used by people. So far about 759 ha, or 19% of the overlapping area are currently used for human activities. It is crucial that lands classified as A&D are reclassified as protected areas in particular those areas that are currently still unused. Further discussions are needed to determine what to do with the overlapping areas that are currently already converted. There is also still ongoing conversion of forest lands. Southern Palawan counts about 150,709 ha of forest of the total land area) including primary and secondary upland and mangrove forests in the Core Zone of the ECAN. These forests are essential for water regulation (maintaining river water flows in the dry season), carbon sequestration, providing non-timber forest products including to indigenous people, and, in the case of mangroves, for coastal protection and as nursery area for a range of fish species. Under Philippine law, these areas are protected. Nevertheless, croplands, fishponds and built-up areas continued to expand in 2014 in forest land, with an aggregated area of 1,590 ha in this single year.

One of the main areas of concern are the mangrove forests, where there has been a major conversion to fishponds. The ecosystem accounts clearly indicate which areas have been converted either illegally or with land certificates that are not compliant with environmental regulations. In both cases there is a need to examine if land claims can be revoked, and to ensure that no further land titles are issued in forest lands. Land management and administration in the country is governed by multiple laws, regulations, and processes managed by different institutions with overlapping functions and limited collaboration. A specific and urgent concern is that there is a need to increase collaboration, harmonize spatial databases and enforcement of policies and regulations by national government agencies and LGUs in land use planning and development.

3. **Quantifying and Valuing Forest Carbon Sequestration**

Carbon sequestration is the capture of carbon from the atmosphere by vegetation by different types of forests. In line with the UNSEEA (2014), carbon sequestration is an ecosystem service. The physical and monetary accounts of carbon provide insights in the contribution of the carbon sequestration service to the green economy of the Philippines. Carbon accounting registers sequestration as well as increases and decreases in carbon stocks, as a function of growth or depletion of forest resources. The Forest Management Bureau has prepared a carbon account for the years 2003, 2010 and 2014 as part of the Southern Palawan ecosystem account. The carbon sequestration service of the forests in Southern Palawan was computed on the basis of the mean Carbon Sequestration Rate in tons of CO2 per hectare

per year of each forest type (closed forest, open forest, and mangrove forest), based on Villarin (1999) and IPCC (2006). Monetary valuation of the carbon sequestration service was done for each of the three types of forests: closed, open forest and mangrove forest. Valuation was based upon the Social Cost of Carbon (SCC), which estimates the value of economic damages associated with a small increase in CO2 emissions, conventionally one metric ton, in a given year. Conversely, this figure also represents the value of damages avoided for small emission reductions. It is assumed to be US$32 or P1,344 per ton CO2 at 3% discount rate while the SCC at 5% is estimated to be US$11 or 462 pesos per ton CO2 (US EPA, 2013). The social cost of carbon estimate decreases as the discount rate increases because a higher discount rate implies that people care less about future generations than they do about the present.

Compared to changes in carbon stock, the changes in the carbon sequestration rate during the same period are less dramatic. This is due to the fact that on a per hectare basis there is little difference in carbon sequestration between open and closed forests. On average, open forests grow slightly faster and, therefore, have a slightly higher sequestration rate. Given the larger area that they cover, most of the carbon sequestration in Southern Palawan thus takes place in open forests. Carbon sequestration is lowest in the mangrove forest due to their relatively low area coverage. The carbon accounts show that the year 2003 had the highest carbon sequestration rate, which was subsequently reduced in 2010 and 2014. As forests decline so does biodiversity as they serve as natural habitats to the myriad species of flora and fauna.

The accounts show that carbon sequestration is a key ecosystem service in Southern Palawan. Overall deforestation in Southern Palawan for the period 2003 to 2010 had major consequences on the carbon stock stored in the forests. Although there is a slight increase in carbon stock in in the period 2010 to 2014, the increase has been much smaller than the decrease in the preceding period. This indicates that the forest resources in Southern Palawan have not been sustainably managed affecting biodiversity, given the challenges faced by the various agencies in the implementation of forest policies The continuing pressure on the forests shows the rationale for a clear and well-funded forest protection and law enforcement program including strict implementation of forest policies. As the findings of the accounts are robust, improvements can be made to further enhance the accuracy of the outcomes. First, further analysis of land cover change is needed to test if the suggested trends in forest cover rehabilitation between 2010 and 2014 are confirmed through an analysis over a longer period. Second, data can be improved by using (radar) remote sensing technology to estimate standing stock of carbon and sequestration for individual forest areas rather than assuming a single value per ecosystem type. In this regard, a National Forest Monitoring System (NFMS) set up by the Forest Management Bureau serve as the primary system for collecting relevant data, generating and managing information on the country's forest cover and status, making use of free products to produce forest maps, and make use of existing data generated by related projects, that can supplement available forest inventory data.