

COMPONENT 3

INFORMATION-SHARING, AWARENESS-RAISING AND NETWORKING TO MAINSTREAM NATURAL CAPITAL ACCOUNTING



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Output 3.2.2

IMPLEMENT A SERIES OF TECHNICAL
TRAINING WORKSHOPS/SESSIONS

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THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN PUBLIC AND PRIVATE
SECTOR POLICY AND DECISION-MAKING FOR SUSTAINABLE LANDSCAPES

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Executive Summary

This report summarizes a series of technical training workshops conducted to support the development of Natural Capital Accounting (NCA) and the Provincial SEEA for Krabi Province, Thailand. The training sessions to strengthen technical capacity among the project consultant team, relevant agencies, and provincial stakeholders.

The training sessions covered four main areas: foundational concepts and methods in SEEA and ecosystem accounting, the application of NCA to Krabi's policy and environmental context, GIS and QGIS-based spatial data preparation, and the presentation of Provincial SEEA accounts to local agencies and stakeholders. Collectively, these sessions supported the development of ecosystem extent, condition, services, and monetary asset accounts.

Overall, the training programs enhanced participants' understanding of environmental-economic accounting and its practical application for policymaking. It provides an important foundation for using Provincial SEEA outputs to inform sustainable natural resource management, eco-tourism planning, and long-term environmental resilience in Krabi Province

1. Introduction

Natural capital accounting (NCA) is an accounting framework that systematically measures the stocks and flows of natural resources (natural capital) and the ecosystem services they provide to humans (United Nations, 2014; United Nations, 2021; United Nations, 2024). It aims to recognize that the environment is important to society and the economy, thus, should be valued and managed well. NCA frameworks integrate data to quantify the value of these natural resources as a tool for policymakers to make informed decisions and recognize the importance of environmental sustainability and economic development. This project implements NCA through UN's SEEA framework with additional accounts: Tourism Satellite Account and Water Resources Satellite Account. These accounts being piloted in Krabi Province, Thailand and aims to implement the accounts nationwide for national sustainable development and strengthen resilience.

Training to understand what NCA is and how to utilize it is crucial for environmental protection efforts. As natural resources are scarce, understanding its value in numbers can contribute to strategies to optimize benefits from natural resource use. Integration of NCA into national policy and strategy is vital for natural resource management for sustainable development. Policymakers will understand the opportunity costs (quantifiable) between economic development activities and ecosystem conditions for the best environmental, social, and economic outcomes at the national level.

The training sessions have been conducted includes as follows:

1. Dr. Gem B. Castillo, PhD

Expert on Natural Capital Accounting (SEEA in the Philippines)

Dr. Gem taught 4 sessions on foundational knowledge of NCA (SEEA) and implementation

2. Dr. Carl Obst, PhD

Expert from IDEEA Group (based in Melbourne, Australia) on Natural Capital Accounting

Taught 4 sessions on how to incorporate ecosystem accounting to the context of Krabi, Thailand (practical applications)

3. Mr. Chakris Phithakrattanasakun

GIS Systems expert from Geo-Informatics and Space Technology Development Agency (GISTDA)

Taught 8 sessions on the GIS system along with practical training using real data sets via the QGIS software

4. Dr. Adis Israngkura and Mr. Peerawat Suriyaburaphakul

NCA Project Manager and Researcher from the Project Consultant team (TDRI)

Taught 1 session on how the Provincial SEEA was developed (where the raw data was sourced, calculation formulas, and applications of the account) to the Provincial agencies and stakeholder groups in Krabi.

2. Dr. Gem B. Castillo's Training Session on SEEA and Ecosystem Accounting

Dr. Gem Castillo's session was focused on building foundational knowledge of how NC accounting can be done using the SEEA framework and how it can be implemented for Thailand. Participants of these training sessions consisted of representatives from the public sector (mostly tourism and water resources related), academic institutions, and researchers from Thailand Development Research Institute. All sessions were conducted for approximately 3 hours and were delivered online.

Dr. Gem Castillo's training was done in 4 sessions (online) as follows:

1. Concepts in Ecosystem Accounting
2. Physical Accounting
3. Monetary Valuation and Accounting
4. Application of the process in Developing Ecosystem Asset Accounts

1st Session: Concepts in Ecosystem Accounting

Date: March 16, 2023

This session introduced the concepts and principles of ecosystem accounting, linking ecosystem accounting to other accounting frameworks, the steps (methodology) in ecosystem accounting, what natural capital accounting is and the applications of ecosystem accounting.

Main concepts in this session

- Systems of National Accounts
- SEEA Central Framework (SEEA CF)
- SEEA Ecosystem Accounting (SEEA EA)
 - Ecosystem assets classification
 - Spatial units in ecosystem accounts and Ecosystem Accounting Area (EAA)
- DPSIR Framework (Driving forces, Pressure, State, Impacts, and Responses)
- Natural Capital Accounts and its importance

2nd Session: Physical Accounting

Date: March 17, 2023

This session focused on natural capital accounting, ecosystem accounting (extent, condition, ecosystem assets, and ecosystem services), and spatial considerations. Dr. Gem goes over the technicalities of building the accounts and which data sources are needed to be used for each sub account.

Main concepts in this session

- Natural Capital Accounting (NCA)
- Ecosystem Accounting (Extent, Condition, Physical, and Monetary)

- How to build the account(s) using GIS data systems
- Account structures and accounting entries
- Ecosystem classification (type or reference)

3rd Session: Monetary Valuation and Accounting

Date: April 4, 2023

This session centered around the technical information of ecosystem valuation methods. The learning objectives include understanding the need for ecosystem valuation (and how it can inform policy decisions), be familiar with various valuation methods, understanding the strengths and limitations of valuation methods, how to collect and analyze data, gain the ability to interpret and communicate valuation results, and understanding the implications of ecosystem valuation.

Main concepts in this session

- Monetary valuation
 - Exchange values and welfare values
- Ecosystem services in SNA
- Techniques for valuing transactions in ecosystem services
- Valuation methods by SEEA EA
- Spatial Variations of Values
 - Value transfer
 - Benefit transfer
- Replacement Cost Method

4th Session: Application for Monetary Ecosystem Assets

Date: April 5, 2023

In the final session, Dr. Gem presented the processes of using accounting frameworks on ecosystem assets, starting from setting the account, calculations of the ecosystem's asset value, and practicing from an example data set (using knowledge learned from previous sessions).

Main concepts in this session

- Net Present Value (NPV) Computations
- Setting up the Ecosystem Monetary Asset Account
 - NPV and ecosystem conversions
 - Incorporating the change in "extent" of ecosystem asset
 - Derivations of the three effects: area, price, and volume

3. Dr. Carl Obst's Training Session on How to Incorporate NCA for Krabi, Thailand

Dr. Carl Obst's sessions reinforce foundational knowledge of NCA and goes into the detail on how NCA can be applied for Krabi Province, Thailand. These sessions go through the foundational knowledge of natural capital approach (as a concept), how accounting links to policy, introducing Australian case examples on how NCA was utilized and the policy implications from NCA data. Each session was conducted for approximately 1 hour and was delivered online.

Dr. Carl Obst's training was done in 4 sessions, as follows:

1. Introduction and building foundational understanding of how NCA is connected to policy decision-making
2. Accounting for ecosystem extent
3. Examples of ecosystem accounting in Australia: Forico, Tasmania and Geographe Bay, Western Australia
4. Policy questions (linking to natural capital accounting data)

1st Session: Introduction and how NCA connects to policy-decision making

Date: May 9, 2024

This session was focused on reinforcing the core concepts of natural capital accounting, starting with "natural capital approach" and its' importance (for policy making). Understanding which accounts would be relevant and useful to Thailand's geographical context to inform appropriate public policies. The session demonstrates how data from NC accounts can be useful for policy priorities.

Main concepts in this session

- Natural capital approach and natural capital program logic
- Components of ecosystem assets (ecosystem asset mapping)
- Measuring ecosystem conditions
- Measuring ecosystem services and asset value

2nd Session: Accounting for ecosystem extent

Date: May 23, 2024

This session focused on ecosystem accounting, namely extent accounting. The TDRI team presented GIS (mapping) data of Thailand to consult with Dr. Carl on how to build the extent account to be appropriate to Krabi's ecosystem context. Dr. Carl advised that the data TDRI provided is helpful in tailoring the objectives of this project using available data.

Main concepts in this session

- The steps to do “extent accounting”
 - Creating the accounting area (boundaries*)
 - Identify and ingest the governance layers
 - Accounting for ecosystem extent and land use or land cover
 - Integrate and present data

* a question was raised on the boundaries of the map (an island under Krabi Province’s jurisdiction was outside the boundary line). Dr. Carl suggested that the boundaries should be sensible based on international guidelines for standardization if other groups were to conduct natural capital accounting to contribute for national policy.

3rd Session: Examples of ecosystem accounting in Australia

Date: June 7, 2024

This session introduced real life (Australian) examples of ecosystem accounting: Forico, Tasmania and Geographe Bay, Western Australia. Forico was presented to demonstrate a terrestrial ecosystem accounting methodology, and Geographe Bay was introduced to demonstrate the example of marine ecosystem accounting, which can be relevant to Krabi’s ecosystems. The challenge of how to link human activity to the indicators of the accounts was also discussed.

Main concepts in this session

- Extent Account
 - Spatial distribution of ecosystem services, which tabulates the spatial data (using the IUCN global ecosystem typology) into the extent account (excel table form)
 - It was noted that governance needs to be considered to monitor impacts on different zones (such as national park zones could have different jurisdiction power)
- Conditions Accounting
 - Overlaying ecosystem types, compiling the conditions of each ecosystem in the area
 - Condition index by ecosystem type
 - “Scores” from the Seagrass meadows example were calculated based on data (derived from comparing the zones to a healthy and/or unhealthy ecosystem as a reference point)
- Ecosystem Services Accounting

4th Session: Policy questions

Date: June 20, 2024

In the final session, the focus was on how NCA links to policy. Investments (that could also be in the form of policy) can cause changes in “impact drivers” that affect the changes in stock (natural capital), which may cause changes in ecosystem services and ultimately resulting in economic and social impacts. These changes can be reflected in natural capital accounts. An example of an asset account was used to demonstrate which indicators

or data that could be relevant. TDRI raised a question of how wastewater that is disposed into the ocean would be represented in the account. Reiss (Dr. Carl's colleague) advised that the extent of account could be modified (from the example shown) to incorporate measures on wastewater, to illustrate its impacts on the ecosystem. Examples of how to construct an asset account and a "supply and use" account were demonstrated in this session as well.

4. Mr. Chakris' Training Session on GIS Systems and Practical Applications

Mr. Chakris's sessions were focused on what GIS systems are and how to use them. The sessions were divided into 8 sessions, spanning over two weeks (4 sessions per week). The first 4 sessions were introductory (lecture-styled) and the basics on using QGIS. The remaining 4 sessions were practical sessions practicing QGIS skills with various data sets. A total of 8 (3 hour) sessions were conducted on-site at the 4th floor meeting room at Thailand Development Research Institute Foundation. All participants of Mr. Chakris's session were exclusively the research team for this project.

Mr. Chakris's training was done in 8 sessions, as follows:

Week 1: 1. Introduction to GIS and QGIS Software

2. Attribute manipulation and working with data sheets (CVS or spreadsheets)
3. Geo-processing Tools
4. Making a map with common data sets (cartographic)

Week 2: 5. Preparation of fundamental project data (Day 1)

6. Preparation of fundamental project data (Day 2)
7. Preparation of fundamental project data (Day 3)
8. Creating a map practicing the skills developed from previous sessions

1st Session: Introduction to Geographic Information System (GIS)

Date: May 2, 2024

The first session was an introduction to what Geographic Information System (GIS) is and how it is used. Mr. Chakris went over the basic or foundation knowledge of GIS such as 3S technology and the components of GIS (point, line, and polygon). The principal concepts and techniques of GIS were explained, along with the types of spatial data used (GNSS). Then participants began to download and install the QGIS software to use (an open-source software for spatial mapping).

Main concepts

- 3S Technology: GIS, RS (Remote Sensing), and GPS (Global Positioning System)
- GNSS (Global Navigation Satellite System) – types used by different countries:
 - GPS (USA)

- GLONASS (Russia)
- Beidou (China)
- How to use QGIS (Quantum Geographic Information System) software with plugins
 - Shapefile (.shp)
 - Set-up settings to define map projections
 - Import and export data
 - Editing data

2nd Session: Attribute manipulation and working with data sheets

Date: May 3, 2024

This session continues from the previous session on how to use and navigate QGIS. Mr. Chakris demonstrated how to manipulate (attribute) tables to visualize and analyze data. Attribution manipulation involves query data, add field, deleting row/column, and joining table(s). After being familiar with attribution manipulation, participants were taught how to manage excel sheets (CSV or spreadsheets) before importing to QGIS.

3rd Session: Geo-processing tools

Date: May 9, 2024

This session was devoted to understanding geo-processing tools to aid in spatial analysis using operations such as intersecting, union, merge, and clip data. The density tool is a plug-in which requires installation to be used, referring to the 1st session. Mr. Chakris demonstrated how to find (in the menu bar) and utilize these tools.

Main concepts

- Geo-processing tools
 - Buffer, Clip, Dissect, Intersect, Merge, and Union
- Buffer tools
- Density tools (to calculate density)
- Grid tools (creating grids)

4th Session: Making a map with common data sets

Date: May 10, 2024

This session focused on making map(s) with common data sets. Participants were briefed on the core map elements that should be included. Mr. Chakris demonstrated how to label the map, for instance, marking district boundaries.

Main concepts (of making the map)

- Core map elements: title, content, projection, legend, direction, and scale
- Labeling map feature
- Symbology

5th Session: Preparation of fundamental project data (Day 1)

Date: May 16, 2024

This session begins to use the skills learned from the previous 4 sessions using Krabi data sets. These exercises will be useful to get an idea of what the data and map should look like, which will be useful for constructing natural capital accounts. This session's task is to make survey points to demonstrate the sea water quality.

Skills tested

- Creating a study area (from the admin boundary in the provided data set) using the "buffer tool" and grouping the data using the "dissolve tool"
- Creating survey points (within 1 kilometer) using "point along geometry tools"
- Attribute manipulation

6th Session: Preparation of fundamental project data (Day 2)

Date: May 17, 2024

In this session, participants were tasked with designing a GIS database. Starting with creating a primary key, define the field type, design the "data dictionary", and finally, create "metadata" following the fundamental geographic data set (FGDS). It was explained that "metadata" is data that provides information about other data. As many organizations use GIS data that uses different sources, having clear metadata can help avoid issues when selecting data.

7th Session: Preparation of fundamental project data (Day 3)

Date: May 23, 2024

This session was focused on data cleansing, transforming the data set into Shapefile (to be compatible with QGIS).

Skills tested

- Transforming data (table) to GIS format
- Add, edit, or delete field
- Define a projection

8th Session: Creating a map practicing the skills developed

Date: May 24, 2024

This final session aims to apply the skills participants developed in using the QGIS software and their understanding of GIS. Participants were tasked to build up "GIS application" for survey points and to build a dashboard for the data.

5. Training Session by the Project Consultant Team (TDRI) in Krabi Province

Date: June 5, 2026

The purpose of the session is to build capacity of the provincial agencies to sustain the Provincial SEEA after the end of the NCA project. The data from the Provincial SEEA can be utilized to inform environmental policymaking for Krabi Province. Krabi Province is widely known as an eco-tourism destination. Protecting its ecosystem is vital for long-term sustainability.

The session covers the foundational knowledge of the UN-SEEA Framework, the 5 accounts in the Provincial SEEA, and the policy implications of NCA. The sample presentation slides can be referred to in Appendix 13.

Foundational knowledge of NCA began with the introduction of the UN System of Environmental-Economic Accounting (SEEA): the UN-SEEA Central Framework and the UN-SEEA Ecosystem Accounting. As the internationally accepted standard for NCA, the UN-SEEA Ecosystem Accounting framework was used a guideline in the development of the Provincial SEEA with the following 5 accounts:

- 1) Ecosystem Extent Account** uses spatial data to show the size (extent) of the identified ecosystems in Krabi Province (classified according to IUCN Global Ecosystem Typology), which the spatial data demonstrates the changes (additions or reductions in extent) of the ecosystem. These changes are demonstrated in tables and maps.

Agencies that provided data for this account

- Land (use) Benefits from the Land Development Department
- Maritime Zones from Royal Thai Navy
- Administrative Jurisdictions from the Department of Provincial Administration
- Data of Seagrass and Coral Reef from the Department of Marine and Coastal Resources
- Areas & Location of Mooring Sites from the Department of National Parks, Wildlife and Plant Conservation
- Boundaries of Koh Rok, Krabi from the Geo-Informatics and Space Technology Development Agency (GISTDA)

- 2) Ecosystem Condition Account** measures and monitors the quality and integrity of ecosystems across multiple dimensions: physical, biological, and functional, reflecting changes between the opening and closing periods. The ecosystem condition account defines the study area (based on the data from the ecosystem extent account) and selects the condition variables that are relevant and appropriate to the study areas (3 ecosystem groups: Freshwater, Terrestrial, and Marine). These variables are then standardized into a (0-1) scale, demonstrating richness or degradation, allowing for analysis of trends and aggregation of multiple variables.

Agencies that provided data for this account

- Quality of Surface Water and Seawater from the Pollution Control & Regional Environmental Office 15
- Species Richness of Fish from the Department of Fisheries

- Species Richness of Trees and Birds & Protected Forest Areas and Their Density in Relation to the Total Area of Krabi Province from the Department of National Parks, Wildlife and Plant Conservation
- Crop Density from the Office of Agricultural Economics
- Vegetation water content (NDWI) and Vegetation index (NDVI) from the Geo-Informatics and Space Technology Development Agency (GISTDA)
- Soil Organic Carbon Content from the Land Development Department

3) Ecosystem Service Account – Physical quantifies the ecosystem services in physical terms (supply and uses), demonstrated in Supply and Uses Tables (SUTs). The supply of services from ecosystems and how much is used demonstrates the contribution and benefits enjoyed by society. Ecosystem services of each ecosystem (relevant to the study area) are identified and categorized under three main categories: provisioning services, regulating and maintenance services, and cultural services.

4) Ecosystem Services Account – Monetary calculates the ecosystem services from physical terms into monetary values. The SUTs are calculated by multiplying the physical terms of services with unit prices from the relevant agencies to demonstrate the monetary value (in Thai Baht) of ecosystem services.

Agencies that provided data for the service account (physical and monetary)

- Agricultural Yields and Agricultural Commodity Prices from the Office of Agricultural Economics
- Data on Fisheries and Aquaculture in Freshwater and Marine Environments from the Department of Fisheries
- Quantity of Natural Water Bodies and Reservoirs & the Water usage for various purposes from the Department of Water Resource, Department of Groundwater Resource, Metropolitan Waterworks Authority, and the Royal Irrigation Department
- Forests from the Royal Forest Department & Forest Industry Organization (Southern Region)
- Quantity and Price of Electricity Generated from Biomass Power Plants from the Electricity Generating Authority of Thailand & Office of Energy Regulatory Commission
- Mangrove Forests from the Department of Marine and Coastal Resources
- Number of Accommodation Rooms and the Number of Tourists from the Office of the Permanent Secretary, Ministry of Tourism and Sports
- Carbon Prices from the Excise Department

5) Monetary Ecosystem Asset Account records the changes in ecosystem assets expressed in monetary terms. The ecosystem assets are valued using the net present value (NPV) of the ecosystem services expected to be supplied by those assets over time, with 2020 adopted as the base year for calculation.

Applications of NCA for policymaking can be seen in the Monetary Ecosystem Asset Account. The values in the Asset account are aggregated from the other four accounts. The net change and closing values of each ecosystem will inform prioritization of environmental policies to protect and conserve degraded ecosystems.

6. Conclusion

Overall, the series of technical training sessions successfully strengthened the capacity of the Project Consultant team, relevant agencies, and provincial stakeholders to understand NCA following the UN-SEEA framework. Through the sessions led by Dr. Gem B. Castillo, Dr. Carl Obst, Mr. Chakris Phithakrattanasakun, and the Project Consultant team, participants gained both conceptual and practical knowledge in ecosystem accounting, monetary valuation, GIS-based spatial analysis, and the development of Provincial SEEA accounts. These trainings provided an important foundation for improving the quality, consistency, and usability of environmental-economic data for Krabi Province.

The training program also demonstrated the importance of collaboration among technical experts, research teams, and government agencies in building accounts that reflect Krabi's ecosystem conditions and policy priorities. By combining knowledge on SEEA, ecosystem extent, condition, services, monetary asset accounts, and GIS applications, the project helped participants connect technical data preparation with real-world policy questions. This is particularly important for Krabi Province, where natural resources and ecosystem services are closely linked to tourism, livelihoods, water resources, and long-term environmental sustainability.

In conclusion, the training sessions contributed significantly to the development and future application of the Provincial SEEA for Krabi Province. The knowledge and skills gained from these sessions will support provincial agencies and stakeholders in using natural capital accounting outputs to inform evidence-based decision-making, prioritize ecosystem protection, and promote sustainable development. Continued capacity building, data sharing, and inter-agency coordination will be essential to ensure that the Provincial SEEA remains useful beyond the project period and can serve as a model for broader implementation in other provinces in Thailand.

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Appendices

Appendix 1: Dr Gem's Sample Slide Presentations- From all four sessions

Training on Ecosystem Accounting for TDR and EEI-LMS

Part 1: Concepts in Ecosystem Accounting
March 16, 2023

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Why is NCA important?

- ❑ A lack of awareness by policy makers on the value added of NCA and how it can address policy needs;
- ❑ Traditionally policymaking has taken a "silo" approach instead of a systems approach.
- ❑ Since the environment is important to society and the economy, it should be recognized as an asset that must be maintained and managed.
- ❑ Placing environmental statistics into an accounting framework dramatically increases their usefulness for policy,
- ❑ Manage biodiversity effectively

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SEEA Ecosystem Accounts

1. Ecosystem extent account – physical terms
2. Ecosystem condition account – physical terms
3. Ecosystem services flow account – physical terms
4. Ecosystem services flow account – monetary terms
5. Monetary ecosystem asset account – monetary terms

Focused on ecosystems how individual components function together

Stock accounts and change in stocks

Ecosystem extent

Ecosystem condition

Monetary ecosystem asset

Flow accounts

Ecosystem services flow

Ecosystem services flow

Thematic accounts

- Biodiversity
- Climate change
- Oceans
- Urban areas

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SNA, UNSEEA Central Framework, Ecosystem Accounting, Natural Capital Accounting

SNA (System of National Accounts)	SEEA-CF (Central Framework)	SEEA-EA (Ecosystem Accounting)
Economic units: <ul style="list-style-type: none"> • Household • Business • Government • NPISHs 	Stocks <ul style="list-style-type: none"> • Minerals & energy • Land, Soil (excavated) • Timber • Aquatic • Other biological • Minerals & energy • Water 	Core Accounts <ul style="list-style-type: none"> • Extent • Condition • Ecosystem Assets • Ecosystem Services
Output and Production <ul style="list-style-type: none"> • Market Output • Non-market output • Own-account production 	Flows <ul style="list-style-type: none"> • Materials • Energy • Water • Emissions • Wastes • Production expenditures • Subsidies 	Thematic: <ul style="list-style-type: none"> • Carbon • Water • Biodiversity
Produced asset <ul style="list-style-type: none"> • Fixed assets and inventories • Cultivated biological assets 	<ul style="list-style-type: none"> • Natural inputs • Products • Residuals 	Flows <ul style="list-style-type: none"> • Ecosystem Services Supply • Provisioning • Regulating • Cultural • Ecosystem Services Use
Non-produced assets <ul style="list-style-type: none"> • Marketing assets, etc. • Natural resources • Land 		
Financials Assets		

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Ecosystem and Natural Capital Accounting

Part 2: Physical Accounting
March 17, 2023

Gem B. Castillo, PhD
Ecosystem Accounting Training for Thailand

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Summary of Natural Capital and Ecosystem Accounting

Ecosystem Type/ Ecosystem Asset

- Extent
- Condition

Capacity to generate Ecosystem Services

Flows of Ecosystem Services

Benefits to Economic and other human activities

Analyzed using maps and tables (Spatially-explicit approach)

Needs integration of data from various sources

Uses: Policy, Land use planning, Local Action Plans, Development Plans, System of National Account

- Protection areas
- Production areas
- Built up areas
- Other Use areas

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Building Ecosystem Accounts

Data and Tools

- Two period or more series data
- Global
- National
- City level

Land Cover Data

- Applying GIS Tools
- Land Cover Change Analysis
- Survey
- KII
- FGDs
- Ancillary data

Develop Core Accounts

Extent Accounts → Condition Accounts → Ecosystem Services

Item	Annual	Quarterly	Half-year	Year
Spring 2018	20	10	10	5
Autumn	25	12	13	6
Spring 2019	30	15	15	7
Autumn	35	18	18	8
Spring 2020	40	20	20	9
Autumn	45	22	22	10

Group A: Abiotic ecosystem characteristics

- Physical - e.g., soil structure, water availability
- Chemical - e.g., soil nutrient levels, water quality

Group B: Biotic ecosystem characteristics

- Compositional state
- Structural state
- Functional state

Group C: Landscape level characteristics

- Landscape
- Seascape

Ancillary data

- Roads, elevation
- Economic activities
- Management boundaries

Monetary Asset Account

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Relationship between ecosystem condition, ecosystem capacity and ecosystem degradation

Sustainability

Supply of ES

Use of ES

Depletion, Degradation

Extent → Condition → Ecosystem Service → Ecosystem Capacity

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Ecosystem and Natural Capital Accounting

Part 3: Monetary Valuation and Accounting
April 4, 2023

Gern B. Castillo, PhD
Ecosystem Accounting Training for Thailand

Role of exchange value based monetary valuation

Summary

Economic decision-making: decision on benefits and costs of different uses of the ecosystem

Incentives for conservation: demonstrate the economic benefits of preserving ecosystems

Payment for ecosystem services: design payment for ecosystem services (PES) schemes

Cost-benefit analysis: to evaluate the economic efficiency of policies and projects that affect ecosystems

- comparing the values of environmental assets (including ecosystems) with other asset types (e.g., produced assets) as part of extended measures of national wealth;
- highlighting the relevance of non-market ecosystem services (e.g., air filtration);
- assessing the contribution of ecosystem inputs to production in specific industries and their supply chains;
- comparing the trade-offs between different ecosystem services through consideration of relative prices;
- deriving complementary aggregates such as degradation adjusted measures of national income;
- evaluating trends in measures of income and wealth;
- improving accountability and transparency around the public expenditures on the environment by recognizing expenditure as an investment rather than a cost;
- providing baseline data to support scenario modelling and broader economic modelling;
- assessing financial risks associated with the environment; and calibrating the application of monetary environmental policy instruments such as environmental markets and environmental taxes and subsidies.

Part 3 Page # 02/12/2023 Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Typology of valuation methods by SEEA EA preference order

SEEA EA order	SEEA EA Category of method	Methods	Alternative description / related methods	Conceptual basis
1	Prices are directly observable	Market prices	Gross revenue, public pricing, monetary incentives	Market price
2	Prices from similar markets	Similar markets		Market price (adjusted)
3	Prices embodied in market transactions	Residual value, resource rent	Net factor income	Revealed preference - direct
4	Prices from revealed expenditures on related goods and services	Hedonic pricing		Revealed preference - indirect
		Productivity change	Production function method	Revealed preference - direct
		Averting behaviour	Defensive expenditure, averting cost	Revealed preference - direct
5	Prices from expected or simulated expenditures or expected markets	Travel expenditure	As revealed in: consumer expenditure method, zonal based models, random utility model studies	Revealed preference - indirect
		Replacement cost	Substitute cost, alternative cost	Revealed preference - direct
		Avoided damage cost	Cost of illness, human capital	Revealed preference - direct
		Simulated exchange value		Modelling

Note: Valuation techniques have been classified in several ways but there exists no formally endorsed typology.

02/12/2023 Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Sample Table of Monetary Asset Account

Ecosystem Assets Account

	Forest	Land	Cropland	Urban area	Waterbody	Program	TOTAL
Opening value	\$905,065	\$1,079,321	\$484,856	\$522,568	\$51,718	\$529,679	\$3,572,207
Ecosystem enhancement	\$0	\$15,300	\$0	\$0	\$0	\$0	\$15,300
Ecosystem degradation	-\$108,111	\$0	\$0	\$0	-\$1,099	-\$163,946	-\$273,156
Ecosystem conversions							
Additions	\$0	\$0	\$16,944	\$0	\$0	\$0	\$16,944
Reductions	-\$43,435	\$0	\$0	\$0	\$0	\$0	-\$43,435
Other changes in volume of ecosystem assets							
Catastrophic losses	\$0	\$0	\$47,704	\$43,098	\$0	\$0	-\$90,802
Upward reappraisals	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Downward reappraisals	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revaluations	\$35,180	\$47,624	\$0	\$215	\$840	\$160,929	\$244,789
Net change in value	-\$116,366	\$62,924	\$64,648	\$43,314	-\$239	-\$3,017	\$1,511,244
Closing value	\$788,700	\$1,142,245	\$549,504	\$565,882	\$51,479	\$526,662	\$3,823,451

02/12/2023 Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Ecosystem and Natural Capital Accounting

Part 4: Application of the process in Developing Ecosystem Asset Accounts
April 5, 2023

Gern B. Castillo, PhD
Ecosystem Accounting Training for Thailand

Supply of ecosystem services

- Forest
 - wood provisioning services (ES1)
 - global climate regulation services (ES2)
 - recreation-related services (ES3)
- Cropland
 - Crop provisioning (ES4)

Ecosystem asset

- EA1 - forest 50 ha
- EA2 - cropland 40 ha

ES1 - forest ES2 - cropland

Wood provisioning, Global climate regulation services, Recreation-related services, Crop provisioning

Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Net Present Value Computations

Discount Rate: 2% (actual is = 2.041%)

Discount Factor = $\frac{1}{(1 + 2.041\%)^t}$ = 0.980

Net Present Value: $V_t = \sum_{t=1}^n \frac{V_t}{(1+r)^t} = \frac{V_1}{1+r} + \frac{V_2}{(1+r)^2} + \dots + \frac{V_n}{(1+r)^n}$

NPV for each EA is computed

Variable	Ecosystem service	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Total NPV (€)
Discount factor (t)	2% discount rate		0.98	0.9604	0.9412	0.9224	0.9038	
Net present value (€10 ⁷)	ES1 - Wood provisioning	5	\$76	\$75	\$73	\$71	\$70	\$3,633
	ES2 - Global climate regulation	5	\$4,800	\$4,546	\$4,299	\$4,057	\$3,818	\$18,205
	ES3 - Recreation-related	5	\$98	\$92	\$87	\$81	\$76	\$3,138
	Total Forest (Ecosystem)	5	\$574	\$559	\$540	\$529	\$524	\$25,176
	ES4 - Crop provisioning	5	\$68	\$62	\$58	\$54	\$51	\$2,482
	Total Cropland (Ecosystem)	5	\$68	\$62	\$58	\$54	\$51	\$2,482
	Total EEA	5						\$28,208

Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Derivations of the three effects

Area effect: $\frac{1}{2} \frac{V_1}{1+r} + \frac{1}{2} \frac{V_2}{1+r} + \frac{1}{2} \frac{V_3}{1+r} + \frac{1}{2} \frac{V_4}{1+r} + \frac{1}{2} \frac{V_5}{1+r} \cdot (a_1 - a_0)$

Price effect: $\frac{1}{2} \frac{V_1}{1+r} + \frac{1}{2} \frac{V_2}{1+r} + \frac{1}{2} \frac{V_3}{1+r} + \frac{1}{2} \frac{V_4}{1+r} + \frac{1}{2} \frac{V_5}{1+r} \cdot (P_1 - P_0)$

Volume effect: $\frac{1}{2} \frac{V_1}{1+r} + \frac{1}{2} \frac{V_2}{1+r} + \frac{1}{2} \frac{V_3}{1+r} + \frac{1}{2} \frac{V_4}{1+r} + \frac{1}{2} \frac{V_5}{1+r} \cdot (Q_1 - Q_0)$

	Area effect	Volume effect	Price effect	Total
ES1 - Wood provisioning	-\$139	-\$482	\$177	-\$444
ES2 - Global climate regulation	-\$738	-\$560	\$654	-\$644
ES3 - Recreation related services	-\$217	\$431	\$192	\$406
ES4 - Crop provisioning	\$113	\$168	\$4	\$285
Total	-\$976	-\$442	\$1,027	-\$392

Training on Ecosystem Accounting for TDBI and EEL LMS Bangkok Thailand, April 4, 2023

Appendix 2: Attendance Sheet for Dr. Gem's Training Sessions

Online Training "Natural Capital Accounting" (16-17 March 2023 and 4-5 April 2023)

under the project "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

การอบรม เรื่อง "การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA)"

ภายใต้ โครงการ "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

วันที่ 16 - 17 มีนาคม 2566 และ วันที่ 4 - 5 เมษายน 2566 เวลา 09.00 - 12.00 น. (ผ่านระบบออนไลน์)













ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

By Mr. GEM BELARMINO CASTILLO, PhD
International Expert in Natural Capital Accounting (NCA)




List of participants

Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
Lecturer 1. Mr. GEM BELARMINO CASTILLO, PhD	International Expert in Natural Capital Accounting (NCA)	President at Resource and Environmental Economics Foundation of the Philippines, Inc.				
Project Manager 2. Adis Israngkura (Ph.D.) รศ.ดร.อดิศร์ อิศรางกูร ณ อยุธยา	Advisor for Resource Sustainability and Mitigation Policy ผู้อำนวยการทีมนโยบายทรัพยากร ธรรมชาติและสิ่งแวดล้อมภาคเรียน	Thailand Development Research Institute (TDRI) ผู้อำนวยการทีมนโยบายทรัพยากร ธรรมชาติและสิ่งแวดล้อมภาคเรียน				
Specialists						
3. Udomsak Seenprachawong (Ph.D.) รศ.ดร.อุดมศักดิ์ ศิลปะชาวงค์	Economic of Tourism Specialist ผู้เชี่ยวชาญด้านเศรษฐศาสตร์	School of Development Economics, NIDA คณะพัฒนาการเศรษฐกิจ, NIDA				

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
4. Tunlawit Satapanajaru (Ph.D.) รศ.ดร.ตุลวิทย์ สถาปนงารุ	Environmental Science Specialist ผู้เชี่ยวชาญด้านเทคโนโลยีและการจัดการด้านสิ่งแวดล้อม	Kasetsart University คณะสิ่งแวดล้อม มหาวิทยาลัยเกษตรศาสตร์				
5. Pasinee Worachananant (Ph.D.) ผศ.ดร.ภาสิณี วรชนะนันท์	Environmental and Tourism Management Specialist ผู้เชี่ยวชาญด้านการจัดการด้านสิ่งแวดล้อมและการท่องเที่ยว	Kasetsart University คณะสิ่งแวดล้อม มหาวิทยาลัยเกษตรศาสตร์				
6. Pasita Chaijaroen (Ph.D.) ดร.ภาสิตา ไชยเจริญ	Environmental Economic Specialist ผู้เชี่ยวชาญด้านเศรษฐศาสตร์สิ่งแวดล้อม	Vidyasirimedhi Institute of Science and Technology (VISTEC) สถาบันวิจัยสิริเมธี (VISTEC)				
7. Ditchaphong Phoomkiattisak (Ph.D.) ดร.ดิชพงษ์ ภูมิเกียรติศักดิ์	Geo-Informatics and space Technology specialist ผู้เชี่ยวชาญด้านเทคโนโลยีอวกาศและภูมิสารสนเทศ	Geo-Informatics and space Technology Development Agency (Public Organization) GISTDA สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) GISTDA				
8. Mr. Chakris Phithakrattanasakun นายชาคริต พิทักษ์รัตนสกุล	Geo-Informatics and space Technology specialist ผู้เชี่ยวชาญด้านเทคโนโลยีอวกาศและภูมิสารสนเทศ	Geo-Informatics and space Technology Development Agency (Public Organization) GISTDA สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) GISTDA				

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
9. Mr. Ricardo Marchant	Biodiversity Finance Specialist ผู้เชี่ยวชาญด้านการเงิน ความหลากหลายทาง ชีวภาพ	Independent Academician นักวิชาการอิสระ			-	
10. Phet Manopawit (Ph.D.) ดร.เพชร มโนปวิตร	Specialist in Information and Communication Technology ผู้เชี่ยวชาญด้านเทคโนโลยี สารสนเทศและการสื่อสาร	The Bird Conservation Society of Thailand (BCST) นายกสมาคมอนุรักษ์นกและ ธรรมชาติแห่งประเทศไทย	-	-	-	-
11. Mr. Sanchai Sutipanwihan อาจารย์สัญญาชัย สุทธิพันธ์วิหิต	Process Mobilisation Specialist ผู้เชี่ยวชาญด้านกระบวนการ มีส่วนร่วม	Faculty of Environment and Resource Studies, Mahidol University คณะสิ่งแวดล้อมและ ทรัพยากรศาสตร์ มหาวิทยาลัยมหิดล	-	-	-	-
UNEP โครงการสิ่งแวดล้อมแห่งสหประชาชาติ						
12. Kavita Sharma (Ph.D.)	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia	UNEP	-	-		-
Project Steering Committee (PSC) คณะกรรมการกำกับโครงการฯ						
13. Ms. Kobkul Pitarachart น.ส.กอบกุล ปิตราชชาติ	Tourism Development Officer, Expert Level ผู้เชี่ยวชาญเฉพาะด้าน พัฒนาแหล่งท่องเที่ยว	Department of Tourism กรมการท่องเที่ยว			-	

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
14. Mr. Verapong Rattanjithumrongkul นายวีรพงษ์ รัตนจิตธำรงกุล	Tourism development officer (Professional level) นักพัฒนาการท่องเที่ยว ท่องเที่ยวชำนาญการ	Department of Tourism กรมการท่องเที่ยว			-	-
15. Ms. Weena Larpchaturaputj น.ส.วีณา ลากจตุรภูษ	Tourism development officer (Professional level) นักพัฒนาการท่องเที่ยว ท่องเที่ยวชำนาญการ	Department of Tourism กรมการท่องเที่ยว		-	-	
16. Ms. Orapa Suwattano น.ส.อรภา สุวัฒน์	Fishery Biologist Professional Level นักวิชาการประมงชำนาญการ	Department of Marine and Coastal Resource กรมทรัพยากรทางทะเลและชายฝั่ง	-	-	-	-
17. Mr. Chanawat Arrunrata นายชนาวัชร อรุณรัตน์	Director of Public Water Resources Management ผู้อำนวยการส่วนบริหาร จัดการทรัพยากรน้ำสาธารณะ	Department of Water Resources กรมทรัพยากรน้ำ	-	-	-	-
18. Mrs. Ratda Patsinghasanee นางรัตดา พัฒนสังขานี	Policy and plan analyst Senior Professional Level นักวิเคราะห์นโยบาย และแผนชำนาญการพิเศษ	Department of Water Resources กรมทรัพยากรน้ำ				
19. Mr. Pipat Ruanggam นายพิพัฒน์ เรืองงาม	Expert ผู้เชี่ยวชาญ	Department of Water Resources กรมทรัพยากรน้ำ		-	-	-
20. Ms. Nattha Jangrajang น.ส.ณัฐา จันทร์กระจ่าง	Plan and Policy analyst, Professional Level นักวิเคราะห์นโยบายและแผน ชำนาญการ	Department of Water Resources กรมทรัพยากรน้ำ		-	-	-

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
21. Mr. Pattaphon Yangprayut นายพัทธพล ยั้งประยูทธิ	Plan and Policy analyst, Practitioner Level นักวิเคราะห์นโยบายและแผนปฏิบัติการ	Department of Water Resources กรมทรัพยากรน้ำ				
22. Ms. Weerana Sompeewong นส.วีรณา สมพิริวงค์	Scientist, Senior Professional level นักวิทยาศาสตร์ชำนาญการพิเศษ	Royal Forest Department กรมป่าไม้				
23. Ms. Pinyarat Chayaporn นส.ปิยนารถน์ ชยาภรณ์	Scientist นักวิทยาศาสตร์	Royal Forest Department กรมป่าไม้				
24. Ms. Chalita Khamsakun นส.ชลิตา คำสกุล	Forest Researcher นักวิจัยป่าไม้	Royal Forest Department กรมป่าไม้				
25. Ms. Kanyapak Kanjanapirom นส.กัญญาภัค กาญจนภิรมย์	Forestry Technical Officer นักวิชาการป่าไม้	Royal Forest Department กรมป่าไม้				
26. Ms. Jidapa Sangsuriya นส.จิตาภา แสงสุริยา	Forestry Technical officer, Practitioner level นักวิชาการป่าไม้ปฏิบัติการ	Royal Forest Department กรมป่าไม้				
27. Mr. Chatchawan Suanchan นายชัชวาลย์ สวนจันทร์	Forestry Technical officer, Practitioner level นักวิชาการป่าไม้ปฏิบัติการ	Royal Forest Department กรมป่าไม้				
28. Mr. Nuntapon Nongharnpitak นายณันทพล นองหารพิทักษ์	Expert on Landuse Planning ผู้เชี่ยวชาญด้านวางแผนการใช้ที่ดิน	Land Development Department กรมพัฒนาที่ดิน				

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
29. Mrs. Nilubol Khanha นางนิลุบล ก็นหา	Forestry Technical Officer Senior Professional Level นักวิชาการป่าไม้ชำนาญการพิเศษ	Department of National Parks, Wildlife and Plant Conservation กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช				
30. Mr. Tammakit Intharaksa นายธรรมกิตติ อินทรักษา	Scientist, Practitioner Level นักวิทยาศาสตร์ปฏิบัติการ	Department of National Parks, Wildlife and Plant Conservation กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช				
31. Ms. Siripan Panyachai นส.ศิริพรรณ ปัญญาใจ	Research Assistant ผู้ช่วยนักวิจัย	Department of National Parks, Wildlife and Plant Conservation กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช				
32. Mr. Teerapat Moleenon นายธีรภัทร โมฬีนนท์	Tourism promotion staff 6 พนักงานส่งเสริมการท่องเที่ยว 6	Tourism Authority of Thailand การท่องเที่ยวแห่งประเทศไทย				
33. Ms. Sarunporn Thongpinyochai นส.ศรินทร์พร ทองปัญญาชัย	Project analyst เจ้าหน้าที่วิเคราะห์โครงการ	Ministry of natural resources and environment สำนักงานปลัดกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม				
34. Mr. Promnarin Timmontha นายพรหมรินทร์ ทิมมณฑา	Project analyst เจ้าหน้าที่วิเคราะห์โครงการ	Ministry of natural resources and environment สำนักงานปลัดกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม				






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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
35. Mr. Chairat Sanguankijpatana นายชัยรัตน์ สงวนกิจพัฒนา	Phd Student นักศึกษาระดับปริญญาเอก	Kasetsart University มหาวิทยาลัยเกษตรศาสตร์			-	-
36. Benchamaporn Wattanatongchai (Ph.D.) ดร.เบญจมาภรณ์ วัฒนธงชัย	Environmentalist, Senior Professional Level นักวิชาการสิ่งแวดล้อม ชำนาญการพิเศษ(กองจัดการ ความหลากหลายทางชีวภาพ)	Office of Natural Resources and Environmental Policy and Planning (ONEP) สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม				
37. Ms. Somawan Sukprasert นส.โสมวรรณ สุขประเสริฐ	Environmentalists, Professional Level นักวิชาการสิ่งแวดล้อม ชำนาญการ	Office of Natural Resources and Environmental Policy and Planning (ONEP) สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม			-	-
38. Mr. Ratchanon Chaba	Environmentalists, Practitioner Level นักวิชาการสิ่งแวดล้อม ปฏิบัติการ	Office of Natural Resources and Environmental Policy and Planning (ONEP) สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม				
39. Ms. Urachwee Unhalekhaka นส.อุรฉฉวี อุณหเลขกะ	Senior Bioeconomy Development Officer เจ้าหน้าที่พัฒนาเศรษฐกิจ ชีวภาพ (อาวุโส)	Biodiversity-based Economy Development Office สำนักงานพัฒนาเศรษฐกิจจาก ฐานชีวภาพ (องค์การมหาชน)				














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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
40. Ms. Suriyaporn Choeychom นส.สุริยาภรณ์ เขยชม	Project Coordinator ประสานงานโครงการ	Biodiversity-based Economy Development Office สำนักงานพัฒนาเศรษฐกิจจาก ฐานชีวภาพ (องค์การมหาชน)			-	
41. Ms. Narissara Chanpet นส.นริศรา จันทร์เพชร	Statistician, professional leve นักวิชาการสถิติชำนาญการ	National statistical office สำนักงานสถิติแห่งชาติ				
42. Mr. Adisak Dampholngam นายอดิศักดิ์ คำพลงาม	Statistics scholar นักวิชาการสถิติ	National statistical office สำนักงานสถิติแห่งชาติ				
43. Ms. Thidaporn Polnon นส.ธิดาพร พลน	Statistician Practitioner Level นักวิชาการสถิติปฏิบัติการ	National statistical office สำนักงานสถิติแห่งชาติ				
44. Ms. Sasipim Putthikorn นส.ศศิพิมพ์ พุฒิก	Statistician Practitioner Level นักวิชาการสถิติปฏิบัติการ	National statistical office สำนักงานสถิติแห่งชาติ				
45. Mr. Sombat Kitjaruwong นายสมบัติ กิจจารวงษ์	Policy and Plan Analyst นักวิเคราะห์นโยบายและ แผนชำนาญการพิเศษ	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการ เศรษฐกิจและสังคมแห่งชาติ				
46. Ms. Nuchada Charoenpanich นส.นุชชดา เจริญพานิช	Plan and policy analyst, senior professional level นักวิเคราะห์นโยบายและ แผนชำนาญการพิเศษ	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการ เศรษฐกิจและสังคมแห่งชาติ				

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
47. Ms. Supaporn Wongwattanasiri นส.สุภาพร ว่องวัฒนศิริ	Plan and policy analyst, Senior Professional level นักวิเคราะห์นโยบายและแผนชำนาญการพิเศษ	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ				
48. Ms. Pattanan Pluwangkan นส.พัทธนันท์ พลุวิงกาญจน์	Policy and Plan Analysis นักวิเคราะห์นโยบายและแผน	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ		-	-	-
49. Mr. Apichat Sukonthasakorn นายอภิชาติ สุคนธสาคร	Policy and Plan Analysis นักวิเคราะห์นโยบายและแผน	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	-	-	-	-
50. Mr. Tepwarith Thonghom นายเทพฤทธิ์ ทองหอม	Policy and Plan Analysis นักวิเคราะห์นโยบายและแผน	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	-	-	-	-
51. Ms. Boonsita Kitikhun นส.บุญสิตา กิติคุณ	Policy and Plan Analysis นักวิเคราะห์นโยบายและแผน	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	-	-	-	-
52. Ms. Tanyathom Osataphan นส.ธัญธร โอสถาพันธุ์	Plan and Policy Analyst, Practitioner Level นักวิเคราะห์นโยบายและแผนปฏิบัติการ	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	-	-	-	-

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
53. Ms. Cholwana Maneesawat นส.ชอลวนา มณีสวัสดิ์	Policy and Plan Analyst Practitioner level นักวิเคราะห์นโยบายและแผนปฏิบัติการ	Office of the National Economic and Social Development Council สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ		-		
54. Mr. Krisada Bamrungwong นายภูษดา บำรุงวงศ์	Policy Researcher (Policy Study Section, Policy Study and Biosafety Unit Division) นักวิจัยด้านนโยบาย (ฝ่ายศึกษานโยบายและความปลอดภัยทางชีวภาพ)	National Center for Genetic Engineering and Biotechnology สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ				
55. Ms. Sirawan Chootong นส.สิริวรรณ ชูทอง	Human Resource Officer Professional Level นักทรัพยากรบุคคลชำนาญการ	Krabi Governor's Office สำนักงานจังหวัดกระบี่		-	-	-
56. Ms. Suwadee Phakkapomphattarapop นส.สุวดี ภัคพรภัทรพบ	Human Resource Officer พนักงานทรัพยากรบุคคล	Krabi Governor's Office สำนักงานจังหวัดกระบี่			-	-
Thailand Development Research Institute Foundation (TDRI)						
57. Dr. Kannika Thampanishvong ดร.กรรณิการ์ ธรรมพานิชวงศ์	Senior Research Fellow นักวิชาการอาวุโส	TDRI	-		-	-
58. Dr. Charika Channuntapipat ดร. ชาริกา ชาญนันท์พิพัฒน์	Research Fellow นักวิชาการ	TDRI	-	-		

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
59. Mr. Promphat Bhumiwat นายพร้อมพัฒน์ ภูมิวัฒน์	Researcher นักวิจัย	TDRi				
60. Mr. Niponpan Sasidhorn นายนิพนธ์พันธุ์ ศศิธร	Researcher นักวิจัย	TDRi				
61. Khun Kanyaphak Ngaosri กัญญาภัค เงาศรี	Researcher นักวิจัย	TDRi			-	
62. Ms. Aekpaween Anuson นส.เอกปวีณ อนุสนธิ์	Researcher นักวิจัย	TDRi			-	
63. Mr. Khajomphong Prasastranuvat นายจรพงษ์ ประศาสตร์านูวัตร	Researcher นักวิจัย	TDRi				
64. Ms. Piramon Siengchareon นางสาวภิรมณ เสียงเจริญ	Intern นักศึกษาฝึกงาน	Thammasat University มหาวิทยาลัยธรรมศาสตร์				
Project Staff						
65. Ms. Thippawan Keawmesri นางทิพย์วัลย์ แก้วมีศรี	Researcher, Liaison นักวิจัยอาวุโส และผู้ประสานงาน	TDRi				
66. Ms. Prinyarat Leangcharoen นางสาวปริญญาวัฒน์ เสียงเจริญ	Researcher นักวิจัยอาวุโส	TDRi				
67. Ms. Kanjana Yasen นางสาวกาญจนา ย่าเสน	Researcher นักวิจัย	TDRi				

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Name	Position	Organization	Signature			
			16 Mar 2023	17 Mar 2023	4 Apr 2023	5 Apr 2023
68. Mr. Achira Sirimongkolkasem นายอชิระ ศิริมงคลเกษม	Researcher, Liaison นักวิจัย และผู้ประสานงาน	TDRi				

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Appendix 3: Poster for Dr. Gem's Training Sessions



กำหนดการอบรม

เรื่อง “การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA)”

ภายใต้ โครงการ “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”



ผู้บรรยาย : Mr. GEM BELARMINO CASTILLO, PhD
ผู้เชี่ยวชาญนานาชาติด้านการจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA)

 วันที่ 16 – 17 มีนาคม 2566 และ วันที่ 4 – 5 เมษายน 2566 เวลา 09.00 - 12.00 น.

วันที่ 16 มีนาคม 2566
(เวลา 9.00 – 12.00 น.)

1. Concept and Principle

Introduction to natural and ecosystem accounting

วันที่ 17 มีนาคม 2566
(เวลา 9.00 – 12.00 น.)

2. Physical Account

Measures in doing accounts on physical dimensions

วันที่ 4 เมษายน 2566
(เวลา 9.00 – 12.00 น.)

3. Monetary Account

Measures in doing accounts on monetary dimensions, conversion of physical account into monetary account, creating monetary account that is applicable with UN-SEEA

วันที่ 5 เมษายน 2566
(เวลา 9.00 – 12.00 น.)

4. Application of Account

Putting lessons from session 1-3 into practice.



แบบตอบรับเข้าร่วมอบรม
<https://shorturl.asia/WOujq>



Join Zoom Meeting
<https://us06web.zoom.us/j/4143093828>
Meeting ID: 414 309 3828

Appendix 4: Dr. Gem's CV

Mr. GEM BELARMINO CASTILLO, *PhD*

gem.castillo@reecs.co, gembcastillo24@gmail.com
 Jose St., Lopez Village, San Antonio, Los Banos 4031 Laguna, Philippines
 Tel. (63-49) 536-8737; Mobile Ph. (63) 916 461 0431
 (As of January 2022)

Education		
Ph.D.	Forest Economics, and Certificate in Resource Economics Department of Forestry, Michigan State University East Lansing, MI 48824 Ph.D. Dissertation: Resource Accounting Framework for the Community-Based Forest Management System of the Philippines: A Case Study. Developed a survey-based social accounting matrix (SAM) that incorporated a timber sustainability assessment.	Fall 2000
MS Forestry	Forest Resource Management specialized in Forest Economics University of the Philippines Los Banos, Los Banos, Laguna, Philippines Master's thesis: Economic evaluation of selected reforestation strategies of the Philippines. Focused on cost- benefit analysis of various reforestation strategies.	1986-1991
Diploma in Development Economics	University of the Philippines School of Economics, Diliman, Quezon City Philippines	1986-1987
BS Forestry	General Forestry, University of the Philippines Los Banos, Laguna, Philippines	1977-1981
Current Positions		
Chairman of the Board	Resources, Environment and Economics Center for Studies	2018 - Present
President	Resource and Environmental Economics Foundation of the Philippines, Inc.	2009 – Present
National Director	Economy and Environment Group Philippines	2015 - Present
Member, Executive Committee	Economy and Environment Partnership for Southeast Asia	2015 - Present
Current Work		
Consultant	Philippine Development Plan for 2023-2028, National Economic and Development Authority	Drafting of Chapter 15 (previously Chapter 17) of the PDP in collaboration with NEDA ANRES, and Planning Committee composed of representatives of various national government agencies, September 2022 – January 2023.
Project Leader	Design of the Community Development Fund for the Oceana Gold Philippines, Inc. in the Didipio Mine in Nueva Vizcaya and Quirino Provinces	March – July 2022, develop the operational framework for the implementation of the Community Development Fund from 1% of the Gross Revenue of the mining operation.

Current Work		
Overall, Team Leader, MICC Mining Review Phase 3	Mining Industry Coordinating Council (MICC) Objective, Fact-Finding, and Science-Based Review of Large-scale Quarry Operations, funded by DENR and Department of Finance, implemented by Development Academy of the Philippines	January 2022 – September 30, 2022; led multi-disciplinary teams composed of mining engineers, environment, legal, social and economic experts in the conduct of on-site assessment of mining operations in the entire country
Resource Person of trainings and webinars	<ul style="list-style-type: none"> • Ecosystem and Natural Capital Accounting • Benefit-Cost Analysis • Valuation of Ecosystem services 	Years 2020, 2021 for various audiences including HEIs
Short Term Consultant	Climate Change & Environmental Governance Project for Case of Iriga City, implemented jointly by PTF Asia Foundation Inc. (PTFA) and Resources, Environment and Economics Center for Studies (REECS)	July 2021- June 2024 Update of LCCAP; Training on Project Development; Revision of the Iriga City proposal on Securing Water as Adaptive Mechanism for Sustainable Water Supply (SWAMSS)
Short Term Technical Specialist: Forest Resource Accounts at the National and Site Level	Sustainable Interventions for Biodiversity, Oceans, and Landscapes (SIBOL) project of the United States Agency for International Development (USAID),	2020 – 2024 Develop natural capital accounts for forest ecosystems in Palawan and at the national level.
National Consultant: Project –	GEF UNEP Project: P#1002048 Small-Scale Funding Agreement for GEF Project Preparation Grant of Natural Capital Accounting and Assessment: Informing development planning, sustainable tourism development, and other incentives for improved conservation and sustainable landscapes	December 2020-May 2021; Prepared 3 baseline reports and provided inputs to the Project Document submitted for approval by GEF for 2021 cycle. Included conduct of stakeholder consultations.

Current Work		
Philippines Research Consultant	Biodiversity Conservation and Management of Protected Areas in ASEAN (BCAMP) 'Knowledge and Capacity Building on Economic Studies of Pilot ASEAN Heritage Parks (AHPs)/Protected Areas (PA) for Conservation Financing' funded by ASEAN Center for Biodiversity	2020 - 2021 (Pending release of funding) Implement the research project entitled: Design and Implementation Guidelines for Payment for Watershed Provisioning Service in Pasonanca National Park. This research project aims to evaluate if a payment for environmental services such as water provisioning service is feasible for the Pasonanca National Park (PaNP) and if so, what schemes would work for the area so that watershed conservation financing for PaNP can be established. July 2019 -September 2020
Deputy Project Leader, Natural Resource Management Specialist	ADB-funded project: "Nature-based approaches for climate change and disaster-risk management" under the Protecting and Investing in Natural Capital in Asia and the Pacific	The key tasks were: (1) support the team leader in working with DPWH and the IPIF TA loan consultants to identify all potential NBS (structural and non-structural, green and green-grey) measures for flood-risk management in the six target river basins; October 2019 – September 30, 2020; led multi-disciplinary team composed of mining engineering, environment, legal, social and economic experts in the conduct of on-site assessment of mining operations in Dinaga Island Province, Palawan and Guiuan, Eastern Samar.
Team Leader, Technical Review Team 1 of MICC Mining Review Phase 2	Mining Industry Coordinating Council (MICC) Objective, Fact-Finding, and Science-Based Review of Mining Operations (4 mining companies out of 17), funded by DENR and Department of Finance, implemented by Development Academy of the Philippines	October 2019 – September 30, 2020; led multi-disciplinary team composed of mining engineering, environment, legal, social and economic experts in the conduct of on-site assessment of mining operations in Dinaga Island Province, Palawan and Guiuan, Eastern Samar.
Past Consultancy Work		
Philippines Research Consultant	Biodiversity/Ecosystem Services Assessment (BESA) and Applied Economic Analysis for Improved Management, Policy Development and Innovative Financing: Knowledge, Uses, Gaps, and Priority Applications funded by ASEAN Center for Biodiversity	2019 Assess existing knowledge on BESA and Economic Analysis applications for improving conservation at both the national level, and at BCAMP pilot AHP/PA levels; Analyze the knowledge gaps, and prioritize the issues that need to be addressed, including training needs that would enhance the use of BESA and Economic Analysis Applications
Trainer	NEDA funded project entitled, Integration of CC DRR processes to Supplemental Manual on Mainstreaming Climate Change and Disaster Risk Reduction (CC/DRR) in the Project Development Evaluation Manual (PDEM)	May – June 2019, conducted capacity building sessions with NEDA staff and other government agencies in integrating CC and DRR in Project Development and Evaluation Manual.

Current Work		
Expert on biophysical aspects of measurement	Revision of the System of Environmental-Economic Accounting—Experimental Ecosystem Accounting (SEEA EEA) coordinated by the United Nations Committee of Experts on Environmental Economic Accounting	Starting October 2018 - For the paper on Biomass provisioning services from agricultural and forestry activity , including input services such as pollination services (paper #1)
Project Team Leader,	Impact Evaluation of the Oceana Gold Philippines, Inc. Social Investment and Development Programs	Starting September 15, 2018 (1 year); lead a team of experts in the conduct of economic and social impact evaluation of the social investment programs of the mining company particularly assessment of the impact of the Social Development and Management Program and Corporate Social Responsibility projects in communities of Kasibu, Nueva Vizcaya and Cabarroguis, Quirino.
Science and Technology Consultant (Evaluator)	Valuing Forest and Bio-resources and Ecosystem Services for Access and Benefit Sharing and Payment of Ecosystem Services: The Case of Bataan Natural Park funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development.	January 2018 – continuing; Provide technical assistance in evaluating the project
Team Leader, Technical Review Team 1 of MICC Mining Review Phase 1	Mining Industry Coordinating Council (MICC) Objective, Fact-Finding and Science-Based Review of Mining Operations (5 mining companies out of 27), funded by DENR and Department of Finance, implemented by Development Academy of the Philippines	February 2018 – July 30, 2018; led multi-disciplinary team composed of mining engineering, environment, legal, social and economic experts in the conduct of on-site assessment of mining operations in Benguet, Nueva Vizcaya and Palawan. The results of which were used as basis for DENR decisions to either continue, suspend or terminate mining operations.
Short Term Technical Consultant – Resource Economist	Philippine Wealth Accounting and Valuation of Ecosystem Services (WAVES), multi-year project started in September 2013 until April 2017, a World Bank Global Partnership implemented in 8 countries	December 2014-June 2017. Provides expertise on environment and natural resource economics and support the government-organized technical working groups in developing ecosystem accounts, undertake valuation of selected ecosystem services, and perform policy analysis of issues.

Current Work		
Project Leader	The Economics of Ecosystem and Biodiversity (TEEB), focusing on coastal reclamation in Manila Bay, 9-month project funded by UNEP and implemented by Biodiversity Management Bureau.	January 2016-June 2017; led a multi-disciplinary team of hydrologist, fisheries, biologist, forester and GIS specialist in conducting trade-off and scenario analysis of the impact of reclamation on biodiversity in the entire Manila Bay.
Project Leader	Economic Impact Analysis of Geothermal Operations, funded by Energy Development Corporation and implemented by REECS, Inc.	September 2015-December 2017; undertake assessment of economic impact of geothermal operations on the local economy; using input-output models to measure the direct, indirect and induced impacts, and estimate economic multipliers
Project Leader	Support Ecotown Initiative: Development and Delivery of Selected Ecotown Modules Capacity Development Modules, funded by the Korean Firm Global Green Growth Initiative.	January 2016-December 2017; lead a multi-disciplinary team in developing training modules on Environment and Natural Resource Accounting, GIS, and Project Development in support of the Climate Change Commission's Ecotown Framework
Short Term Technical Consultant on Municipal Accounts and Valuation	CCC-RAPID-NRA Project in Samar and Leyte implemented by the University of the Philippines; funded by UNDP and Australian Government	April 2015-March 2016. Provide expertise to undertake monetary valuation of natural resources and develop municipal accounts for the Resilient and Preparedness for Inclusive Development (RAPID) project of the Climate Change Commission
Project Leader and Resource Economist	Corporate Ecosystem Service Valuation Project for the Geothermal Operations of the Energy Development Corporation	Lead a team of resource economists and other specialists to provide the basis for EDC to make better-informed business decisions by explicitly valuing both ecosystem impacts and the benefits provided by ecosystem services. December 2013-December 2014
Environment and Natural Resources (ENR) Monitoring Specialist	National Support for Environment and Natural Resources Management Project (NPS-ENRMP) funded by the World Bank and implemented by the Department of Environment and Natural Resources	March 2011 – October 2013 (18 man-months spread); develop a results-based monitoring and evaluation system for four sites (watershed namely Libmanan-Pulantuna Watershed, Kanan Watershed, Bago Watershed and Ligawasan Marsh Wetlands) to pilot the Integrated Ecosystem Management framework; enhance the current Biodiversity Monitoring and Evaluation system and develop a participatory M&E System; conducts training and workshops on Results-Based Monitoring and Evaluation
Team Member of Business Planning Specialists	Sustainable Financing of Protected Areas. Department of Environment and Natural Resources (DENR) through the Protected Areas and Wildlife Bureau (PAWB) with financial assistance from the World Bank	January 2013-December 2013; together with other Business Planning Specialists, provides technical assistance to 18 protected areas in the development of Business Plans to sustain financing of these protected areas; conduct workshops on business planning.

Current Work		
Municipal Income Accounts & Agriculture Specialist	Environmental and Natural Resource Accounting Project for Siargao Island	April 2012 – December 2012; estimation of the municipal gross domestic product for 9 municipalities of Siargao Island; and estimation of agriculture accounts; includes conduct of surveys and community consultations through focus group discussions; developed the Social Accounting Matrix for municipalities
Project Leader	Fiscal Gap and Financing of Southeast Asia's Protected Areas: A cross-country analysis. Project funded by the Economy and Environment Program for Southeast Asia (EEPSEA) of the IDRC-CIDA	April 2011-March 2012. Project leader of the 8-country project to evaluate financing gaps of protected areas in China, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam
Project Leader and Forest Management Specialist	Formulation of the Forest Land Use Plan of Infanta, Quezon with Haribon Foundation with funds from GEF in collaboration with the local government and Department of Environment and Natural Resources	June 2011- January 2013; Conducted training, facilitated workshops and drafted the FLUP in collaboration with the Technical Working Group composed of officials different sector organizations
Project Leader and Resource Economist	Spatial Cost-Benefit Analysis for the Samar Island Natural Park funded by the UNDP	December 2009-April 2010. Developing a framework for valuation and cost-benefit analysis; developed a manual on Ecosystem Spatial Analysis and Spatial Cost-Benefit Analysis; Developed an spreadsheet simulation model to estimate spatial and costs and benefits

Professional Experiences		
Project Leader and Forest Management Specialist	Formulation of the Forest Land Use Plan of General Nakar, Quezon funded by Haribon Foundation for the Conservation of Nature under its EU Golden Forest Program in collaboration with the local government and Department of Environment and Natural Resources	December 2009- April 2010; Conducts training, facilitate workshops and drafting of the FLUP in collaboration with the Technical Working Group composed of officials from different sector organizations
Invited Faculty	Ateneo de Manila University School of Government/ Philippine Environmental Governance Project 2 Master's in Public Management Program	August 2009- December 2009. Teaching Economics of Environmental Governance; Students are senior level officials of the Province of Lanao del Sur

Project Leader	Economic Evaluation of Alternative Forest Land Allocation and Land Use Options in General Nakar, Quezon Province funded by Haribon Foundation, Inc.	February 2009 – February 2010, conduct cost-benefit analysis of various land allocation and land use options for forest lands of General Nakar in Quezon Province
Project Leader	Cost-Benefit Analysis of the NOKIA-Bureau of Agricultural Statistics Market Price Data Generation System funded by the World Wildlife Fund – Kabang Kalikasan ng Filipinas	March 2010-November 2010; conducted surveys, developed simulation models and technical paper on CBA of the NOKIA-BAS MDGS
Member of a Team of Consultants	National Environmental, Economic and Development Study (NEEDS) For Climate Change: Assessment of Financial Flows in the Philippines undertaken by REECS	A short-term study funded by the UNDP in collaboration with Manila Observatory and the Environmental Management Bureau of the Department of Environment and Natural Resources
Resource Economist	Philippine Environmental Governance Project 2 (USAID funded project)	October 2008-February 2009 (Short-term Technical Assistant). Provide technical assistance to the Province of Nueva Vizcaya and DENR-ARMM in Cotabato City in institutionalizing Payment for Environmental Services in Barobbob Watershed and Dimapatoy Watershed, respectively.
Sector Leader – Forests and Forestlands Management Sector	Philippine Environmental Governance Project 2 (USAID funded)	November 2004 – September 2006. Principally responsible for guiding the project toward achieving the targets and deliverables for the FFM sector in the approved EcoGov 2 life-of-project and annual work plans. Manage the operations of the FFM team. Coordinate and provide directions and technical inputs for resource-economics related activities of Urban Environment Management, Forests and Forestlands Management, and Coastal Resources Management.
Resource Economist	Philippine Environmental Governance Project 1 (USAID)	March 2002 - October 2004. Provided technical assistance on resource-economics related task of the project for the three sectors namely coastal resources management, forest and forestlands management, and solid waste management.

Related Work Experiences

Visiting Research Associate (Post-Doctorate)	Michigan State University, Department of Forestry	<p>Part 1. Compiled market data and conducted market analysis for forest products trade in the US using statistical tools for economic time series; provided assistance in analysis of Indonesian plywood industry data in order to conduct economic efficiency evaluation.</p> <p>Part 2. Developed metadata for Great Lakes Ecological Assessment (geospatial and socio-economic data) and provide recommendations for improvements in metadata standards being developed by the US Forest Service North Central Forest Research Station.</p>
Technology Manager for Furniture	Science and Technology Agenda for National Development, Department of Science and Technology (DOST), Philippines	August 1993- August 1995 (Concurrent position). Developed R&D plans, programs and coordinated technology development and transfer.
Member of Furniture Task Force	Export Development Council, under the Office of the President	August 1993- August 1995 (Concurrent position). Conduct regular dialogue with furniture industry associations and manufacturers; Provide technical assistance to Export Champion for Furniture.
Product Manager for Furniture and Member of Secretariat of the STCC	Science and Technology Coordinating Council (STCC), Department of Science and Technology (DOST), Philippines	1991- 1993 (Concurrent position). Coordinate development of Science and Technology priority programs for furniture. Also, represent the forestry and natural resources sector in developing the Science and Technology program presented to the Cabinet.
Doctoral Intern	Environmental and Natural Resources Accounting Project, Resources, Environment & Economics Centre for Studies, Inc. and Department of Environment and Natural Resources, Philippines	September 1998-December 1998. Worked with the Environmental and Natural Resources Accounting Program of the Philippines while conducting field surveys for the doctoral dissertation entitled, "Resource Accounting Framework for the Community-Based Forest Management System of the Philippines: A Case Study."
Graduate Research Assistant	Economic Impact of Ungulate Browsing	Michigan State University Department of Forestry, 1997-1998. Assisted Dr. Larry A. Leefer, principal investigator, and faculty adviser in studying forest trees damage and related economic losses of ungulate browsing in Michigan. Specifically, conducted field data collection and analysis of data from the Pigeon River Country State Forest in Northern Michigan.

Graduate Research Assistant	Socio-Economic Aspects of the Great Lakes Assessment	Michigan State University Department of Forestry and USDA Forest Service, 1996-1998. Assisted the principal investigators, Mike Vasievich, Larry Leefers, and Matt Sands in the assemblage and analysis of environmental, socio-economic and biological for the Northern Lake States. Part of the work was the application of spatially-explicit Knowledge-based Ecosystems Management Decision-Support System, developed by the USDA Forest Service, for the assessment of forest land-use suitability and seasonal home location decisions in Michigan
Teaching Assistant	FOR 466 Natural Resource Planning and Policy; FOR 101 Michigan's Forests	MSU Department of Forestry. FOR 466: Spring 1999 and Spring 2000; FOR 101: Spring 1998, Spring 1999 and Spring 2000
Graduate Research Assistant	Thoman Fellow Program	Developed a curriculum on "Grassroots Development for Alleviating Hunger and Poverty" for the W.B. and Candace Thoman Fellows Program of Michigan State University. Fall 1999-Summer 2000
Unit Head, Technology Management Section	Forestry Research Division, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Los Banos, Laguna, Philippines	June 1994 - August 1995. Coordinated, planned, monitored and evaluated technology development and assessed forestry-related technologies.
R&D Project Coordinator	Project 5 - Plantation Development Technology for Fast-growing Reforestation Species in the Philippines, Department of Environment and Natural Resource (DENR) - PCARRD Joint project	June 1993-June 1994. Conceptualized and implemented the project.
Science Research Specialist II	Forestry Research Division, PCARRD, Los Banos, Laguna, Philippines	1989-1995. Technology Packaging specialist for forestry-related technologies.
Science Research Specialist I	Forestry Research Division, PCARRD, Los Banos, Laguna, Philippines	1983-1989. Commodity specialist in-charge of program planning, coordinating, monitoring and evaluating Agroforestry and Forest Plantation R&D programs
Science Research Assistant II	Forestry Research Division, Philippine Council for Agriculture Resources Research (PCARR), Los Banos, Laguna, Philippines	1981-1983. Assist in planning, coordinating, monitoring and evaluating the Mangrove Forests, Molave Type Forests and Reforestation Commodity R&Ds.

Trainings/Workshops/ Seminars/Conference Conducted/Facilitated/Attended

Trainings/Workshops/ Seminars/Conference Conducted/Facilitated/Attended		
Panelist	High-Level Launch for the Philippines Environmental-Economic Accounting for Evidence-Based Policy in Africa and Asia 28 May 2021, conducted by the Philippine Statistical Authority and United Nations Statistical Division	Topic: From SEEA to Policy and Applications: How does environmental-economic accounting link to related policy needs and priorities in the Philippines
Plenary Speaker	Economy and Environment Group Philippines National Conference 2020, "Health, Environment, and Economic Development: The Road to Recovery and Resiliency (HEED The 3Rs)" 19-20 November 2020	Topic Environment: A Triple Balance Sheet Challenge
Plenary Speaker	1st International Conference on Sustainability sponsored by the the University of the Philippines Visayas, February 26-27, 2019, Iloilo City, Philippines	Topic: Ecosystem Accounting: A Framework and Tool in Support of Meeting the Goal of Sustainability; Discussed measurement of sustainability and current tools used.
Session Chair, Parallel Session 4: Microeconomics of Electricity Consumption and Generation	ENERCON 2018 2 nd International Energy Conference entitled, "Energy and Environment: Challenges and Opportunities Amidst Asean Integration Towards Inclusive Growth	July 19-20, 2018 Acacia Hotel, Alabang Muntinlupa, Manila, Philippines. Chaired the presentation of papers and engaged the participants in discussions related to issues of microeconomics of energy production and utilization.
Resource Person	Sustainable Management and Rehabilitation of Manila Bay: Threats, Status, and Solutions	June 27, 2018, provided information and knowledge inputs in the design of the Manila Bay Master Plan by presenting the results of the project UNEP funded country study entitled, "The Economics of Ecosystem and Biodiversity" Case of Manila.
Trainer/Resource Person	Training on SEEA Experimental Ecosystem Accounting, April 3-7, 2017, Ace Hotel Suites, Pasig City, funded by the Phil-Wealth Accounting and Valuation of Ecosystem Services funded by the World Bank	Trainer and Resource Person

Trainings/Workshops/ Seminars/Conference Conducted/Facilitated/Attended		
Resource Person	Training on Environment and Natural Resources Accounting; Component of Training. Support to Community of Resilience Training of Trainers for the Climate Change Commission.	Three training sessions, for (1) Luzon held at La Breza Hotel, Quezon City September 12-16, 2016; (2) Visayas Cluster, Punta Villa Resort, Iloilo City, September 26-30, 2016; (3) Mindanao Cluster, Apo View Hotel, Davao City, October 3-7, 2016
Trainer/Resource Person	Economy and Environment Program for Southeast Asia Training on Ecosystem Accounting, August 29-September 2, 2016. Acacia Hotel, Alabang Muntinlupa City, funded by EEPSEA	Developed the training materials; conducted the training; training was attended by 25 participants from ASEAN countries and China.
Trainer/Resource Person	Training on Policy Analysis in Support of the Wealth Accounting and Valuation of Ecosystem Services Project of the World Bank, December 11-13, 2015, Hotel Inter Park, Subic Freeport Zone	Developed the training, design, lead facilitator and resource person
Trainer/Resource Person	Training on Ecosystem Valuation for the Phil-WAVES Technical Working Groups for Laguna de Bay Basin and Southern Palawan, funded by the World Bank project on Wealth Accounting and the Valuation of Ecosystem Services, July 28-31, 2015, Grand View Hotel, Clark, Angeles, Pampanga	Training organizer, facilitator and resource person
Trainer/Resource Person	Training on Ecosystem and Accounting and Valuation for Non-Government Organizations, Sunlight Hotel, Puerto Princesa City, March 16-20, 2015, sponsored by Ecosystem Alliance and Resources, Economics and Environment Center for Studies, Inc.	Training organizer, facilitator and resource person

Trainings/Workshops/ Seminars/Conference Conducted/Facilitated/Attended		
Resource Person	Training on Ecosystem Accounting based on the SEEA Experimental Ecosystem Accounting Framework conducted through the World Bank Philippine Wealth Accounting and Valuation of Ecosystem Services Project	Presenter and one of the facilitators for the two sessions: Session 1 – February 11-14, 2014 Session 2 – September 13-15, 2014 with experts from the World Bank in Washington DC, Wageningen University of Netherlands, and Australian Bureau of Statistics
Resource Person	Valuing and Accounting for the Environment in the Asia-Pacific Region', Bangkok, Thailand, 8-10 October 2013 convened by UNEP, SANDEE and ESCAP	Member of Panel of Discussant of Panel 2: Role of Economic Valuation in National Accounts
Resource Person on Financing	Orientation-Training on Integrated Protected Area Fund conducted by the New Conservation Areas of the Philippines Project, November 21-23, 2012, November 27-29, 2012, and December 4-6, 2012	Discussed updates on user fee valuation studies and protected area income projection, and conducted workshop on estimation and projection of existing and potential revenue options.
Project Manager	Capability Building on Sustainable Resource Management for the Davao City Chamber of Commerce and Industry, Inc. conducted by REECS for the PAHRDF of the AusAid.	October 2009-February 2010. Also as resource person on Environment Management Accounting, and Coach for the development of Consultancy Module for the SMERN.
Conference Co-Coordinator	6th Resource and Environmental Economic Foundation of the Philippines Conference entitled "Climate Change Adaptation and Mitigation Technologies for Green Growth" August 23 – 24, 2012, Traders Hotel, Roxas Boulevard, Pasay City	Coordinated the organization, conceptualization, and identification of resource persons; Facilitated the conduct of the conference; Resource person for one session in the conference.
Conference Coordinator	5th Resource and Environmental Economic Foundation of the Philippines Conference entitled "Integrating CCA, DRR and Watershed Management in Local Land Use and Development Planning" March 31- April 1, 2011, Traders Hotel, Roxas Boulevard, Pasay City	Coordinated the organization, conceptualization, and identification of resource persons. Facilitated the conduct of the conference.

Trainings/Workshops/ Seminars/Conference Conducted/Facilitated/Attended		
Conference Coordinator	4th Resource and Environmental Economic Foundation of the Philippines Conference entitled "Recent Developments on Climate Change Mitigation and Adaptation in the Philippines" July 9-10, 2009, Traders Hotel, Roxas Boulevard, Pasay City	Coordinated the organization, conceptualization, and identification of resource persons. Facilitated the conduct of the conference.
Resource Person	PAHRDF Capability Building for Effective Local Government Solid Waste Management Planning for Surigao del Norte, January 15-19, 2007, Davao City	Lectured and facilitated the workshop on Full-Cost Accounting and Solid Waste Management Plan Formulation
Resource Person	Training on Environmental Protection and Management for Agriculture and Environment Officials of Afghanistan, November 2008 – February 2009	Lectured on Environmental Problems and Impacts and facilitated part of the training.
Resource Person	Financing and Cost Recovery for Ecological Solid Waste Management for Baguio City, June 20, 2005	Lectured on Full Cost Accounting for Ecological Solid Waste Management
Facilitator and Resource Person	Trainings on Solid Waste Management for Local Government Units conducted by the Philippine Environmental Governance Project	Lectured and facilitated workshops on Waste Characterization, Data Analysis and Options Analysis for Solid Waste Management from 2002-2004
Paper Presenter	Solid Waste Management Association of the Philippines (SWAPP) Annual Conference in Davao, Nov. 20-21, 2002	Presented a paper on Full Cost Accounting for Solid Waste Management
Resource Person	In Situ and Ex-Situ Biodiversity Conservation Techniques for Ecotourism, August 6-10, 2007, Los Banos, Laguna, a training program sponsored by Philippine Council for Agriculture, Forestry and Natural Resources Research and Development.	Lectured on economics of biodiversity conservation
Recent Trainings Attended		

Participant	Impact Evaluation Course on Quasi Experimental Economics Tools, MIDAS Hotel August 17-18, 2015	sponsored by the Economy and Environment Program for Southeast Asia
Participant	Facilitating Participatory Processes Using Visualization Techniques, August 19-20, 2015	sponsored by the Economy and Environment Program for Southeast Asia
Participant	Course on Spatial Modelling, Ho Chi Min City, Vietnam 17 May 2015,	sponsored by the Economy and Environment Program for Southeast Asia
Participant	Journal Writing Workshop, 4-6 March 2013, Penang, Malaysia. EEPSEA, through WorldFish	sponsored by the Economy and Environment Program for Southeast Asia
Participant	Risk Analysis in CBA, 2013, one day course	sponsored by the Economy and Environment Program for Southeast Asia

Honors and Awards

National Academy of Science Outstanding Scientific Paper Award for 2007 for the paper entitled, "A Decision Support Model for Determining Sizes of Marine Protected Areas: Biophysical Considerations. The Philippine Agricultural Scientist Vol. 89 No. 1 (March 2006) 507; award shared with other authors	July 2007
2006 Dr. Elvira O. Tan Memorial Awards for best published paper for the paper entitled, "A Decision Support Model for Determining Sizes of Marine Protected Areas: Biophysical Considerations." The Philippine Agricultural Scientist Vol. 89 No. 1 (March 2006) 507; award shared with other authors	July 2006
Dissertation Completion Fellowship, Michigan State University Fellow, W.B. and Candace Thoman Fellows Program, Michigan State University	Summer 2000
Phi Beta Delta Honor Society for International Scholars, Michigan State University	1997-1998 1997
Philippine Council for Agriculture and Resources Research and Development Graduate Scholarship Award	1989-1990
Outstanding Junior Staff, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)	1993-1994
Graduated With Honors, Diploma in Development Economics, University of the Philippines School of Economics	1987
3 rd Place, Philippine National Board Examination for Foresters	1981

Membership in Organizations/Committees

Resources, Environment & Economics Centre for Studies, Inc. (REECS)	Current Chairman of the Board (As of March 2018); Member of the Board, 2009-2010; 2011-2012	Member since 2002
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Resource and Environmental Economics Foundation of the Philippines	Current President Member of the Board; President, 2012-2013 President, 2011-2012; Acting President for October 2010-March 2011; Vice President for 2008-2009	2003-Present
Environment and Economy Group-Philippines, a partner of the Economy and Environment Partnership for Southeast Asia supported by the Economy and Environment Project for Southeast Asia (EEPSEA)	National Director and member of the Core Group	April 2015-Present
Technology Action Group and Policy Action Group, PCARRD, Philippines	Forestry Representative	1994-1995
Technical Committee of the Furniture Industry Board, Philippines	Representing PCARRD	1994-1995
Furniture Task Force of the Export Development Council of the Philippines	Member	1993-1995
Philippine Forest Research Society	Member	1981
Society of Filipino Foresters, Inc., Philippines	Member	1981
Lakas Angkan Ministires, Inc.	Member	1988-present

Project Reports Prepared and Submitted

Objective, Fact-Finding and Science-Based Review of Mining Operations, Phase 2. Report submitted as Team Leader of by Technical Review Team 1 to the Mining Industry Coordinating Council through the Development Academy of the Philippines. Submitted in November 2020.

Impact Evaluation of Oceana Gold Philippines' Social Investment and Development Programs. This report present the results of survey and application of the impact evaluation methodologies to evaluation social and economic impacts, funded by OGPI, submitted in August 2019.

Objective, Fact-Finding and Science-Based Review of Mining Operations, Phase 1. Report submitted as Team Leader of by Technical Review Team 1 to the Mining Industry Coordinating Council through the Development Academy of the Philippines. Submitted on August 13, 2018.

The Economics of Ecosystem and Biodiversity (TEEB) Philippine Country Study. Submitted to the Biodiversity Management Bureau of the DENR and to the UN Environment. February 2018.

Economic Impact Study of the Energy Development Corporation's Negros Island Geothermal Operations A project funded by Energy Development Corporation and implemented by REEECS, Inc. Submitted December 2017.

- Training Module for Environment and Natural Resources Accounting. Support to Eco-town Initiative: Development and Delivery of Selected Ecotown Modules for Climate Change Commission. Submitted November 2016
- Corporate Ecosystem Service Valuation Project for the Geothermal Operations of the Energy Development Corporation, December 2014. Funded by the Energy Development Corporation and implemented by REECS, Inc, pp 165. Submitted December 2014
- Fiscal Gap and Financing of South East Asia's Protected Areas: A cross-country analysis. Project funded by the Economy and Environment Program for Southeast Asia (EEPSEA) of the IDRC-CIDA, pp 64. Submitted/Published in 2015.
- Integrated Ecosystem-based Management-Results-Based Monitoring and Evaluation System Primer submitted to the Department of Environment and Natural Resources as output of the National Program Support- Environment and Natural Resources Management Program funded by the World Bank. Submitted December 2013.
- Forest Land Use Plan of the Municipality of Infanta, Quezon. Report presented to the Executive and Legislative Council of the Municipality of Infanta, Quezon, March 2012. Project Funded by the Haribon Foundation. Pp 240
- Municipal Income Accounts and Agriculture Accounts (Two Reports) of the Environmental and Natural Resource Accounting Project for Siargao Island. Project funded by US Agency for International Development as part the Climate Change Commission project on ENRA in Siargao Island 2010, pp 66 and 98
- Forest Land Use Plan of the Municipality of General Nakar, Quezon. Report presented to the Executive and Legislative Council of the Municipality of General Nakar Quezon. April 2010. Project funded by Haribon Foundation. Pp 271.

Publications

Academic Publications

- Castillo, G. B. Somaly Chan, Wenjun Li, Yanbo Li, H. Luthfi Fatah, Sivannakone Malivarn, Kian Foh Lee, Alexander D. Anda, Prinyarat Laengcharoen, Chien Pham Duc, Benoit Laplante. 2015. Fiscal Gaps and Financing of Southeast Asia's Protected Areas: A Cross-Country Analysis. Economy and Environ Program for Southeast Asia. Research Reports
- Castillo, G. B., Larry A. Leefers, J. Michael Vasievich, Matthew D. Sands, 1998. Use of the Ecosystem Management Decision Support System (EMDSS) in Assessing Forest Land-Use Suitability and Timber Production: Two Case Studies Department of Forestry, Michigan State University; USDA Forest Service. Poster presented at the First International Conference on Geospatial Information in Agriculture and Forestry, 1-3 June 1998 at Disney's Coronado Springs Resort, Lake Buena Vista, Florida.
- Guiang, E.S. and G.B. Castillo, 2006. "Trends in forest ownership, forest resources tenure and institutional arrangements in the Philippines: Are they contributing to better forest management and poverty reduction?" In: Understanding forest tenure in South and Southeast Asia. FAO Forestry Policy and Institutions Working Paper.

- Licuanan, W. Y. P. M. Aliño, W. L. Campos, G. B. Castillo, and MA. Juinio-Meñez. 2006. A Decision Support Model for Determining Sizes of Marine Protected Areas: Biophysical Considerations. *The Philippine Agricultural Scientist* Vol. 89 No. 1 (March 2006) 507
- Leefers, L..A. and G.B. Castillo. 1998. Bridging the gap between economics and ecology. *Conservation Ecology* 2(2): <http://www.consecol.org/Journal/vol2/iss2/>
- Larry A. Leefers, Gem Castillo, J. Michael Vasievich, Deborah S. Carr, 1998. Identifying Relevant Social and Economic Data for Use in Ecological Assessments: An Example from the Great Lakes States. Michigan State University; North Central Forest Experiment Station. Poster presented at the First International Conference on Geospatial Information in Agriculture and Forestry, 1-3 June 1998 at Disney's Coronado Springs Resort, Lake Buenvista, Florida.
- Castillo, G. B. 1991. Economic Evaluation of Selected Reforestation Strategies in the Philippines (Case studies of government, private and community reforestation). MS. Thesis, University of the Philippines Los Banos 233 pp.
- Castillo G. B. 1987. Evaluation of Contract Reforestation Scheme: The MADECOR Experience. Research Paper, University of the Philippines School of Economics, Diliman, Quezon City. 100+ p.

Technical Reports Jointly Prepared with Other Authors

- Natural Resource Assessment of Siargao Island, Surigao Del Norte as part of Demonstrating the Climate Change Commission's Ecotown Framework. Municipal Accounts for Siargao Island Municipalities. 2013. Climate Change and Clean Energy Project. USAID (Prepared by Noela C. Lasmarias, Gem B. Castillo Rina M. Rosales, Antonio P. Carandang)
- Corporate Ecosystem Services Valuation for the Geothermal Operations of the Energy Development Corporation. Submitted to the Energy Development Corporation. 2014. (Prepared by Gem B. Castillo, Arvin B. Vista, Julie Carl, Ureta, Casiano S. Abrigo Jr., Cherrys O. Abrigo).
- Philippine Environmental Governance Project 2. 2008 Conservation of Biological Diversity and Tropical Forests in the Philippines: FAA 118-119 Analysis. 2008 Update. Publication prepared for review by the US Agency for International Development (Prepared by Ernesto S. Guiang, Steve Dennison, Aurelia Micko, Maria Zita Butardo-Toribio, Gem Castillo, Trina Galido-Isorena, Perry Aliño, JamesL.Kho, Oliver Agoncillo and Joy Jochico)
- Castillo, G. B., R.R. Paz, E. S. Guiang, 2006. Assessment of Forest Management in Tenured Forest Lands: Issues and Recommendations. Produced by the Department of Environment and Natural Resources-United States Agency for International Development's (DENR-USAID) Philippine Environmental Governance (EcoGov) Project through the assistance of the USAID under Contract No. 492-C-00-04-00037-00.

Policy Papers Jointly Prepared with Others

- Forestry policies, legislation and institutions in Asia and the Pacific: Trends and emerging needs for 2020. Asia-Pacific Forestry Sector Outlook Study II. Asia-Pacific Forestry Sector Outlook Study II, Working Paper Series, Working Paper No. APFSOS II/WP/2010/34. Contributed the paper entitled, Analysis of Key Trends in Forest Policies, Legislation and Institutional Arrangements in the Philippines

Other Publications

- Financial Analysis of the Electric Pole Production Technology from Bagras (*Eucalyptus deglupta*). PCARRD Technology Series, 1993.

Economics of Electric Pole Production from Bagras (*E. deglupta*). PCARRD Technology Fliers, 1994.

Primer on Furniture Production from Yemane (*Gmelina arborea*). PCARRD Media Series. *Paksang PCARRD* Radio Program, 1994.

Special Skills and Research Interests

Accounting and valuation of environment and natural resources; Payment for Environmental Services; Benefit-Cost Analysis/Financial analysis; Decision-support systems; Geographic Information System; Project Evaluation and Review Techniques; Systems modeling, simulation and linear programming; Statistical analysis/econometric analysis/logit & probit analysis (Using SAS, LIMDEP, TSP, SPSS, Excel); Database development, Economic Impact Analysis

Other Information:

Place of Birth: Masbate, Philippines

Date of Birth: May 22, 1961

Nationality: Filipino (Philippines)

Status: Married to Chessed O. Abrigo-Castillo, MD

Children: 1 daughter

Examples of ecosystem accounting

Training material

IDEAA Group
07 June 2024

IDEAA Group
Recognise. Account. Decide.

Building a suite of natural capital accounts

Stocks

Flows

- Various accounts are compiled for recording different parts of the ecosystem – economic relationship.
- A chart of accounts can be designed tailored to each context.
- Direct links can be made to standard financial data on income, costs, employment, etc.
- Monetary values for ecosystem services can be estimated and used to derive values of ecosystem assets
- Other accounts for individual stocks and flows can also be compiled
 - Carbon & GHG emissions
 - Timber
 - Water
 - Species (Biodiversity)
 - Energy

Recognise. Account. Decide. 3

Spatial distribution of ecosystem services

Carbon sequestration

Water provisioning

Habitat provisioning

Timber provisioning

All services (normalised)

Recognise. Account. Decide. 10

Seagrass meadows condition

Accounting area	Seagrass meadow density (t/ha)	Biomass of fish > 20cm (t/ha)	Fish abundance (t/ha)	Fish species diversity (t/ha)
Commonwealth waters				
Geographic Marine Park	66.1	33.1	45.1	12.4
Multiple Use Zone	65.2	22.7	43.2	12.0
Regional Park Zone	79.6	13.2	36.5	12.5
Special Purpose Zone	60.8	20.0	37.2	11.2
Geographic Marine Park Total	63.4	21.5	36.6	11.6
Other	63.8	16.6	40.9	10.1
Commonwealth waters Total	63.5	11.2	38.7	11.5
State waters				
Great Coastal Marine Park	77.7	25.8	41.1	11.5
Other	64.0	15.1	28.9	9.7
State waters Total	71.8	20.6	35.2	10.6
Accounting area Total	66.2	21.0	38.0	11.2

Recognise. Account. Decide. 15

Policy questions and natural capital accounts

20/06/24

Date

IDEAA Group
Recognise. Account. Decide.

Impact drivers and investments

Different themes of impact drivers may be natural input use, ecosystem service use, investments, and residuals

Investments in built, social or human capital typically occur with in the boundary of the economy / society, but can have an impact on natural capital through changes in use of inputs, ecosystem services, and the provision of residuals

Investments in natural capital typically aim at restoring, protecting, or enhancing ecosystems

Recognise. Account. Decide. 3

Example of waste accounts

Supply of waste				Use of waste			
Waste category	Waste type	Waste collection, treatment & disposal	Manufacturing	Waste type	Energy recovery (t/yr)	Waste collection, treatment & disposal services (t/yr)	Landfill (t/yr)
Metals	Aluminium	21,110	22,440	22,220	22,220	22,220	22,220
	Brass	74,700	85,110	85,670	85,670	85,670	85,670
	Copper	29,040	146,370	151,670	149,670	149,670	149,670
	Other MSW	262,810	146,070	151,670	149,670	149,670	149,670
Paper	Cardboard & paper	14,270	9,870	24,710	24,710	24,710	24,710
	Steel	115,710	74,110	189,670	189,670	189,670	189,670
	Aluminium	6,750	5,090	14,810	14,810	14,810	14,810
	Non-ferrous metals	4,410	4,410	10,710	10,710	10,710	10,710
Organics	Food organics	8,300	27,070	19,310	19,310	19,310	19,310
	Garden organics	39,240	24,440	63,680	63,680	63,680	63,680
	Textiles	76,010	41,210	117,610	117,610	117,610	117,610
	Other organics	41,360	26,840	68,110	68,110	68,110	68,110

Note: subset of accounts, shown see: <https://www.abs.gov.au/statistics/environment/environmental-management/waste-account-australia-experimental-estimates/latest-release>

Recognise. Account. Decide. 6

Accounts – stock

Investment / policy	Change in stock	Accounts
Tourism marketing campaign an investment in turning solid waste into electricity	Water quality -> deterioration of ecosystem function over time -> changed composition of ecosystems	Ecosystem condition account Ecosystem extent account
Investment in household wastewater management		

Condition indicator mapping

Extent mapping

Recognise. Account. Decide. 10

Appendix 6: Attendance Sheet for Dr. Carl's Training Sessions (1-3)

Online Training/Tutorial on "Natural Capital Accounting based on UN-SEEA Framework" (9, 23 May and 7 June 2024 / 10.00-11.00 AM)

under the project "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

การอบรม เรื่อง "การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA) จังหวัดกระบี่"

ภายใต้โครงการ "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

วันที่ 9, 23 พฤษภาคม และวันที่ 7 มิถุนายน 2567 เวลา 10.00 - 11.00 น. ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย





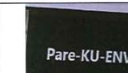






By Mr.CARLOBST

Director of Institute for Development of Environmental-Economic Accounting (IDEEA Group), Melbourne, Australia

List of participants

Name	Position	Organization	Signature		
			9 May 2024	23 May 2024	7 June 2024
Lecturer					
1. Mr.Carl Obst	Director, IDEEA Group	IDEEA Group			
2. Mr.Reiss McLeod	Researcher, IDEEA Group	IDEEA Group	-		
3. Ms. Kavita Sharma	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia	UNEP	-		

1

Name	Position	Organization	Signature		
			9 May 2024	23 May 2024	7 June 2024
Project Manager					
4. Adis Israngkura (Ph.D.) รศ.ดร.อดิศร์ อิศรางกูร ณ อยุธยา	Advisor for Resource Sustainability and Mitigation Policy ผู้อำนวยการทีมนโยบายทรัพยากรธรรมชาติและ การลดก๊าซเรือนกระจก	Thailand Development Research Institute (TDRI) ผู้อำนวยการทีมนโยบายทรัพยากรธรรมชาติและ การลดก๊าซเรือนกระจก			
Specialists					
5. Tunlawit Satapanjaru (Ph.D.) รศ.ดร.ตุลวิทย์ สถาปนจารุ	Environmental Science Specialist ผู้เชี่ยวชาญด้านเทคโนโลยี และการจัดการด้าน สิ่งแวดล้อม	Kasetsart University คณะสิ่งแวดล้อม มหาวิทยาลัยเกษตรศาสตร์	-		
6. Mr. Chakris Phithakrattanasakun นายชาคริต พิทักษ์รัตนสกุล	Geo-Informatics and space Technology specialist ผู้เชี่ยวชาญด้านเทคโนโลยี อวกาศและภูมิสารสนเทศ	Geo-Informatics and space Technology Development Agency (Public Organization) GISTDA สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) GISTDA			
Project Staff (Thailand Development Research Institute: TDRI)					
7. Ms. Thippawan Keawmesri นางทิพย์วัลย์ แก้วมีศรี	Researcher, Liaison นักวิจัยอาวุโส และ ผู้ประสานงาน	TDRI			

2

Name	Position	Organization	Signature		
			9 May 2024	23 May 2024	7 June 2024
8. Ms. Prinyarat Leangcharoen นางสาวปริญญารัตน์ เลียง เจริญ	Researcher นักวิจัยอาวุโส	TDRi			
9. Ms. Kanjana Yasen นางสาวกาญจนา ย่าเสน	Researcher นักวิจัย	TDRi			
10. Ms. Panida Phranphanat นางสาวปณิตา พราน พนัส	Researcher นักวิจัย	TDRi			

Appendix 7: Attendance Sheet for Dr. Carl's Final Training Session (4th)

**Online Training/Tutorial on “Natural Capital Accounting based on UN-SEEA Framework”
(20 June 2024 / 10.00-11.00 AM)**



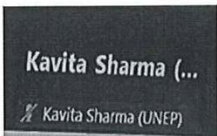

under the project “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

การอบรม เรื่อง “การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA) จังหวัดกระบี่”
ภายใต้ โครงการ “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

วันที่ 20 มิถุนายน 2567 เวลา 10.00 - 11.00 น. ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

By Mr.CARLOBST
Director of Institute for Development of Environmental-Economic Accounting (IDEEA Group), Melbourne, Australia

List of participants

Name	Position	Organization	Signature
			20 June 2024
Lecturer 1. Mr.Carl Obst	Director, IDEEA Group	IDEEA Group	
2. Mr.Reiss McLeod	Researcher, IDEEA Group	IDEEA Group	
UNEP 3. Ms. Kavita Sharma	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia	UNEP	
Project Manager 4. Adis Israngkura (Ph.D.) รศ.ดร.อดิศร์ อิศรางกูร ณ อยุธยา	Advisor for Resource Sustainability and Mitigation Policy ผู้อำนวยการทีมนโยบาย ทรัพยากรธรรมชาติและ การลดก๊าซเรือนกระจก	Thailand Development Research Institute (TDRI) ผู้อำนวยการทีมนโยบาย ทรัพยากรธรรมชาติและ การลดก๊าซเรือนกระจก	

**Online Training/Tutorial on “Natural Capital Accounting based on UN-SEEA Framework”
(20 June 2024 / 10.00-11.00 AM)**

under the project “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

การอบรม เรื่อง “การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA) จังหวัดกระบี่”
ภายใต้ โครงการ “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

วันที่ 20 มิถุนายน 2567 เวลา 10.00 - 11.00 น. ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

**By Mr.CARLOBST
Director of Institute for Development of Environmental-Economic Accounting (IDEEA Group), Melbourne, Australia**

Name	Position	Organization	Signature
			20 June 2024
Specialists			
5. Tunlawit Satapanajaru (Ph.D.) รศ.ดร.ตุลวิทย์ สถาปนจารุ	Environmental Science Specialist ผู้เชี่ยวชาญด้านเทคโนโลยีและการจัดการด้านสิ่งแวดล้อม	Kasetsart University คณะสิ่งแวดล้อม มหาวิทยาลัยเกษตรศาสตร์	<i>online</i>
6. Mr. Chakris Phithakrattanasakun นายชาคริต พิทักษ์รัตนสกุล	Geo-Informatics and space Technology specialist ผู้เชี่ยวชาญด้านเทคโนโลยีอวกาศและภูมิสารสนเทศ	Geo-Informatics and space Technology Development Agency (Public Organization) GISTDA สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) GISTDA	<i>Chakris</i>
Project Staff (Thailand Development Research Institute: TDRI)			
7. Ms. Thippawan Keawmesri นางทิพวัลย์ แก้วมีศรี	Researcher, Liaison นักวิจัยอาวุโส และผู้ประสานงาน	TDRI	<i>TKm</i>
8. Ms. Prinyarat Leangcharoen นางสาวปริญญารัตน์ เลียงเจริญ	Researcher นักวิจัยอาวุโส	TDRI	<i>Prinyarat</i>
9. Ms. Kanjana Yasen นางสาวกาญจนา ย่าเสน	Researcher นักวิจัย	TDRI	<i>Kanjana</i>
10. Ms. Panida Phranphanat นางสาวปณิดา พรานพนัส	Researcher นักวิจัย	TDRI	<i>Panida</i>

CARL OBST

Curriculum Vitae

September 2023

CAREER & QUALIFICATIONS

Career summary:

Current	Director, Institute for Development of Environmental-Economic Accounting (IDEEA Global)
2013 - 2023	Co-editor, United Nations project to revise the System of National Accounts focusing on chapters concerning wellbeing and sustainability Consultant to Eurostat, Drafting of Handbook for the European Forest Accounts Consultant to Eurostat, as part of consortium supporting the implementation of ecosystem accounting in the EU (KIP INCA Phase 3) Consultant to ILO, Conceptual framework linking Decent work and nature-based solutions Consultant to Conservation International, National strategy and capacity building for natural capital accounting in Liberia Consultant to World Bank, Development of Natural Capital Accounting Roadmap for Pakistan Consultant to Pacific Tourism Organization (SPTO), Conduct of the Pacific Tourism Statistics Assessment and drafting of the Pacific Tourism Statistics Strategy Lead author and editor, United Nations System of Environmental-Economic Accounting – Ecosystem Accounting Lead technical expert for United Nations World Tourism Organization on Measuring Sustainable Tourism project including drafting of the Statistical Framework for Measuring the Sustainability of Tourism (SF-MST) Lead author and editor, UN Technical Recommendations for the implementation of the SEEA Experimental Ecosystem Accounting Lead chapter author, Evaluation framework TEEB AgriFood project Consultant to the World Bank WAVES program on valuation of ecosystem services and editor of sourcebook on forest accounting Technical expert for United Nations Food and Agriculture Organization, System of Environmental-Economic Accounting (SEEA) – Agriculture, Forestry and Fisheries Consultant to joint United Nations Statistics Division, UNEP and CBD project to advance the testing and guidance on ecosystem accounting Consultant to the National Accounts branch of Statistics New Zealand reviewing the work program and compilation practices

	Lead technical consultant to UNEP ProEcoServ project in Trinidad and Tobago on Implementation of Environmentally Adjusted National Accounts
	Consultant to United Nations Economic and Social Commission for the Asia Pacific (UNESCAP) and Australian Bureau of Statistics on Implementation of the SEEA
2010-2013	Consultant to United Nations Statistical Division as Editor and Lead author of the international statistical standard, the System of Environmental-Economic Accounting (SEEA)
2008-2010	Regional Director, Victorian Office, Australian Bureau of Statistics (ABS)
2003-2007	Branch Head, National Accounts Branch, ABS
2001-2003	Director, Quarterly National Accounts, ABS
1998-2000	Manager, Main Economic Indicators, Statistics Directorate, OECD. Projects included development of standards for tourism satellite accounting and development frameworks for the measurement of sustainability
1993-1997	National Accounts compilation and research roles, ABS. Projects included development of Australia's initial tourism satellite account and measuring the output of financial institutions

Qualifications:

1988-1992	Bachelor of Economics (1 st class Honours in Econometrics), University of New England (UNE), Armidale, NSW, Australia.
1991-1992	Master of Philosophy – Management, Economics and International Relations, University of St Andrews, St Andrews, Scotland
1995-1998	Master of International Law, Australian National University, Canberra, ACT, Australia.

Academic awards:

1990	General Accident Insurance Bicentennial Scholarship to the University of St Andrews, St Andrews, Scotland
1990	ABS Economics Graduate Cadetship
1991	John Guise Memorial Prize in Econometrics (UNE)
1992	Economic Society of Australia (NSW Branch) Prize for Econometrics

Fellowships, memberships and boards:

2021-	Member, Values Commission and Value Accounting Network, Capitals Coalition
	Member, TNFD Forum, Taskforce for Nature related Financial Disclosures
2020-	Member, Monash University Accounting Department Advisory Committee
2018-	Member, Advisory Panel, Capitals Coalition

2014-	Member, SEEA Technical Committees for the SEEA Central Framework and SEEA Ecosystem Accounting Member, National Accounts Technical Committee, Global Footprint Network
2013-20	Honorary Research Fellow and Associate, Melbourne Sustainable Society Institute (MSSI), School of Architecture, Building and Planning, University of Melbourne.
2010-13	Chair, Editorial Board, UN System of Environmental and Economic Accounting
2008-	Executive, Board member and Fellow, Institute Public Administration Australia (IPAA), Victorian Branch
2001-07	Member, Australian Commonwealth Treasury Joint Economic Forecasting Group (JEFG)

AUTHORSHIP & PUBLICATIONS

2022	Farrell C.A. et al (2022) Applying Ecosystem Accounting to Develop a Risk Register for Peatlands and Inform Restoration Targets at Catchment Scale: A Case Study for the European Region, <i>Restoration Ecology</i> Vardon M., et al (2022) From Covid-19 to Green Recovery with Natural Capital Accounting, <i>Ambio</i> .
2021	<i>System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA EA)</i> White cover version pending final UNSD editorial clearance, Published by United Nations Statistics Division (2021), New York El-Hage Scialabba and Obst (2021) From Practice to Policy: New Metrics for the 21st Century, in <i>True Cost Accounting in Food: Balancing the Scale</i> El-Hage Scialabba, Obst, Merrigan and Muller (2021) Mobilizing the Power and Potential of True Cost Accounting, in <i>True Cost Accounting in Food: Balancing the Scale</i> Bannerjee O., et al (2021) Gross domestic product alone provides misleading policy guidance for post-conflict land use trajectories in Colombia, <i>Ecological Economics</i> Keith H., et al (2021) Evaluating nature-based solutions for climate mitigation and conservation requires comprehensive carbon accounting, <i>Science of the Total Environment</i> , Vol 769
2020	Hein L., et al (2020) Progress in natural capital accounting for ecosystems, <i>Science</i> IDEA Group (2020) Valuation of disaster risk reduction ecosystem services of Australia’s coastal wetlands: Review and recommendations. Prepared for the Department of Agriculture, Water and the Environment (DAWE). Canberra, Australia.
2019	<i>System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries (SEEA AFF)</i> White cover version pending final UNSD editorial clearance, Published by Food and Agriculture Organization of the United Nations and United Nations Statistics Division (2018), FAO, Rome.

- Agard J., et al (2019) *Integrating natural capital and ecosystem services into policy and decision making in Trinidad and Tobago*, Routledge
- Rucklehaus M., et al (2019) *Scaling Pathways for Inclusive Green Growth*, in Green Growth that Works, Springer
- Sandhu H., et al (2019) The future of agriculture and food: Evaluating the holistic costs and benefits, *The Anthropocene Review*
- Vardon M., et al (2019) Putting biodiversity into the national accounts: Creating a new paradigm for economic decisions, *Ambio*
- 2018 *System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries (SEEA AFF)* White cover version pending final UNSD editorial clearance, Published by Food and Agriculture Organization of the United Nations and United Nations Statistics Division (2018), FAO, Rome.
- Eigenraam and Obst (2018) Extending the production boundary of the System of National Accounts (SNA) to classify and account for ecosystem services, *Ecosystem Health and Sustainability*, DOI: 10.1080/20964129.2018.1524718
- Ogilvy et al (2018) Accounting for liabilities related to ecosystem degradation, *Ecosystem Health and Sustainability*
- Obst (2018) Measuring sustainable tourism: Proposal for estimating Tourism Direct GDP with limited data. Paper presented to the 18th meeting of the UN World Tourism Organization Committee on Tourism Statistics and TSA, Madrid, February 2018.
- 2017 Obst (2017) “Australia must make the environment integral to economic decision-making”, Article published in the *Conversation*, 18 January, 2017
- Obst (2017) “Statistical Framework for Measuring Sustainable Tourism”, Draft prepared for 6th International Conference on Tourism Statistics, Manila, Philippines, 21-24 June, 2017
- Obst (2017) “Linking TSA and the SEEA: A Technical Note”, Draft prepared for 6th International Conference on Tourism Statistics, Manila, Philippines, 21-24 June, 2017
- Obst (2017) “Defining spatial areas for measuring sustainable tourism”, Draft prepared for 6th International Conference on Tourism Statistics, Manila, Philippines, 21-24 June, 2017
- Obst and Vardon (2017) “Recording environmental assets in the national accounts and the Australian experience”, in Hamilton and Hepburn (eds) *National Wealth: What is missing, Why it matters*, Oxford University Press, UK
- Obst and Eigenraam (2017) “Incorporating the environment in agricultural productivity: Applying advances in international environmental accounting” in Ancev, Azad and Hernandez-Sancho (eds) *New Directions in Productivity Measurement and Efficiency Analysis*, Edward Elgar Publishing, UK.
- Robinson, Panagos, Borrelli, Jones, Montanarella, Tye, Obst (2017) “Soil natural capital in Europe; A framework for state and change assessment”, *Scientific Reports*, 7:6706
- Atkinson G. and C. Obst (2017) *Prices for ecosystem accounting* (draft), Paper prepared as part of the work program of the World Bank WAVES project, May 2017. Available at:

<https://www.wavespartnership.org/en/knowledge-center/prices-ecosystem-accounting-draft-1>

SEEA Experimental Ecosystem Accounting Technical Recommendations, White cover version, UNSD, New York

WAVES Partnership and World Bank Group (2017) *Forest Accounting Sourcebook: Policy application and basic application*, Castañeda, Obst, Varela, Barrios and Narloch. World Bank, Washington, DC.

UNEP-WCMC & IDEEA Group (2017) *Experimental Ecosystem Accounts for Uganda*. King, Eigenraam, Harfoot, Obst, et al., Cambridge, UK.

Eigenraam and Obst (2017) *Linking AWS and the SEEA: Applying Advances in Accounting for Natural Capital to Support the Implementation of AWS*, Alliance for Water Stewardship, IDEEA Group, Australian Aid *System of Environmental-Economic Accounting 2012 – Applications and Extensions*. Published by United Nations, European Union, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, and The World Bank (2017), United Nations, New York.

- 2016 Obst, Eigenraam (2016) “Using the SEEA Experimental Ecosystem Accounting framework to advance I-O and CGE integrated environmental-economic modeling”, Paper presented to the Global Trade Analysis Project (GTAP) Annual Conference, Washington, D.C., 15-17 June, 2016
- Hein, Bagstad, Edens, Obst, de Jong, Leeschen (2016) “Defining ecosystem assets for natural capital accounting”, *PLOS ONE*
- Obst, Ivanov (2016) “Advancing the statistical co-ordination of land data”, Paper prepared for discussion at the meeting of the OECD Committee on Statistics and Statistical Policy, April 2016.
- Obst (2016) “Framing sustainable tourism”, Discussion paper prepared for Working Group of Experts on the Measurement of Sustainable Tourism, Madrid, 21-23 October, 2016.
- 2015 Obst (2015) “Reflections on natural capital accounting at the national level”, *Sustainability Accounting, Management and Policy Journal*, Vol 6, No 3
- Obst, Hein, Edens (2015) “National accounting and the valuation of ecosystem assets and their services”, *Environmental and Resource Economics*, DOI 10.1007/s10640-015-9921-1
- Obst (2015) “Australia is among the most livable countries, but it lags other countries on sustainability”, *The Conversation*, 17 September, 2015
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- Schreyer and Obst (2015) “Towards complete balance sheets in the national accounts: The case of mineral and energy resources”, *OECD Green Growth Papers* 2015/02, DOI 10.1787/5js319256pvf-en

- Hein, Edens, Obst, Remme, Schroter, Sumarga (2015) "An Introduction to Ecosystem Accounting" in *Routledge Handbook of Ecosystem Services*, edited by Marion Potschin, Roy Haines-Young, Robert Fish and Kerry Turner, Routledge, Abingdon, United Kingdom.
- Obst (2015) "How the SEEA Experimental Ecosystem Accounting framework could be used for growth accounting and productivity analysis", Paper prepared for the OECD Expert Workshop on Measuring Environmentally Adjusted TFP and its Determinants, 14-15 December, 2015.
- 2014 *System of Environmental-Economic Accounting 2012 – Central Framework*. Published by United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and The World Bank (2014), United Nations, New York.
- System of Environmental-Economic Accounting 2012 – Experimental Ecosystem Accounting*. Published by United Nations, European Union, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, and The World Bank (2014), United Nations, New York.
- with Michael Vardon, "Recording Environmental assets in the national accounts", *Oxford Review of Economic Policy*, 30(1), 126-144
- 2013 with Lars Hein & Bram Edens, "Ecosystem services: Accounting Standards" Letters, *Science*, October 25, 2013.
- System of Environmental - Economic Accounting 2012 – Experimental Ecosystem Accounting* (UN, 2013) – Pre-publication version
- System of Environmental - Economic Accounting – Applications and Extensions* (UN, 2013) – Pre-publication version
- System of Environmental – Economic Accounting – Implementation Guide* (UN, 2013) – Pre-publication (white cover) version
- with Rob Mayo & Silvia Cerilli, *System of Environmental-Economic Accounting for Agriculture: A measurement framework for agri-environmental indicators and analysis*, Paper presented to the 19th London Group meeting on Environmental Accounting, London, November 2013.
- 2012 *System of Environmental - Economic Accounting – Central Framework*, (UN, 2012) – Pre-publication (white cover) version.
- 2006 "Broader Measures of Progress", *Spotlight on National Accounts*, (ABS cat. no. 5202.0)
- 2005 "The Terms of Trade and the National Accounts", *Australian National Accounts: National Income, Expenditure and Product*, December quarter 2004, (ABS cat. no. 5206.0)
- "The Relationship between GDP and Employment", *Australian National Accounts: National Income, Expenditure and Product*, June quarter 2005, (ABS cat. no. 5206.0)
- "Estimates of Productivity in the Australian National Accounts", *Australian National Accounts: National Income, Expenditure and Product*, September quarter 2005, (ABS cat. no. 5206.0)
- 2001 Chapter 3, *Sustainable Development: Critical Issues*, OECD.

2000 *Frameworks to Measure Sustainable Development*, Collected papers and report of an OECD Expert Workshop, OECD.

Clearance of ABS statistical publications:

2001-07 *Australian National Accounts: National Income, Expenditure and Product* (ABS cat. no. 5206.0) – 28 issues (qtly)
Australian System of National Accounts (ABS cat. no. 5204.0) – 7 issues
Australian National Accounts: State Accounts (ABS cat. no. 5220.0) – 7 issues

2003-07 *Australian National Accounts: Input-Output Tables* (ABS cat. no. 5209.0) – 1 issue
Australian National Accounts: Tourism Satellite Account (ABS cat. no. 5249.0) – 5 issues

2006-07 *Australian National Accounts: Financial Accounts* (ABS cat no. 5232.0) – 6 issues (qtly)

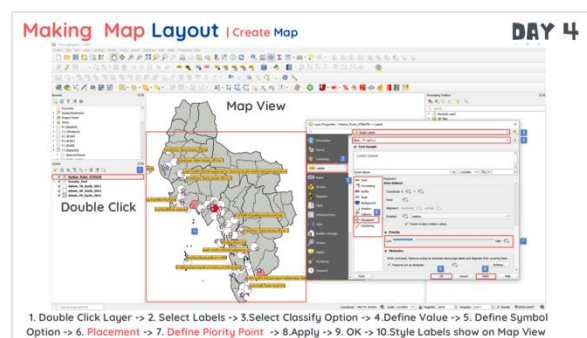
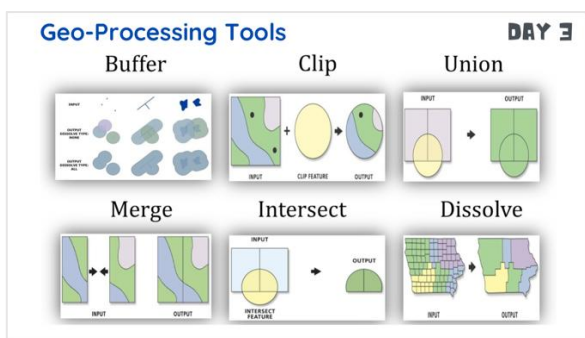
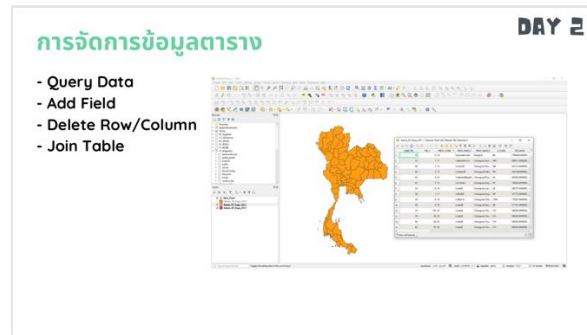
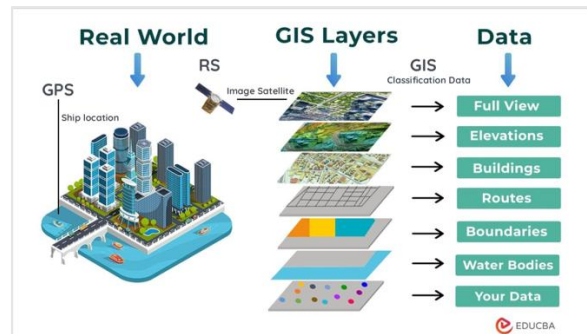
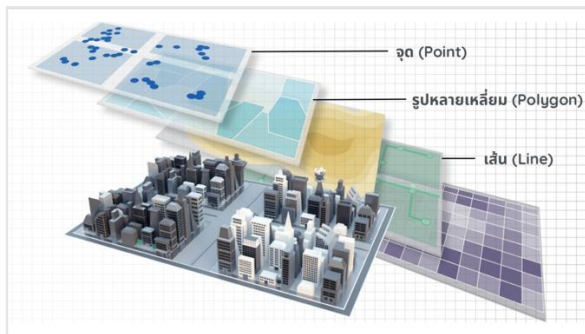
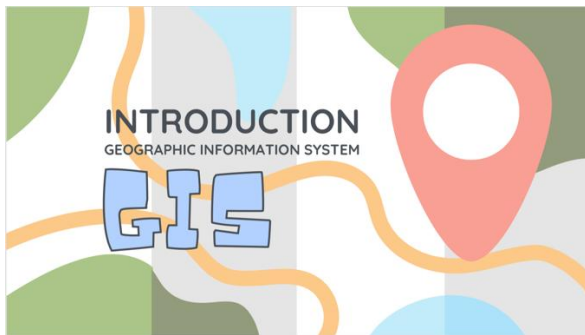
Dissertations:

1992 Dissertation for B.Ec (Hons): “The Effects of Protection on Australian Factors of Production”

1992 Dissertation for M. Phil: “Agricultural Trade Liberalisation: The Effects of Altering EC Trading Policy on Australia”

1998 Dissertation for M. Int Law: “The Role of the Most Favoured Nation Principle in the General Agreement on Tariffs and Trade”

Appendix 9: Mr. Chakris's Presentation Slide Samples



On the Job Training

PREPARATION OF FUNDAMENTAL PROJECT DATA

GISTDA

About Us

DAY#1 SURVEY POINT SEA WATER QUALITY

Data preparation

- Create study area 1 Km from Krabi Admin Boundary by "Buffer Tool" and group the data "Dissolve Tool"
- Create each point survey within 1 km by using "Point Along Geometry Tools."
- Design a field of attributes that follows the sea water quality standard.

GISTDA

HOW WE CAN DO

Add data

- Admin_TH_Krabi_2011
- Admin_PV_Krabi_2011
- Admin_TB_Krabi_2011

Processing

- Create Buffer 1 Km from admin_pv_krabi_2011
- Dissolve buffer data
- Create survey point: follow the buffer dissolve area
- Exported output survey point data

Buildup ready to use data

- Create a new field following the sea water quality standard.
- Exported survey point data

GISTDA

RESULT

Admin boundary
Buffer 1 Km
Survey Point

About Us

DAY#2 DESIGN GIS DATABASE

GIS Database Design

- Create a Primary key | Relate table.
- Define a name and type of field data.
- Design the Data Dictionary.
- Create metadata following the FGDS.

GISTDA

HOW WE CAN DO

Create Primary key

- Province_ID
- Province_Name
- Personal_ID

Define Field type

- Number
- text
- date
- geometry

Design the Data Dictionary

- Province_ID = "จังหวัด"
- Province_Name = "ชื่อจังหวัด"
- Personal_ID = "รหัสตัว"

Create Metadata

- About the data.
- Term of used
- EULA
- Credit
- Spatial Reference
- Scale
- Last update
- Owner

GISTDA

DAY#3 DATA CLEANSING

Data Cleansing

- Download the data from google drive
- Create each field and type it following the database design.
- Transform the data from the table into a Shapefile.
- Create the metadata in a Shapefile.

GISTDA

HOW WE CAN DO

Prepare data

- The data from "google drive"
- Investigate the attribute data
- Compiled a data following the structure design.

Processing

- Transformation data table to GIS format.
- Add edit delete field.
- Define a projection.

Export Data

- Export data to database

GISTDA

DAY#4 GIS APPLICATION

GIS Application

- Demo GIS application.
- Build up GIS Application for Survey.
- Build up GIS Dashboard.

GISTDA

Appendix 10: Attendance Sheets for Mr. Chakris's Sessions

On the job training - Krabi NCA"
(2-3, 9-10, 16-17, 23-24 May 2024)

under the project "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

การอบรม เรื่อง "การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA) จังหวัดกระบี่"
ภายใต้ โครงการ "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

วันที่ 2-3, 9-10, 16-17 และ 23-24 พฤษภาคม 2567 เวลา 09.00 - 12.00 น.

ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

By Mr. Chakris Phithakrattanasakun
Geo-Informatics and Space Technology Development Agency (Public Organization) - GISTDA

List of participants

Name	Position	Organization	Signature			
			2 May 2024	3 May 2024	9 May 2024	10 May 2024
Lecturer						
1. Mr. Chakris Phithakrattanasakun นายชัชกรวิศ พิทักษ์รัตนสกุล	Innovation Development officer นักพัฒนานวัตกรรม	GISTDA				
Project Manager						
2. Adis Israngkura (Ph.D.) รศ.ดร.อดิศร์ อิศรางกูร ณ อยุธยา	Advisor for Resource Sustainability and Mitigation Policy ผู้อำนวยการทีมนโยบายทรัพยากร ธรรมชาติและ การลดก๊าซเรือนกระจก	Thailand Development Research Institute (TDRI) ผู้อำนวยการทีมนโยบายทรัพยากร ธรรมชาติและ การลดก๊าซเรือนกระจก				
Project Staff						
3. Ms. Thippawan Keawmesri นางทิพย์วัลย์ แก้วมีศรี	Researcher, Liaison นักวิจัยอาวุโส และ ผู้ประสานงาน	TDRI				

1

Name	Position	Organization	Signature			
			2 May 2024	3 May 2024	9 May 2024	10 May 2024
4. Ms. Prinyarat Leangcharoen นางสาวปริญญารัตน์ เลี้ยงเจริญ	Researcher นักวิจัยอาวุโส	TDRI				
5. Ms. Kanjana Yasen นางสาวกาญจนา ย่าเสน	Researcher นักวิจัย	TDRI				
6. Ms. Panida Phranphanat นางสาวปณิดา พรานพนัส	Researcher นักวิจัย	TDRI				

2

**On the job training - Krabi NCA”
(2-3, 9-10, 16-17, 23-24 May 2024)**

under the project “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

การอบรม เรื่อง “การจัดทำบัญชีทุนทางธรรมชาติ (Natural Capital Accounting: NCA) จังหวัดกระบี่”
ภายใต้ โครงการ “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”

วันที่ 2-3, 9-10, 16-17 และ 23-24 พฤษภาคม 2567 เวลา 09.00 - 12.00 น.
ณ ห้องประชุมชั้น 4 สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

By Mr. Chakris Phithakrattanasakun
Geo-Informatics and Space Technology Development Agency (Public Organization) - GISTDA

List of participants

Name	Position	Organization	Signature			
			16 May 2024	17 May 2024	23 May 2024	24 May 2024
Lecturer		GISTDA				
1. Mr. Chakris Phithakrattanasakun นายชาคริส พิทักษ์รัตนสกุล	นักพัฒนานวัตกรรม					
Project Manager						
2. Adis Israngkura (Ph.D.) รศ.ดร.อดิศร์ อิศรางกูร ณ อยุธยา	Advisor for Resource Sustainability and Mitigation Policy ผู้อำนวยการทีมนโยบาย ทรัพยากรธรรมชาติและ การลดก๊าซเรือนกระจก	Thailand Development Research Institute (TDRI) ผู้อำนวยการทีมนโยบาย ทรัพยากร ธรรมชาติและการ ลดก๊าซเรือนกระจก				
Project Staff						
3. Ms. Thippawan Keawmesri นางทิพย์ แก้วมีศรี	Researcher, Liaison นักวิจัยอาวุโส และ ผู้ประสานงาน	TDRI				

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Name	Position	Organization	Signature			
			16 May 2024	17 May 2024	23 May 2024	24 May 2024
4. Ms. Prinyarat Leangcharoen นางสาวปริญญารัตน์ เลี้ยงเจริญ	Researcher นักวิจัยอาวุโส	TDRI				
5. Ms. Kanjana Yasen นางสาวกาญจนา ย่าเสน	Researcher นักวิจัย	TDRI				
6. Ms. Panida Phranphanat นางสาวปณิดา พรานพนัส	Researcher นักวิจัย	TDRI				
7. Mr. Passawit Pinijant นาย ภาสวิชัย พินิจจรรยา	Intern นักศึกษานิเทศศาสตร์	จุฬาลงกรณ์มหาวิทยาลัย Chulalongkorn University	-	-		
8. Ms. Tipawan Bovonsaree นางสาว ทิพย์วรินทร์ บวณเสนีย์	Intern ศึกษานิเทศศาสตร์	มหาวิทยาลัยแม่ฟ้าหลวง Mae Fah Luang University.	-	-		

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Appendix 11: Agenda or Schedule of Mr. Chakris's Sessions

On the job training - Krabi NCA

Date	Time	Topic
2 May 2024	9.00 - 10.00	Introduction to Geographic Information System (GIS) <ul style="list-style-type: none"> - Basic GIS knowledge - 3S Technology: GIS RS GPS - Principal concepts and techniques of Geographic Information System - Fundamental of data structure / Spatial data types
	10.00 - 11.00	Desktop QGIS software packages <ul style="list-style-type: none"> - Downloading and Installing software - Plugins
	11.00 - 12.00	Explore data using QGIS <ul style="list-style-type: none"> - Define projections - Data processing systems (import/ export/ edit)
3 May 2024	9.00 - 10.30	Attribute manipulation <ul style="list-style-type: none"> - Query Data - Add Field - Delete Row/Column - Join Table
	10.30 - 12.00	Working with CSV or Spreadsheets
9 May 2024	9.00 - 12.00	Geo-Processing Tools <ul style="list-style-type: none"> - Intersect / Union/ Merge /Clip data - Calculate Density - Create Buffer - Create Grid
10 May 2024	9.00 - 12.00	Making map with common data set (Cartographic) <ul style="list-style-type: none"> - Core map element - Labelling map feature - Symbology - Making map (Map Layout)
16 May 2024	9.00 - 12.00	Preparation of fundamental project data (Day 1)
17 May 2024	9.00 - 12.00	Preparation of fundamental project data (Day 2)
23 May 2024	9.00 - 12.00	Preparation of fundamental project data (Day 3)
24 May 2024	9.00 - 12.00	Creating a map illustrating the foundational data of the project



CHAKRIS PHITHAKRATTANASAKUN

WORK EXPERIENCE

Innovation Developer: GISTDA (Geo-Informatics and Space Technology Development Agency) | 2012 – Present

- Geospatial Data Management & Development:
 - Produced and managed high-precision Vector and Raster maps.
 - Designed and maintained spatial databases using PostGIS and SQL.
 - Developed and deployed Web Applications to support agency missions.
 - Service Deployment & OGC Standards:
 - Configured and administered map services (Shapefiles, Satellite Imagery, Aerial Photography) and Metadata via ArcGIS Server, GeoServer, and ERDAS APOLLO.
 - Ensured all data services complied with OGC standards (WMS, WFS, WMTS).
- Training & Knowledge Transfer:
 - Served as a key lecturer/trainer on GIS data creation, data security, and online geospatial services.
 - Instructed users on application development using ArcGIS Portal.
- Media & Communication:
 - Created technical presentations and multimedia content to publicize GISTDA's innovations and projects.


EDUCATION

Bachelor of Science (B.Sc.) in Geo-Informatics Buriram Rajabhat University

- Honors: Second Class Honors
- TECHNICAL SKILLS
 - GIS Software: ArcGIS Desktop, QGIS, ArcGIS Server, GeoServer, ERDAS APOLLO.
 - Database: PostGIS, SQL (Basic).
 - Programming & Web: HTML, Python (Basic).
 - Standards: OGC Web Services (WMS, WFS), Metadata standards.
 - Other: Multimedia creation, Presentation design.

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THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN
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