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LECB INDONESIA
RESEARCH NOTE 02

LOW EMISSION CAPACITY BUILDING PROGRAMME

UNDP

The Use of Green Economy Indicators in the Indonesia Green Economy Model (I-GEM)

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List of Abbreviations

I-GEM	: Indonesia Green Economy Model
LECB	: Low Emission Capacity Building
GDP	: Gross Domestic Product
RPJMN	: National Mid Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional)
RAD-GRK	: Regional Action Plan for Green House Gas Emission Reduction (Rencana Aksi Daerah untuk Penurunan Emisi Gas Rumah Kaca)
RAN-GRK	: National Action Plan for Green House Gas Emission Reduction (Rencana Aksi Nasional untuk Penurunan Emisi Gas Rumah Kaca)
TEEB	: The Economics of Ecosystems and Biodiversity
ILO	: International Labour Organisations
BAPPENAS	: National Planning and Development Agency (Badan Perencanaan dan Pembangunan Nasional)
BAPPEDA	: Regional Planning and Development Agency (Badan Perencanaan dan Pembangunan Daerah)
BPS	: Central Statistics Agency (Badan Pusat Statistik)
SEEA	: System of Environment Economic Accounts
UN	: United Nations
SAKERNAS	: National Labour Force Survey (Survei Angkatan Kerja Nasional)
ISCI	: International Standard Classification of Industry
NTFP	: Non Timber Forest Product
WTP	: Willingness to Pay
GNP	: Gross National Product
N	: Nitrogen
P	: Phosphor
K	: Kalium

1. Executive Summary

Transitions towards a 'Green Economy' are being sought actively by many nations, and Indonesia is a leader among them. "I-GEM" (Indonesia Green Economy Model) is a flexible and easy-to-learn System Dynamic Model being piloted in a few Indonesian provinces, as part of a capacity building programme supported by the United Nations Development Programme (UNDP) in collaboration with United Nations Environment Programme (UNEP), to evaluate trade-offs and test the sustainability dimensions of policy interventions in provincial economies. Kalimantan Tengah is its first pilot application. I-GEM is being tailored to incorporate an additional set of three 'Green Economy' outcome indicators which will be standardized across provinces. These outcome indicators address rural poverty alleviation, job creation and sustainability in economic growth, respectively by measuring the 'GDP of the rural poor', measuring decent and green jobs and green accounting at the province level. This paper outlines the rationale for our indicator selection, provides some early illustration of their methodology and benefits, and opens rational discourse on policy and investment choices for a wealthy future for Indonesia.

2. Indicators for a GE in Indonesia

Indonesia's interest in developing sustainably is evident through its efforts to incorporate environmentally friendly policies and emissions reduction activities into its national plans and targets. The Low Emissions Capacity Building (LECB) project is one example of various initiatives that are ongoing in the country to help Indonesia transition towards a "Green Economy". Based on dialogues and activities surrounding the drafting of the next National Mid Term Development Plan (RPJMN 2015-2019) and ongoing initiatives under the National and Regional Action Plans on Green House Gas Emission Reduction (the RAN-GRK and RAD-GRKs) there is clear determination to mainstream Green Economy principles into development and planning policies by the national government.

For such a Green Economy transition to take place it is important for Indonesia to have the right macro indicators that will help it measure progress towards all four of its development goals (*pro-growth, pro-jobs, pro-poor, pro-environment*). It is found that conventional macroeconomic indicators (such as GDP growth, per-capita GDP growth) are not fit for measuring sustainable development[i]. What Indonesia needs are *three* new outcome indicators - "Inclusive Wealth" and "Green GDP", "Decent Green Jobs", and "GDP of the Rural Poor" to build a path towards development that is sustainable, equitable and economically competitive.

Collecting and building upon provincial level data, these three indicators can be calculated by the Provincial System Dynamic Model that is being created under LECB, which will help Indonesia establish development strategies and incorporate changes into the Third RPJMN reflecting the social and environmental needs and realities of the thirty four provinces. Therefore, three indicators would enable the government to make strategies and plans based on existing regional strengths, and also enable provincial governments to assess their applications of policies through scenario analysis, with outcomes measured by these green economy outcome indicators.

I-GEM also has the capacity to use bespoke indicators for specific circumstances (eg: measuring and integrate traffic congestion levels as a driver of urban labour productivity) in specific provinces (eg: Jakarta). However, whilst the circumstance may be sector-specific (transportation) and province-specific (Jakarta) the model has the integrated structure that enables effects to be calculated in economy-wide aggregates (productivity, output, emissions, etc) as well as connected sectors. All such bespoke causal relationships are programmed in to reflect appropriately in the suite of indicators used by I-GEM.

Moreover, due to the fact that GDP of the Rural Poor, Green Jobs and Green Accounting are based upon "ground realities" and (in the case of Green Jobs and GDP of the Rural Poor) they require panel data collection that goes down to the level of detail of a household, they are able to take into account equity concerns as well as sustainability in a time series approach. Thus they are easily integrated into the existing administration of provincial level governments. Local officials often have to face the challenge of preserving natural resources in a business as usual discourse that pits them against a conventional development paradigm. The setting up of a process would provide local governments with the tools to make economic estimations of the benefits accrued from nature in their provinces. This would enable them to make more informed trade-off decisions about where

investments should be directed, which industries should be established and how livelihoods can be secured as well as diversified, as these would all result from improved management of natural capital that a province ultimately relies upon as its fundamental economic asset-base.

The purpose of this note is to provide government officials with a reference document that introduces each indicator in detail and outlines the assessment that would be achieved by implementing each indicator at the national and provincial levels.

2.1 GDP of the Poor Indicator

This indicator measures the value of household incomes of rural and forest-dependent communities including economically invisible - but critical and valuable - ecosystem services.[ii] Measuring and modeling how the aggregate and per-household "GDP of the poor"[1] can be improved - by interventions for better ecosystem management, greater and more equitable access to markets, better provision of public health and education, and additional employment opportunity - is a useful way of evaluating policy impacts on the populations whose development is at the heart of national development planning. (See Annexure 2 for a step by step guide to calculating the GDP of the Poor)

In exploring some examples (TEEB in National & international Policy, 2010[iii]) it was noted that the most significant beneficiaries of forest biodiversity and ecosystem services are rural poor communities, and the predominant economic impact of a loss or denial of these unpriced elements of their household income is to the income security and well-being of the poor.

The initial survey in Central Kalimantan, following the methodology above, showed that households with no alternative sources of income to the forest and riverside ecosystems in which they live are overwhelmingly dependent upon those ecosystems (see Table 1). As expected, households involved in rattan and coal production - who have distanced themselves from natural ecosystems and adopted mixed productive economies - are less directly dependent upon ecosystem services.

A further detailed survey based on primary data collection is planned for Jakarta to provide a picture of the role that ecosystem services play in varying contexts, thereby,

An initial assessment was undertaken in Central Kalimantan using the GDP of the Poor indicator to determine what the extent of dependence was amongst the rural populations on natural resources. One percent of villages were selected as a representative sample of all rural villages in Indonesia and out of these a sample of 119 households across six districts was selected in Central Kalimantan. The following methodology was followed.

Step 1. Village selection is drawn in appropriate proportion to the total number of villages in the province. In this case, 1% sampling is applied.

Step 2. The types of villages were identified based on the provincial context. For example, for Central Kalimantan the categories for villages were forest, riverside, rural mixed with rattan and rural mixed with coal.

Step 3. A survey questionnaire was developed to elicit information about sources of cash and non cash in-

[1] The term "GDP of the poor" is used in this paper to refer to the overall incomes of rural and forest households, including cash earnings as well as non-cash elements such as direct consumption of forest products. This indicator highlights the contribution of ecosystem services to the livelihoods of the poor, and was a term coined by the TEEB study (Interim Report, 2008), however it essentially represents the "GDP of the rural poor" in a holistic way, including invisibles.

comes per household. (See Annexure 3 for survey questionnaire template)

Step 4. Sample households were selected from each category of village.

Step 5. Survey team members were selected based on previous experience with surveying, data gathering and familiarity with areas in province.

Step 6. Survey team members were briefed about what a Green Economy is and introduced to the 'GDP of the Poor" indicator and how it seeks to determine ecosystem services dependence before they went into the field.

Step 7. Teams of two were dispatched to different households in different villages to gather data simultaneously.

Step 8. A Senior Economist, familiar with the provincial context, oversaw the data collection process and assimilated the data gathered.

Step 9. Responses from each household was noted on a separate Survey Form.

Step 10. Data from all households was entered into a spreadsheet to be analysed.

Outcomes: Panel data is created that local officials can refer to over time to determine the impacts of policies they put into place on GDP of the poor.

Table 1: Ecosystem Services Dependence in Central Kalimantan

Type of Village	Total average ecosystem based Non Cash Income (% of total income)	Total average ecosystem based Cash and Non Cash Income (% of total income)
Forest N = 31 households (Murung Raya District)	**51.43**	**77.41**
Riverside N = 44 households (North Barito, South Barito, Pulang Pisau and Kapuas Districts)	**43.55**	**86.38**
Rural mixed with rattan N = 27 households (Katingan District)	**44.63**	**74.99**
Rural mixed with coal N = 22 households (North Barito and South Barito)	**21.79**	**34.14**
All type N = 119 households	**43.63**	**76.38**

enabling provincial governments to make informed decisions that result in equity as well as growth in their regions. Moreover, due to the availability of panel data for 119 households now it is possible to periodically monitor what the status of these households is due to policy interventions.

2.2 Decent Green Jobs

In order to measure the impact of policy interventions on the nature and number of new jobs created or old jobs lost due to green economic transition, a second indicator is needed: 'Decent Green Jobs'. Decent Green Jobs are defined by the International Labour Organisation (ILO) as direct employment created in different sectors of the economy and through related activities that reduces the environmental impact of those sectors and activities, and ultimately brings it down to sustainable levels. The specific criteria utilised to select a job as decent and green will be elaborated further based on feedback from ILO. However, a preliminary analysis at the provincial level shows the following trends in Decent Green Jobs in Central Kalimantan.

A review of the overall labour market situation and green jobs, based on the methodology above, in Central Kalimantan shows that the province has a greater proportion of jobs that could be considered to be both "green" and "decent" than the national level, with green jobs estimated to be linked to 9 percent of jobs in the province in 2010. The majority of green jobs within the province are found

How can the Decent Green Jobs indicator be implemented?

Step 1. Identification of International and National Economists who have an understanding of System of National Accounts, labour statistics and Green Economy approach and framework.

Step 2. Identification of National Partner who is from BAPPENAS or BAPPEDA to facilitate data collection and Stakeholder Consultations. National Partner should be the host of Stakeholder discussions.

Step 3. Review available data: Review the BPS SAKERNAS survey (obtain access to BPS micro data) and regional GDP data including the sampling methodology, to get an initial idea of the economy and employment structures to identify key sectors. This is a 1% sample.

Step 4. Identify key and relevant green sub sectors and activities within these green sub sectors through a dialogue based approach. Engage Line Ministries, experts and representatives from employers organisations from the selected sectors. Invite these stakeholders for consultations to determine economic activities based on National law and instructions, Government regulations, Voluntary standards and Activity based approaches in order to identify green sub sectors. At the national level nine green sub sectors have been identified, the sectors within any province would be nine or less. (Stakeholder discussion size should be a maximum of 10 – 15 people)

Step 5. Gather data /reports that were shared in Stakeholder Consultations.

Step 6. Senior Economists match regulations with International Standard Classification of Industry (ISCI).

Step 7. Determine the proportion of identified activities that are green. Review literature on individual eco-

nomic activities and gather further data based on surveys, interviews, etc, to provide rationale for proportion determined that is green.

Step 8. Validation of green sectors by Stakeholder group followed by identification of green sub sectors.

Step 9. Generate employment estimates.

Step 10. Engage with "social partners" of the economy to discuss employment conditions within the identified green sub sectors using decent work indicators (see Ahmad, 2013[iv]). Social partners engaged are from the employers organisations, workers organisations, producers organisations and government. The number of Stakeholder consultations will be based on the number of green sub sectors identified in the province.

Step 11. Gather data /reports that were shared in Stakeholder consultations.

Step 12. Senior Economists apply the decent work criteria to the employment estimates.

Step 13. Validation of results through a Stakeholder Consultation with social partners.

Step 14. Final validation for all nine green sub sectors with Stakeholders from social partners group and broader group (experts with sector knowledge).

Outcomes: Local officials can recognize the role of green and decent employment in improving the well-being of the poor and ensure that livelihood generation policies and planned interventions maximise on the growth opportunities existing in sustainability sectors.

in the agriculture, forestry, hunting and fishery sectors.

Employment is growing in both palm oil and in rubber, and it is important to promote more environmentally friendly models for these industries, such as "jungle rubber", "rubber inter-cropping" to reduce the environmental impact of these sectors.

Employment in the construction industry has been increasing, particularly in building construction, and it is important to promote alternative materials, technologies and low impact work practices, as well as environmental compliance, to reduce the environmental impact of this sector.

Jobs in solid waste management and in management of tourism destinations, such as national parks, have increased and there are signs of job quality improvement in this sector as well. Indeed, all jobs in the management of gardens, national parks and agro-tourism were considered to meet the criteria for decent work. Ecotourism accommodation and related services are still very limited in Central Kalimantan, and an area for potential growth.

Such an analysis is extremely important for local officials who are responsible for creating development in their provinces and who often find it difficult to contextualise environmental preservation within jobs creation and revenue generation. The analysis based on this indicator would not only allow them to increase investments in jobs that are sustainable and based on regional capacities, but also those that are socially defensible.

2.3 Inclusive Wealth / Green GDP Indicator

Two preferred indicators for environmentally sound growth (i.e. addressing '*pro-growth*' and '*pro-environment*' goals together) are 'Inclusive Wealth' and 'Green GDP'. Both require estimating invisible economic benefits from ecosystem services, and accounting for *depreciation* of natural capital (i.e. degradation and depletion of ecosystems and their services over time). They both *also* include accounting for changes in the value of Human Capital (education, skills, health), a statistical capacity we seek to add at a suitable stage.

'Inclusive Wealth' is a preferred measure of sustainable development on a year-on-year basis, as it builds a time series of overall wealth per capita, measured in terms of total available physical, natural and human capital per capita. Measuring 'Green GDP' as a time series can convey the mistaken impression that all is well and sustainable, whereas in fact unsustainable growth rates in both unadjusted GDP and natural capital depletion are in fact setting off one another. In addition, GDP does not differentiate between unsustainable and sustainable rates of consumption of natural resources by not making any distinctions between the resource-depletion intensities of different regions. This can lead to misinterpretation and bias when Green GDP as is utilised as an indicator (Armida and Yusuf, 2003[v]). However, the publication of Natural Capital and Human Capital *Adjustments* that translate conventional 'GDP' into 'Green GDP' is also recommended because it is relatively easier to communicate through media generally as against 'Inclusive Wealth' which can appear esoteric to the average citizen.

The measurement for Green GDP follows the principles of the System Environmental- Economic Accounting ("SEEA") of the European Commission, United Nations and several other partners, including the latest versions (SEEA, 2013[vi]). Technically referred to as 'Environmentally Adjusted (Gross/State) Domestic Product', it requires a series of flow adjustments (to increase final value addition with invisibles) and stock adjustments (to reflect addition/ depletion of natural capital.) There is already a good start to this in Indonesia, as the BPS Directorate of Production Accounts have had a System of Environmental Economic Accounts (SEEA) since 1997, with adjustments for Mining and Forestry following the methodology of UN-SEEA. Additional adjustments are recommended – for depletion/ degradation of ecosystem services, for agriculture's impacts (chemical fertilizers/ pesticides) on soil quality and human health. Regulating Services (Intermediates) such as water augmentation and soil erosion prevention are also important to track, and may also be measured.

To enable Indonesia to develop Green Accounts, data on forests, agriculture, freshwater and human capital is needed (see Annexure 1 for list of data requirements).

2.3.1 Forests

Forests are probably the most challenging and significant area of evaluation due to the quality of data available. Both 'direct use' values of forests (timber, fuelwood, non-timber forest products, eco-tourism, etc) as well as 'indirect use' values (the value of flood and drought control, watershed maintenance, carbon storage, etc) are calculated.

The approach that is suggested is to cast in sequence physical accounts, monetary accounts, and finally, integration into Provincial accounts. Physical accounts are constructed both in area as well as volume terms, and they generally have the following format :

- Opening stocks
- Changes due to economic activities

- Other changes
- Closing stocks

Monetary accounts are based on depreciation adjustments computed from the valuation of opening stocks and closing stocks, as well as adjustments for the unaccounted services of forests. If they are indirect use values, then appropriate contingent valuation methods are used. This is followed by integration into National Accounts, by adjusting for unaccounted service flows, as well as for unaccounted changes in stocks.

Within forests the following natural capital adjustments need to be made.

Timber, Fuelwood, Non-timber Forest Products & Carbon

Timber extraction is modeled for forested areas other than protected areas (national parks and sanctuaries) for which it is assumed that the main economic purpose from a purely 'bio-mass' perspective is carbon storage and not timber or fuelwood extraction. Fuelwood and non-timber forest produce (NTFP) comprise a very significant part of the household incomes of forest-dwelling or forest-edge communities, a fact which is not necessarily captured by the economic value per hectare of NTFP (Pearce, 2003[vii]). It is easy to overlook the stabilizing social role of NTFP as a sustaining value stream for local communities, and therefore as a means of poverty alleviation.

Soil Conservation, Water Augmentation & Flood Prevention

Probably the most critical of all aspects of natural capital can be the value of forests as watersheds for lakes and rivers, helping to store rainwater and release it gradually over the dry months, thus regulating flows. Arable land, standing crops, cattle, farms, houses, and human lives are lost in floods with regularity, and widespread deforestation is represented as a key cause. It is important to filter out the natural level of forest loss due to geophysical disturbances and climatic extremes, and establish (or otherwise) causality above this 'baseline'.

Ecosystem and Species Diversity Values

Indonesia's National Parks and Sanctuaries are potential future magnets for eco-tourism, if attendant infrastructure is properly developed, without destroying the forests and wildlife (e.g. orangutans) which are on display, and without damaging numerous accessible coral reef sites around the 17,000 island archipelago of Indonesia, a key part of the so-called Coral Triangle. Annual rents could then be derived from the rapid growth of this eco-tourism sector both in terms of volume and per-capita visitor contribution. For estimating the value of biodiversity with a particular focus on eco-tourism, the most often used methods have been the travel cost method and the contingent valuation methods, which require primary surveys. It is recommended that in-depth surveys are carried out at the provincial level in Indonesia to collect primary data and establish the infrastructure necessary for local governments to do this at regular intervals. However, considering the short timeframe available to draft the Third RPJMN and to incorporate estimations of biodiversity values a 'benefit function transfer' method can be utilised, which refers to the extrapolation of existing knowledge on valuations to new contexts after making appropriately conservative assumptions.

Bio-prospecting Values (if relevant)

Almost all new pharmaceutical drugs and remedies are discovered in forests first, then replicated by industrial processes. The pharmaceutical value of "hot spot" land areas in Indonesia can be identified based on existing activities around collection of NTFPs, listing species that have medicinal values, also based on traditional knowledge and cultures, and examining the production chain of pharmaceutical companies that are deriving their ingredients from natural resources.

Estimating bio-prospecting values involves partitioning the information on total species found in forests into different leads (a species which has a chance of yielding valuable drug) of varying quality. Here each and every province is assumed to have species of different quality. The next step is to compute the probability of a hit in proportion to the quality of the lead. The probability of a hit is assumed to be directly proportional to the density of species in that province. Setting the search program to be optimal and random, and using financial parameters such as the cost of discovering a species and revenues obtained by different pharmaceutical companies which use this species, the option value of pharmaceuticals as a component of the value of the bio-diversity of Indonesia's forests can be estimated.

Existence Value of Biodiversity

These are the values the global community would be willing to pay (WTP) to preserve biodiversity. Existence values can be estimated through WTP to conserve a particular species (e.g. orangutans). A flagship species can be selected to extrapolate how much people are ready to spend to conserve its population. Similarly, existence values of endangered coral reef ecosystems could be subjected to a WTP survey.

2.3.2 Agricultural Cropland & Pasture Land

Agricultural cropland and pasture lands are incorporated into national accounts by first analyzing the changes in land use. The effect of the changes in land use under this category has been estimated from the annual crop value, Annual rents from cropland, set at appropriate percentages of crop value (after factoring in a return on irrigation), projected using appropriate growth rates of area and yield and discounted at the standard discount rate being used for all rentals-based appropriate rate.

If land is used sustainably it can have an infinite life. No adjustment of degradation is required and the whole resource rent can be considered as income. However, the use of land for agriculture using unsustainable practices would mean degradation of the land due to soil erosion in the form of loss of nutrients from the top soil, movement of soil, salinization due to improper irrigation practices, etc. In such cases, an adjustment to income derived from agriculture is necessary. Degradation due to soil erosion both on-site (impact of loss of top soil) and off-site values can be estimated (impact of sedimentation of waterways) using approaches such as replacement cost, loss of productivity, and maintenance cost methods.

2.3.3 Freshwater

The change in physical stock of surface and ground water is assumed to be constant at least in the time span of 10-15 years, in the strict sense of hydrological science, but the human use of water and therefore its quality changes. This change in quality of surface and ground water can be estimated by adopting the replacement cost approach. The water recharge function of rainforests, for example, is a valuable ecosystem service that can be evaluated.

2.3.4 Subsoil assets

Subsoil assets such as coal, petroleum and natural gas are very valuable assets being finite and non-renewable, and they play an important role in the Indonesian economy. They constitute vital raw materials for many industries and are a major resource base for development. Clearly, minerals being non-renewable resources, their extraction and sale definitely increases income but does not contribute to increase in asset stock.

To enable proper accounting of mineral wealth, physical accounts are developed in the format suggested by SEEA, 2013. The depreciation of the assets is obtained as the difference between the value of mineral stocks of the previous and current year. Sustainable income can be es-

timated by deducting depreciation from the gross value added. It is not necessary that depreciation is always a deduction; reserve variations due to new discoveries and reclassifications which may exceed depreciation caused by extraction, thus depreciation may be a net addition in such circumstances.

2.3.5 Human Capital – Education & Health

Evaluating the knowledge, experience, and skills resident in population is at the heart of modeling human capital. Current expenditures (eg: teachers salaries, subsidies for books, scholarships) are treated a consumption, which is clearly incorrect. The effect of including human capital investment can be quite significant. A telling example (Hamilton & Clemens, 1998) demonstrates in the case of Chile how its three percent of GNP spent on education, re-expressed under 'green accounting' rules, helped keep genuine savings rates positive in the late eighties, and notionally countered nearly half the natural capital depletion in 1993 and 1994.

An income based approach is recommended based on Jorgenson and Fraumeni (1989[viii], 1992[ix]), which measures the stock of human capital by summing the total discounted values of all the future income streams that all individuals belonging to the population in question expect to earn throughout their lifetime. The value of education is based on a state-wise statistical study of relative income levels across selected age cohorts and sexes, with assumptions about their implied educational requirements. These earnings differentials are computed over the expected working lives of the 'model' population, and present-valued appropriately. To these present-values of the different components of education annual school-leaving rates, annual graduation rates, and annual passing-out rates for vocational training are applied.

The multiple of these quantities gives an estimate of educational capital creation across each category of education, which would be a statistic of considerable public policy significance for budgetary allocations to education.

In common with education, much of the investment in health is classified as 'consumption'. Capturing investment in health is further complicated by the fact that it is affected by factors that are not explicitly classified as part of the healthcare sector (for example, pollution control, provision of public toilets and so on). This is a major flaw because healthcare has important externalities that affect sustainability.

Annexure 1 – Data Requirements For Green Accounting For Indonesia's Provinces

- **Socio-economic context of province**
  - Population
  - Water consumption
  - Energy consumption (total or per capita)
  - GDP shares

- **To Value of Timber, Carbon, Fuelwood and Non-Timber Forest Products**
  - Forest cover (area) in different provinces of Indonesia
  - Area accounts of timber and fuelwood (in ha) for different provinces
  - Volume accounts for timber and fuelwood for different provinces
  - Unit (net) price of timber and fuelwood as recorded in national accounts
  - Monetary accounts for timber and fuelwood for different provinces
  - Volume accounts of carbon for different provinces
  - Estimates of carbon in biomass, value of NTFPs and fodder (per ha)
  - Forest dependent population in different provinces
  - Monetary accounts of carbon for different provinces
  - Monetary accounts of NTFPs for different provinces

- **To Value Ecological Services**
  - Existing case studies on economic values of intangible benefits of forests
  - Soil erosion and sediment estimates
  - Run-off and soil loss under treated and untreated micro-watersheds
  - Soil loss prevented by dense forest cover
  - Concentration of nutrients in run-off
  - Estimation of nutrient loss (N, P, K, organic matter)
  - Economic value of nutrient loss
  - Economic value of nutrient loss in soil erosion prevented by dense forest
  - Groundwater recharge figures for provinces
  - Total flood damage calculated based on population lost, heads of cattle lost, damage to crops and houses, damage to public utilities

- **To Value Species Biodiversity**
  - Area under National Parks
  - Number of species in different provinces
  - Net consumer surplus from ecotourism in different provinces
  - Amount sanctioned under different schemes for protection, maintenance and upkeep of National Parks
  - Estimates of medicinal value of plants
  - R&D expenditure of firms
  - Marginal WTP by the pharmaceutical companies for bioprospecting
  - Non-use values for species conservation

- **To Value Freshwater Quality**
  - River length and volume (by province)
  - Water pollution sources in provinces
  - Groundwater volumes in problem areas
  - Contamination in groundwater (metal, chemical)
  - Coliform and pesticide concentration in groundwater
  - Cost of treatment of pollutants in surface water (by province)
  - Cost of groundwater treatment
  - Estimates of economic cost of treatment of degraded surface water
  - Average annual loss due to degradation of freshwater

- **To Value Agriculture**
  - Land-use classification of different provinces
  - Area under different categories of crops
  - Physical accounts for agricultural and pastureland
  - Monetary accounts for agricultural land and pastureland
  - Area under different categories of wastelands
  - Province-wise wastelands
  - Value of inputs and outputs from agriculture
  - Extent of subsidies
  - Total investments made in treating the degraded lands under various schemes

- **To Value Subsoil Assets**
  - Growth of mining activities (formal / regulated)
  - Value of mineral production by principal minerals
  - Growth of mining activities (informal)
  - Share of provinces in the value of mineral production
  - Values of mineral imports and exports

- Physical accounts for minerals (coal, oil, natural gas, etc)
- Externalities associated with mining sector
- Environmental impacts of mining

- **To Estimate Human Capital (Education)**
  - Educational attainment by cohort
  - Employment rates by cohort
  - Enrollment rates in educational institutions
  - Education attainment by profession
  - Employment rates by profession
  - Annual incomes by cohort & profession
  - Survival rates in primary, secondary, tertiary education

Annexure 2 – Calculating GDP Of The Poor

1. **Understand how poor people interact with their environment daily and in times of crisis in various spatial and biophysical settings**
    - Understand livelihood analysis in sample communities
    - Understand how people interact or use various ecosystems in sample locations
    - Understand their coping strategies based on adjacent natural resources such as forests and wetlands, and their coping strategies if such ecological resources do not exist, and hence understand the role of ecosystem health in resilience

2. **Quantify the proportion of direct and indirect income that the poor people get through various ecosystems services vis-a-vis income from other means**
    - Enumerate their direct and indirect dependence on adjacent natural resources
    - Use market prices where possible to quantify this direct and indirect dependence

3. **Compute the proportionate loss in income due to loss in natural resources**.
    - Quantify to what extent their income would be affected due to loss in ecosystem service provision
    - Elicit the household coping strategies if the ecosystem services would not be there

4. **Examine how the income gap changes if we systematically quantify all the ecosystem services drawn from the natural capital**
    - Quantify the sources of income from other sources from different study sites
    - Add the direct and indirect income to other income sources

5. **Compare this with the macroeconomic indicators of well-being i.e GDP which do not take into account of the micro picture**
    - Scale-up the contribution to a larger scale
    - Compare these with the macro-economic indicators to recognize divergences and trade-offs and to iteratively adjust policy prescriptions

Annexure 3 – Survey Template For Central Kalimantan

SURVEI PENDAPATAN DAN PENGELUARAN RUMAH TANGGA SERTA KETERGANTUNGAN PADA JASA EKOSISTEM DI KALIMANTAN TENGAH

I. **KETERANGAN TEMPAT DAN RESPONDEN**	
1. Nama Kabupaten [kode]	
2. Nama Kecamatan	
3. Nama Desa/Kelurahan	
4. Nomor Bangunan Fisik	
5. Posisi GPS	Latitute :
	Longitude:
6. Nama Kepala Rumah Tangga	
7. Nama Responden	

Kode Kabupaten

Katingan	- 1	Barito Selatan	- 4
Pulang Pisau	- 2	Barito Utara	- 5
Kapuas	- 3	Murung Raya	- 6

II. **KETERANGAN PETUGAS**		
Uraian	**Pencacah**	**Pengawas/Pemeriksa**
(1)	(2)	(3)
1. Nama		
2. Tanggal		
3. Tanda Tangan		

III. **KETERANGAN DEMOGRAFIS DAN PENDIDIKAN ANGGOTA RUMAH TANGGA**						
No	Nama Anggota Rumah Tangga	Hubungan dengan Kepala Rumah Tangga [kode]	Jenis Kelamin Laki-laki = 1 Perempuan = 2	Umur [tahun]	Ijazah/ STTB ter-tinggi yang dimiliki [kode]	Apakah masih sekolah? Ya = 1 Tidak = 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
01		1				
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						

Kode kolom (3)

Kepala rumah tangga	- 1	Orang tua/mertua	- 6
Istri/Suami	- 2	Famili lain	- 7
Anak	- 3	Pembantu rumah tangga	- 8
Menantu	- 4	Lainnya	- 9
Cucu	- 5		

Kode kolom (6)

Belum/tidak punya	- 1	D1/D2	- 5
SD/setara	- 2	Akademisi/D3	- 6
SLTP/setara	- 3	Universitas/D4	- 7
SMU/setara	- 4		

I. KETERANGAN DEMOGRAFIS DAN PENDIDIKAN ANGGOTA RUMAH TANGGA						
No	Nama Anggota Rumah Tangga	Hubungan dengan Kepala Rumah Tangga [kode]	Jenis Kelamin Laki-laki = 1 Perempuan = 2	Umur [tahun]	Ijazah/ STTB ter-tinggi yang dimiliki [kode]	Apakah masih sekolah? Ya = 1 Tidak = 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						

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SMU/setara	- 4		

I. JENIS PEKERJAAN UPAHAN (BEKERJA UNTUK ORANG LAIN) DAN PENDAPATAN						
Keterangan kegiatan anggota rumah tangga yang berumur 10 tahun ke atas selama setahun yang lalu.						
Apakah jenis pekerjaan? [kode] \	Upah/gaji yang dibayar-kan setiap? Hari = 1 Bulan = 2	Bila kolom (2) berkode 1 [Harian]			Bila kolom (2) berkode 2 [Bulanan]	
		Berapa upah/gaji yang diterima setiap hari [000 Rp]	Berapa hari bekerja dalam satu bulan [hari]	Berapa hari bekerja dalam satu tahun [hari]	Berapa upah/gaji yang diterima setiap bulan [000 Rp]	Berapa bulan bekerja dalam satu tahun [bulan]
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Keterangan untuk kolom (1)

Perkebunan karet/getah	- 1	Jasa perkebunan/pertanian	- 6	Perkebunan kayu konsesi	- 10
Perkebunan rotan	- 2	Pertambangan emas	- 7	Pengolahan kayu (*saw mill*)	- 11
Perkebunan kelapa sawit	- 3	Pertambangan batubara	- 8	Membersihkan/buka lahan	- 12
Perkebunan padi	- 4	Jenis pertambangan lain	- 9	Jenis pekerjaan lain	- 13
Jenis perkebunan lain	- 5				

V. HASIL HUTAN NON-KAYU									
Jenis	Jumlah yang dikumpulkan dari hutan				Jumlah hasil hutan yang dijual				
	Jumlah yang dikumpulkan setiap hari		Berapa hari dalam satu bulan [hari]	Berapa bulan dalam satu tahun [bulan]	Jumlah yang dijual setiap minggu			Berapa minggu dalam satu bulan [minggu]	Berapa bulan dalam satu tahun [bulan]
	Jumlah	Satuan			Jumlah	Satuan	Harga jual [000 Rp per satuan]		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Rotan taman									
Rotan jenis lain									
Getah									
Kulit gemor									
Arang									
Keladi									
Sarang burung									
Madu									
Kayu bulat kecil									
Lainnya: …									
Nilai keseluruhan hasil hutan non kayu [000 Rp]	Nilai hasil hutan NK yang dikumpulkan: Total (2)x(4)x(5)x(8) = [000 Rp]				Nilai hasil hutan NK yang dijual: Total (6)x(9)x(10)x(8) = [000 Rp]				

Catatan: Satuan dalam Kolom (3) dan (7), bila bukan dalam satuan standar Kg, perlu diberi catatan tentang padanan satuan tersebut bila dinyatakan ke dalam Kg.

VI. PENGGUNAAN KAYU BAKAR, MINYAK TANAH DAN BAHAN BAKAR LAIN				
A. KAYU BAKAR				
Musim	Jumlah kayu bakar **dari hutan** setiap hari		Berapa hari dalam satu minggu	Berapa bulan dalam satu tahun
	Jumlah	Satuan		
(1)	(2)	(3)	(4)	(5)
Pada saat musim kering				
Pada saat musim hujan				
Musim	Jumlah kayu bakar **dari kebun** setiap hari		Berapa hari dalam satu minggu	Berapa bulan dalam satu tahun
	Jumlah	Satuan		
Pada saat musim kering				
Pada saat musim hujan				
B. MINYAK TANAH				
Musim	Jumlah minyak tanah setiap hari		Berapa hari dalam satu minggu	Berapa bulan dalam satu tahun
	Jumlah	Satuan		
Pada saat musim kering				
Pada saat musim hujan				
C. BAHAN BAKAR LAIN				
Musim	Jumlah bahan bakar lain setiap hari		Berapa hari dalam satu minggu	Berapa bulan dalam satu tahun
	Jumlah	Satuan		
Pada saat musim kering				
Pada saat musim hujan				

VII. PENANGKARAN/PEMILIKAN SATWA LIAR SETAHUN YANG LALU		
Jenis satwa liar	Jumlah [ekor]	Nilai [000 Rp]
(1)	(2)	(3)

VIII. KEPEMILIKAN/PENGUSAHAAN LAHAN	
Luas lahan [Ha]	Status kepemilikan/pengusahaan lahan Milik sendiri - 1 Bagi Hasil - 2 Menerima upah - 3

IX. SUMBER IRIGASI	
Jenis	Ya - 1 Tidak - 2
Sungai	
Kanal	
Sumur	
Lainnya (sebutkan)	

X.A. PETERNAKAN

Peternakan yang dimiliki (atau hewan yang diternakan) oleh rumah tangga

Jenis	Periode	Jumlah yang dikonsumsi sendiri				Jumlah yang dijual setiap tahun			
		Dikonsumsi untuk kebutuhan sehari-hari setiap tahun		Digunakan untuk perayaan agama setiap tahun		Jumlah	Satuan	Harga per satuan [000 Rp]	Bila tidak dalam Kg, berapa harga per Kg [000 Rp]
		Jumlah	Satuan	Jumlah	Satuan				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sapi	Tahun lalu								
	2 tahun lalu								
Kerbau	Tahun lalu								
	2 tahun lalu								
Kambing	Tahun lalu								
	2 tahun lalu								
Domba	Tahun lalu								
	2 tahun lalu								
Babi	Tahun lalu								
	2 tahun lalu								
Ayam	Tahun lalu								
	2 tahun lalu								

X.B. PRODUK PETERNAKAN LAIN					
Produk peternakan yang dijual oleh rumah tangga.					
Jenis produk	Jumlah yang dijual setiap minggu		Berapa minggu dalam sebulan	Berapa bulan dalam satu tahun	Harga jual [000 Rp]
	Jumlah	Satuan			
(1)	(2)	(3)	(4)	(5)	(6)
Susu					
Telur					
…					
…					
…					
Produk peternakan yang dikonsumsi oleh rumah tangga.					
Jenis produk	Jumlah yang dikonsumsi setiap minggu		Berapa minggu dalam sebulan	Berapa bulan dalam satu tahun	Harga jual [000 Rp]
	Jumlah	Satuan			
Susu					
Telur					
…					
…					
…					

XI.A. USAHA BUDIDAYA PERIKANAN									
Perikanan yang dimiliki (atau yang dibudidayakan) oleh rumah tangga									
Jenis ikan	Periode	Jumlah yang dikonsumsi sendiri				Jumlah yang dijual setiap tahun			
		Dikonsumsi untuk kebutuhan sehari-hari setiap tahun		Digunakan untuk perayaan agama setiap tahun		Jumlah	Satuan	Harga per satuan [000 Rp]	Bila tidak dalam Kg, berapa harga per Kg [000 Rp]
		Jumlah	Satuan	Jumlah	Satuan				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ikan	Tahun lalu								
	2 tahun lalu								
	Tahun lalu								
	2 tahun lalu								
	Tahun lalu								
	2 tahun lalu								
	Tahun lalu								
	2 tahun lalu								
	Tahun lalu								
	2 tahun lalu								

XI.B. IKAN HASIL TANGKAPAN						
Jenis ikan	Jumlah tangkapan per hari		Berapa hari dalam sebulan	Berapa bulan dalam setahun	Harga jual [000 Rp]	
	Ekor	Satuan lain			Per ekor	Per Kg
(1)	(2)	(3)	(4)	(5)	(6)	(7)

XI.C. KONSUMSI IKAN RUMAH TANGGA				
Jenis ikan yang paling sering dikonsumsi rumah tangga.				
Urutan	Jenis ikan	Harga pasar [000 Rp]		Dibeli di Pasar = 1 Pedagang = 2 Hasil sendiri = 3
		Per Kilogram (Kg)	Per ekor	
(1)	(2)	(3)	(4)	(5)

XII. KONSUMSI DAN PENGELUARAN RUMAH TANGGA UNTUK MAKANAN								
Kelompok	Jenis makanan	Jumlah yang dikonsumsi setiap minggu				Jumlah yang berasal dari produksi sendiri, pemberian atau dari hutan		
		Jumlah yang dibeli	Satuan	Harga per satuan [000 Rp]	Berapa minggu dalam sebulan	Jumlah	Satuan	Berapa minggu dalam sebulan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Padi-padian	Beras							
	Tepung							
Umbi-umbian	Ketela pohon/singkong							
	Ketela rambat/ubi jalar							
	Kentang							
Daging	Daging sapi							
	Daging kerbau							
	Daging kambing/domba							
	Daging babi							
	Daging ayam ras							
	Daging ayam kampung							
	Daging unggas lain							

Kelompok	Jenis makanan	Jumlah yang dikonsumsi setiap minggu				Jumlah yang berasal dari produksi sendiri, pemberian atau dari hutan		
		Jumlah yang dibeli	Satuan	Harga per satuan [000 Rp]	Berapa minggu dalam sebulan	Jumlah	Satuan	Berapa minggu dalam sebulan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Telur dan susu	Telur ayam ras							
	Telur ayam kampung							
	Telur itik							
	Susu murni							
	Susu bubuk/kental							
	Susu bayi							
Kacang-kacangan	Kacang tanah							
	Kacang kedele							
	Kacang hijau							
	Tahu							
	Tempe							

Kelompok	Jenis makanan	Jumlah yang dikonsumsi setiap minggu				Jumlah yang berasal dari produksi sendiri, pemberian atau dari hutan		
		Jumlah yang dibeli	Satuan	Harga per satuan [000 Rp]	Berapa minggu dalam sebulan	Jumlah	Satuan	Berapa minggu dalam sebulan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sayur-sayuran	Bayam							
	Kangkung							
	Kacang panjang							
	Tomat							
	Wortel							
	Ketimun							
	Daun singkong							
	Terong							
	Bawang merah							
	Bawang putih							
	Cabe merah							
	Cabe rawit							
	……							
	…..							

Kelompok	Jenis makanan	Jumlah yang dikonsumsi setiap minggu				Jumlah yang berasal dari produksi sendiri, pemberian atau dari hutan		
		Jumlah yang dibeli	Satuan	Harga per satuan [000 Rp]	Berapa minggu dalam sebulan	Jumlah	Satuan	Berapa minggu dalam sebulan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Buah-buahan	Jeruk							
	Mangga							
	Durian							
	Pisang							
	Pepaya							
	Nangka							
	Lainnya: ….							
Minyak dan lemak	Minyak goreng							
	Kelapa							
Bahan minuman	Gula pasir							
	Teh							
	Kopi							

Kelompok	Jenis makanan	Jumlah yang dikonsumsi setiap minggu				Jumlah yang berasal dari produksi sendiri, pemberian atau dari hutan		
		Jumlah yang dibeli	Satuan	Harga per satuan [000 Rp]	Berapa minggu dalam sebulan	Jumlah	Satuan	Berapa minggu dalam sebulan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bumbu-bumbuan	Garam							
	Kecap							
	Bumbu lain: ….							
Konsumsi lainnya	Mie instan							
	Mie basah							
	Bihun							
Makanan dan minuman jadi	Air mineral							
	Lainnya: …							
Tembakau	Rokok kretek filter							
	Rokok kretek tanpa filter							
	Rokok putih							
	Tembakau							

XIII. PENGELUARAN RUMAH TANGGA BUKAN-MAKANAN					
Kelompok	Jenis	Satuan	Pengeluaran per bulan [000 Rp]		
			3 bulan lalu	2 bulan lalu	1 bulan lalu
(1)	(2)	(3)	(4)	(5)	(6)
Komunikasi	Pulsa HP				
Aneka barang	Sabun mandi, pasta gigi, sampo				
	Alat kecantikan (bedak, dll) dan pembalut				
	Sabun cuci				
Pengobatan	Rumah sakit/Puskesmas				
	Pengobatan tradisional				
	Biaya beli obat				
Sekolah	SPP				
	Alat tulis dan buku pelajaran				
Bahan bakar	Bensin				
	Solar				
Transportasi	Biaya kendaraan				
Pemeliharaan	Pemeliharaan motor				
	Pemeliharaan alat kerja (parang, cangkul, dll)				
	Pemeliharaan perahu				
Pakaian	Pakaian untuk laki-laki dewasa				
	Pakaian untuk perempuan dewasa				
	Pakaian untuk anak-anak				
	Alas kaki (sepatu, sandal)				
Listrik					

XIV. PENGELUARAN UNTUK PAKAN TERNAK							
Jenis ternak	Jenis makanan/pakan	Pengeluaran untuk makanan/pakan ternak setiap hari			Makanan/pakan yang dikumpulkan **dari hutan** setiap hari		
		Jumlah makanan/pakan		Berapa hari dalam satu minggu	Jumlah makanan/pakan		Berapa hari dalam satu minggu
		Jumlah	Satuan		Jumlah	Satuan	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sapi							
Ayam							
Babi							
Ikan							
Lainnya: …							

Endnotes

[i] See the following papers for further analyses on the inability of conventional indicators to measure sustainability.

- Repetto et. al., 1989, *Wasting Assets: Natural Resources in the National Accounts*, World Resources Institute, Washington D.C. Pg. 16.
- Kirk Hamilton and Michael Clemens, 1998, *Creating and Maintaining Wealth*. In Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development, Environmentally Sustainable Development Studies and Monographs Series, No. 17. World Bank, Washington D.C. Pg. 8.
- Armida Alisjahbana and Arief Anshory Yusuf, 2003, To What Extent Green Accounting Measure Sustainable Development, Working Paper in Economics and Development Studies, Department of Economics, Padjadjaran University. Pg. 1.

[ii] A somewhat similar approach of environmental income, with a lot more observations, is applied in Arild Angelsen, Pamela Jagger, Ronnie Babigumira, Brian Belcher, Nicholas Hogarth, Simone Bauch, Jan Boerner, Carsten Smith-Hall, and Sven Wunder (2014), "Environmental income and rural livelihoods: a global-comparative analysis," *World Development*, doi:10.1016/j.worlddev.2014.03.006

[iii] TEEB (2011), The Economics of Ecosystems and Biodiversity in National and International Policy Making. Edited by Patrick ten Brink. Earthscan, London and Washington.

[iv] Ahmad, Iftikhar, (2013). Decent Work Check: Analysing De-Jure Labour Market Institutions from Work Rights Perspective. Wageindicator.org.

[v] Armida Alisjahbana and Arief Anshory Yusuf, 2003, To What Extent Green Accounting Measure Sustainable Development, Working Paper in Economics and Development Studies, Department of Economics, Padjadjaran University.

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[vii] D.W. Pearce, (2003), 'The social cost of carbon and its policy implications', Oxford Review of Economic Policy 19 (3), pp. 362–384.

[viii] Jorgenson, D.W., and Fraumeni, B.M., (1989). 'The accumulation of human and non-human capital, 1948-1984'. In The Measurement of Savings, Investment and Wealth. pp. 227-282, edited by R.E. Lipsey and H.S. Tice, Chicago, IL: The University of Chicago Press.

[xi] Jorgenson, D.W., and Fraumeni, B.M., (1992). 'The output of the education sector'. In Output Measurement in the Services Sector. pp. 303-338, edited by Z. Griliches, Chicago, IL: The University of Chicago Press.