UNDP-UNEP Poverty Environment Initiative

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Working Paper

The application of the System of Environmental-Economic Accounting (SEEA 2012) for integrated planning, budgeting and monitoring for poverty related Sustainable Development Goals (SDG)

The Poverty-Environment Accounting Framework (PEAF)

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Prepared by Mark Eigenraam, Director, IDEEA[1], consultant to the UNDP-UNEP Poverty-Environment Initiative (PEI) with contributions from Seonmi Choi, Regional Manager- UNDP-UNEP PEI Asia-Pacific, United Nations Environment Programme

[1] www.ideeagroup.com

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1 Introduction

There is broad recognition that there are strong links between poverty and the environment, often referred to as the poverty-environment-nexus (PEN). However, it is not clear how to report and account for these links in an empirical manner to support both poverty and environmental policy and decision making. In order to report empirically on the links there is need to understand how changes in the environment impact on poverty and, conversely, how changes in poverty levels are linked to changes in the environment.

Clearly the environment, encompassing all natural resources, is important since it underpins most economic activity and is a source of individual and social wellbeing. For instance, natural resources including land, water, soil, forests, and minerals, are all necessary inputs to economic activity. In broad terms, there are three key links between poverty and the environment – (i) access to, and distribution of natural resources; (ii) distribution of benefits (both monetary and non-monetary) derived from natural resources; and (iii) the condition of natural resources and their capacity to provide benefits to people.

1.1. UNDP-UNEP Poverty-Environment Initiative (PEI)

Over the past 10 years, the joint UNDP-UNEP Poverty Environment Initiative (PEI) has been supporting ministries of planning, finance and environment as well as local governments to identify country-specific poverty-environment nexus issues and strengthen countries' own system of development planning and policy-making processes to achieve poverty reduction and environmental management objectives in an integrated manner.

The PEI works with key government partners to raise awareness, influence policy making and strengthen the mainstreaming of the Poverty-Environment Nexus issues into development planning and budgeting processes, sector programmes, investment management processes and sub-national planning. PEI is supporting countries to achieve the following outputs by 2017:

- Output 1: P-E approaches and tools for integrated development policies, plans and coordination mechanisms applied.
- Output 2: Cross-sectoral budget and expenditure processes, and environmental-economic accounting systems institutionalised.
- Output 3: P-E approaches and experiences documented and shared to inform country, regional and global development programming by the UN and Member States.

This report builds specifically on the objectives of output 2, the institutionalisation of environmental-economic accounting systems by explaining the logic, rationale and framework of environmental-economic accounting in the poverty-environment nexus mainstreaming context.

With PEI support, countries have made a notable progress in integrating pro-poor environmental priorities into the national, sectoral and sub-national development planning and budgeting processes. However, many PEI-supported countries have been experiencing challenges in measuring and accounting for the nexus between poverty and environment in an empirical and systematic manner throughout the core development planning process.

1.2. Purpose of the paper

This working paper has been prepared to review the approach of PEI in identifying, measuring, accounting for and reporting on the Poverty-Environment Nexus (PEN) and to explore ways to strengthen PEI's current approach. This report provides an assessment of the opportunities to use the System of Environment Economic Accounting (SEEA) to enhance the PEN mainstreaming work of PEI and other partners.

This paper will also contribute to one of the focus areas of the current phase of PEI which is to analyse achievements and lessons learned to build on PEN knowledge and prepare products to influence regional and global development agendas in support of sustainable development.

This report will focus on explicitly linking the environment to poverty by developing a measurement and analytical approach that addresses two key questions:

i) How are changes in poverty linked to changes in the extent and condition of environmental assets?
ii) How are changes in the environment (extent and condition) driven or influenced by the impoverished or through changes in poverty?

In order to understand and analyse both these questions, this paper will develop and present a framework that reflects the inherent connections within the PEN. The resulting framework will be used to provide links (through quantitative data or demonstrate causal relationships) between changes in poverty and changes in the environment to support both policy and decision making.

2 Poverty-Environment Nexus

This section outlines the general approach to understanding the linkages between the poverty and the environment, commonly referred to as the Poverty- Environment Nexus (PEN).

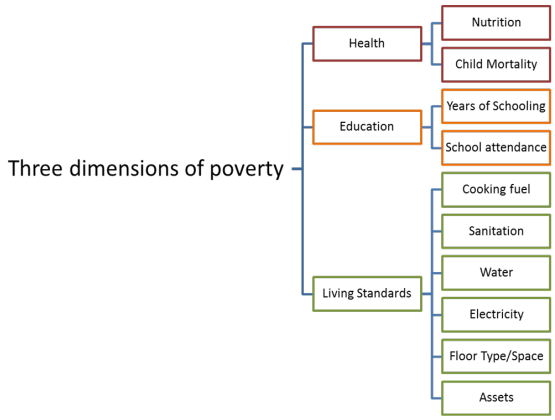
2.1 Existing approaches to poverty measurement

Poverty itself is difficult to define and measure. There are many poverty indicators that are based solely on income. Income based indicators focus on a threshold level of income and people that are below the threshold, are considered to be poor. This approach to estimating poverty is common in developed economies. However, income based approaches do not account for many of the non-market goods and services the poor rely upon, in particular the goods and services provided by the environment.

There are a number of alternative approaches to measuring poverty that go beyond income and include indicators of health, education and living standards. Quite often indices are developed that include a number of these factors and these are referred to as multi-dimensional poverty indexes (MPI).

Figure 1 below is an example of an MPI that includes health, education and living standard indicators. Within each of the indicators there are sub-indices, for instance the health indicator includes indicators on nutrition and child mortality.

Figure 1 Multi-dimensional poverty index (MPI)[2]



Generally, MPIs make reference to elements of the environment but provide limited information to understand the causal links between the environment and poverty to inform policy and decision making. For example, in

Figure 1 above, the environment may be implicitly recognised in the sub-indices of water and assets[3] but it is not clear how the quality of environmental assets or access to them is taken into account nor are the linkages between environmental indicators and other dimensions of poverty made apparent.

There are some efforts underway to incorporate some environmental factors into an MPI framework or to the HDI such as a "green HDI". However, even if additional indicators or sub-indicators are incorporated to reflect the environmental concerns of the poor, there is no underpinning rationale for the selection and weighting of these indicators within the overall index (a problem that besets most composite indicators). As a result, interpretation of the results and the ability to use the information to inform policy responses and link with underlying environment assets is limited.

By increasing the number of environmental factors, existing approaches in poverty measurement such as MPI may be able to respond partially to the question on how changes in the extent and condition of environmental assets affect changes in poverty. However, existing approaches in poverty measurement, even if they further incorporate environmental and climatic factors into indicators of poverty, cannot respond to another critical question on "How changes in poverty are driving or influencing changes in the environment (extent and condition of environmental assets)"?

2.2 Multiple dimensions of Poverty-Environment Nexus

The linkages between poverty and the environment are complex, and strongly influenced by demographic, institutional and cultural factors. In some circumstances, a positive relationship between poverty and environmental degradation has been identified, lending support to the hypothesis that poor producers systematically degrade the natural resources on which they depend if they have no alternatives. In addition, a positive relationship is observed between poverty and environment and climate-related disaster risks. Poverty is one of the key determinants of exposure to environment and climate-related disaster risks, with impacts on income, health, education and

[2] Adaptation from Alkire et al 2016
[3] Assuming assets include natural resources such as land

employment (ODI 2013). In other cases, it appears that over-exploitation of natural resources (such as forests and fisheries) is more likely the result of actions by relatively wealthy interests engaged in the pursuit of commerce[4].

Understanding and quantifying the PEN is essential for developing policies across a broad range of areas – labour, economic, environmental, markets, institutional, etc. The following discussion examines some of the dimensions in which poverty exhibits itself and is linked to environmental assets. This discussion will be used to help guide the nature and form of information (environmental-economic accounts) that can be used to better understand and quantify the PEN.

Spatial dependencies: There are a number of spatial dependencies that exist between the poor and the environment. The poor's exposure to environmental degradation is distinctive for two reasons. First, the location and the surroundings inhabited by the poor are often environmentally vulnerable or degraded. For instance, a degraded water source (lake or river) results in poor water quality and if consumed ill health. The individual natural resources the poor have access to are often fragile or degraded and present significant risks to both current and future health and income generation. Second, the lack of a strong resource base makes it difficult for the poor to opt out of a degraded environment and generate income from alternative sources or using less degraded resources[5]. In that sense, the poor in many instances are victims of location (circumstance) rather than degraders of the environment.

Diverting labour: Environmental degradation can lower labour productivity, even when people are relatively healthy. For example, as fuel wood becomes scarce, poor households must spend an increasing amount of time collecting it. Time taken away from other productive activities like agriculture has an opportunity cost for the poor and can result in lower incomes. Further, families are not able to compensate for this diversion of labour resulting in a reduction in household income from agriculture and deterioration in food consumption levels and nutritional status. Often this is also linked to gender issues were women are often required to spend more time collecting wood and water for the family.

Reduced productivity of the poor's natural resources: Where the poor depend on biomass fuel and confront increasing fuel-wood scarcity, they often shift to using animal dung, fodder, and crop residues for fuel. Since reduced quantities of these residual materials are returned to the soil, its fertility may decline. Where the poor depend on the consumption of wild animals are exposed to a fall in quality of natural resources their capture of the animals becomes scarce and they turn to domesticated stock and animals. The increased pressure on domesticated herds often reduces the poor's ability to produce in the future and be exposed to greater risk without a buffer in stock numbers.

Growth in rural populations can put extra pressure on local and surrounding land resources to produce more crops resulting in the shortening of fallow periods for land in the community. This too can have a negative impact on the health of the soil and hence its productivity.

Poverty may also constrain farmers' ability to maintain soil productivity through more intensive application of variable inputs, such as fertiliser and water.

[4] http://www.prem-online.org/index.php?p=about&a=21

[5] It is becoming more apparent that emerging pockets (concentrations) of urban poverty are linked to migration of the poor from rural (degraded environments) to urban centres seeking income and support.

Impact of poverty on resource management: The poor struggling at the edge of subsistence levels of consumption are pre-occupied with survival strategies on a day-to-day basis. Their ability to plan ahead is often restricted to a critically short time horizon, often measured in days or weeks. They have less ability to save for the future. As a result, they cannot opt for investment in natural resources including in better crop varieties that can have higher yields or withstand higher temperature or drier weather conditions, which is likely to provide a return in the medium- and long-run. A high, subjective discount rate (high rate of pure time preference) implies rapid resource extraction to meet present income or consumption needs, and low investment in natural resources to improve future returns. This has significant dynamic implications for growth and subsequently on poverty reduction over the long term and environmental resource recovery and planning over the long term.

Risk and access to natural resources: Generally, the poor are faced with higher risks or greater uncertainty. Poor farmers may perceive their access to land as tenuous because of conflicts associated with managing and accessing the land. Further, because of other claimants, or the overlap of different land rights, the poor are generally marginalised. Better-off families (often rural) are more likely to have the capacity to establish farm claims to land where a transition is occurring from common property to private property, or where there are lengthy and costly administrative procedures for establishing legal title to land. Under such circumstances, the poor's interest in undertaking longer-term investment in the productive capacity of land is likely to be severely diminished.

Common Property Resource (CPR) often serves as a form of insurance that poor rural residents can turn to if they face setbacks in their primary income generating activities. However, often the issues affecting the poor in particular regions are common to all of them thus placing increased short term pressure on any other CPR located within the region. Degrading natural resources significantly affect access to this natural form of insurance for the poor and expose them to greater risk and uncertainty.

The poor's constraints in managing risks: Poor households mostly at risk of falling below subsistence levels of consumption treat available natural resources as an asset to be drawn down in times of emergency. The options for managing the resources are often limited or not always available to the poor. Their assets and agricultural stores are minimal and quickly depleted. Credit and insurance markets for the poor are frequently fragmented or non-existent. This lack of options implies higher levels of uncertainties and insecurities with implications for the management of environmental resources.

Based on the above discussion the following environmental features emerge as important: *asset location* (spatial dependencies), *extent and condition of environmental assets, sustainability* (degradation), *resource (asset) management, patterns of change* (time and location), *productivity* (both labour and environmental assets) and *risk* (thresholds and resilience of environmental assets). The SEEA framework provides guidance on how to measure and report on these features in order to make links to economic wellbeing. The following sections outline how the SEEA may be extended to focus on measurement and reporting to of environmental features to inform poverty policy and decision making.

3 System of Environmental Economic Accounting (SEEA)

Based on the analysis of the limitations of existing approaches to poverty measurement and the core elements for understanding the causal relationships between poverty and environment, this report proposes to build on current environmental-economic accounting (EEA) frameworks and develop a poverty specific application of EEA.

In 2012 the United Nations (UN) adopted a new approach to accounting for the connections between the environment and the economy called the System of Environmental-Economic Accounting (SEEA). SEEA is an information and analytical framework for linking economic activities to the quantity and quality of environmental assets[6]. It provides statistical standards that build on the principles of the System of National Accounts (SNA) – the accounting framework that underpins the measurement of gross domestic product, national wealth and other key macro-economic variables. The SEEA framework (presented in two documents - the SEEA Central Framework and the SEEA Experimental Ecosystem Accounting) encompasses accounting for minerals, energy, water, fisheries, land and ecosystems, biodiversity, agriculture and forestry. Some of these environmental assets and activities are reported in standard economic accounts following the SNA, but the SEEA extends the information set using a systems approach which explicitly accounts for the extent and condition of environmental assets and how changes in them impact on individuals and society. Indeed, a key feature of the SEEA is the recognition and quantification of the linkages between environmental assets and social and economic wellbeing.

The challenge in applying the accounting principles of the SEEA to help understand the PEN is to take poverty related measures of social and economic wellbeing and link them to environment. The SEEA provides an opportunity to re-examine the methods employed to understand the PEN. Employing statistical and accounting standards brings a new approach to defining the 'environment' and also provides for more formal approaches to linking the environment to social and economic wellbeing.

In order to support the integrated analysis that is required for measuring and accounting for the Poverty-Environment Nexus, an adaptation of the SEEA framework is proposed that brings relevant information, notably concerning the features listed in Section 2 above, into a common and integrated setting. The next section introduces the SEEA, describes the ecosystem accounting core model and discusses how the SEEA framework can be adapted to link specifically with poverty through a Poverty Environment Accounting Framework (PEAF).

3.1 An Introduction to the SEEA

A key motivation for environmental-economic accounting is that previous approaches to analysing the economy did not recognise the vital nature of the relationship between humans and the

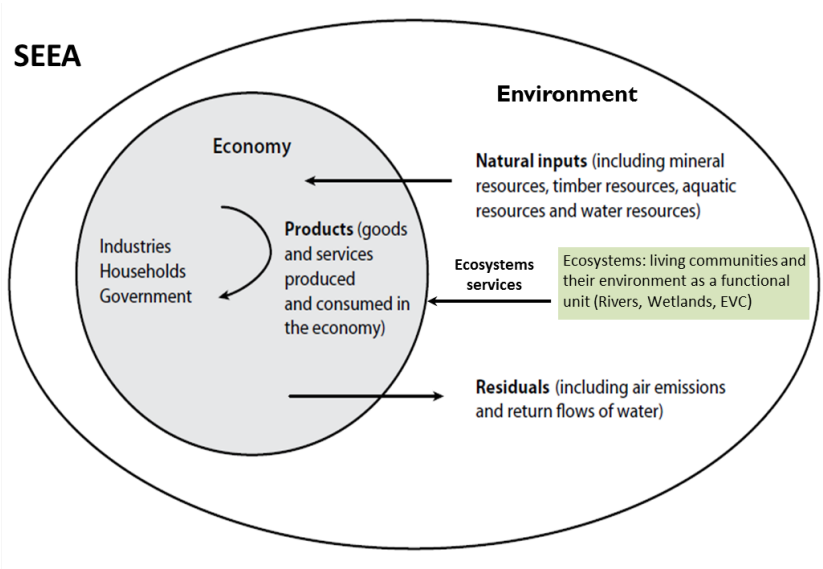
[6] The development of SEEA commenced in 1993. The final revision process was administered by the UN Committee for Environmental-Economic Accounting (UNCEEA). The Statistical Commission established the Committee of Experts (UN Committee for Environmental-Economic Accounting, UNCEEA) at its thirty-sixth session in March 2005 with the mandate, among others, to oversee and manage the revision of the SEEA. The Committee was composed of representatives from national statistical offices and international agencies as members. Expert groups including academic and research organisations, corporate groups and national environmental agencies also contributed. See: http://unstats.un.org/unsd/envaccounting/seea.asp

environment. The SEEA provides a platform for the integration of information on environmental assets and environmental flows with information on economic and other human activity.

Figure 2 presents a generic overview of the SEEA framework showing the links between the environment and the economy. The environment provides natural inputs to the economy that are then combined with man-made capital and labour to produce goods and services. The economy in turn produces residuals during the production process of which some are returned to the environment. The environment can also assimilate some of those residuals, such as nutrient runoff into waterways and emissions to the atmosphere.

A key feature of the SEEA is the recognition that the environment provides natural inputs to the economy that are then combined with manufactured assets and labour to produce goods and services. The distribution of benefits (goods and services) to people is key to understanding the sources of poverty based on the use and condition of environmental assets.

Figure 2 Overview of the SEEA



The SEEA has emerged from work initiated by the international community of official statisticians with an initial edition of the SEEA in 1993 following the first Rio conference on sustainable development. A revision process that commenced in 2007 led to the release of two key SEEA publications, the SEEA Central Framework (SEEA CF) and the SEEA Experimental Ecosystem Accounting (SEEA EEA). The SEEA CF has been adopted by the United Nations Statistical Commission (UNSC) as an international statistical standard on par with the System of National Accounts (SNA) which is the standard underpinning the measurement of gross domestic product and other key economic variables. The SEEA CF is based on the same accounting standards that are used in the SNA to ensure consistency and coherence between the two and enable links between environmental and economic data. In the SEEA CF, environmental assets are accounted for as individual resources such as timber resources, soil resources and water resources.

Ecosystem accounting, as described in the SEEA EEA, complements and builds on the accounting for environmental assets described in the SEEA CF. In ecosystem accounting the individual resources are accounted for in terms of their combination within an *ecosystem*. "Ecosystems are a dynamic complex of plant, animal and micro-organism communities and their non-living environment

interacting as a functional unit." (Convention on Biological Diversity (2003), Article 2, Use of Terms). Ecosystems may be identified at different spatial scales and are commonly nested and overlapping. Consequently, for accounting purposes, ecosystem assets are defined through the delineation of *specific and mutually exclusive spatial areas*.

While there has long been recognition of ecosystems in the context of environmental-economic accounting, and particularly of the need to account for the degradation of ecosystems, the approach described in the SEEA EEA has only emerged in recent years. Its design is attributable to the relatively recent development of concepts concerning ecosystem services. With these concepts, it has been possible to incorporate accounting for ecosystems using the accounting principles and techniques that have been developed for the measurement of manufactured assets such as buildings, dwellings, machines and equipment.

The ecosystem accounting approach outlined in SEEA EEA extends and complements a range of other ecosystem and biodiversity measurement initiatives in a number of important ways. In particular, it:

- accounts for the changes in ecosystem condition and function (including changes in biodiversity) and the flows of ecosystem services;
- encompasses measurement in both biophysical terms (e.g. in hectares, tonnes) and in monetary terms where flows of ecosystem services can have monetary valuations attributed or through various non-market valuation techniques;
- recognises the residuals from economic activity that are often associated with health and welfare impacts (impacts that are generally more acute for those on low incomes or poor)
- facilitates comparison and integration with the economic data prepared following the SNA (e.g. components of GDP) and facilitates the mainstreaming of ecosystem information with standard measures of income, production and wealth; and
- provides a broad, cross-cutting perspective on ecosystems at a country, sub-national and local scale.

More recently, a separate application of the SEEA CF has been developed; the SEEA for Agriculture, Forestry and Fisheries (SEEA AFF). SEEA AFF has been developed by the Food and Agriculture Organization of the United Nations (FAO). It is a statistical framework for the organization of data that permits the description and analysis of the relationship between the environment and the economic activities of agriculture, forestry and fisheries. These primary activities are dependent upon the environment and the resources and services it provides and, at the same time, the activities have impacts on the local and surrounding environment.

Understanding the relationship between these activities and the environment supports a broader understanding of the nature and impact of the production of agricultural, forestry and fisheries products, and provides information for the analysis of food security; environmental condition and the sustainability of food, fibre and material production; the potential for bioenergy and the associated trade-offs, and issues related to rural incomes, employment and poverty.

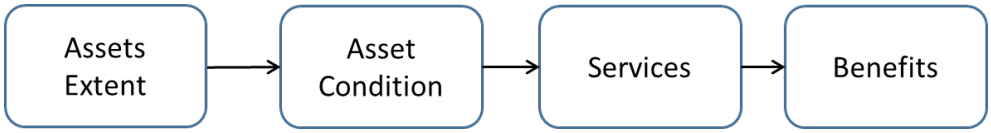
Additional thematic SEEA documents have been developed in the areas of water and energy, and a separate release describes relevant applications and extensions for SEEA based datasets. Overall, the SEEA family of publications provides a comprehensive description of how environmental and economic data can be integrated for analytical purposes.

3.2 Ecosystem accounting

Figure 3 provides an overview of the SEEA ecosystem accounting core model. Ecosystem assets, in accounting terms referred to as ecosystem units, range from highly modified to natural including forests (native and plantation), waterways, rivers, wetlands, estuaries, flood plains, cropping land, grazing land. An ecosystem unit can be described and delineated (mapped) based on differences in plant communities.

The condition of each asset provides information about how the asset is performing and its capacity to produce ecosystem services. Generally, the condition of the asset is reported empirically in the form of an index or aggregate measure (Eigenraam, Obst et al. 2016). For example, a set of benchmark indicators can be developed that describe the soil, plant density and type, weed and pest presence, etc. For any given location, the benchmarks can be used to compare what is expected to be present for an ecosystem (forest, pasture, etc) to what is actually present. Each component (soil, plant density and type, weed and pest presence) is then weighted and aggregated to give an overall score or index of condition. The condition of the ecosystem asset impacts on the productivity of the asset (tonnes per hectare) and, in turn, its ability to provide ecosystem services and, ultimately, benefits (e.g. food and fibre, clean air and water) that used by individuals, businesses and society more generally, collectively referred to as beneficiaries.

Figure 3 Ecosystem accounting core model



Both the extent (area, size) and condition of an ecosystem determine its ability to function and provide services and benefits. The model encompasses (i) the services that flow into the economy (e.g. soil nutrients, water, timber) and (ii) the services that influence our physical/cultural living environment (e.g. water filtration and habitat). Both of these types of services contribute to our social and economic wellbeing received in the form of benefits. Following the Millennium Ecosystem Assessment (MA, 2005) ecosystem services include:

- **Provisioning** services reflect material and energy contributions generated by or in an ecosystem, for example a fish or a plant with pharmaceutical properties.
- **Regulating** services result from the capacity of ecosystems to regulate climate, hydrological and bio-chemical cycles, earth surface processes, and a variety of biological processes. These services often have an important spatial aspect. For instance, the flood control service of an upper watershed forest is only relevant in the flood zone downstream of the forest.
- **Cultural** services are generated from the physical settings, locations or situations which give rise to intellectual and symbolic benefits that people obtain from ecosystems through recreation, knowledge development, relaxation, and spiritual reflection. This may involve actual visits to an area, indirectly enjoying the ecosystem (e.g. through nature movies), or gaining satisfaction from the knowledge that an ecosystem containing important biodiversity or cultural monuments will be preserved.

Benefits include the social, economic and environmental benefits society gains from the services supplied by environmental assets. Benefits may accrue in both monetary and non-monetary terms. Changes in the extent and condition of environmental assets will have an impact of the supply of

benefits. All benefits are associated with a beneficiary – an individual a business or group of people. The benefits provided by an environmental asset may be transported and distributed to global, national or local beneficiaries.

4 The Poverty Environment Accounting Framework (PEAF)

The Poverty Environment Accounting Framework (PEAF) is an application of the accounting principles described in the System of Environmental-Economic Accounting (SEEA) to advance the measurement and analysis of the Poverty Environment Nexus. The description in this section reflects the first articulation of the PEAF and, as such, serves as a basis for further discussion, testing and refinement through the UNDP-UNEP PEI programme and other relevant initiatives and partners.

The PEAF is not a new accounting standard but is an adaptation of the SEEA to portray the casual relationships between the environment and poverty and thus support quantifying, reporting and accounting for the PEN to support decision making and policy analysis. A key aim of the paper is to describe the PEAF building on the principles and guidelines contained in the SEEA.

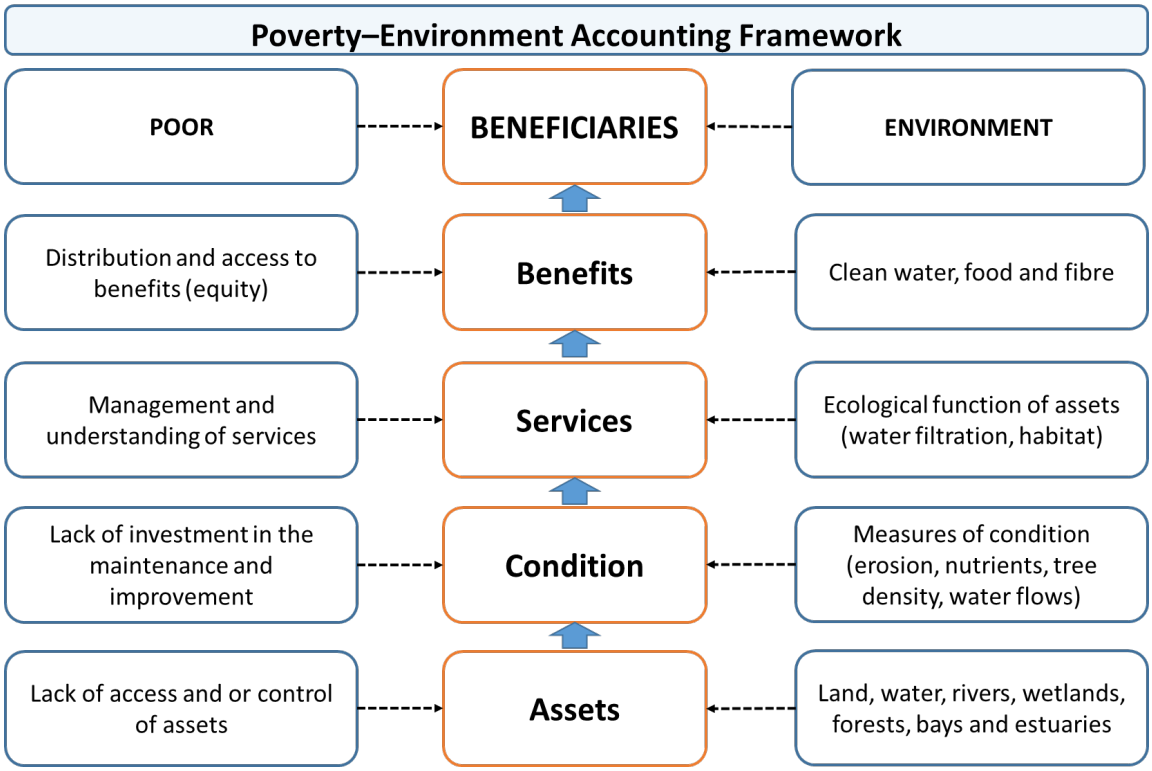
4.1 Introduction to the PEAF

The PEAF is a framework that is used to produce a set of information to underpin Poverty-Environment Nexus (PEN) specific indicators. The key difference of the PEAF from traditional approaches is the deliberate attempt to produce an information set that is inherently integrated. An integrated information set allows for the coherent quantification and empirical examination of the PEN, and can be used to inform policy and decision making – both from a planning, investment decision-making and performance assessment perspective.

The PEAF is an integrating framework for poverty-environment data and statistics that can be used to help understand how effective institutional policies and programs are at addressing the PEN. The information set should, consequently, strengthen the ability of institutions to engage in PEN related policies in a systematic and coordinated manner. The PEAF is not a new accounting standard but an adaptation of the SEEA to portray the causal relationships between the environment and poverty and thus support quantifying, reporting and accounting for the PEN to support decision making and policy analysis.

The PEAF shown below emerges from the application of the core model of ecosystem accounting thus bringing together assets, condition, services, benefits and beneficiaries. A key feature of the PEAF is the recognition of beneficiaries (including the poor) and their connection to the environment. This focus makes the framework fundamentally an empirical approach to accounting and reporting on the PEN.

Figure 4 Poverty-Environment Accounting Framework (PEAF)



In line with the SEEA EEA, the foundation of the PEAF is the spatial units of ecosystem assets. It is the access to, and control of, spatial areas – i.e. specific areas of land and ecosystems - by people, both the poor and the wealthy that underpins the link between the environment and human activity. By framing poverty-environment accounting in terms of spatial areas, the accounting framework provides a means by which a wide range of data can be integrated. It is this spatial perspective that underpins the PEAF and makes quantifying the PEN possible. Using the condition, services and benefits elements of the ecosystem core model, the PEAF envisages producing basic data tables and accounts to support analysis of alternative management and policy approaches to improving the condition of environmental assets and reducing levels of poverty.

In section 2.2, the following environmental features were identified as core elements that need to be measured and reported on in order to link the environment to poverty: asset location (spatial dependencies), extent and condition of environmental assets, sustainability (degradation), resource (asset) management, patterns of change (time and location), productivity (both labour and environmental assets) and risk (thresholds and resilience of environmental assets).

The following provides a discussion on how each of the features can be incorporated into the PEAF and the PEAF can be used to account and report on the links between the environment and poverty.

Asset Location: access to and control of environmental assets (land, rivers, wetlands and forests)

It is critical to understand where the poor and natural resources are located. The PEAF incorporates information on the location of environmental assets and their condition which can be used to quantify the benefits (food and fibre) that can be provided. Location is also an important factor of poverty in terms of geographic distribution of exposure to different types of environment and climate related hazards across different income groups. Further, this information can be linked to spatial distributions of poverty (e.g. in terms of numbers of people below certain income levels) to assess potential impacts on access, common property issues, travel and mobility in times of hardship

and stress and importantly the substitutability of natural resources in a spatial context. PEAF accounts that consider location can also be used to understand rural-urban migration patterns and potential drivers, such as situations in which rural environmental assets are being degraded or otherwise used unsustainably. Alternatively, the accounts can focus on urban areas and account for locational changes in urban amenity linked with environmental changes including air pollution and health impacts.

Using information at the spatial level (assets) of the PEAF, it is possible to undertake an analysis of how institutional and legal frameworks influence access and control of ecosystem assets. It is also possible to measure changes in ecosystem condition. Combining these two elements, it is possible to develop a spatial map of the distribution and condition of ecosystem assets on the one hand and the location of the poor to help understand how distance from resources and location impact on multiple dimensions of poverty.

Asset Condition: maintenance and improvement of condition of environmental assets for and by the poor

Measures of resource condition (quality) are essential to understanding the capacity of a natural resource to provide services and benefits. The PEAF incorporates condition accounts at a spatial level and reports on the quantity of benefits being provided by environmental assets. Further, environment asset accounts can also be presented to highlight measures of degradation and report on changes in environmental assets due to human use and changes due to natural disasters (e.g. flood, cyclone, drought). For water resource management, understanding the condition and extent of rivers and wetlands is essential and links also to issues of the availability of clean and reliable water resources. This type of information can be used to inform investment programs that could focus on resource recovery (a healthier river or lake) or targeted clean water distribution systems (filtration of poor quality water for potable use).

Asset Services: risk and sustainability of services from environmental assets for and by the poor

By combining information from a number of accounts, sustainability indicators can be developed. For example, understand the flow of services and benefits relative to the changing condition of the natural resource. Such measures can also be linked to spatial statistics on poverty to help inform the PEN in an empirical manner. The design of information produced using the PEAF explicitly recognises the importance of time series information to understand the current and future use of resources and to find pathways towards sustainable use. From a PEN perspective, understanding sustainability supports answering questions such as whether the current flow of services and benefits can be sustained into the future; and whether the current rate of degradation can be sustained without investment in resource condition (or at what point an irreversible threshold may be reached).

Thresholds (the risk to assets) concerning the extent and condition of environmental assets are important to understand so that policies and programs can be put in place to prevent complete system failure. A key feature of the PEAF is that the design of the asset and condition accounts is based on ecological principles. The principles take into account ecological thresholds and the resilience of ecological assets. This type of information is important for managing risk both in the short and long term.

Benefits provided by assets – productivity, patterns and drivers of use

Labour productivity refers to the ability of people to manage environmental assets efficiently with the minimum of labour as an input. Due to the integrated nature of the PEAF – building on, and

linking with traditional economic and labour statistics – it is possible to provide more comprehensive measures of productivity taking into account labour force, degradation and sustainability. Using this information, it is possible to better target educational and capacity building programs aimed at improving the ability of people to use environmental assets more effectively, in effect increasing productivity by increasing output or more effectively employing labour, manufactured assets, and natural resources.

Both the level of poverty and the drivers of poverty are dynamic – it is important to understand how the pattern of use and the flow of benefits is changing through time to direct resources appropriately. As noted for degradation, the PEAF accounts explicitly consider dynamic drivers for both the long and short term. Time series information can be produced to identify key dynamics and the rate of change for specific locations and environmental assets. This information can then be used to target both long and short term strategies to help address the PEN.

The following section considers in more detail the application of the PEAF in the context of existing approaches to developing information for PEI and other relevant programme purposes.

4.2 The PEN information challenge the PEAF responds to

There is much social and economic data that is collected and used to report on poverty. However, much of the data is collected in isolation from the underlying environmental asset base. Without clear links to environmental assets it is very difficult to make casual links between changes in either poverty or the environment. Both can be reported on independently but it is not possible to quantify the connection between them and empirically examine the PEN.

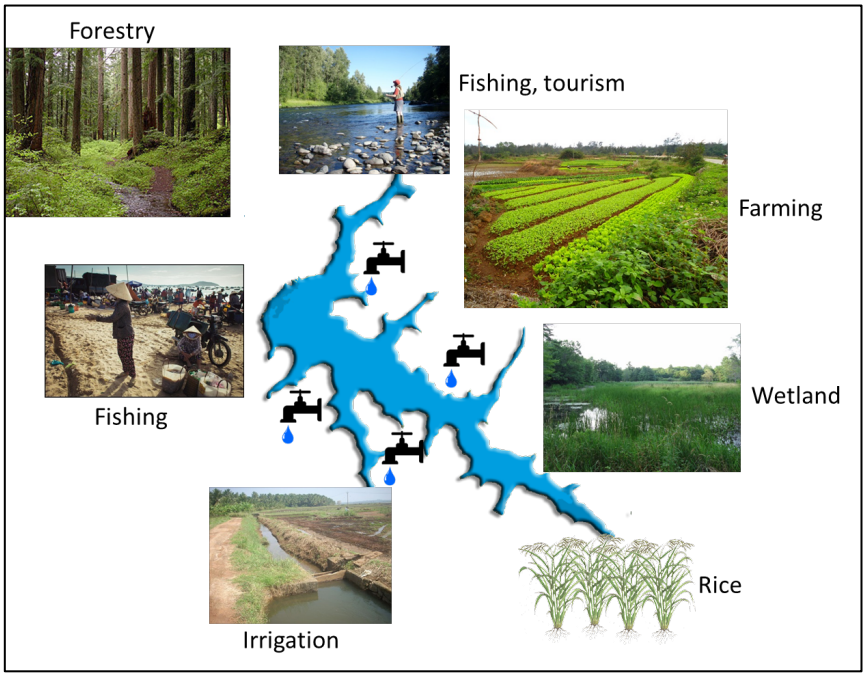
In this context, the PEAF responds to two key issues:

I. The hierarchy between statistics and indicators is not well understood i.e. indicators are commonly selected based on issues (poverty or the environment) rather than emerging from an integrated measurement framework that reflects an understanding of the asset base.
II. Location is key to understanding the poverty-environment nexus. Information needs to be collected and linked to location in an integrated and coordinated manner. Variable and ad hoc approaches to geo-referencing of data sets and other spatial referencing of data do not support the integration of data.

Figure 5 below shows how a lake can be impacted by a number of different uses. From an integrated spatial accounting perspective, the following accounting themes can be integrated in the PEAF:

- SEEA Central Framework: water accounts (volume and use of water from the lake), forest accounts, land accounts (rice, farming, irrigation), tourism accounts, fish production accounts
- SEEA Ecosystem accounting: wetland accounts, species accounts (both in the lake and on land), ecosystem diversity account (native forests), river quality and extent accounts (flowing into the lake)
- SEEA Agriculture: farming (linking excess nutrient flows to lake condition and water quality accounts), irrigation (linking water use to agricultural output)
- SEEA Water: potable and irrigation water accounts, water quality accounts

Figure 5 Integrated spatial accounting



There is a clear overlap in the accounts using each of the SEEA focus areas. For instance, water is accounted for in four areas. However, the distinctive feature is that having designed the collection of basic data, the PEAF can be used to apply a single coherent data set to look at water issues from multiple perspectives – i.e. different perspectives emerge from the different accounts within the PEAF. For example, from a basic water data set, a number of water accounts can be produced that meet the needs of users including accounts reflecting: water supply, water quality, access to clean water, water use by industry, location of water supplies, and water use by purpose (drinking or irrigation).

The links between basic data, accounts and indicators can be reflected as an information pyramid as shown in Figure 6 below. Basic statistics are collected with location in mind and data in each domain can be linked back to the underlying environmental assets (land, water, rivers, wetlands, soil, etc.). The accounts developed from the basic statistics, structured following the PEAF, can also be location specific if required (region, watershed, etc.). For each account the data can be disaggregated back to the basic statistics to gain an understanding of where a change may be occurring.

The PEAF accounts for each domain of interest, social, economic and environmental can be spatially analysed and integrated based on the user's requirements. In the past, the data for each domain were collected independently and work undertaken ex poste to understand the links between changes in each domain.

Based on a broad set of accounts, a series of indicators can be developed based on the management and policy questions users are interested in examining. It should be noted that the selection and definition of indicators should be built on basic statistics and accounts not the other way around. Often users (of indicators) develop a suite of indicators based on a discussion or the selection of

policy issues and then look for data to populate the indicator. In these cases, it will often be necessary to accept proxy data where none exists thus reducing the efficacy of the indicator. By adopting an approach to developing indicators based on basic statistics and accounts, users can identify data gaps and initiate new data collection and accounts if required. The advantage of this approach is that new data are collected in an integrated manner and can be combined with other statistical and account information.

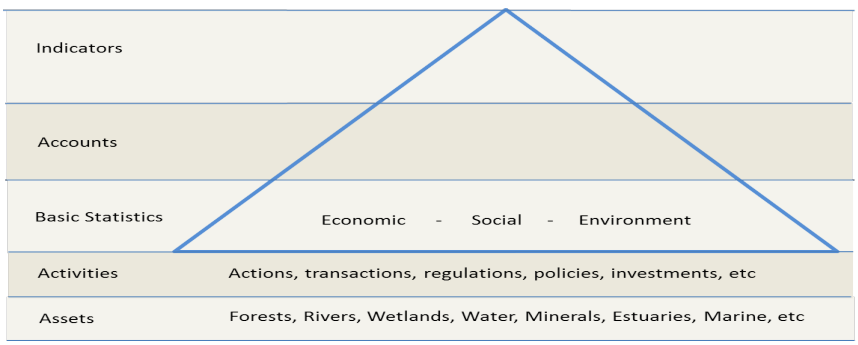
As an example of how this approach can work consider the theme of water quality. Water quality measures are often included in multi-dimensional poverty indices. However, in a broader context, poor water quality is a symptom of poor quality environmental assets. For instance, a polluted river or a degraded wetland can lead to low water quality. If the focus is solely on the issue of water quality, a plausible response is to target water purification as a solution. However, that may be only part of the solution. The other part of the solution is to understand why the water is of poor quality and whether the underlying environmental assets are degraded. Policy response can then consider what can be done to improve asset condition so that water quality is improved. The advantage of this approach is that any improvement in the underlying environmental asset will likely have other benefits over and above improvements in water quality. In sum, through the PEAF relevant information on both water quality and environmental asset condition is considered jointly, and coherently, and thus provides a more holistic information base for developing policy responses.

Wood from forests for energy production is another example. An energy initiative or program that aims to provide electricity or gas as a substitute to wood does not address that underlying problem of a degraded forest asset. If the forest assets were managed differently or forest assets were expanded, the supply of wood would change. The PEAF provides an approach to consider this type of information in a coherent manner.

At the base of the information pyramid are a set of activities including regulation, management, and policies which all impact on the use and condition of environmental assets. These activities may originate from any number of agencies (for example environmental, planning and finance) and be motivated by different objectives. However, in essence the choices of all agencies have an impact on the same set of underlying environmental assets. Within a PEAF based information set, one set of information on the underlying environmental assets and related flows is maintained and then used across different policy agencies. This is analogous to the situation for economic statistics where one measure of economic activity, GDP, is compiled for a country and used by all policy agencies, as well as the finance sector and other private sector operations.

Applying the PEAF, and keeping in mind the information pyramid, it is possible to use basic data to compile accounts and then to develop indicators to report on the PEN. The following sections provide further detail on how SEEA data sets can be used to understand the PEN.

Figure 6 Linking environmental statistics to poverty indicators



4.3 SEEA macro level accounts and sub-aggregates

The discussion above provides a broad characterisation of the relationships between different types of information. In practice, information is required at different levels to inform specific policy questions and decision making contexts, such as those relating to the PEN. Aggregate environmental accounts are used to develop macro level indicators of the relationship between environmental assets and social and economic wellbeing. For specific analytical purposes, these macro indicators can be disaggregated to different levels including industry, institutional sectors, type of environmental activity, asset types and population groups. The following descriptions of these different approaches to disaggregation are provided based on the SEEA Applications and Extensions.

- **Industry Level Disaggregation**: in accordance with standard industry classifications (ISIC). Industry disaggregation aids understanding of how structural changes in the economy affect environmental pressures and the use of environmental resources. It is also useful in understanding the contribution of different industries to common environmental issues (such as GHG emissions, water pollution) when reviewing the integration of environmental and industry specific policies.
- **Institutional Sector Disaggregation**: such levels of disaggregation help to distinguish government responses from those of the corporate, government or household sectors. This could be relevant to a range of issues, including understanding expenditure on environmental protection, which sectors pay environmental taxes and who receives resource rent.
- **Disaggregation by type of environmental activity:** represents an extension beyond standard industry disaggregation. Here the purpose of activity undertaken by economic units (enterprises, governments and households) may be broken down into different types of environmental activity following the Classification of Environmental Activities (CEA) described in Chapter 4 of the SEEA Central Framework. Examples of relevant types of environmental activity include environmental protection activity and resource management activity.
- **Disaggregation by Product or Asset Type**: can help in understanding issues such as the extraction of resources in relation to their availability/sustainability of use. Another example is disaggregation by type of energy product, which can be useful in understanding the fuel mix and other compositional issues in the analysis of energy supply and demand.
- **Disaggregation by population groups**: for example, by age classes, gender and income levels may be important in understanding the distributive aspects and social consequences of environmental policies and economic instruments. The combination of data required for disaggregation by population groups with SEEA based information is considered further in Chapter 4 of SEEA Applications and Extension.

Of particular interest in analysing the PEN are the dis-aggregations by institutional sector, in particular households; dis-aggregations by industry, including agriculture, mining, manufacturing, minerals, forestry and fisheries; and dis-aggregations by population groups, particularly by income and consumption cohorts.

Given the potential for focusing on lower level groupings of information, SEEA based indicators can help capture and inform the multi-dimensional poverty and environment nexus. As described in this report, poverty will commonly be linked to environmental condition and often the poor and vulnerable groups rely on the environment for their livelihoods and well-being. For these reasons the poor can also contribute to and be affected by policies designed to manage natural resources and respond to related environmental issues.

Given the many different factors influencing well-being, livelihoods, and sustainable development, no single indicator, such as income or other financial data, can reflect the multiple aspects of poverty, deprivation, and links to the environment. The multiple dimensions of poverty link to the environment and the economy in many ways. These links include empowerment, inclusion, health, education, living standards, environmental degradation, ecosystem services, income, employment, food, water, sanitation, energy, safety, and access to basic services and infrastructure.

Key areas in which SEEA might be further disaggregated to capture relevant information relate to data on spatial location of stocks and flows of water, energy and land resources. Water and energy resources are central to the operation of well-functioning households and communities in all parts of the world. The extension of most direct relevance is the breakdown of household consumption of water and energy by household.

The types of disaggregation that are applied will depend on the location, analytical interest and data availability. There may be interest in disaggregating information on household consumption of energy and water use by purpose, i.e. differentiating energy used for heating, cooking, transportation or water used for washing, cooking, bathing, etc. Alternatively, there may be interest in dis-aggregations that aid in the study of equality and development. In this case data that differentiates urban, regional and ecosystem specific areas, special population groups (e.g., the elderly, families with young children, specific ethnic groups) or household consumption and activity by income decile or quintile, may be most relevant.

5 PEAF in practice

The PEAF accounts play an important role in integrating information on ecosystems using a spatial approach. When national level indicators hide important regional variations, spatial disaggregation is a necessary component in understanding the relationship between, for example, the location of natural resource stocks, settlement areas and economic activities. The SEEA Land accounts present a method of assessing shares of land use and land cover within a country. Further, land is a fundamental resource and often linked to poverty either via access, degradation, productivity and common use.

Since the finalisation of the SEEA Central Framework in 2012 there has been a concerted effort by countries to implement environmental-economic accounting. Key agencies leading the efforts include the National Statistics Offices, Finance and Environmental agencies. Initially these agencies were motivated to understand investment in the environment and how economic and social wellbeing are linked to the environment. However, it is now recognised that many government programs at both the national and global levels are engaging in the management of environmental assets and dealing with climate change mitigation and adaptation but approaching it with slightly different objectives. This has led to a much broader recognition of the potential role of a common, coherent and integrated set of environmental-economic information that can be compiled centrally and used by many agencies.

Given the broader global and national efforts in environmental-economic accounting, the PEAF is not a stand-alone initiative but a refinement of current reporting and accounting methods with the specific purpose of enhancing integrated planning and investment management efforts of the PEI and other relevant initiatives. Being a part of the larger SEEA global initiative makes the integration and adoption of the PEAF simpler for countries and also reduces the costs of development and refinement by building on past experience.

5.1 PEAF and PEI Tools

The PEAF will help guide the production of a single set of data that is fully integrated and spatially specific. From that data set it is then possible to build accounts and indicators to support the design and implementation of P-E programs, monitor and evaluate P-E programs and support the systematic and integrated delivery of current PEI tools. Listed below are some of the current tools being employed as part of the PEI and other relevant poverty-environment mainstreaming initiatives and a brief analysis of what the accounts that the PEAF (based on SEEA) could provide.

Economic Analysis of Sustainable and Unsustainable Use of Natural Resources

The sustainable use of natural resources (environmental assets) is a key long-term driver of sustainable income and wellbeing. As noted above if there are climatic or other external pressures on the poor they may use natural resources in an unsustainable manner. The SEEA is designed to provide information on the degradation of environmental assets which is an indicator of potentially unsustainable use.

Building on the SEEA CF, the PEAF focuses on the spatial measurement and reporting of environmental assets including land, water, forests, minerals, soils and energy. For instance, soil, land and food production accounts can be linked to understand whether soil degradation on specific land is leading to lower food production and potential increases in poverty. This information can also be linked to other neighbouring ecosystem assets to understand how the soil degradation may be leading to degradation of say, rivers and wetlands (potentially influencing the quality of water used by the poor).

In Malawi, soil erosion has been largely caused by the expansion of agriculture, deforestation, overgrazing, and land scarcity which leads to cultivation in marginal and fragile lands. Scarcity of land predisposes land too short or no fallow and the resulting land use tends to be erosive (Yaron et al 2011). Using the PEAF to spatially quantify the land that is sensitive to erosion and link it to spatial planning and population statistics would provide an integrated set of information for a number of agencies and allow national governments to assess the trade-offs between alternative policies.

The SEEA EEA includes methods for classifying and reporting on ecosystems assets as an alternative representation of individual environmental assets (land, water, timber). There is potential to use estimates of ecosystem condition to help understand whether ecosystem assets are being used sustainably or if they are being degraded. Linking the asset and condition accounts it is possible to develop estimates of the benefits (goods and services) that could be provided.

Environmental (and Social) Impact Assessment

The SEEA EEA may be used to measure the extent and condition of environmental assets to help inform environmental impact. The environmental impact measured as a part of this tool links very closely to the economic analysis of the sustainable and unsustainable use of natural resources

above. For instance, it is common to see the economic impact of new investments (say mining or forestry) show significant returns at the national level. However, those analyses generally do not account for changes in the environment especially at the site of the investment. Often there are significant local impacts from mining and forestry activity with little change in local social and economic wellbeing. Further, over the longer term, local people are often deprived of income due to changes in local environmental conditions (environmental asset degradation) and a lack of access to the projects benefits (often the income is channelled to national and multinational agencies and companies).

It is clear that at a local level, the social impacts are a result of changes in the underlying assets and the benefits they are providing. Once again the information about the benefits an environmental asset is providing can be used to estimate social impacts in the form of ecosystem services and benefits available for use. There are also a number of other services linked to cultural practices and norms that may be linked to environmental assets that could be incorporated.

Integrated Ecosystem Assessments

The SEEA provides guidelines on how to use environmental, economic and demographic information for integrated analysis and reporting. The analysis can be used to help understand the causal links between changes in the environment and social impacts, and the reporting can provide information on trends in environmental degradation.

Millennium Ecosystem Assessments offer a framework for demonstrating connections between ecosystem services to sustain people's livelihoods and national economies, and for quantifying their value in monetary terms where possible. However, the approach used in each assessment is different for each country, whereas a consistent core model for linking ecosystems to economic and social wellbeing is required to understand causal links. By improving the understanding of the causal links, it is possible to evaluate and target interventions aimed at improving the environment and gaining pro-poor outcomes. Further, by applying the same core information model, it is possible to compare between sub-national programs and also between countries to inform program design and evaluation.

Valuation of Ecosystem Services

The SEEA provides guidance on valuation and how it can be used to understand changes in the value of environmental assets. However, in general, the SEEA focuses primarily on the use of bio-physical information and the development of indicators or metrics which can then be used to link with poverty or social metrics as described in the PEAF.

Indeed, often it is not the value of ecosystem services that is important but rather the source of the services (the environmental asset) and the sustainability of those services being provided in the future. The first two stages of the PEAF core model (assets and condition) focus on the physical accounting of assets to gain a deeper understanding of the assets and their location. This information is missing in many valuation exercises and/or the links between the underlying assets and the valuations are not well understood or demonstrated. This can lead to a lack of focus in future programs – the results indicate high values but there is not sufficient information to guide future decisions with respect to managing the underlying environmental assets. Since the PEAF has as its foundation an understanding of the links between environmental assets and social/economic wellbeing in bio-physical terms, valuation within the PEAF framework is developed in a well-established context supporting additional understanding and coherence of information.

Public Environment and Climate Expenditure Reviews[7]

The PEAF can be used to inform future financial (or budget) expenditure reviews to help focus data collection so it is possible to link expenditure to ecosystem asset condition and extent changes and understand how expenditure (national budget analysis) is linked to social policy objectives. The SEEA also offers guidance on the classification of environmental and climate expenditures to link with the System of National Accounts (SNA).

The purpose of establishing accounts for environmental protection expenditure (EPEA) is to enable identification and measurement of society's response to environmental concerns through the supply of, and demand for, environmental protection services and through the adoption of production and consumption behaviour aimed at preventing environmental degradation. To this end, EPEA go beyond providing transparency in expenditure to providing information on the output of environmental protection specific services produced across the economy and on the expenditure of economic units (government and private) on all goods and services for environmental protection and climate change purposes.

With this information, the EPEA can be used to analyse the extent of environmental protection and climate change activities and to assess how expenditure on environmental protection and climate change is financed. The accounts can also be used to derive indicators for highlighting change in key areas, such as the expenditure on pollution prevention and abatement, the contribution made by environmental protection and climate change activities to the economy, and the shift to pollution-preventing technologies.

Measuring the financial commitment of an economy to environmental protection may assist in evaluating the influence of environmental protection costs on international competitiveness, the implementation of polluter pays principles, and the cost-effectiveness of environmental control mechanisms (return on investment).

Additional analysis may also be supported by linking expenditure on environmental protection and climate change to physical and spatial data, such as the amount of waste treated, the quantity of air emissions and changes in environmental asset condition and rates of degradation. Models may be developed that link potential changes in environmental pressures, such as air emissions and spatially linked land degradation, to future economic wellbeing, given particular amounts of expenditure on environmental protection and climate change. This additional analysis can help assess the cost-effectiveness of public spending on poverty, environment and climate change and find measures to improve efficiency of public spending in both areas.

The analysis and comments provided on each of the tools above are preliminary. Further work is required to gain a deeper understanding of the tools, what they aim to achieve and how they are being implemented currently.

5.2 PEAF Indicators, monitoring and evaluation

As noted earlier, many MPIs include elements of the environment but do not link explicitly to the extent and condition of ecosystem assets. Using the information pyramid above, a new set of poverty-environment indicators based on the PEAF can be developed with a strong focus on location

[7] Source SEEA 2012

and links to ecosystem assets. These new indicators could be used to improve PEI and relevant initiatives work on national monitoring systems and going beyond GDP and, thereby, influence budgets and investments towards pro-poor environmental sustainability priorities.

Table 1 below provides examples of indicators and data themes built around the core PEAF model with either a poverty or environment focus. For instance, the location and degree of poverty is needed to both target spatially explicit poverty programs and also link to the environmental assets the poor may depend on, the former having a poverty focus and the latter an environmental focus. The information can be combined to develop a spatially explicit indicator of the ratio of poor to the area of an ecosystem asset (Asset-Poverty Ratio Indicator). One would expect the ratio to vary spatially and to be based on levels of poverty and the extent of ecosystem assets. The ratio can then be linked to measures of ecosystem condition and the capacity of people to manage the assets.

Table 1 Example accounts using the PEAF

Poverty focused accounts	**Core Model**	**Environmentally focused accounts**
Location and degree of poverty Ratio of people to assets (extent and condition) by location	**Beneficiaries**	Distance from key ecosystem assets Asset condition (productivity, and ability to provide goods and services to people)
Distribution and control of benefits Taxation and subsidies associated with benefits Market access	**Benefits** **Services**	Markets and non-market benefits (ecosystem services) provided by assets Productivity of assets Distance from markets
Social and economic drivers of changes in asset condition Education and capacity to manage assets	**Condition** **Services**	Asset condition, degradation, drivers of change in condition Ecosystem services
Asset access Asset Ownership Distance from key assets	**Assets**	Land, Forest, Rivers, Wetlands, Lakes extent accounts

This information described in Table 1 is also relevant for Monitoring Evaluation and Reporting (MER). Thus, rather than a generalised approach to MER, it would be possible to target the evaluation to particular issues, say asset condition or the success of an education program aimed at helping manage ecosystem assets. Finally, due to the spatial nature of the data and indicators, the approach is particularly amendable to spatial planning and reporting.

6 PEAF and global reporting

At the global level, poverty-environment mainstreaming is defined as integrating poverty-environment linkages into national development planning processes for poverty reduction and pro-poor growth. It involves (1) establishing the links between environment and poverty and (2) identifying the policies and programmes to bring about better pro-poor level implementation that reflects the need to integrate the valuable contribution of environmental management to improved

livelihoods, increased economic security and income opportunities for the poor. These factors are usually overlooked in government policy making processes[8].

The PEAF provides an information framework that can clearly describe the links between the environment and poverty both conceptually and empirically. The PEAF provides a robust framework to integrate both poverty and environment specific data, and thus derive meaningful indicators and measures of performance. Further, the PEAF is spatially explicit, a key feature that has been lacking in many approaches to understanding and reporting on the poverty-environment nexus.

The PEAF can be used to underpin MER approaches to establishing and assessing the performance of (a) policies and (b) programmes that aim to bring about better pro-poor, environment and climate related implementation. The design of the PEAF focuses on integrating the valuable contribution environmental management makes to improving livelihoods, increasing economic security and income opportunities for the poor.

The information set underpinning the PEAF can also be used to link to other global initiatives including:

- UN Framework Convention on Climate Change (UNFCCC) – making links between climate change and its impacts on environmental assets (condition) and their ability to continue providing benefits. Vulnerability and health – driven by climate change and natural disasters
- UN Convention to Combat Desertification (UNCCD) – there are links between the management of land to prevent desertification and pro-poor outcomes which require an understanding of environmental assets and how they are changing in condition.
- UN Convention on Biological Diversity – linking characteristics of environmental assets, including biodiversity, to the provision of services and benefits across different groups of populations
- BIOFIN – biodiversity finance and expenditure on environmental assets that may also provide pro-poor benefits
- WAVES – through wealth accounting and linking to environmental assets and distributional aspects

6.1 PEAF application to SDGs

There are two key poverty related SDG goals, Goal 1: End poverty in all its forms everywhere and Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Table 2 below lists the key areas within the SDGs that the PEAF could be used to support accounting, measurement and reporting.

Table 2 SDG goals and accounts

Sustainable Development Goals	**PEAF related accounts**
1.4 ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources including ownership and ***control over land and other forms of property and natural resources***	Spatial land tenure accounts linked to spatial hot spots of poverty
1.5 build the resilience of the poor and those in vulnerable situations and reduce their ***exposure and vulnerability to climate-related extreme events*** and	Ecosystem accounts vulnerable to climate change (that the poor rely on) Ecosystem accounts that are linked to

[8] UNDP-UNEP Poverty Environment Initiative website

other economic, social and ***environmental shocks and disasters***	regulating climate change – flood control
1.a Ensure significant mobilization of resources from a variety of sources, ***including through enhanced development cooperation***, in order to provide adequate and predictable means for developing countries, in particular least developed countries, ***to implement programmes and policies to end poverty in all its dimensions***	Environmental expenditure accounts linked to spatial location (land and ecosystem accounts) Combined ecosystem condition accounts and environmental expenditure to enhance return on investment and the spatial coordination of investment (poverty hotspots)
1.b ***Create sound policy frameworks*** at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to ***support accelerated investment in poverty eradication actions***	Combined ecosystem condition accounts and environmental expenditure to enhance return on investment and coordination of investment – targeted investment linked to policy with outcome based reporting
2.3 double the ***agricultural productivity*** and incomes of small-scale food producers through secure and ***equal access to land***	Spatial land (agriculture) tenure accounts linked to spatial hot spots of poverty Ecosystem (agricultural and soil) condition to accounts measuring agricultural productivity
2.4 ensure ***sustainable food production systems*** and implement ***resilient agricultural practices*** that ***increase productivity and production***, that help maintain ecosystems, that strengthen capacity for ***adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality***	Ecosystem (agricultural and soil) condition to accounts measuring agricultural productivity Spatial ecosystem extent accounts exposed to climate risk (say, drought and degradation of environmental assets) linked to poverty
2.5 ***maintain the genetic diversity*** of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and ***promote access to and fair and equitable sharing of benefits*** arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	Spatial ecosystem (agricultural) genetic diversity accounts linked to diversification risk and climate exposure.

Further, SDG targets 17.18 and 17.19 aim to strengthen the means of implementation and revitalize the global partnership for sustainable development. Specifically, implementation of the PEAF would be a step towards meeting these targets:

- 17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, ***to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts***
- 17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, ***and support statistical capacity-building in developing countries***

7 PEAF and country level applications

The following sections outline how the PEAF may be applied to enhance integrated planning, budgeting and measurement in Bangladesh and Laos through PEI and other relevant initiatives.

7.1 Bangladesh

The Bangladesh Bureau of Statistics (BBS) has a long history of reporting environment statistics. At the time of writing this report, the Compendium of Environment Statistics of Bangladesh 2009 was available for review[9]. The compendium contains data for over 60 items for 10 time periods between 1995-96 and 2007-08. Data included in the compendium range across a number of areas including forest, rice and cropping areas, fish catch, gross value of agricultural production, climate data (rainfall, temperature, air quality), contaminated land, water quality/quantity (supply and demand), flood areas, population density and household data.

More recently the Development Results Framework of the newly approved 7th Five Year Plan aims to strengthen the BBS' branch on environmental accounts ability to generate and analyse data. This work is also closely linked to the Bureau's aims to improve the current poverty measurement methods.

Further work has been done by the Bureau looking at links between poverty, vulnerability and climate change. This work has been promoted because Bangladesh is one of the most vulnerable countries to climate change. This determination is based on its geography, a multiplicity of rivers (over 300 rivers and 57 transboundary rivers), the monsoon climate, a deltaic landscape of which 80% is a floodplain, a high population density (1045/km2) and finally a predominantly agrarian economy with high levels of poverty. The following are key observations made by the BBS when considering the nexus between vulnerability and poverty:

- Poverty is mainly viewed as an indicator of lack of access to resources and income opportunities, but it has other aspects of social positioning such as geographical location, age, sex, class, ethnicity, community structure, and community decision making processes that determine poor people's vulnerability.
- Poor households often identify vulnerability as a condition that takes into account both exposures to serious risks and defencelessness against deprivation.
- There is a poverty-vulnerability nexus holding a cause-effect relation.

Thus, they conclude that it is important to integrate poverty-environment-climate linkages into national development planning. The Report "Bangladesh: Disaster-related Statistics 2015: Climate Change and Natural Disaster Perspectives" has covered following objectives:

1. To measure the socio-economic characteristics of Households and Population in disaster prone areas
2. To assess the loss of agricultural production (Crops, Livestock, Poultries, Fisheries and Homestead Forestry) due to natural disasters;
3. To calculate the damage and loss of cultivable land and useable land in disaster prone areas;
4. To measure the damage and loss of residence (dwelling), cowsheds, and kitchens in the disaster prone area;
5. To collect data on the health and sanitation conditions from disaster prone areas;

[9] It was not clear at the time of writing if the data was collected and reported beyond 2009

6. To assess the vulnerability of women, children, aged persons and people with disability
7. To collect information on the perception and knowledge about climate change, impact of climate change, environment and disaster management.

The following table provide examples of the type of data being collected and reported. Further work is underway to design and implement spatially explicit data collection at the household level.

Figure 7 Distribution of disaster affected household by division and disaster, (2009-14)

Division	Total Household	Disaster Affected Household (%)											
		Drought	Flood	Water Logging	Cyclone	Tornado	Storm/Tidal Surge	Thunderstorm	River/Coastal Erosion	Landslides	Salinity	Hailstorm	Others (Fog, Insecticides etc.)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bangladesh	**4361261**	**14.80**	**34.48**	**13.88**	**21.31**	**4.14**	**8.65**	**14.94**	**4.95**	**0.08**	**4.09**	**11.88**	**7.90**
Barisal	818137	1.41	5.24	3.91	78.31	0.91	31.51	3.72	4.35	0.00	0.85	0.31	0.05
Chittagong	430540	10.61	32.03	34.39	30.96	1.80	13.51	8.39	7.01	0.80	5.30	9.46	12.86
Dhaka	931668	19.89	51.89	18.68	0.00	3.88	0.00	17.69	6.42	0.00	0.00	20.86	9.27
Khulna	668873	9.30	7.68	34.88	23.23	2.62	9.16	7.39	4.15	0.00	22.24	10.31	7.32
Rajshahi	613704	25.39	48.47	0.65	0.00	7.51	0.00	20.40	3.39	0.00	0.00	12.86	14.73
Rangpur	488564	23.99	41.74	0.68	0.00	12.30	0.00	23.53	6.87	0.00	0.00	16.62	8.34
Sylhet	409776	16.51	69.97	2.57	0.00	1.30	0.00	31.84	1.95	0.02	0.00	12.54	5.42

Figure 8 Distribution of damage and loss by sector and by disaster categories, (2009-14)

Disaster	Damage and Loss (by sector)							
	Total	Crops	Livestock	Poultry	Fishery	Land degradation	Houses	Homestead & forestry
1	2	3	4	5	6	7	8	9
	in million taka	Percentage (%)						
All	184247.34	36.20	4.76	1.21	5.82	26.72	17.19	8.10
Drought	10569.20	4.96	0.10	0.04	0.10	0.38	0.00	0.14
Flood	42807.19	12.03	1.29	0.32	1.08	4.87	2.74	0.91
Water logging	16062.24	4.70	0.38	0.11	1.34	0.84	0.96	0.39
Cyclone	28384.81	2.28	1.70	0.41	1.14	0.00	5.88	3.99
Tornado	4299.03	0.53	0.08	0.02	0.00	0.00	1.35	0.36
Storm/Tidal Surge	12676.02	1.27	0.42	0.17	1.78	1.80	1.00	0.44
Thunderstorm	10940.12	1.35	0.23	0.06	0.00	0.00	3.37	0.92
River/Coastal Erosion	36408.92	0.58	0.40	0.02	0.18	17.23	1.10	0.25
Landslides	249.01	0.00	0.00	0.00	0.00	0.11	0.01	0.01
Salinity	6072.94	1.17	0.08	0.01	0.00	1.50	0.03	0.51
Hailstorm	11471.69	5.25	0.03	0.01	0.00	0.00	0.75	0.18
Others	4306.11	2.06	0.05	0.04	0.19	0.00	0.00	0.00

Source: Bangladesh Bureau of Statistics

7.2 Bangladesh – PEAF Applications and Extensions

BBS has made significant progress in understanding the vulnerabilities and households to climate induced shocks. This work has also been extended to undertake a preliminary analysis of the economic impacts on sectors. However, the link between poverty and environment from a statistical point of view could be improved. Key areas in which the PEAF can improve the use of currently available data from the statistics office include:

- The adoption of environmental asset classifications and methods consistent with the SEEA to improve links to current SNA data.
- Determining agreed disaster prone areas in terms of both administrative areas and ecological factors.
- Spatial mapping/delineation of ecosystem assets (particularly those related to rivers and flooding) using SEEA based classifications of ecosystem type and developing measures of the condition of those ecosystem assets. An initial focus may be on disaster prone areas.
- Spatial referencing of household data collection surveys, in particularly identifying consumption, income and wealth for poor and vulnerable groups.
- Developing land use datasets, with a particular focus on types of agricultural production.
- Reconciling spatially detailed agriculture, forestry and fisheries production data with national accounts estimates of production for these activities and with land use data sets (particular focus should be placed on understanding own-account and subsistence production).
- Develop datasets showing the link between the location of the poor and vulnerable groups and the location and condition of different ecosystem asset types
- Use current vulnerability data (frequency and magnitude of climatic events) to link with environmental asset condition and economic and social wellbeing.
- Link social capacity (vulnerability) data to changes in environmental assets to assess the ability of the poor to respond to change
- Combine environment asset vulnerability data (frequency and magnitude of climatic events) with poverty indicators to understand cause and effect.

An example of policy applications for social protection: Using an integrated set of data provided by the PEAF for particular policies or investment decisions, it can help better integrate climate change and environmental determinants of poverty into national poverty reduction programmes. By better measuring and accounting for the causal relationships between poverty and environment/climate change, national social protection programs can better target the beneficiaries (geographic, populations groups near disaster-prone areas – e.g. people under national poverty line, people who have high risk of falling back into poverty, disadvantaged populations or groups of women, etc.) and reduce vulnerability of the poor to future environment and climate related risks, and build resilience of the poor over the long-run through building their assets (material and non-material capital of the poor such as education, health).

Further, better integration of environment and climate determinants of poverty, social protection programs can help the country reduce the need for future public spending on social protection. Social protection programs could help the moderately poor but vulnerable population groups avoid falling back to below poverty line in the event of environment/climate shocks, which could have increased the number of people who may need social protection and support. On the other hand, environment and climate-friendly social protection programs can help absolute poor lift themselves out of poverty line through reducing their exposure and vulnerability to climate and environment related risk.

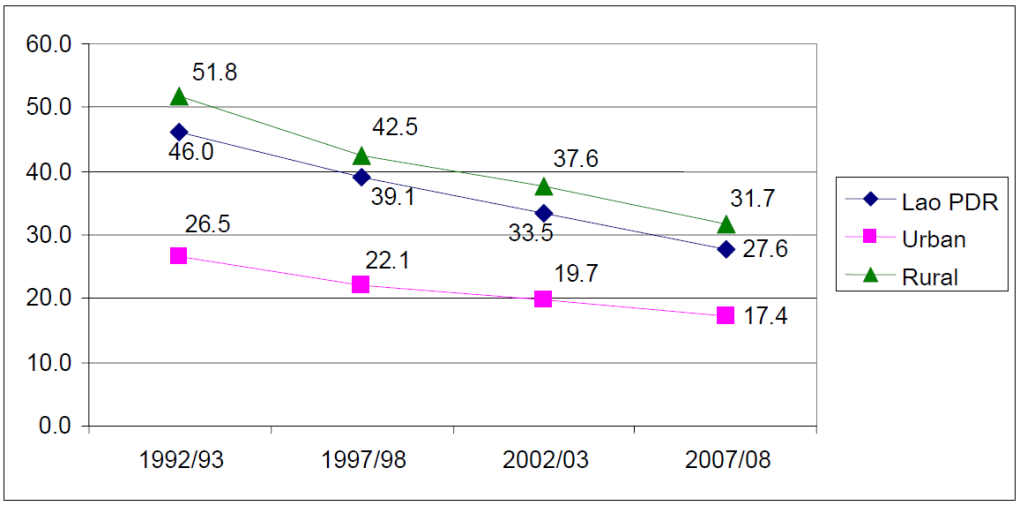
7.3 Laos

The Seventh Five-Year Plan (2011-2015) is a continuation of the Sixth Five-Year Plan and it has an important role in realizing the Ninth Party Congress Resolution. It is regarded as a measure for achieving socio-economic development, industrialization and modernization towards the year 2020. It is also expected to create new changes by taking firm steps to graduate from Least Developed Country (LDC) status by 2020, and widen and deepen regional and international integration. The Seventh Plan is characterized by a continuation of the dynamic plan — "Boukthalu Plan (Break through Strategy)" which consists of the following four dynamic objectives: (1) mind set; (2) human resource development; (3) mechanism, regime, administrative rules, and; (4) poverty reduction by mobilizing resources and implementing special policies, and constructing strategic basic infrastructure.

According to surveys conducted between 1992-1993 and 2009-2010, poverty trends have shown a decline at all levels: provincial, regional and national. Between 1992 and 1993, the poverty rate was 46%, which declined to 39.1% in 1997-1998, 33.5% in 2002-2003, 27.6% in 2007-2008 and 26% in 2009-2010 (See

Figure 9 below). According to research, poverty reduction depends upon geography; for example, at the border areas shared with Vietnam the poverty rate is high at 54.5%, with Myanmar 28.2%, and with Cambodia 23.1%. At the same time, locations close to the Mekong River (areas which are fertile and better connected) have a lower poverty rate at 16.1%.

Figure 9 Lao poverty levels 1992-1993 to 2007-2008



The PEI program worked with the Laos government to include a series of PE indicators in the directions and main tasks of the socio-economic development section of the Seventh Five-Year Plan (see *Table 3* below). The indicators focus on districts with land use plans, households fuel use, population food security and populations exposed to high environmental risks.

PE Indicators	Data layer / Source	Scale / Resolution	PEAF Account Extensions
Number of districts with land use plans developed	- District level land use plans - Kumban and village-level land use plan - Map of conservation areas (MAF)	National-scale Landsat Survey 30x30m per pixel Kumban/ village and district-level land use maps	Map all land use/ownership Link to national land use maps, agr. land, conservation areas Lakes, rivers, wetlands, forests, etc
% households using fuel wood or charcoal as main energy source	Household questionnaire on use of energy for cooking and heating (census) Lao Expenditure and Consumption	National Population and Household Survey	Spatial maps, link to conservation areas, forests Spatial maps
% population who are food insecure	1. size of agricultural land per household (MAF)	National scale: 1. pixel	Map all land use

	2. Lao Expenditure and Consumption Survey (LECS) 3.map of village level vulnerability to food insecurity	2. household level resolution (LECS) 3. village-level analysis (Epprecht et al., 2008)	Access and ownership of ENR Link to land use/condition, agriculture, water, rivers, lakes
% poor population who are exposed to, or living in areas of, high environmental risk	- map of population density (Census) - map of poverty incidences or density (Census) - map of flood or drought risk (MRC, WREA, CDE) - map of climate change Vulnerability (WWF)	National / district (population/ poverty)	Link and overlay to ENR locations Link to ENR locations Link to conservation areas, forests, rivers, land use, ecosystems Link to conservation areas, etc

Table 3 Laos Poverty Indicators

7.4 Laos – PEAF Applications and Extensions

The proposed data collection objectives (see ***Table 3*** above) consider each of the indictors specifically however they are not well integrated across indicators and nor do they address the spatially linkages between data sets and indicators. Key areas in which the PEAF can improve the use of currently available data and data collected as part of the Seventh Five-Year Plan to inform the PEI include:

- Asset extent accounts –
  - Extend land use planning data to include full coverage to all areas of Laos with a focus on understanding areas used for agriculture by type of agricultural activity (e.g. crops, plantations, livestock, etc.) and productivity (output per hectare) and condition of the land
  - Extend conservation mapping to include other environmental assets including lakes, rivers, wetlands, forests, and other key ecosystem types following the SEEA classes of ecosystem assets.
- Asset condition accounts
  - Develop maps of the condition of environmental assets
- Asset access and used rights
  - Link household survey of fuel use to spatial maps of fuel source locations (e.g. timber) and the condition of environmental assets
  - Analyse the size of agricultural holdings relative to land condition (e.g. using indicators of soil health such as soil depth and organic carbon) and hence understand the capacity of holdings of different sizes and in different locations
- Environmental expenditure account
  - Link expenditure and consumption surveys to land use, fuel use and ecosystem types

Link all of the above data collection activities to the spatial location of economic activity.

An example of possible policy applications: The PEAF accounts can be used to report on the location and percentage of the population that are food insecure and be used to target policy responses. Public authorities (local, provincial and national) can develop integrated data through the PEAF, and determine major causes of food insecurity related to environmental assets, such as access to and ownership over land or other assets such as Non Timber Forest Products. Further the accounts can be used to report of the condition of the lands or assets that are able to provide food security services and benefits.

Once these causal links are clear, public authorities can then assess their current policies and public investments related to these causes of food insecurity, their efficiency and effectiveness and propose measures to address them, through changes in sectoral or local public investments or regulatory or institutional arrangements (e.g. access to productive land or forests resources or measures to improve their conditions of environmental assets).

8 PEAF: Next steps

This report has presented PEAF for linking the environment to poverty to help quantify the PEN. It can be used to supplement and improve the application of current PE tools. However, further work is required to refine the framework with a focus on providing further guidance on data collection, analysis and how the framework can be applied to inform core economic growth and poverty reduction policies, plans and programmes. Building on the SEEA and specifying poverty from a spatial perceptive provides an opportunity to improve current approaches to poverty measurement and develop new indicators that can be used to better target regional and sub-national development policies, programmes and projects.

Based on the analysis contained in this report the following are a set of possible steps that other countries might apply to build on the PEAF:

1. **Developing land use maps especially for agriculture, forestry and fisheries and with particular emphasis on detailed information by crop type, plantation, grazing etc**. The SEEA Land Use classification is particularly suited to this and for at least agricultural areas the information will be a focus of collection in the forthcoming 2020 Round of Agricultural Censuses. The census is being co-ordinated by the FAO in which all countries should be undertaking (the Census form that has been developed uses the SEEA land use classification). This information is particularly relevant to the nexus between environmental asset extent, condition, climate change and food security.

2. **Develop spatial measures of agriculture, forestry and fisheries production with particular focus on reconciliation with national accounts estimates and own-account/subsistence production**. In many Asian countries production data is often undertaken at a detailed administrative level and so this should be a possible. Co-ordination with the final national accounts results may be the larger challenge. The data will help to understand the difference between food produced for sale and food produced for 'own' consumption, and the overall link to environmental asset condition. Ownership of land may also emerge as an issue when determining if food is sold or consumed.

3. **Developing spatial measures of household income and consumption, particularly of food, fibre and energy**. A reconciliation of these data with the related estimates in the national accounts should also be an area of investigation, generally there is a large discrepancy between the macro and micro estimates.

4. **Undertake land cover and ecosystem type mapping across the country applying SEEA based classifications**. A key step will be understanding the links between the ecosystem unit boundaries and administrative boundaries that generally underpin socio-economic data.

5. **Developing condition measures for ecosystem assets**. A particular focus might be placed on condition measures for agricultural soil, forests and water bodies (rivers and lakes) as these will be critical in understanding the use of the environment by the poor.

Key strengths of the PEAF are:

- Its ability to inform the global sustainable development debate and link with global movements towards more integrated environmental-economic accounting (SEEA).
- The core data sets used for other SDG reporting are common to the PEI needs and can be integrated readily.
- Methodological developments in the SEEA can be easily integrated into the PEAF
- The ability to move beyond current 'symptom' focused poverty indicators to a more integrated and causally linked set of indicators.

Building on this report and looking to the future to establish an evidence base for dealing with trade-offs between poverty and environmental policies and investments and thereby increasing efficiency and effectiveness of achieving the inter-related targets of the SDGs, there are a number of opportunities for further development including:

1) Socialisation of PEAF with donors, UN agencies, National Governments and other poverty and environment focused institutions

PEAF builds on current global accounting initiatives (SEEA) however its use of the environmental (economic) data for accounting and reporting are quite new requiring communication and socialisation. The PEAF provides a simpler but more integrated approach to accounting for the PEN, however how it builds and extends on current approaches is important to communicate and demonstrate those linkages order to gain acceptance and adoption.

2) Country level pilot studies on the application of the PEAF

Country level pilot studies can be used to demonstrate the utility of the PEAF and in communication. The pilot studies provide hands-on experience for countries and also guidance on how to improve the PEAF for application in other countries. The countries benefit from pilot studies because they will improve their understanding of the PEAF and gain capacity (capability) in the collection and collation of data for reporting on the PEN.

3) Review and update current PEI mainstreaming tools to incorporate PEAF

Current PEI tools have been designed to collect and provide information within focused areas of interest: Public (climate, environment, poverty) expenditure and institutional reviews; Economic analysis of (un) sustainable use; Environmental and social impact assessment; Household surveys; Integrated ecosystem assessments; Institutional capacity assessments; Monitoring and evaluation of PE linked indicators; and Valuation of ecosystem services.

However, the PEAF is an integrated and coherent approach to the collection and collation of data that can be applied in a number of ways to inform most of the tools. The advantage of PEAF approach is lower costs in the collection of data and the reuse and integration of data to understand how key areas of interest are changing and causally linked – working across all PEI and other integrated planning and budgeting tools in an integrated and coordinated manner.

4) Write guidance and training material to support the mainstreaming of PEAF

The current PEAF conceptual report does not provide sufficient detail for other to adopt and implement. Further material needs to be produced in order to provide training. This material is also linked to the socialisation of the PEAF – with use will come greater awareness.

5) Develop a methodological reference document to support the integration and implementation of PEAF.

Over the medium to long term a more comprehensive document could be written that links more substantially to the current SEEA family of publications and to current economic reporting, particularly the SNA and regional economic (development) reporting processes.

6) A review of SDG reporting requirements and the use of the PEAF

Undertake a review of the SDG reporting needs and identify specific accounts that could be developed based on the PEAF. Provide guidance material on the data and information that could be collected to build the accounts and how they may be used to developed indicators for PEN.

PEI is planning to gather feedback from relevant partners on the PEAF and test the application of PEAF through selected PEI country-based projects. Based on the feedback and the country-level application results, PEI will further refine the PEAF to inform global, regional and national efforts to advance the integrated approach to implementing the SDGs.

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For further information:

Seonmi Choi
Regional Manager, UNDP-UNEP Poverty-Environment Initiative
United Nations Environment Programme
Choi12@un.org

Mark Eigenraam
Director, IDEEA
Consultant, UNDP-UNEP Poverty-Environment Initiative
Mark.Eigenraam@ideeagroup.com