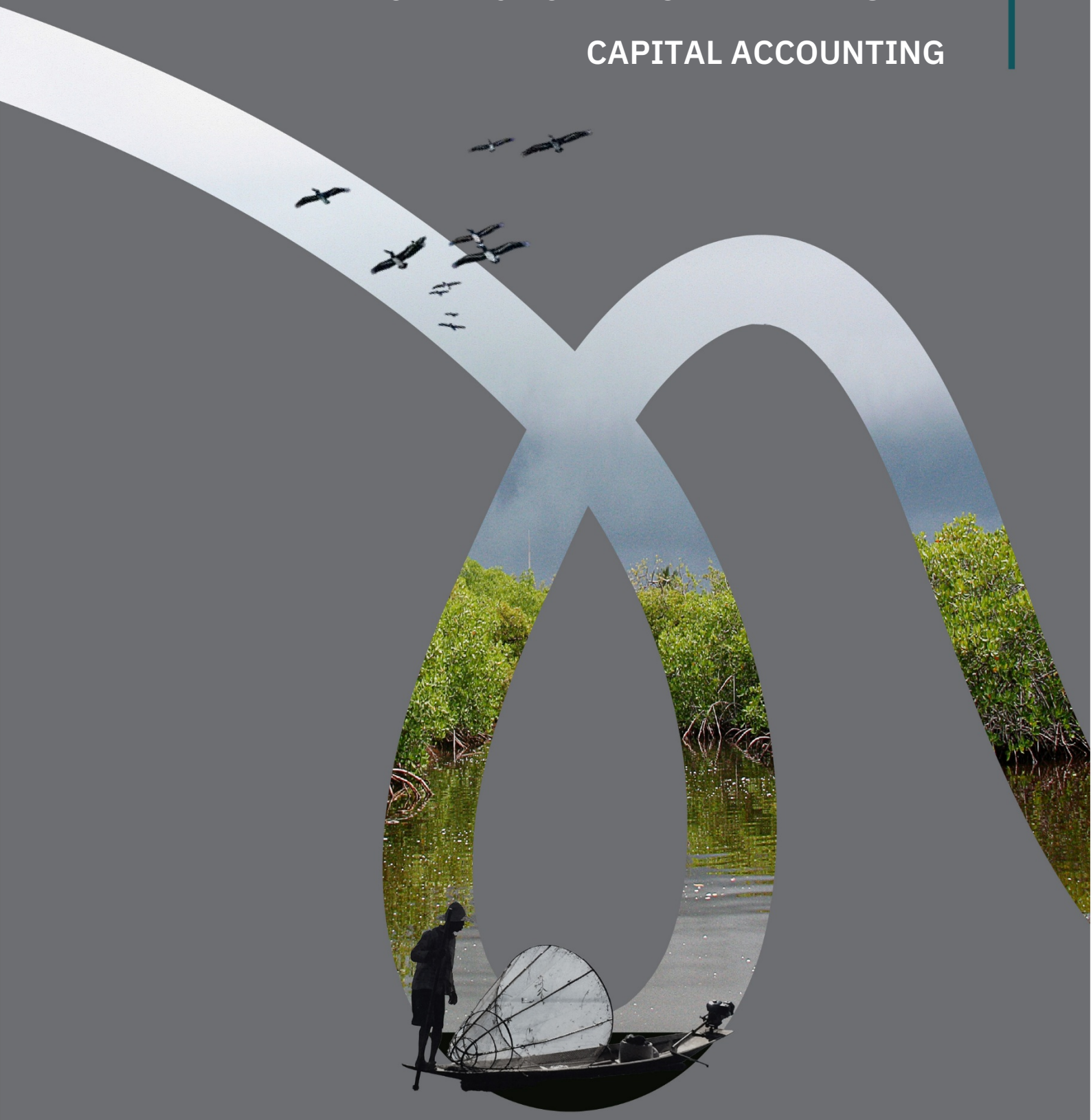
COMPONENT 3

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



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

NATURAL CAPITAL

Funded by gef UN environment programme

Executing Agencies TDRI THAILAND DEVELOPMENT RESEARCH INSTITUTE

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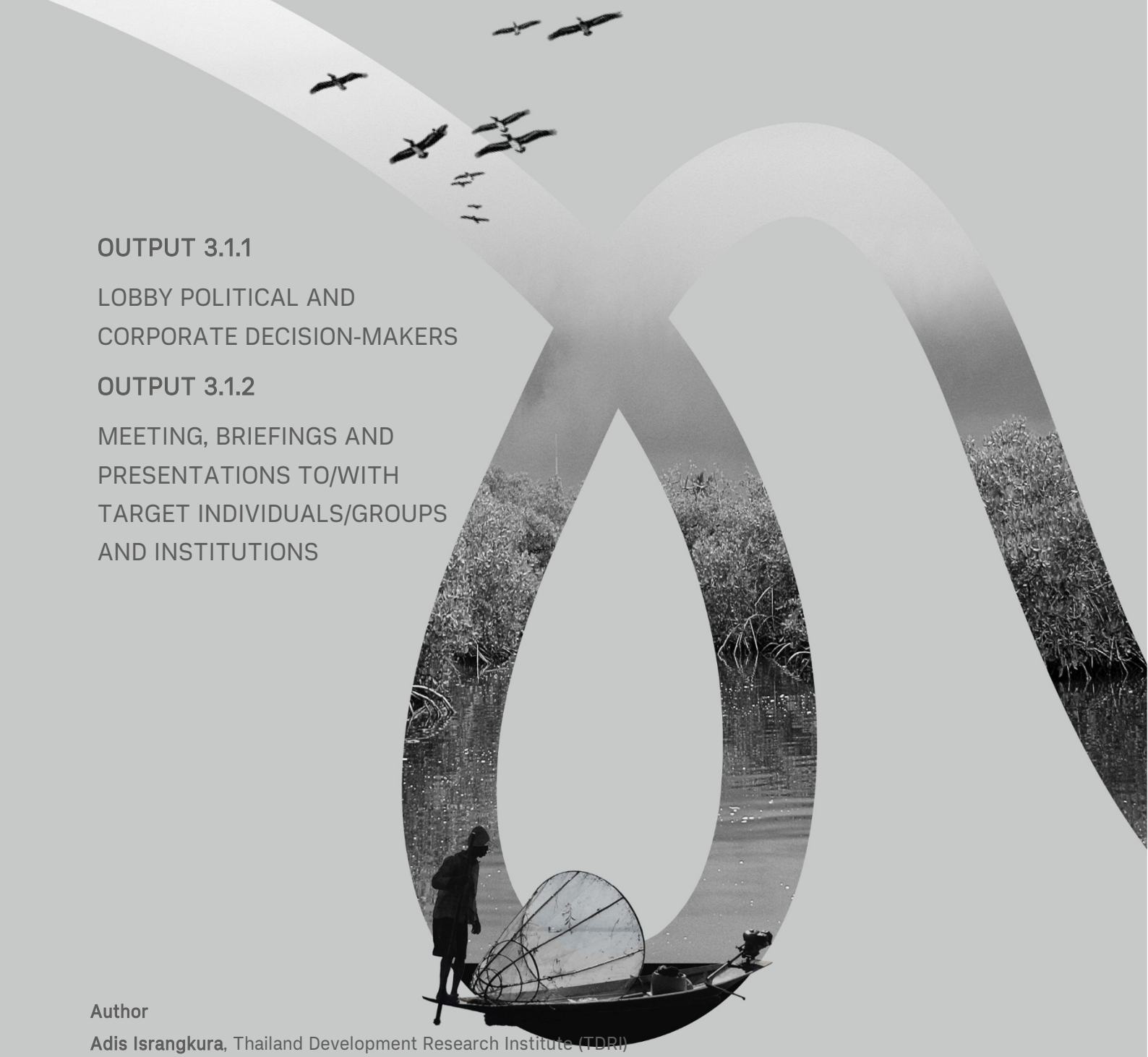

OUTPUT 3.1.1

LOBBY POLITICAL AND CORPORATE DECISION-MAKERS

OUTPUT 3.1.2

MEETING, BRIEFINGS AND PRESENTATIONS TO/WITH TARGET INDIVIDUALS/GROUPS AND INSTITUTIONS

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Acknowledgement

The Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand Development Research Institute (TDRI) in collaboration with the United Nations Environment Programme (UNEP), gratefully acknowledges the generous financial support provided by the Global Environment Facility (GEF) for the project "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes."

We also acknowledge the active participation and constructive inputs of representatives from government agencies, public enterprises, private sector organizations, academic and research institutions, civil society groups, and international partners. Their collaboration and recommendations have been instrumental in shaping the conceptual framework of Natural Capital Accounting and ensuring its relevance to Thailand's tourism and water resource sectors.

Finally, we would like to express our sincere appreciation to stakeholders from both public and private sectors at the national and provincial levels in Krabi, including the National Economic and Social Development Council (NESDC), the National Statistical Office, the Department of Marine and Coastal Resources, the National Water Resources Office, the Water Resources Information Institute (Public Organization), the Department of Tourism, the Krabi Provincial Office, the Krabi Provincial Office of Natural Resources and Environment, the Office of Environmental and Pollution Control Region 15 (Phuket), the Krabi Provincial Industry Office, the Krabi Hotel Association, as well as hotel and restaurant operators in Ao Nang, Krabi, among others. Their active participation and expertise have played a vital role in strengthening the integration of natural capital into national policy and planning. Their continued commitment underscores the importance of collaborative action in advancing sustainable landscapes and fostering an eco-friendly economy

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Executive Summary

The Office of Natural Resources and Environmental Policy and Planning (ONEP), in collaboration with the United Nations Environment Programme (UNEP) and with financial support from the Global Environment Facility (GEF), is promoting the integration of Natural Capital Accounting (NCA) into Thailand's policy formulation and decision-making processes. The Thailand Development Research Institute (TDRI) serves as the project's implementing consultant.

This initiative focuses on two priority sectors: tourism and water resources management, with Krabi Province selected as a pilot area due to its ecological significance and its role as a leading tourism destination.

The project aims to develop natural capital accounts for tourism and water resources, providing scientific data and evidence-based information to support planning at both national and provincial levels. It seeks to strengthen decision-making mechanisms by integrating the value of biodiversity and ecosystem services, while enhancing awareness and capacity among stakeholders to promote the sustainable use of natural resources.

Key activities under this outcome include national dissemination meetings, provincial-level consultations and stakeholder dialogues in Krabi, and tripartite joint meetings (UNEP, ONEP, TDRI). These platforms bring together government agencies, private sector representatives, academia, and civil society organizations to exchange knowledge, foster collaboration, and provide recommendations for effective project implementation.

1. Introduction

This report presents the outcomes of Outcome 3.1.1: Lobbying political and business decision-makers, and Outcome 3.1.2: Meetings, briefings, and presentations to target individuals, groups, and institutions. These outcomes constitute key pillars of the project's advocacy strategy, designed to enhance dialogue, foster collaboration, and influence decision-making across multiple governance levels.

This report provides comprehensive details of the information dissemination meetings aimed at building understanding and raising awareness of natural capital and ecosystem services among public and private sector executives, political and business policymakers, and operational stakeholders, as well as the tripartite joint meetings (UNEP, ONEP, TDRI). In total, 14 meetings were conducted throughout the project. These meetings have been systematically organized into three main categories:

1. **National Dissemination Meetings** – Convened with political leaders, organizational leaders, and representatives from government agencies, the private sector, civil society, academia, and research institutions. These meetings served as formal platforms for presenting evidence, exchanging views, and promoting project objectives within national policy forums. They underscored the project's commitment to ensuring that key decision-makers are informed, engaged, and aligned with the broader vision of sustainable development. Two dissemination meetings were held.
2. **Provincial-level Meetings (Krabi Province)** – Convened with political leaders, organizational leaders, and representatives from institutions and the private sector in Krabi Province. These meetings provided formal platforms for presenting evidence, exchanging perspectives, and facilitating dialogue among stakeholders at the provincial level. They strengthened institutional linkages and promoted the integration of community-level initiatives into broader policy frameworks. The meetings underscored the project's commitment to ensuring that decision-makers are informed, engaged, and aligned with the national vision of sustainable development, while contextualizing national issues within local realities. *A total of six meetings were held.*
3. **Joint Meetings of Three Agencies (UNEP, ONEP, TDRI)** – As UNEP serves as the project management agency (GEF Agency), ONEP as the executing agency, and TDRI as the project consultant, joint meetings among the three parties were essential to report on progress, identify challenges, and collaboratively plan actions to achieve project objectives. *A total of six meetings were held.*

The fourteen meetings documented in this volume demonstrate the project's ongoing efforts to bridge national and provincial perspectives, ensuring that support is comprehensive and responsive to the needs of diverse stakeholders. Subsequent chapters present detailed summaries of each meeting, including objectives, participants, key discussion points, and outcomes. By documenting both the processes and content of these engagements, the report underscores the importance of systemic dialogue as a mechanism for building consensus and driving meaningful change.

2. National Dissemination Meetings

2.1 Minutes of the Kick-off Meeting "Ripples of Changes: Harnessing Natural Capital for Sustainability"

Meeting Minutes of the Kick-off Meeting "Ripples of Changes: Harnessing Natural Capital for Sustainability" **on Friday 18th August 2023** 08:30 am - 01:30 pm, Benchasiri Ballroom 3rd floor, Marriott Bangkok Hotel Sukhumvit, Bangkok Thailand

2..1.1 Principle and Reasons

Office of Natural Resources and Environmental Policy and Planning (ONEP) and United Nations Environment Programme (UNEP) has designated Thailand Development Research Institute (TDRI) as the project consultant for implementation of "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes" which has received budgetary support from Global Environment Facility (GEF) with implementation period of 54 months (between August 2022 and February 2027).

The objective of the "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes" project is to integrate the natural capital into the policy preparation and implementation of major economic sectors both at the local and the national levels, and to enhance the protection and mitigate the impact of the production sector on the biodiversity and ecosystem services by implementing in 2 sectors, i.e., tourism sector and water management sector, with Krabi province as the project implementation area. This is due to its significance as the headwaters covering the coastal and marine areas which are crucial to the livelihood of local population and as the country's major tourism destination. The project success consists of the natural capital accounting in the tourism and water management sectors of Thailand which would lead to the integration of policy preparation at both the national and local levels; enhancing the knowledge, understanding, and awareness of the natural capital, for the sustainable utilisation of biodiversity resources and ecosystem services, including the enhancement of decision-making mechanism and natural resources management planning at the provincial level based on scientific body of knowledge and economic value of the marine and coastal and clean water basin ecosystems.

Therefore, ONEP has organised the kick-off meeting of "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes" project to create the awareness on details, extent, and goals of project implementation together with the dissemination of knowledge, understanding, and awareness related to natural capital, including presentation of the conceptual framework on natural capital accounting with exchange of opinions, and recommendation for development and improvement of project implementation guidelines.

2.1.2 Objectives

1. To create the awareness of details, extent, and goals of the implementation of natural capital accounting for policy decision-making toward sustainable development.

2. To present the conceptual framework of national natural capital accounting with emphasis on tourism and water resources sectors, and roadmap toward integration of natural capital into preparation of policy and implementation of major economic sectors both at the local and the national levels.

3. Exchange of opinions, with recommendation for development and improvement of project implementation guidelines.

2.1.3 Implementation Method

1. Kick-off Meeting to clarify details, extent, and goals of project implementation

2. presenting the information of past operation and activities, and conceptual framework for Natural Capital Accounting (NCA) with emphasis on tourism and water resources sectors, and roadmap

3. Collaborating in learning and opinion sharing with recommendation for improvement and development in project implementation guidelines

2.1.4 Target Group

Representatives from governmental agencies, public enterprises, international organisations, private sector, NGOs, experts, and scholars related to national Natural Capital Accounting (NCA), with emphasis on tourism and water resources sectors, totally about 100 persons

2.1.5 Minutes of the Kick-off Meeting

The Biodiversity Management Division, Office of Natural Resources and Environmental Policy and Planning (ONEP), in collaboration with The United Nations Environment Programme (UNEP), and Thailand Development Research Institute (TDRI) has organised the kick-off meeting of “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes” “Ripples of Changes: Harnessing Natural Capital for Sustainability” Project, with the objective to create awareness of the detail, scope, and goal in implementation of natural capital accounting in policy decision-making for sustainable development, and presenting the conceptual framework of Natural Capital Account (NCA) by focusing on tourism and water resources sectors, in order to integrate the natural capital into policy preparation and implementation of mainstream economic sector both at the local and the national levels, together with hearing and exchange of recommendations for development and improvement from the related parties both public agencies and private sector, NGOs, international organisations, educational institutions, scholars, and experts. The expected outcome from this meeting are recommendations for development and improvement of project implementation.

The kick-off meeting of “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes” “Ripples of Changes: Harnessing Natural Capital for Sustainability” Project was held on Friday 18th August 2023 08:30 am – 01:30 pm at Benchasiri Ballroom, 3rd floor, The Marriott

Bangkok Hotel Sukhumvit with participants from representatives of related agencies such as representatives from both public agencies, public enterprises, private sector, educational institutions, NGOs, international organisations,, scholars, and experts totally 124 persons.

The meeting is divided into 4 sessions as follows:

Session 1 : Reporting, opening , and keynote speech

Dr. Jittinun Ruengverayudh, Director of Biodiversity Management Division, ONEP reported, mentioned the project background, and objectives of the meeting which can be summarised as follows:

- ONEP is the project owner of "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision making for Sustainable Landscapes", with UNEP as the project manager, and TDRI as the project consultant, and funded by Global Environment Facility (GEF), with the objective to integrate the natural capital into the policy preparation and implementation of the mainstream economy at both the local and the national levels, and to enhance the protection and mitigation the impact from the production sector on the biodiversity and ecosystem services. The goal of the project is the guideline for the policy preparation to support the integration of natural capital into the national accounting system.
- This project emphasises on two sectors, i.e., tourism and water management sectors in which Krabi project was selected as the project implementation area due to its significance as the head waterway covering the marine and coastal areas which is crucial to the livelihood of the local population and a major tourism destination of the country.
- Mr. Jirawat Ratisoontorn, the Deputy Director-General of ONEP gave the opening remarks and delivered the keynote speech "The Importance of Natural Capital and the Sustainable Development" with keypoints as follows:
- There are three interconnected important crises issues which is of global concern, namely : (1) Interconnected Crises - Global crises begin from environmental problem but lead to impact on society and economy interconnectedly; (2) Interconnected Policies - Integrated and comprehensive policy planning with the environment and natural resources as the basis for conceptual process; and (3) Interconnected Solutions - Employing natural capital as the concept and tool for policy planning leading to sustainable development.
- Interconnected Crises - Global crises begin from environmental problems but lead to impact on society and economy interconnectedly. From Global Risk Report 2023 by World Economic Forum (WEF) the ranking of global risk for the next 10 years has revealed that the environmental issues are the origin of crises which have repercussions on economy, society, and other problem interconnectedly. The top ranking global risks are the biodiversity loss and ecosystem collapse, which was ranked as # 4, and natural resources crisis ranked as #6, with the economic and social system which should be prioritised in transformation to Nature Positive Economy are 1) Food, land, and ocean; 2) Infrastructure and environment created by humans, and 3) Energy. Together these 3 systems are responsible for up to 80% extinction risk of "endangered species" and "near threatened species".
- Interconnected Policies - Integrated and comprehensive policy planning with the environment and natural resources as the basis for conceptual process. The 15th Conference of the Parties to the Convention on

Biological Diversity (CBD COP 15) in December 2022 at Montreal, Canada has adopted "Kunming-Montreal Global Biodiversity Framework" by Year 2030 conforming to the sustainable development with 23 targets implementation guideline covering 3 main aspects 1) Reduce harm to biodiversity, 2) Sustainable utilisation of biodiversity, and 3) Tool and solutions for implementation and integration as Target # 14 from 23 targets ensure the full integration of biodiversity and its multiple values into policies, planning, strategy, and development processes as appropriate, including integration into national accounting, within and across all levels of government and across all sectors, in particular those with significant impacts on biodiversity.

- Interconnected Solutions - Natural capital concept leading to sustainable development. Biodiversity integration into planning and policy decision-making require tool significantly employing natural resources as the conceptual base including the Natural Capital Accounting (NCA) for value analysis of resources and biodiversity, and feasibility study for integration into national policy decision-making which the tool is not merely top-down policy making, but can drive the appropriate policy locally by including the local information in the assessment process or bottom-up approach.

Session 2 : Presentation of "Natural Capital Accounting Framework for Policy Decision-making Toward Sustainable Development" by Associate Professor Dr.Adis Israngkura, TDRI

- Project implementation comprises of 3 components, namely : (1) Policy preparation and incentive creation to support the integration of natural capital at the national level with outcomes as (1.1) conceptual framework preparation of natural capital accounting at the national level, (1.2) integration natural capital accounting into the policy, planning, and budgetary system, (2) Information integration of natural capital accounting into development planning at the provincial and the local levels (Krabi Province), with outcomes as (2.1) natural capital accounting for tourism and water resources, (2.2) integrate the data collection system of natural capital accounting of the provincial level into the policy, workplan, and budgeting of the local agency level, (2.3) mitigation of environmental impact, and rehabilitation and protection of natural capital resource, (3) Preparation of information for capacity and awareness enhancement, network creation for integration of natural capital accounting, with outcome as, (3.1) dissemination and transfer of information preparation in natural capital accounting system, (3.2) knowledge sharing to enhance the capacity widely for the natural capital accounting system preparation.

- Project implementation comprises of 5 steps as follows: (1) Stock - Data compilation of natural resources quantitatively and qualitatively with Geographic Information System (GIS) Mapping, (2)Flow "Service" from natural resources in terms of quantity, quality, and benefit to the society, (3) value assessment and tool utilisation testing by economic value assessment of tourism and water resources sectors applying market tool to assess economic value integrating into policy level, and employing appropriate tool for pilot testing in Krabi Province, (4) integrate NCA into policy decision-making, as integration of natural capital accounting toward preparation of policy, workplan, and budgeting at the provincial level, and (5) disseminate, produce and sharing the body of knowledge on natural capital accounting system via various communication channels, e.g., website, and publications, etc.

- Presenting the case of Ecosystem Assets in the Philippines, e.g. Closed Forest Open Forest Grass-Land Beach areas Annual Crops Mangrove, etc. including the concept leading to The System of Environmental-Economic Accounting (SEEA)
- Presenting the physical landscape of Krabi Province, water resources (southern watershed on the west coast), land ecosystem (forest resource, wildlife), Krabi River Mouth wetland, rare plant vital to national conservation, classified wildlives, river mouth ecosystem (migrating birds), marine and coastal ecosystem (coral, seagrasses, rare marine creatures)
- Presenting the environmental value assessment, comprising of (1) Market-based valuation Techniques, i.e. Cost of Illness (Cost of curing foot diseases), Change in Productivity (Increase in cost of doing business), Mitigation Cost (Cost of relocating people), Defensive Expenditure (Cost of sandbags), Replacement Cost (Repairing from Flooding), and (2) Non-market Value Techniques, i.e. Travel Cost Method (TCM), Hedonic Price Method (HPM), Contingent Valuation Methods (CVM), Benefit Transfer Method (BT)

Session 3 : Forum "Policy Design for Sustainable Development : Krabi Province"

by Dr. Wiparat Tharatheeraparn (Deputy Director-General of Tourism Department), Dr. Sasithorn Kitithornkul (representative from Krabi Province), and facilitated by Dr.Phet Manopawit (Green World Foundation and advisor to international environmental organisations)

(1) Dr.Wiparat Tharatheeraparn, Deputy Director-General of Tourism Department

Question Issue #1 : Policy concept of Tourism development with awareness to environmental cost issue

- Tourism revenue accounts for 18% of Gross Domestic Product (GDP) both directly and indirectly from 12 branches of the tourism industry. In Year 2019, the highest international tourist arrival is 40 million with revenue from tourism sector 3,000 billion baht (domestic Thai tourists 1,000 billion baht, and overseas tourists 2,000 billion baht) but this revenue still has not accounted for the cost of natural resources and environment.
- In Year 2019, The Economics Tourism and Sports Division under the Office of Permanent Secretary of Tourism and Sports has initiated the preliminary study of "Tourism Satellite Account System of Environmental Economic Accounting (TSA-SEEA)" or "Tourism Satellite Account (TSA)" It found that from the GDP in the tourism sector of 1,000 billion baht in 2017, after deduction of 200 billion baht in cost of natural resources and environmental utilisation, or accounted for about 18% of GDP in the tourism sector. From the same study, it also found that hotel/accommodation is the sector with highest water utilisation.The next phase of study will begin in Year 2023 to scrutinise the TSA continuously to get up-to-date information, including the study of both positive and negative impacts from the Covid'19 pandemic of which tourists have vanished. However, the balancing in economic and environment has to be considered for policy implementation to see which type of policy is appropriate in Thailand context.
- In addition to the above-mentioned study, The National Science and Technology Development Agency (NSTDA) in collaboration with The Ministry of Tourism and Sports have further studied the economic value of natural resources in marine and coastal ecosystem with reflection of value in the next 20 years, e.g. mangrove

forest as of now is valued at 211 billion baht but will be valued at 2,360 billion baht in the next 20 years, coral is valued at 3.94 billion baht as of now but will be valued at 44 billion baht in the next 20 years. This is the reflection that the tourism sector is the industry using natural resources and intellectual resources both tangible and intangible. Moreover the water usage in tourism accounts for 5% of the total water usage in the industrial sector of the country. The energy usage in the tourism sector accounts for 13% of the total energy usage in the industrial sector of the country. The GHG emission of the tourism sector accounts for 3.11% of the total GHG emission in the industrial sector of the country, while the tourism sector accounts for 12.68% of solid waste generated in the country.

- From mentioning above, the Ministry of Tourism and Sports has undertaken study and research of which the question is how to extend the result into the local implementation which is quite difficult as 80% of the tourism industry is in community enterprises and small-and-medium enterprises (SME), but in order to proceed to policy it has to be implemented for all parties.
- Question Issue #2 : What would be the prospects of tourism in Krabi province for the next 10 - 20 years, and what factors would contribute to make Krabi a high-quality travel destination?
- In the next 10 years, we would need to address the trend of global tourism which is expected to be growing at 3.3% annually. There are 1,400 million tourists in Year 2019 and will be increased to 1,800 million tourists by Year 2030. The policy preparation is usually based on the number of tourists, but at the same time is inclined to see a policy of Green GDP and sustainability.
- Many countries in the world are no longer talking in terms of “volume”, which Thailand still needs both “volume” and “value”, but requires more “value” than “volume”. However, it could be worse if there are less tourists and less spending. The policy of the government is to expedite income creation which requires collaboration with the National Economic and Social Development Board (NESDB) which encourages the Department of Tourism to promote sustainability. The question is how to come up with a policy that ensures the preferred GDP type has the necessary tools to achieve the goal.
- The tourism sector contributes to 5% of CO2 emission which 75% comes from the transportation sector. There is a tendency to come up with small aircraft which would reduce the emission, and campaign to use less fuel, and beginning to utilise Sustainable Aviation Fuel
- The measurement of CO2 emission by various tourism activities is difficult and creates impact due to its complexity and numerous stakeholders involved. There were attempts to measure CO2 created or carbon footprint at travel destinations and measuring tools need to be identified, studied, and shared in the future.
- Over the past several year, the governmental sector has policy to promote the local resources utilisation to create or add value, e.g. Krabi saline hot water spring which Institute of Small and Medium Enterprises Development (ISMED) has undertaken in the Khlong Thom area, Krabi Province which the management is difficult because majority of the area is private land. If the governmental sector has policy to promote local resource utilisation to create/add value by designating Krabi Province as a world spa or wellness destination, the local population might view their land as asset for exploration of saline hot water, and lead to the issue of local land ownership or even the land under the Local Administrative Organization. If there is any commercial extension,

issue would arise whether the water can be proven for commercial exploitation which would require cooperation from many parties concerned.

- E.g. Onsen in Japan has specific laws in management which Thailand still does not have any. The resource extracted for utilisation from the land is subject to taxation by beneficiary with benefit sharing to the local population which Thailand has yet to come to this. Therefore, feasibility and natural cost study is necessary to have cooperation from the related agencies, not specific to a single ministry.
- In Year 2023, there is a study into the routing of hot water spring and the design in activities for 3 provinces, i.e. Ranong, Krabi, and Phang-Nga to see how to manage and provide recommendations in terms of policy to the local agencies how to oversee the resources utilisation and include the resource cost, and give due attention to the routing design conforming to sustainable development. The next step is the discussion with ONEP to see how to support this project.
- On the national policy level, a tourism capacity indicator would be developed which the World Economic Forum (WEF) has ranked Thailand in Year 2017 on resources capacity among 140 countries as #10 on biodiversity, but ranked #130 on sustainable management. Therefore, this is a challenge for Thailand to expedite.

(2) Dr. Wimonpak Bumbatsaparok Kumkanya, Expert in Economics Analysis of Water Basin Development Project, Office of The National Water Resources

Question Issue #1 : What are Thailand's water management guidelines and how to assess the value of water resources in the country?

- Office of The National Water Resources (ONWR) has a 20 year (2017 - 2036) Master Plan on Water Resources Management and Water Resources Act with numerous subordinate laws classifying water basins, which Krabi is in Water Basin# 22 and the announcement of the National Water Resources Board (NWRB) prioritising the water distribution into 9 levels, the top priority as Level 1 of water distribution is “potable and non-potable” which each water basin can be prioritised from Level 2 to 9 subject to suitability.
- Most of the water resources for the tourism sector is consumed by accommodation or hotels but the usage can not be separated into potable (treated for human consumption - drinking and cooking) or non-potable (untreated, not for human consumption.) ONWR has carried out Strategic Environmental Assessment (SEA) to identify the “carrying capacity” of the water basins and how to manage to balance the supply and demand without causing harm to the environment.
- From the SEA, water basins in the west coast of the southern region were found to have two crucial problems, i.e. flood and drought. Drought is in the up-stream, mid-stream, and down-stream. Upstream is a narrow area with heavy rain. Due to the changing watershed area utilisation pattern, e.g. from national park to rubber plantation, the water slow down capacity is lower. For the mid-stream area, the storage capacity is minimal due to the short river, and therefore cannot function as a water storage or check dam, including changing community land utilisation and economic area resulting in water drainage blockage causing flooding. Down-stream is adjacent to the sea area which is subject to ocean tide, and water draining is difficult due to physical limitation and causing flooding.

- Drought is also a physical problem due to the geographical condition of Krabi province as it is long, narrow, and steep where large water reservoirs cannot be built. As of now, there are medium and small water reservoirs with storage capacity of 82 million cubic meters, but the annual water demand is 4,000 million cubic meters. However, the southern region has been raining all year around which would replenish the storage reservoirs several times. The agriculture sector is the highest water user, but with perennial plants which do not require too much water, the balance of water demand and supply can be maintained during the period.
- The water basins on the west coast of the southern region has potential in 3 dimensions, i.e. economic, social, and environment, but the constraint of water supply is posing a challenge for livelihood improvement, e.g. the building of new water source and the issue of violation of natural park area, or if detention pond (Kam-Ling) will infringe on private land.
- Majority of the people are not aware of the value of water, except the price. However, such price may not reflect its true value because of a subsidy from the government, just a reflection of part of the cost in acquiring it.
- Moreover, ONWR is attempting to study the water value and water distribution by looking into productivity of water, the higher the better, which is a matter of policy.
- Water circulation in nature gives rise to the ecosystem service which is a natural capital. Withdrawal of one unit of underground water for agriculture will cause soil subsidence which is a challenge in determining if soil subsidence is worth the output from agriculture.
- Moreover, ONWR is in technical cooperation with Australia and the Food and Agriculture Organization (FAO) which has an ongoing study of water accounting to find out the amount of water extracted from the system to produce what product and in what quantity, and how to allocate water to achieve the best productivity.

Question Issue #2 : How would water accounting connect with other contexts such as headwater or cost in protection of watershed forest?

- The 20-year Master Plan on Water Resource Management (2018-2037) is revised every 5 years with the first revision due this year (2023). With collaboration with ONEP, Climate Change has been integrated, and after the project completion of “Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes”, it shall be integrated into the Master Plan on Water Resources Management for better sustainable management.
- A water challenge is the quality of wastewater from municipal waste or untreated wastewater which ONWR view the solution with 3 R : Reduce, Recycle, and Reuse, to maximise the use value from the existing quantity, and provide wastewater treatment at the appropriate location to apply with Polluter Pays Principle as an economic tool.
- One other challenge of water quality is the unusable water, e.g. brackish water, muddy water, which are a physical constraint due to inadequate water supply or insufficient water budget to clean or dilute. This is difficult as Thailand's irrigation system is an open system and therefore cannot identify who withdraws water along the channel.

- Australia has a closed irrigation system which water accounting is easier than Thailand because the flow of water can be tracked where and who takes what quantity, and the amount returned, which is quite a challenge for Thailand including also data retrieval.
- In the future the function of ONWR is sourcing water for people in cooperation with various agencies with consideration of flood, drought, and wastewater, and also maintaining water supply in the system.
- Regarding the issue of dam mentioning by the Deputy Director-General, Mr.Jirawat Ratisoontorn, we can say that the "grey policy" e.g. the infrastructure as building is still necessary for Thailand because it is still under control, but the "green policy" is also needed as appropriate tool, by properly applying to work with the engineering structure or building in that particular water basin.
- ONWR attempted to apply "Nature-based Solution (NBS)" or "Ecosystem-based Adaptation (EBA)" into the water Master Plan because NBS or EBA are believed to enhance the diversity in the water basin as well.
- A challenge on the demand side is how to ensure valuable water utilisation as water is viewed as a public good, but the quality of water is continuously poorer with the usage, as well as the decreasing amount available. Water in a bottle is a private good, but if we fill the bottle with water passing in front of the house and claim the right of use, this is where Thailand still has yet to come to the point, because water right still has not been clearly defined as posing a problem in the future. In theory it is possible if the buyer and seller exist, but in reality Thailand still does not have any law or lacks a perfect market to implement this.
- Water accounting consists of 3 accounts, the first account is "flow", i.e. inflow, outflow, return flow from the system, with several levels from the farm level to the water basin level. Initially, ONWR need to clarify where the inflow of water come from and where the outflow go to, and for what use. The flow comes from the environment system to the economic system and returns to the environment system. It can be seen that ONWR attempt to connect to the environment system, e.g. water in the forest system because the service provided by forest is purifying the water and water in turn provide moisture to the forest which is a symbiosis relationship.
- The second account is "stock", the water in the storage area. The water basin on the west coast of the southern region can only store 82 million cubic meters, but the utilisation demand is 4,000 million cubic meters. How to prevent water shortage? By management of storage area systems which require forecasts and preparation of systematic management tools.
- The third account is "economic", water withdrawing from the natural system which is a "provisional service" from the water extract for utilisation in the economic sector, from the surface water to underground water, which is provided into the system as drinking water or agricultural usage in the irrigation system to reinforce the economy of the country, with water flow from environment system to economic system. As per the UN study, we apply to study the water accounting of the Pa Sak Water Basin because the area has usage in various sectors.
- For Krabi Province, the study of water accounting should be "from source to sea", i.e. from headwater to the sea and covering the ecosystem from the headwater forest to the sea area as full cycle.
- What ONWR is monitoring now is how much water has been withdrawn from the system, and lead to how much in the production system. This perspective is to answer SDGs, Goal # 6 : "Clean Water and Sanitation" to see how much production value can be derived from one unit of water. In economist's view there should be

other dimensions aside from productivity which is the priority of water use, e.g. Should we allocate the same amount of water for agriculture and industry? Is it appropriate? This is another challenge as in each water basin, there should be prioritisation, and water shortage should be solved by negotiation.

- ONWR reckons that water accounting will be used as a tool for making decisions in management which has two issues, in theory and data compiling as policy recommendation, but in policy implementation there are many issues to consider.

(3) Miss Sasithorn Kittithornkul, Chairman of Krabi Tourism Business Association

Question Issue # 1 : How important is the natural resources strategy for Krabi Province?

- Krabi is a small province with only 8 districts in the central part of the southern region on the Adaman coast. Despite the size of the province, in 2019 its tourism income was ranking as # 4 of the country amounted to 120 billion baht. However, as the country has just reopened the income from January to August 2023 is just 16 billion baht. The number of tourists for Krabi has decreased from 6.9 million to just 1.2 million which still need stimulation continuously with the support from the Ministry of Tourism and Sports, and Krabi has the advantage of the travel facility by air, land, and water.
- As for Green GDP, it is quite a new issue in the tourism sector, especially on the business side, which previously only touched on the sustainability and Corporate Social Responsibility (CSR), many of which were undertaken by Krabi, such as Krabi Provincial Development Plan, and Vision of Krabi Province as a travel destination, high-quality, universal standard, sustainable agro-industry, “charming society, keep-pace with changes”.
- 30% of Krabi income comes from tourism, with the main source of income from agriculture which helped the tourism business to sustain during the Covid’19 pandemic.
- In 8 districts of Krabi Province, there is biodiversity, with 130 islands and 13 inhabited islands, e.g. Phi Phi Islands, Lanta Island, etc.
- Phi Phi Islands, or Maya Bay which reopened to tourists recently has introduced carrying capacity and utilised a system on application and manually limiting to 375 visitors with no more than one hour per round. After the Tsunami, the government has declared Phi Phi Island to be a pollution control area which is not allowed for new construction especially in the form of hotels.
- Islands in Krabi Province encountered a water problem which requires utilisation of underground water, and would have to purchase water from mainland if there is any shortage. ONWR has a project to install a reverse osmosis (RO) public water supply on the Phi Phi Island, Krabi District, which is under budget allocation for study.
- Presently, the people and enterprises in Maya Bay, Krabi Province have been aware of the carrying capacity of Maya Bay which limits the number of visitors and duration, and also phobiting tourists from swimming in the beach area, with a penalty up to 100,000 baht.
- On the Green GDP, this is a new issue in the tourism business because we need to be aware of cost and return on investment. Although this is a good policy, awareness and understanding have to be made to drive the economy toward a sustainable environment. The business sector needs to be aware of how to invest to be worthwhile because the businesses that can afford green investment would be those with substantial capital.

- Koh Ngai is planned to be a Green Destination because it has a low carbon footprint due to being car-free and road-free, with only just over ten enterprises.
- The use of electric boats still has not addressed the problem of seawave in the Andaman Sea as safety might be a concern. It would be feasible with technological progress in the future.
- Koh Hong has banned single use plastic on the island and also banned certain sun protection creams harmful to the coral. Moreover, the Khlong Thom saline hot spring has been upgraded to be a wellbeing travel destination.

Question Issue # 2 : How does Krabi Province view the challenge of balance under sustainable development?

- There are quite a number of challenges for Krabi Province because it needs to create awareness and understanding of Green GDP among the investment managers both from inside and outside the province, including the community. Consideration should be given to the cost of natural loss, e.g. the release of wastewater from hotels, and non-standard restaurants. However, there are some enterprises which have undertaken.
- Moreover, on the social cost which Krabi Province has previously spent substantial budget with the CSR, but might not have continuity, e.g. forest planting, etc.
- Obstacles and problems on the other hand is System of Environmental Economic Accounting (SEEA) which is believed that 90% of the people in Krabi Province still do not understand how to calculate, and Sweden, which is the country with high ranking on this, is Krabi's number 3 tourist group.
- Krabi Office of Tourism and Sports have been to Sweden to promote the Green Destination, which set up "Tung Yee Peng Community" as Koh Lanta community implementing Green Tourism.
- Why Krabi Province still has not succeeded in terms of sustainable economy. The answer is high cost because out of 8 districts, the main travel destinations are Muang District and Koh Lanta District. The other districts are not adjacent to the coastal area. Nua Klong District has beaches with Krabi International Airport, but tourists arrive and leave for other travel destinations.
- Krabi has a declaration banning the activities with engines, e.g. water sports jet ski or banana boat, and no beach umbrella. Therefore, Nua Khlong District which has a beautiful beach by the name "Had Yao (Long Beach)" but cannot have any beach activities, has no coral in the area. It is under consultation if Had Yao Beach should be exempted as a special case, because the people cannot capitalise economically from the existing natural resources in term of tourism, and if such activities in Had Yao Beach will decrease or increase the Green GDP?
- The saline hot spring and hot waterfall in Khlong Thom are managed by Local Administration Organization (LAO), with the saline hot spring managed Huay Nam Kao LAO, and hot waterfall managed by Khlong Thom Nua LAO, with different management patterns, of which the latter is better while the former one has several limitations due to LAO regulations but have received assistance from Designated Areas for Sustainable Tourism Administration (DASTA). However, what is worrisome is when DASTA pulls out and transfers back to the LAO on the personnel and financially, whether the LAO can handle it or not is a question. Moreover the public transportation still has not been up to the standard.

- Whether future energy sources in the Krabi Province area such as solar panels or wind turbines can be of any help depend on the case study because the lignite power plant might not be sustainable. Therefore it is necessary to search for replacement natural energy sources which is a question of how to reduce the cost.

Session 4 : Opening for hearing and recommendations from meeting participants facilitated by Dr. Phet Manopawit

(1) Mr.Por Bunyaratapan - advisor, Sustainable Water and Environment (The Federation of Thai Industries - FTI)

Question Issues and recommendations

- The Environmental Fund has a major problem of fund allocation which is a policy that the government should resolve.
- Most of the wastewater is viewed as coming from the industrial sector but instead come from agricultural sector without any measurement, be it fertiliser or pesticide which pollutes the water sources in general. This is a major problem still without any solution.
- FTI has attempted to implement Smart Agriculture Industry (SAI) and there is a question as to why we do not do agriculture just like industrial parks.
- Marine trash should be traced back to the current carrying, and fish in the Krabi Province area had plastic parts inside the stomach as trash from the Philippines and Indonesia. How to reckon the cost of this problem, and how to claim or prevent it?

(2) Miss Nirun Nirunnuj - Project Manager of BIOFIN Thailand (UNDP Thailand)

Question Issue and Recommendations :

- The budget that reflects monitoring of biodiversity of the country is only 0.08% of the national budget which is very minimal.
- Tourism Fund, partly for the ecosystem which is in line with the spending that reflects tourism. Could it be possible to have a policy allocating “one baht for biodiversity” or to create an awareness for tourists in contribution to the environmental conservation effort. Therefore it would be appreciated for considering this policy.
- Policy change to “repurposing subsidy” or reduction in subsidy that create a negative impact on biodiversity and water resources.
- There is a meeting of leaders from Koh Lanta in “Sustainable Island Tourism” and with joint-declaration from dwellers of 21 islands that this declaration should be included to be a part of the country’s policy reflecting the island management of Thailand as everyone has prepared costing which expects to be extended from this.
- For the monetary mechanism to be employed in the natural capital accounting project, it should be review to see what is appropriate, e.g. Tourist User Charge collection of 20 baht at Koh Tao which the law does not permit to collect more than this amount. This fund is utilised in the municipal budget and the community can obtain the fund to conserve the coral reef or trash management. Therefore financial mechanisms are recommended to drive these activities, as tourists are willing to pay to contribute to resolve the problems.

(3) Dr. Chuwit Mitchop - Deputy Director of Designated Areas for Sustainable Tourism Administration (DASTA)

Question Issues and Recommendation :

- Green GDP should be adopted vigorously by agencies at the national level as Thailand is focused mostly on the demand side, but neglected the supply side. How much of the tourism revenue of 3,000 billion baht has been spent on rehabilitation, even in the negative figures. Therefore the supply side has long been neglected and this project is hoping to be answering this supply side seriously.
- There is not much correlation between the number of tourist arrivals and revenue as the revenue was not a prominent figure despite the growth in tourism. At the same time the figures recorded in tourism were an illusion economically because several types of revenue have flowed out of Thailand.
- A challenging question is how to distribute the revenue rather than merely increasing the revenue, especially at the grassroot economy, and also the limitation in databases, as DASTA is party member of "Global Sustainable Tourism Council" as sustainable tourism has "Global Sustainable Tourism Criteria (GSTC)" which is a clear scientific measurement criteria and has problem of nature capital inventory, data access in fieldwork. If natural resources can be classified, e.g. household water consumption, an area under DASTA has limitations in identifying household water consumption from tourism sector water consumption, including the three branches of GDP, i.e. agriculture, industry, and service, although tourism is in the service sector.
- For natural capital, there are two options, i.e. first option : to be conserved only, and second option : to be capitalised. However, no matter which option to choose, there is the cost of public and private sectors, which if the cost can be reflected by the research, GDP can be expedited clearly.
- The National Tourism Board has approved for DASTA to study the capacity of Khlong Thom and connecting areas to be a sustainable travel destination according to GSTC. Moreover, DASTA is pleased to support "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes" project and shall be a user of this research.

Kick-off Meeting
Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes

"Ripples of Changes: Harnessing Natural Capital for Sustainability"

Friday 18th of August 2023 08:45 am - 01:30 pm

At Benchasiri Ballroom, 3rd Floor, Bangkok Marriott Hotel Sukhumvit

08:45-09:15 am	Registration
09:15-10:00 am	Opening Ceremony of the Meeting **addressed** by Dr. Jittinun Ruengverayudh Director of Biodiversity Management Division **Meeting Opening and Keynote Address** "The Significance of Natural Capital on Sustainable Development" by Mr. Jirawat Ratisoontorn Secretary-General - Office of Natural Resources and Environmental Policy and Planning
10:00-10:05 am	Photo - Opportunity
10:05-10:30 am	Presentation of **"Natural Capital Accounting Framework for Policy Decision-making Towards Sustainable Development"** by Associate Professor Dr. Adis Israngkura na Ayutthaya (Project Leader) Thailand Development Research Institute
10:30-10:45 am	Coffee break
10:45 am-12:05 pm	Discussion and Exchange of Opinions **"The Policy Design for Sustainable Development : Krabi Province"** by (1) Dr.Wiparat Tharatheeraparn Deputy Director-General of Tourism Department (2) Dr.Wimonpak Bumbatsaparok Kumkanya Expert in Economics Analysis of Water Basin Development Project, Office of The National Water Resources (3) Miss Sasithorn Kittithornkul Chairman of Krabi Tourism Business Association Discussion facilitated by Dr.Petch Manopawitr - Secretary-General of Green World Foundation and advisor to international environmental organisations
12:05-12:20 pm	Opinion hearing and recommendations
12:20-12:30 pm	Summary and closing of the meeting and souvenir session
12:30-13.30 pm	Lunch

Figure 1 The Kick-off Meeting "Ripples of Changes: Harnessing Natural Capital for Sustainability

Image source by the author

2.2 Participation in the 8th Global Policy Forum on Natural Capital, organized by the World Bank

The World Bank's 8th Global Policy Forum on Natural Capital was held **on 9–10 June 2026 in Bangkok, Thailand**, co-hosted with the Government of Thailand and Earth Jump 2026. The Forum convened global policymakers, finance ministers, investors, and thought leaders to advance the integration of nature into national balance sheets and macro-financial decision-making.

Natural Capital Accounting (NCA) was highlighted as a key instrument, with the World Bank urging countries such as Thailand to measure the economic value of forests, watersheds, and ecosystems, and to integrate these values into GDP and national accounts. Approximately 100 leaders from Ministries of Finance, Environment, Planning, and Statistics, together with regulators, central bankers, and private sector innovators, joined the Forum. Collectively, they represent a global community of practice committed to a shared imperative: making nature count in the decisions that shape economies, investments, and the wellbeing of people and the planet.

The Forum provided a platform for sharing knowledge, experiences, and policy perspectives on integrating natural capital into sustainable development planning. **Dr. Adis Israngura, Project Manager of Thailand's NCA** initiative, was invited as a speaker in Session 1: Country Cases (Lightning Talks) on 9 June 2026, presenting Thailand's progress in developing natural capital accounts.

Key messages and outcomes from the Forum included:

Integrating natural capital into economic systems – Governments and the private sector were encouraged to incorporate data on forests, water, and biodiversity into GDP and fiscal decision-making to promote sustainable growth.

Credibility as a foundation for scaling – Experts emphasized that financial markets for nature, such as carbon and biodiversity trading, must be built on transparent, verifiable data and sustainable financial instruments.

Thailand's context – Discussions highlighted Thailand's efforts to position natural capital as an asset driving GDP growth, alongside investment planning to address climate change challenges.

By convening diverse stakeholders and showcasing country experiences, the Forum reinforced the global momentum toward integrating natural capital into economic and financial systems, thereby supporting sustainable development and resilience.

Forum Agenda

Event | 8th Global Policy Forum on Natural Capital 2026

Scan to view the full agenda and events details

8th Global Policy Forum on Natural Capital

Day 1 | June 9 — Policy & Investment

Opening
(08:30 – 09:30)

- *Mr. Atthaphol Rerkpiboon*, Advisor to Prime Minister of Thailand, jointly with Earth Jump
- *Ms. Melinda Good*, Division Director, World Bank Group, Thailand, jointly with Earth Jump
- *Dr. Arnunchanog Sakondhavat* | Director | Office of the National Economic and Social Development Council (NESDC), Thailand
- *Dr. Valerie Hickey* | Global Director, Environment | World Bank Group
- *Mr. Roger Heath* | Deputy Director | DEFRA, United Kingdom
- *Welcome: Dr. Bekele Shiferaw* | Program Manager, GPS | World Bank
- Moderator: *Mr. Craig Meisner* | Senior Environmental Economist | World Bank

Keynote
(09:30 – 10:00)

Macro-Critical Nature: Why Natural Capital Is Now Central to Economic and Financial Stability: Economic and financial dependencies on Nature.
Dr. Nicola Ranger | Executive Director | Earth Capital Nexus | Professor LSE

From Measurement to Policy
(10:30 – 12:30)

Objective: Demonstrate how countries are translating natural capital accounts into macroeconomic policy, fiscal frameworks, and public investment decisions, and what enables successful institutional uptake for mainstreaming natural capital solutions: policies and investments

Session 1

Country Cases (Lightning Talks)

- *Dr. Adis Israngkura* Na Ayutthaya | Advisor for Resource Sustainability and Mitigation Policy | TDRI | Thailand
- *Mr. Feleke Demsis* | Lead Executive Officer | Ministry of Planning and Development | Ethiopia
- *Mr. Stanley Nkhuwa* | Principal Planner | Ministry of Finance and National Planning | Zambia
- *Mr. Kibet Reuben* Soy | GIS and Remote Sensing Expert | Directorate of Resource Surveys and Remote Sensing | Kenya

High-Level Panel

- *Moderator: Mr. Craig Meisner* | Senior Environmental Economist | World Bank
- *Dr. Nicola Ranger* | Executive Director | Earth Capital Nexus | Professor LSE
- *Ms. Claudine Uwera* | Senior Strategic Advisor | Office of the Prime Minister, Rwanda
- *Dr. Sam Mugume* | MEPD, MoFPD | Uganda | Chair, Coalition of Finance Ministers for Climate Action
- *Dr. Lisa Mandle* | Co-Executive Director, Natural Capital Alliance | Stanford University

Figure 2 Presentation on the Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes by Dr. Adis Israngkura, Thailand Development Research Institute (TDRI), 9 June 2026.

Tourism Satellite Account (TSA)

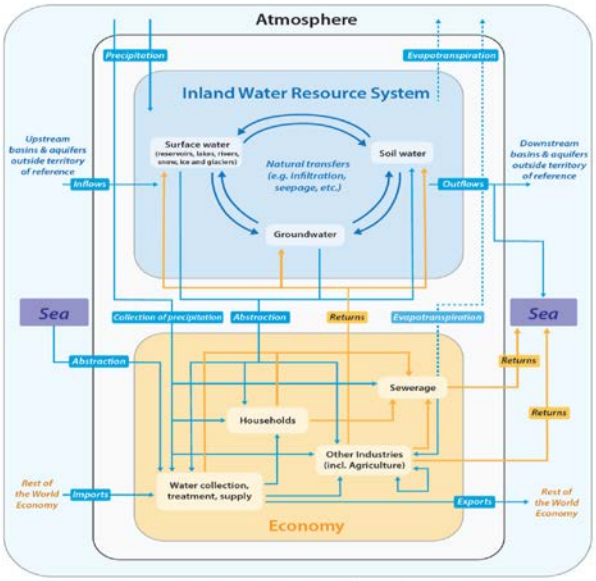
Table 1 Inbound tourism expenditure by products and classes of visitors in 2021 in Krabi

Products	2021 (Million Baht)					
	Thailand			Krabi		
A. Consumption products	Tourists	Excursionists	Visitors	Tourists	Excursionists	Visitors
				Krabi inbound ratio		1.93
A.1 Tourism characteristic products	**88,944.20**	**0.00**	**88,944.20**	**1,716.62**	**0.00**	**1,716.62**
1. Accommodation services for visitors	36,988.57	0.00	36,988.57	713.88	0.00	713.88
2. Food and beverage serving services	30,685.89	0.00	30,685.89	592.24	0.00	592.24
3. Railway passenger transport services	26.19	0.00	26.19	0.51	0.00	0.51
4. Road passenger transport services	1,210.58	0.00	1,210.58	23.36	0.00	23.36
5. Water passenger transport services	39.40	0.00	39.40	0.76	0.00	0.76
6. Air passenger transport services	9,724.46	0.00	9,724.46	187.68	0.00	187.68
7. Transport equipment rental services	386.57	0.00	386.57	7.46	0.00	7.46
8. Travel agencies and other reservation services	7.66	0.00	7.66	0.15	0.00	0.15
9. Cultural services	12.32	0.00	12.32	0.24	0.00	0.24
10. Sports and recreational services	1,039.60	0.00	1,039.60	20.06	0.00	20.06
11. Country-specific tourism characteristic goods	3,247.19	0.00	3,247.19	62.67	0.00	62.67
12. Country-specific tourism characteristic services	5,575.77	0.00	5,575.77	107.61	0.00	107.61
A.2 Other consumption products	**13,710.00**	**0.00**	**13,710.00**	**264.60**	**0.00**	**264.60**
Total	**102,654.20**	**0.00**	**102,654.20**	**1,981.23**	**0.00**	**1,981.23**

Table 2 Domestic tourism expenditure by products and classes of visitors in 2021 in Krabi

Products	2021 (Million Baht)					
	Thailand			Krabi		
A. Consumption products	Tourists	Excursionists	Visitors	Tourists	Excursionists	Visitors
				Krabi Domestic ratio		0.50
A.1 Tourism characteristic products	**143,242.13**	**21,528.45**	**164,770.58**	**722.58**	**108.60**	**831.18**
1. Accommodation services for visitors	51,037.82	0.00	51,037.82	257.46	0.00	257.46
2. Food and beverage serving services	49,095.22	12,376.44	61,471.66	247.66	62.43	310.09
3. Railway passenger transport services	97.72	9.58	107.30	0.49	0.05	0.54
4. Road passenger transport services	4,486.06	2,103.03	6,589.09	22.63	10.61	33.24
5. Water passenger transport services	48.73	1.30	50.03	0.25	0.01	0.25
6. Air passenger transport services	6,307.05	141.68	6,448.73	31.82	0.71	32.53
7. Transport equipment rental services	471.91	219.80	691.71	2.38	1.11	3.49
8. Travel agencies and other reservation services	4,720.54	0.00	4,720.54	23.81	0.00	23.81
9. Cultural services	227.02	23.24	250.26	1.15	0.12	1.26
10. Sports and recreational services	1,376.27	294.68	1,670.95	6.94	1.49	8.43
11. Country-specific tourism characteristic goods	7,259.70	2,028.53	9,288.23	36.62	10.23	46.85
12. Country-specific tourism characteristic services	18,114.09	4,330.17	22,444.26	91.38	21.84	113.22
A.2 Other consumption products	**70,323.46**	**19,065.27**	**89,388.73**	**354.74**	**96.17**	**450.92**
Total	**213,565.59**	**40,593.72**	**254,159.31**	**1,077.32**	**204.77**	**1,282.10**

Water Resources Satellite Account (WRSA)



Source: After SEEA Water (UN, 2012)

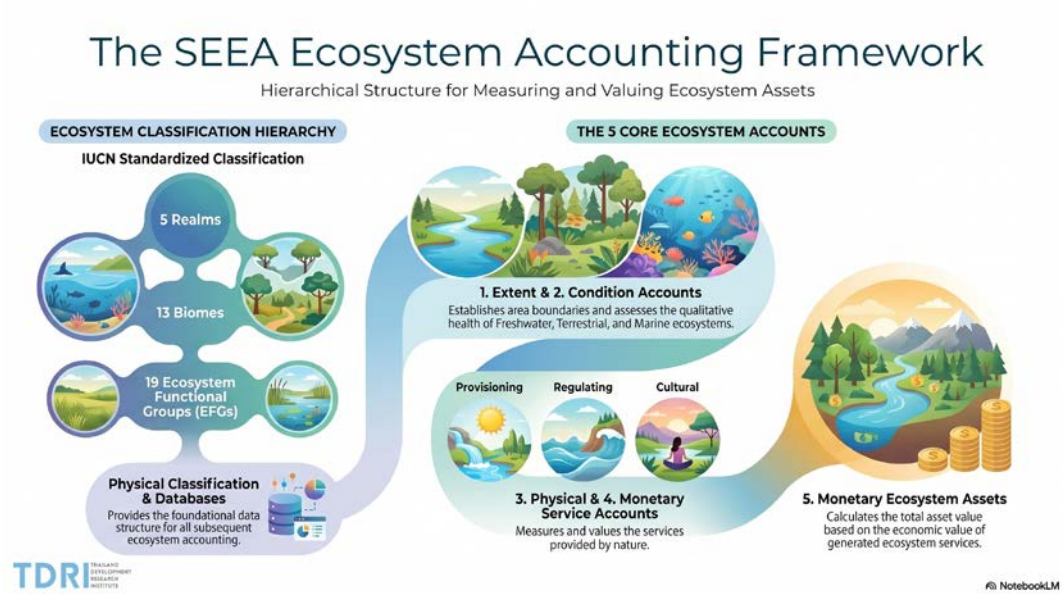
Krabi Natural Capital Account

5 Realms

13 Biomes

19 Ecosystem Functional Groups (EFGs)

Level 1 5 Realms	Level 2 13 Biomes	Level 3 19 Ecosystem Functional Groups (EFGs)
T Terrestrial	T1: Tropical-subtropical forests	T1.3 Tropical-subtropical montane rainforests
	T2: Temperate-boreal forests & woodlands	T2.2 Deciduous temperate forests
	T3: Shrubland & shrubby woodlands	T3.1 Seasonally dry tropical shrubland
	T4: Savanna and grasslands	T4.5 Temperate subhumid grassland
	T7: Intensive land-use	T7.1 Annual Cropland
		T7.3 Plantations
		T7.4 Urban and industrial ecosystem
F Freshwater	F1: River and streams	F1.1 Permanent upland streams
	F2: Lakes	F2.1, F2.2, Large and Small permanent freshwater lakes
	F3: Artificial fresh waters	F3.1 Large reservoirs
		F3.3 Rice paddies
		F3.4 Freshwater aquafarms
		F3.5 Canals, ditches and drains
M Marine	M1: Marine shelfs	M1.1 Seagrass meadows
		M1.3 Photic coral reefs
	M2: Pelagic ocean waters	M2 Pelagic ocean water (Unable to categorize M2.1 -M2.5)
	M4: Anthropogenic marine systems	M4.1 Submerged artificial structures
MFT Marine-Freshwater-Terrestrial	MFT1: Brackish tidal	MFT1.2 Intertidal forests and shrublands
MT Marine-Terrestrial	MT1: Shoreline systems	MT1.3 Sandy shorelines



TDRI

Ecosystem Extent Account

Realms	Terrestrial							Freshwater						Marine				Marine-Freshwater-Terrestrial	Marine-Terrestrial	
Biomes	T1. Tropical-subtropical forests	T2. Temperate-boreal forests and woodlands	T3. Shrubland	T4. Grassland	T7. Intensive land use			F1. River and streams	F2. Lake biome	F3. Artificial wetlands biome				M1. Marine shelf		M2. Pelagic ocean water	M4. Anthropogenic marine biome	MF1. Marine-freshwater-Terrestrial	M1. Marine-Terrestrial	
Ecosystem Functional Group (EFG)	T1.3 Tropical-subtropical montane rainforests	T2.2 Deciduous temperate forests	T3.1 Seasonally dry tropical shrubland	T4.5 Temperate subhumid grassland	T7.1 Annual Cropland	T7.3 Plantations	T7.4 Urban and industrial ecosystem	F1.1 permanent upland stream	F2.1, F2.2, Small and large freshwater lakes	F3.1 Large Reservoir	F3.2 Rice paddies	F3.4 Fresh water aquaform	F3.5 Canals/ Ditches, Drains	M1.1 Seagrass meadows	M1.3 Photic coral reefs	M2 Pelagic ocean water (Usable to categories M2.1 M2.5)	M4.1 Submerged artificial structures	MF11.2 Intertidal forests and shrublands	M11.3 Sandy shorelines	Total Ecosystem Accounting Area
Opening extent [2016]	63,487.50	11.75	2,689.75	1,392.00	908.75	351,152.75	19,148.75	7,558.50	156.50	984.75	1,310.00	4,395.50	556.75	5,686.50	2,269.00	457,861.00	1,822.75	39,832.50	845.00	960,768.00
Additions to extent	668.50	0.00	700.50	483.25	346.00	2,610.50	4,787.50	34.75	10.50	117.00	6.50	102.75	568.25	0.00	0.00	53.50	0.00	440.50	12.00	10,902.00
Reductions to extent	1,563.25	11.75	400.00	188.75	311.75	6,325.00	920.50	40.50	7.00	19.25	307.00	335.25	14.75	0.00	0.00	0.00	0.00	452.00	16.25	10,902.00
Net change in stock	[894.75]	[11.75]	291.50	296.50	34.25	[3,714.50]	3,867.00	[5.75]	3.50	97.75	[300.50]	[232.50]	553.50	0.00	0.00	53.50	0.00	[11.50]	[4.25]	0.00
Closing extent [2020]	62,592.75	0.00	2,981.25	1,686.50	963.00	347,438.25	23,015.75	7,562.75	160.00	1,082.50	1,009.50	4,163.00	1,090.25	5,686.50	2,269.00	457,914.50	1,822.75	39,821.00	860.75	960,768.00
Retained stock	61,944.25	0.00	2,980.75	1,203.25	597.00	344,837.75	18,228.25	7,518.00	149.50	965.50	1,003.00	4,060.25	542.00	5,686.50	2,269.00	457,861.00	1,822.75	39,380.50	828.75	959,866.00

TDRI

Ecosystem Condition Account - Freshwater

SEEA Ecosystem Condition Typology Class		Variables		Freshwater (F)											
				Variable values (observed)		Reference level values		Indicator values (rescale)			Indicator weight	Index Values			
		Descriptor	Measurement unit	Opening 2016	Closing 2020	Lower level	Upper level	Opening	Closing	Change in indicator		Opening	Closing	Change	
Abiotic characteristics	A1.Physical state	Data Not available													
	A2. Chemical state	WQI at Saphan Tha Nam Station	index [0-100]	62.0	73.2	0	100	0.62	0.73	0.11	0.20	0.12	0.15	0.02	
		WQI at Khlong Yai Station	index [0-100]	58.0	77.1	0	100	0.58	0.77	0.19	0.20	0.10	0.15	0.06	
	Total abiotic							0.60	0.75	0.30	0.40	0.22	0.30	0.08	
Biotic characteristics	B1.Compositional state	Fish species richness[1]		54.00	54.00	0	176	0.31	0.31	0.00	0.20	0.06	0.06	0.00	
	B2.Structural state	Data Not available													
	B3.Functional state	BOD at Saphan Tha Nam Station	[mg/l] rescaled 4.0 =0%, 1.5=100%	80	140	0.00	100.00	0.8	1.40	0.60	0.20	0.16	0.28	0.12	
		BOD at Khlong Yai Station	[mg/l] rescaled 4.0 =0%, 1.5=100%	80	108	0.00	100.00	0.8	1.08	0.28	0.20	0.16	0.22	0.06	
	Total biotic							0.64	0.93	0.88	0.60	0.38	0.56	0.18	
Landscape/waterscape characteristics	C1.Landscape/waterscape	Data Not available													
	Total landscape/waterscape	Data Not available													
Total											1.00	0.60	0.86	0.26	

Ecosystem Condition Account - Terrestrial

SEEA Ecosystem Condition Typology Class		Variables		Terrestrial [T]									
				Variable values (observed)		Reference level values		Indicator values (rescale)			Indicator weight	Index Values		
		Descriptor	Measurement unit	Opening 2559	Closing 2563	Lower level	Upper level	Opening	Closing	Change in indicator		Opening	Closing	Change
Abiotic characteristics	A1.Physical state	Normalized Difference Water Index (NDWI)	index (-1 to 1)	-0.31	-0.35	-1	1	0.35	0.33	-0.02	0.13	0.04	0.04	0.00
	A2. Chemical state	Soil organic carbon content (2021)	index (0 to 8)	4.66	4.66	0	8	0.58	0.58	0.00	0.13	0.07	0.07	0.00
	Total abiotic							0.46	0.45	-0.02	0.25	0.12	0.11	0.00
Biotic characteristics	B1.Compositional state	Tree species richness[1]	Number	423	423	0	100	4.23	4.23	0.00	0.13	0.53	0.53	0.00
		Bird species richness[2]	Number	348	348	0	1083	0.32	0.32	0.00	0.13	0.04	0.04	0.00
	B2.Structural state	Forest cover density[3]	%	6.34	6.34	0	100	0.06	0.06	0.00	0.13	0.01	0.01	0.00
		Crop diversity[4]	Number	10	10	0	27	0.37	0.37	0.00	0.13	0.05	0.05	0.00
	B3.Functional state	Normalized Difference Vegetation Index (NDVI)	index (-1 to 1)	0.36	0.40	-1	1	0.68	0.70	0.02	0.13	0.09	0.09	0.00
	Total biotic							0.95	0.95	0.02	0.63	0.71	0.71	0.00
Landscape/ waterscape characteristics	C1.Landscape/waterscape	Forest area density	%	0.127	0.126	0	100	0.00	0.00	0.00	0.13	0.00	0.00	0.00
	Total landscape/waterscape							0.00	0.00	0.00	0.13	0.00	0.00	0.00
Total											1.00	0.82	0.82	0.00

Ecosystem Condition Account - Marine

SEEA Ecosystem Condition Typology Class		Variables		Marine [M] + [MFT] + [MT]										
				Variable values (observed)		Reference level values		Indicator values (rescale)			Indicator weight	Index Values		
		Descriptor	Measurement unit	Opening 2559	Closing 2563	Lower level	Upper level	Opening	Closing	Change in indicator		Opening	Closing	Change
Abiotic characteristics	A1.Physical state (Transparency)	Nappharat Thara Beach	Meter	0.55	0.40	0.35	0.44	2.38	0.50	-1.88	0.02	0.04	0.01	-0.03
		Ao Nang	Meter	0.55	0.50	0.45	0.55	2.00	0.50	-1.50	0.02	0.04	0.01	-0.03
		Maya Bay	Meter	1.10	1.20	1.10	4.00	0.00	0.24	0.24	0.02	0.00	0.00	0.00
		Railay Bay	Meter	0.90	0.80	0.20	0.90	1.00	0.83	-0.17	0.02	0.02	0.01	0.00
	A2. Chemical state (MWQI)	Nappharat Thara Beach	index (0-100)	82.30	81.67	0	100	0.82	0.82	-0.01	0.02	0.01	0.01	0.00
		Ao Nang	index (0-100)	60.40	63.63	0	100	0.60	0.64	0.23	0.02	0.01	0.01	0.00
		Maya Bay	index (0-100)	83.46	87.79	0	100	0.83	0.88	0.04	0.02	0.01	0.02	0.00
		Railay Bay	index (0-100)	88.41	85.15	0	100	0.88	0.85	-0.03	0.02	0.02	0.02	0.00
	Total abiotic										0.86	0.37	0.20	-0.17
Biotic characteristics	B1.Compositional state	Fish species richness	no.	57.00	57.00	0	631	0.09	0.09	0.00	0.02	0.00	0.00	0.00
		Coral species richness (2021)	no.	38.00	38.00	0	55	0.69	0.69	0.00	0.02	0.01	0.01	0.00
		Bird species richness	no.	222.00	222.00	0	1083	0.20	0.20	0.00	0.02	0.00	0.00	0.00
	B2.Structural state	coral cover: healthy coral reefs	%	0.95	25.57	0	100	0.01	0.27	0.25	0.02	0.00	0.00	0.00
		coral cover: moderate health coral reefs	%	13.30	40.53	0	100	0.13	0.41	0.27	0.02	0.00	0.01	0.00
		coral cover: damaged coral reefs	%	85.75	32.81	0	100	0.86	0.33	-0.53	0.02	0.02	0.01	-0.01
	B3.Functional state	Data Not available												
	Total biotic										0.11	0.04	0.04	0.00
Landscape/seascape characteristics	C1.Landscape/waterscape	Seagrass meadow cover	%	38.00	38.00	0	100	0.38	0.38	0.00	0.02	0.01	0.01	0.00
		Mangrove cover (2014 and 2022)	%	66.23	70.15	0	100	0.66	0.70	0.04	0.02	0.01	0.01	0.00
	Total landscape/waterscape										0.04	0.02	0.02	0.00
Total											1.00	0.43	0.26	-0.17

Ecosystem Service Account - Physical Supply

Supply			Freshwater [F]					Terrestrial [T]					Marine [M] + [MFT] + [MT]				
			2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Provisioning Services																	
Biomass	Crops (ha)		1,310.00	1,234.88	1,159.75	1,084.63	1,009.50	351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	Not Applicable				
	Wood (ha)		Not Applicable					351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	39,832.50	39,829.63	39,826.75	39,823.88	39,821.00
	Wild fish and other natural aquatic biomass (ha)		9,256.50	9,413.75	9,571.00	9,728.25	9,885.50	Not Applicable					457,861.00	457,874.38	457,887.75	457,901.13	457,914.50
	Aquaculture (ha)		4,295.50	4,337.38	4,379.25	4,221.13	4,163.00	Not Applicable					457,861.00	457,874.38	457,887.75	457,901.13	457,914.50
	Biomass-based energy (ha)		Not Applicable					3.00	3.00	3.00	3.00	3.00	Not Applicable				
Water supply	Surface Water	Natural (MCM)	46.40	51.90	41.40	35.01	32.26	Not Applicable					Not Applicable				
		Reservoir (MCM)	18,328.00	13,637.00	10,426.50	8,325.50	7,879.00	Not Applicable					Not Applicable				
	Groundwater (MCM)		5,706.52	5,518.09	6,593.00	4,899.85	4,862.70	Not Applicable					Not Applicable				
Regulating and maintenance Services																	
Carbon sink	Wood (tCO2eq/ha)		Not Applicable					382.63	382.63	382.63	382.63	382.63	Not Applicable				
	Seagrass (tCO2eq/ha)		Not Applicable					Not Applicable					330.00	330.00	330.00	330.00	330.00
	Mangrove (tCO2eq/ha)		Not Applicable					Not Applicable					93.75	93.75	93.75	93.75	93.75
Flood control/Water flow regulation (ha)			Not Applicable					351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	Not Applicable				
Water purification/Water quality regulation (ha)			9,581.75	9,639.44	9,697.13	9,754.81	9,812.5	351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	39,832.50	39,829.63	39,826.75	39,823.88	39,821.00
Nursery and protective habitats /Provisioning of habitat (ha)			9,581.75	9,639.44	9,697.13	9,754.81	9,812.5	351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	39,832.50	39,829.63	39,826.75	39,823.88	39,821.00
Cultural Services																	
Seaview (Rooms)			Not Applicable										18,904	21,447	21,853	22,405	22,405
Water, Shore, and Island recreation (place)													154	154	154	154	154
Coral and Scuba diving (ha)													2,249	2,249	2,249	2,249	2,249
Migratory bird watching (ha)													21,299	21,299	21,299	21,299	21,299

Ecosystem Service Account – Physical Use

Use			Freshwater [F]					Terrestrial [T]					Marine [M] + [MFT] + [MT]				
			2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Provisioning Services																	
Biomass	Crops	Rice [Tons]	1,729.00	1,309.00	1,403.00	2,517.00	2,626.00	Not Applicable					Not Applicable				
		Para Rubber [Tons]	Not Applicable					145,290	146,893	153,989	145,420.00	133,651	Not Applicable				
		Oil palm [Tons]	Not Applicable					2,675,684	3,349,672	3,383,122	3,504,487	3,345,467	Not Applicable				
	Wood	Acacia Species [Tons]	Not Applicable					0.00	0.00	6,129.85	6,129.85	0.00	Not Applicable				
		Mangrove [Tons]	Not Applicable					Not Applicable					3.96	3.96	3.99	4.01	4.02
	Wild fish and other natural aquatic biomass [Tons]		98.87	171.05	356.50	111.33	280.96	Not Applicable					10,431.00	10,396.00	8,952.00	12,261.00	27,731.41
	Aquaculture [Tons]		288.78	389.00	569.00	358.00	332.00	Not Applicable					13,286.39	13,203.83	14,078.37	15,039.26	14,632.17
	Biomass-based energy [kW per year]		Not Applicable					183,960.00	183,960.00	183,960.00	183,960.00	183,960.00	Not Applicable				
Water use	Service sector [MCM]		6.38	7.94	9.43	10.84	15.36	Not Applicable					Not Applicable				
	Accommodation [MCM]		4.05	5.08	6.85	8.08	4.12	Not Applicable					Not Applicable				
	Household [MCM]		12.02	12.05	11.47	11.41	11.68	Not Applicable					Not Applicable				
	Wastewater Management [MCM]		1.11	1.25	1.29	1.34	1.42	Not Applicable					Not Applicable				
	Other Industries [MCM]		2.78	2.99	3.13	3.53	3.97	Not Applicable					Not Applicable				
	Agriculture [MCM]		4,377.57	4,227.61	4,080.96	13,541.98	5,085.76	Not Applicable					Not Applicable				
	Recirculation from Environment [MCM]		3,554.00	3,445.59	3,329.08	10,890.08	4,126.69	Not Applicable					Not Applicable				
Regulating and maintenance Services																	
Carbon sink	Wood [Million tC02eq]		Not Applicable					25.25	25.19	25.13	25.07	25.01	Not Applicable				
	Seagrass [Million tC02eq]		Not Applicable					Not Applicable					1.78	1.78	1.78	1.78	1.78
	Mangrove [Million tC02eq]		Not Applicable					Not Applicable					3.73	3.73	3.73	3.73	3.73
Flood control/Water flow regulation [ha]			Not Applicable					19,148.75	20,115.50	21,082.25	22,049.00	23,015.75	Not Applicable				
Water purification /Water quality regulation [MCM]			4.05	4.08	4.11	4.14	4.15	4.05	4.08	4.11	4.14	4.15	4.05	4.08	4.11	4.14	4.15
Nursery and protective habitats /Provisioning of habitat [ha]			9,256.50	9,413.75	9,571.00	9,728.25	9,885.50	351,152.75	350,224.13	349,295.50	348,366.88	347,438.25	39,832.50	39,829.63	39,826.75	39,823.88	39,821.00
Cultural Services																	
Seaview [Rooms]			Not Applicable										12,365	14,601	15,114	15,356	6,091
Water, Shore, and Island recreation [person]													2,110,691	2,337,254	1,749,344	1,268,732	600,758
Coral and Scuba diving [place]													28	28	28	28	28
Migratory bird watching [species]													27	27	27	27	27

Ecosystem Service Account – Monetary Supply

Supply			Freshwater [F]					Terrestrial [T]					Marine [M] + [MFT] + [MT]				
			2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Provisioning Services																	
Biomass	Crops	Rice [THB per Ton]	8,795.00	11,433.00	15,199.00	14,257.00	10,916.00	Not Applicable					Not Applicable				
		Rubber [THB per Ton]	Not Applicable					50,750	54,649	49,170	48,948	47,560	Not Applicable				
		Oil palm [THB per Ton]	Not Applicable					5,500	4,870	3,100	2,710	4,470	Not Applicable				
	Wood	Acacia Species [THB per Ton]	Not Applicable					0.00	0.00	850.00	850.00	0.00	Not Applicable				
		Mangrove [THB per ha]	Not Applicable					Not Applicable					4,941.40	4,969.07	5,006.28	5,030.64	5,065.03
	Wild fish and other natural aquatic biomass [THB per Ton]		85,674.83	85,049.99	87,317.45	78,262.73	97,758.61	Not Applicable					43,459.30	32,865.91	45,065.68	35,674.27	54,246.71
	Aquaculture [THB per Ton]		55,486.18	49,197.41	76,295.08	64,712.29	59,882.53	Not Applicable					175,700.70	192,568.11	178,233.96	171,508.37	176,257.43
	Biomass-based energy [THB per kW]		Not Applicable					4.89	4.87	4.92	4.95	4.73	Not Applicable				
Water supply	Surface water	Natural [Million THB]	69.13	77.32	61.68	52.16	48.07	Not Applicable					Not Applicable				
		Reservoir [Million THB]	27,308.72	20,319.13	15,535.49	12,685.00	10,547.71	Not Applicable					Not Applicable				
	Groundwater [Million THB]		8,699.70	8,221.95	9,822.56	7,261.17	7,265.42	Not Applicable					Not Applicable				
Regulating and maintenance Services																	
Carbon sink	Wood [THB per ton]		Not Applicable					200.00	200.00	200.00	200.00	200.00	Not Applicable				
	Seagrass [THB per ton]		Not Applicable					Not Applicable					200.00	200.00	200.00	200.00	200.00
	Mangrove [THB per ha]		Not Applicable					Not Applicable					200.00	200.00	200.00	200.00	200.00
Flood control/Water flow regulation [THB per ha]			Not Applicable					347.39	3,321.89	1,159.51	23.18	744.92	Not Applicable				
Water purification /Water quality regulation [THB per m^3]			15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Nursery and protective habitats /Provisioning of habitat [THB per ha]			Not Available					Not Available					10,158.14	10,215.01	10,287.48	10,241.17	10,391.16
Cultural Services																	
Seaview [THB per Room]			Not Available										10,698.60	10,758.50	10,834.74	10,891.38	10,922.96
Water, Shore, and Island recreation	6 Islands [THB]												792.62	797.06	802.76	806.93	809.24
	Hong Islands [THB]												1,004.42	1,010.05	1,017.20	1,022.52	1,025.49
	Phi Phi Islands [THB]												1,187.99	1,194.64	1,203.10	1,209.39	1,212.90
	Rok Islands [THB]												1,991.90	2,003.05	2,017.25	2,027.79	2,033.67
Coral and Scuba diving [Million THB]													4.41	5.02	5.72	6.52	7.42
Migratory bird watching [THB/person/visit]													4,327.39	4,351.62	4,382.66	4,405.37	4,418.16

Ecosystem Service Account – Monetary Use

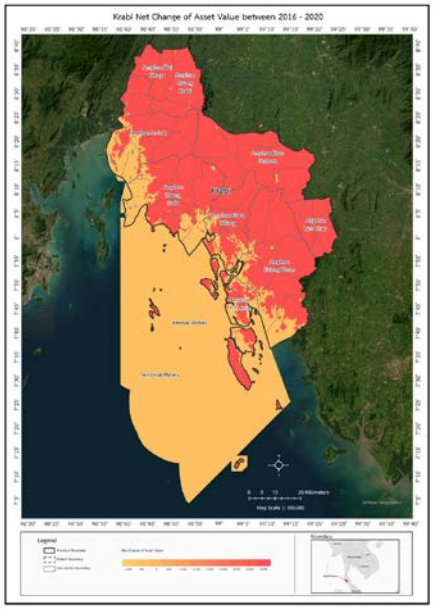
Use			Freshwater [F]					Terrestrial [T]					Marine [M] + [MFT] + [MT]				
			2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Provisioning Services																	
Biomass	Crops	Rice [Million THB]	15.207	14.966	21.324	35.885	28.665	Not Applicable					Not Applicable				
		Para Rubber [Million THB]	Not Applicable					7,373.47	8,026.23	6,185.38	5,956.40	6,356.44	Not Applicable				
		Oil palm [Million THB]	Not Applicable					14,716.26	13,633.17	10,487.68	9,497.16	14,954.24	Not Applicable				
	Wood [Rai]	Acacia Species [Million THB]	Not Applicable					0.00	0.00	5.21	5.21	0.00	Not Applicable				
		Mangrove [Million THB]	Not Applicable					Not Applicable					196.83	197.92	199.30	200.33	200.90
	Wild fish and other natural aquatic biomass [Million THB]		8.47	14.55	31.06	8.71	19.65	Not Applicable					453.32	341.67	403.43	436.69	1,504.34
	Aquaculture [Million THB]		16.02	15.20	40.79	23.17	19.88	Not Applicable					2,334.43	2,542.64	2,509.24	2,579.36	2,580.49
	Biomass-based energy [Million THB]		Not Applicable					0.90	0.90	0.89	0.91	0.87	Not Applicable				
Water use	Service sector [Million THB]		132.66	165.12	196.05	225.49	319.51	Not Applicable					Not Applicable				
	Accommodation [Million THB]		108.59	136.22	183.69	216.83	110.56	Not Applicable					Not Applicable				
	Household [Million THB]		199.51	200.01	190.36	189.36	190.61	Not Applicable					Not Applicable				
	Wastewater Management [Million THB]		16.71	18.79	19.29	20.17	21.24	Not Applicable					Not Applicable				
	Other Industries [Million THB]		74.61	80.30	83.88	94.68	106.59	Not Applicable					Not Applicable				
	Agriculture [Million THB]		2,188.79	2,113.81	2,040.47	6,770.99	2,542.88	Not Applicable					Not Applicable				
	Recirculation from Environment [Million THB]		1,777.00	1,722.80	1,664.54	5,445.04	2,063.34	Not Applicable					Not Applicable				
Regulating and maintenance Services																	
Carbon sink	Wood [Million THB]		Not Applicable					5,049.92	5,038.15	5,026.39	5,014.62	5,002.86	Not Applicable				
	Seagrass [Million THB]		Not Applicable					Not Applicable					356.70	356.70	356.70	356.70	356.70
	Mangrove [Million THB]		Not Applicable					Not Applicable					746.86	746.81	746.75	746.70	746.64
Flood control/Water flow regulation [Million THB]			Not Applicable					6.65	66.82	24.45	0.51	17.14	Not Applicable				
Water purification /Water quality regulation [Million THB]			60.70	61.20	61.71	62.10	62.24	60.70	61.20	61.71	62.10	62.24	60.70	61.20	61.71	62.10	62.24
Nursery and protective habitats /Provisioning of habitat [Million THB]			Not Available					Not Available					404.62	404.60	404.57	404.54	404.51
Cultural Services																	
Seaview [Million THB]			Not Applicable										58.60	69.20	71.63	72.78	19.39
Water, Shore, and Island recreation [Million THB]													709.48	769.45	583.95	418.87	200.01
Coral and Scuba diving [Million THB]													123.51	140.67	160.22	182.48	207.83
Migratory bird watching [Million THB]													5.19	5.22	5.26	5.28	5.30

Ecosystem Monetary Asset Account

	Freshwater (F)	Terrestrial (T)	Marine (M+MFT+MT)	Total
Opening value (2016) (MB)	4,503.80	26,649.03	5,287.58	36,440.41
Ecosystem enhancement	8,674.36	5,301.93	772.65	14,748.93
Ecosystem degradation	(8,196.02)	(8,901.86)	(452.66)	(17,550.54)
Ecosystem conversions				
Additions	371.66	564.56	5.88	942.10
Reductions	(328.13)	(572.45)	(5.45)	(906.02)
Net change in value	521.86	(3,607.82)	320.43	(2,765.53)
Closing value (2020) (MB)	5,025.66	23,041.21	5,608.01	33,674.89

Krabi Asset Value Map as of 2020

Krabi Net change of Asset Value between 2016 - 2020



INTEGRATION OF NATURAL CAPITAL ACCOUNTS INTO LOCAL DEVELOPMENT PLANNING AND OPERATIONS

Meeting with the Budget Bureau (BB) on April 29, 2026, regarding the Medium-Term Budget Framework (MTEF).

Meeting with the National Economic and Social Development Council (NESDC) on May 5, 2026, regarding the 14th National Development Plan.

Meeting with the Office of the Permanent Secretary, Ministry of Tourism and Sports on May 8, 2026, regarding the tourism development plan.

Meeting with the Office of the National Water Resources (ONWR) on May 19, 2026, regarding the water resources development plan.

Joint Public and Private Sector Committee for Economic Problem Solving (JPPCC) in Krabi Province on May 26, 2026

Conserve, mitigate impacts and restore degraded habitats in watershed forests and coastal marine ecosystems (total area of 40,000 ha in Krabi province)

Restoration of targeted mangroves, estuarine swamps, and coastal ecosystems, and management of marine debris

knowledge signs (Krabi Urban Forest)

Ecological Adaptation to a New Equilibrium of Seagrass Bed (Koh Sriboya – Had ChaoAud)

Restoration/conservation of targeted coral reefs

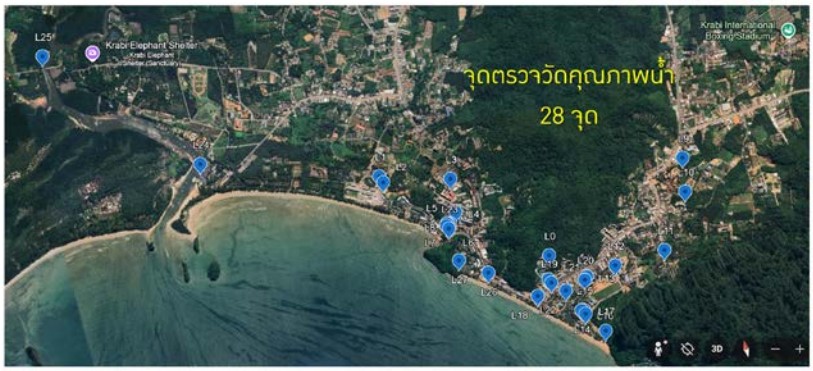
Coral Restoration through the Green Fins Network (Phi Phi Island)

Monitoring and Evaluation of the Shallow Reef Recovery (Had Phra Nang)

Wastewater in the Khlong Ying Suea and Khlong Chak areas, Ao Nang Subdistrict, Krabi Province.

TDRI THAILAND DEVELOPMENT RESEARCH INSTITUTE

A field survey was conducted at 28 wastewater sampling points to assess water quality and identify the primary sources of wastewater in Khlong Ying Suea and Khlong Chak, Ao Nang Subdistrict, Krabi Province.



TDRI THAILAND DEVELOPMENT RESEARCH INSTITUTE

BOD results at 28 wastewater sampling points in Khlong Ying Suea and Khlong Chak, Ao Nang Subdistrict, Krabi Province.

The standard BOD (Biochemical Oxygen Demand) levels in surface water sources in Thailand are categorized according to usage type.
The general standard is set at a maximum of 1.5-4.0 milligrams per liter (mg/L).

Point	Detail	BOD (mg/L)
L0	Kaem Ling pond (Tipa Hotel)	66
L1	Drainage (behind Landmark night market)	6
L10	Y-junction next to Centara Phu Pano Hotel	33
L11	Front of Sainai Hotel	84
L12	The canal opposite Seaseeker Hotel	96
L13	Drainage (behind of Bluesotel Hotel)	102
L14	Under Centara Aonang Hotel	138
L15	Drainage (Next to Centera Aonang Hotel)	105
L16	Next to the toliet (Aonang 15)	147
L17	Drainage Discharge	42
L18	Drainage on Phra Nang Curve	174
L19	Wastewater treatment tank (Police station)	93
L2	Sink (behind Landmark night market)	42
L20	Front of Peach laguna Hotel	102
L21	Front of Aonange Villa	36
L22	Y-junction in Aonang Villa	66
L23	Klong Yink Suea pier	33
L24	Nopparat Thara pier	60
L25	Klong Son	33
L26	Drainage on Reeve	48
L27	Wastewater treatment pond (Krabi Resort)	51
L3	Front of Deevana Hotel	57
L4	Front of Spa	33
L5	Center of Klong Yink Suea	48
L6	Drainage on pavilion side	78
L7	Drainage on 7-11 side	93
L8	Drainage on Wangsai side	57
L9	The canal behind the laundry factory	69

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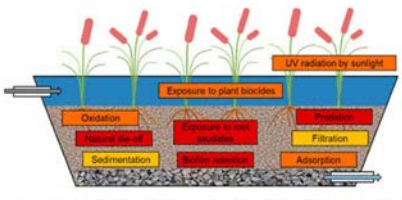
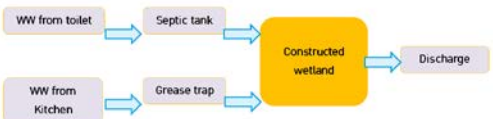
Small scale wastewater treatment

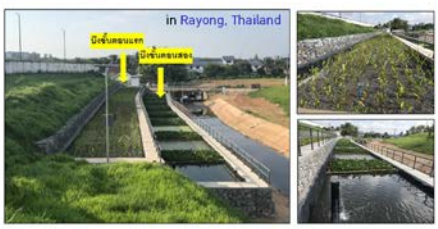
For homestay community: Constructed wetland (natural wastewater treatment)

- Use for household community.
- Advantage:
  - Low construction costs. Simple for maintenance with low operational costs.
  - It can reduce organic matter, suspended solids, and nutrients by about 70%.
- Disadvantages:
  - Cannot handle wastewater with high BOD levels.
  - Require a large area → suitable for areas with low land costs.



Source: Wang, M., Zhu, J., & Mao, K. (2021). Removal of Pathogens in Onsite Wastewater Treatment Systems: A Review of Design Considerations and Influencing Factors. Water, 13(9), 1190.





Source: https://envi101.co.th/featured_item/ระบบบำบัดน้ำเสียแบบบึง/

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Payment for Ecosystem Services

"Jib Jib"
Youth Development
Program for
Conservation-Base
Birdwatching Guides

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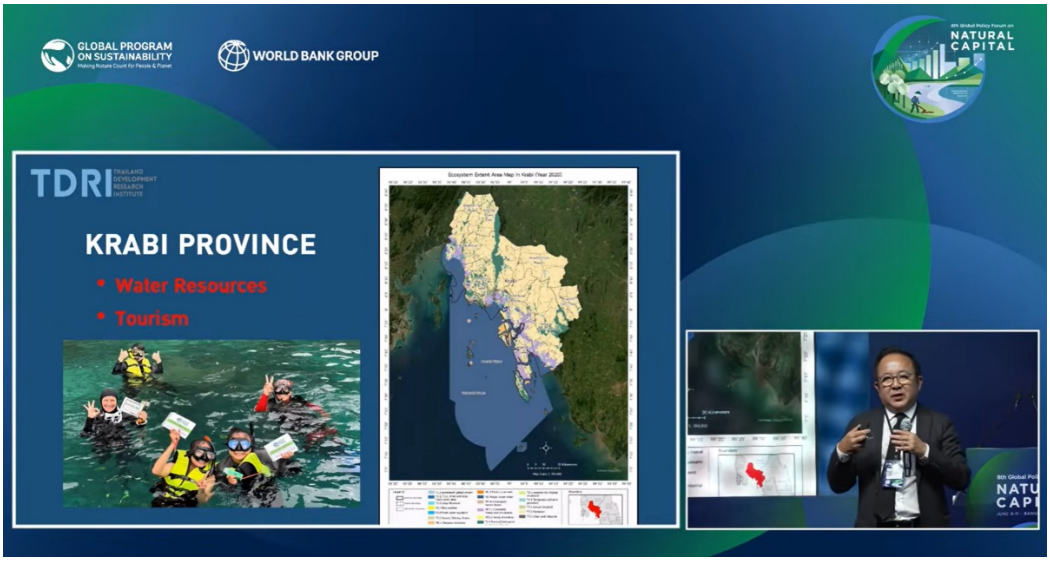
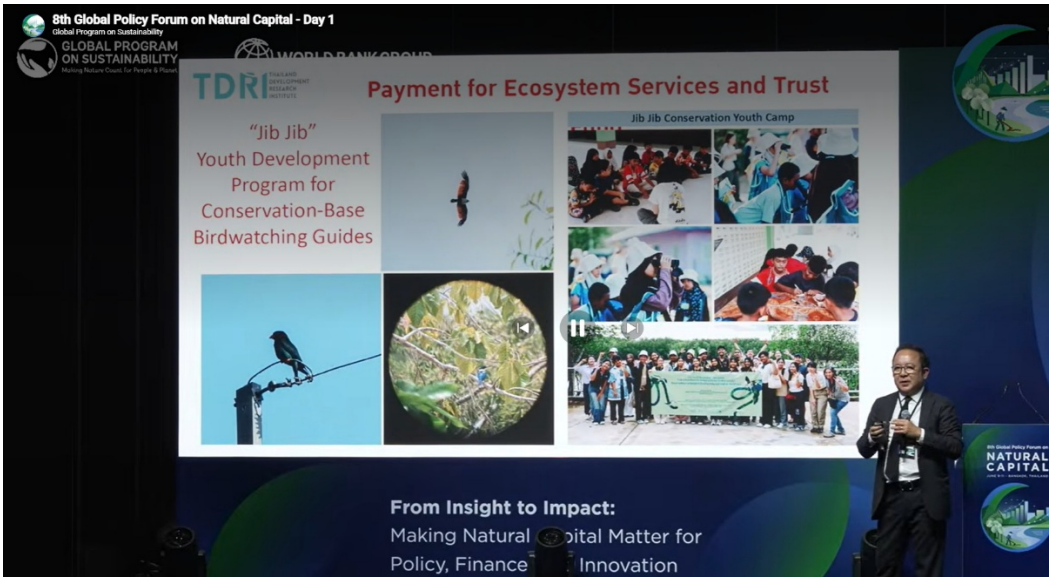
Figure 3 The 8th Global Policy Forum on Natural Capital, organized by the World Bank, Bangkok Thailand (9 June 2029)





3. Provincial-level Meetings (Krabi Province)

3.1 Developing Maritime Zone Map in Krabi Meeting

Date: 16 July 2024, 14.00 – 16.00

Location: the 6th floor, Geo-Informatics and Space Technology Development Agency (Public Organization) – GISTDA, The Government Complex Commemorating Chaengwattana, Bangkok

Attendees: 7 people

Naval War College

1. Capt. Asst. Prof. Saman Dairairam — Sattahip Naval Base Thai Maritime Enforcement Command Center (MECC)

Geo-Informatics and Space Technology Development Agency (Public Organization) – GISTDA

2. Mr. Chakris Phitakrattanasakul — Innovation Specialist
3. Miss Pimnipa Thanupranom — Geoinformatics specialist

Thailand Development Research Institute (TDRI)

4. Ms. Thippawan Keawmesri — Senior Researcher
5. Ms. Prinyarat Leangcharoen — Senior Researcher
6. Ms. Kanjana Yasen — Researcher
7. Ms. Panida Phranphanat — Researcher

Main discussion

Currently, Thailand does not have a map showing the maritime boundaries of its coastal provinces for management purposes. The existing boundaries of responsibility are limited to the delineation of provincial boundaries in the Gulf of Thailand from 1959. For coastal provinces outside the Gulf of Thailand, there is no delineation of maritime boundaries between them. Therefore, the project “Development of a Maritime Boundary Map between Coastal Provinces of Thailand” was implemented by the Office of the Permanent Secretary for Defense in collaboration with Thailand Science Research and Innovation (TSRI) in 2019. This project serves as a central tool for all sectors to manage the Thai seas jointly and to support marine spatial planning for Thailand.

The maritime zone division between the coastal provinces of Thailand is defined as follows: 1) Internal waters are the maritime areas behind the baseline of the territorial sea, extending toward the land. 2) The territorial sea is the maritime area under Thailand's sovereignty, with a width of 12 nautical miles. Thai sovereignty extends to the air space above the territorial sea, as well as the land, seabed, and subsoil beneath it. 3) The contiguous zone is the maritime area extending from the territorial sea, measured from the baseline used for the territorial sea, up to 24 nautical miles. Thus, the contiguous zone is a 12-nautical-mile-wide area adjacent to the territorial sea. 4) The exclusive economic zone (EEZ) is the maritime area extending from the territorial sea, measured from the baseline used for the territorial sea, up to 200 nautical miles.

The steps for dividing marine zones between the coastal provinces of Thailand are as follows: 1. Determine the length of the coastline of each pair of provinces by using the endpoints of the land boundary to measure the coastline of each province. 2. Establish the general direction of the coastline by creating a straight line connecting the endpoints of the land boundary between the provinces. 3. Determine the direction of the coastline (Coastal Front) by projecting the general direction of the coastline out to sea. The result is the overlapping marine areas between the provinces, marked in green. 4. Divide the marine responsibility areas between the provinces using the ratio method.

Coastal coordinates: The starting coordinates for drawing the provincial boundary line from the coast out to sea will be the sub-district at the last point connected to the sea that appears on the inter-provincial boundary line. This point will be considered the starting point for determining the provincial boundary line by sea, based on announcements from the Ministry of Interior (regarding sub-district areas) and the Ministry of Agriculture and Cooperatives (concerning the responsibilities of the Provincial Fisheries Committee in the coastal sea area).

The land coordinates used as the starting point for the Phang Nga-Krabi boundary, according to the announcement of the Ministry of Interior, are as follows: Thap Put District, Phang Nga Province, Marui Sub-district adjacent to Laem Sak Sub-district, Ao Luek District, Krabi Province; east of Khao Pun Nuea Island at coordinates MK633267; Laem Sak Sub-district adjacent to Malui Sub-district, Thap Put District, Phang Nga Province; and in front of Laem Yong Pisang at coordinates MK575130.

The land coordinates used as the starting point for the Krabi-Trang boundary, according to the announcement of the Ministry of Interior, are as follows: Khlong Thom District, Krabi Province; Sai Khao Sub-district adjacent to Khao Mai Kaew Sub-district, Sikao District, Trang Province; Ban Laem Sai area at coordinates NJ288464; Sikao District, Trang Province; Khao Mai Kaew Sub-district adjacent to Sai Khao Sub-district, Khlong Thom District, Krabi Province; and the Phraek Pak Khlong Kalase Noi area at coordinates NJ287462.

Figure 4 Developing Maritime Zone Map in Krabi Meeting

Image source by author

3.2 One-on-one meeting to consult and discuss on "Sustainable conservation of natural resources and economic development of Krabi Province"

Date: **23 July 2025, 14.00 – 16.00**

Location: **Krabi Provincial Hall, Krabi Province**

Attendees

Krabi Provincial Office

1.	Mr. Anuwat Modping	Deputy Governor of Krabi Province

Provincial Office of Natural Resources and Environment Krabi

2.	Mr.Surachai Kulthong	Director of Environmental Division
3.	Ms Kanokporn Phokaanon	Environmentalist

Office of Natural Resources and Environmental Policy and Planning (ONEP)

4.	Mrs. Katunchalee Thammakul	Director of Biodiversity Management Division
5.	Ms. Benchamaporn Wattanatongchai	Senior Professional Level
6.	Ms. Wannapa Maneekul	Policy and Planning Analyst
7.	Ms. Supawin Kuhathanasathian	Policy and Planning Analyst

Thailand Development Research Institute (TDRI)

8.	Dr. Adis Israngkura	Project Leader
9.	Ms. Thippawan Keawmesri	Senior Researcher

Main Discussion

The key conclusions and findings from the Natural Capital Accounting (NCA) project and the context of Krabi Province are summarized as follows.

1. Project Objectives and Application of the Study Results

The primary objective of the project is to integrate the concept of Natural Capital Accounting (NCA) into government planning and decision-making mechanisms. The project comprises three main components:

- Integration of natural capital accounting into the national planning and budgeting framework;
- Integration of natural capital considerations into provincial and local development plans; and
- Raising awareness, strengthening communication, and enhancing the capacity of relevant stakeholders.

Use of Economic Evidence

- The project is undertaking the valuation of natural resources in economic terms, including marine resources such as seawater and coastal ecosystems.

- The resulting economic valuation will serve as evidence to support policy recommendations for provincial development planning and to demonstrate the economic justification for increasing public investment in addressing environmental threats, such as wastewater pollution, where the anticipated environmental and socio-economic benefits outweigh the associated costs.
- The project team will tailor the outputs to respond to the needs of provincial authorities by identifying how the valuation results can best support provincial planning and decision-making processes.

Financial Instruments

- The project also explores financial mechanisms that could enable local authorities to generate additional revenue for the conservation and maintenance of beaches and marine resources. One potential option is to allocate a portion of tourism-related revenues or visitor charges to support the long-term management of coastal and marine ecosystems.

2. Current Situation and Threats to Krabi's Natural Resources

The project focuses primarily on marine resources, which are regarded as one of Krabi Province's most valuable natural assets and a major source of economic income through tourism.

Key Environmental Challenges and Threats

- **Wastewater pollution remains the most critical environmental issue.** While solid waste management has improved considerably, wastewater pollution continues to be a significant yet largely invisible problem until its impacts become evident along beaches and coastal areas.
- **Multiple sources of wastewater pollution** have been identified, including households, industrial facilities, and particularly agricultural activities, especially oil palm cultivation, where the use of agrochemicals and untreated wastewater frequently results in polluted runoff entering canals and eventually discharging into the sea.
- **Wastewater management among private operators remains inadequate.** Existing legal and regulatory mechanisms are insufficient to ensure compliance, particularly among hotels, where wastewater treatment systems are reportedly not operated continuously and may only be activated during inspections. Furthermore, many restaurants and small-scale businesses are not legally required to install wastewater treatment systems.
- **Centralized wastewater treatment infrastructure is insufficient.** Major tourism areas, particularly Ao Nang, generate wastewater volumes that exceed the capacity of existing treatment facilities. In addition, proposals for constructing large centralized treatment ponds in certain locations have encountered public opposition due to concerns over potential environmental impacts.

Impacts on Marine Ecosystems

- **Marine ecosystems are highly sensitive to environmental disturbances.** Coral reefs, seagrass beds, and other coastal ecosystems are particularly vulnerable to wastewater pollution and other human-induced pressures. Combined with the effects of climate change, these stressors have contributed to increasing occurrences of coral bleaching.

- **Dugong migration patterns are changing.** Dugongs have increasingly shifted their feeding grounds away from traditional habitats, such as those surrounding Sri Bo Ya Island. This movement is likely associated with declining seagrass availability and the impacts of climate change. As dugongs move into new areas, they become more vulnerable to entanglement in fishing gear and collisions with vessels.
- **Natural resource recovery during the COVID-19 pandemic** demonstrated the resilience of marine ecosystems. The reduction in tourism and other human activities resulted in noticeable ecological recovery in several locations, including Maya Bay, highlighting the capacity of coastal ecosystems to regenerate when anthropogenic pressures are reduced.

3. Tourism-Related Issues

Impacts of Tourism Growth

- Prior to the COVID-19 pandemic, Krabi Province generated approximately **THB 120 billion** in annual tourism revenue, ranking as the **fourth-largest tourism destination** in Thailand. However, the province received approximately **six million visitors annually**, compared with a resident population of around **400,000**, resulting in excessive pressure on natural resources and ecosystems, as demonstrated by the degradation of Maya Bay.

Management of External Tourism Operators

- Tourism operators based outside Krabi Province frequently utilize the province's tourism resources without contributing to their conservation. These operators primarily focus on deriving economic benefits from the destinations while assuming limited responsibility for the long-term management and protection of Krabi's natural resources.

Promoting High-Quality and Sustainable Tourism

- There is a strong interest in promoting environmentally sustainable tourism in order to attract higher-value visitors, particularly those from Europe and the Scandinavian countries, who place considerable emphasis on environmental quality, cleanliness, and sustainability.

Diversification of Tourism Destinations

- Krabi's tourism potential extends beyond the five coastal districts. The province possesses significant opportunities for **ecotourism**, **mountain tourism**, and **community-based tourism** in inland districts, which could help reduce visitor congestion in sensitive coastal areas while distributing tourism benefits more broadly across the province.

4. Challenges Related to Stakeholder Participation and Partnerships

Income Inequality

- Significant disparities exist between the economic benefits received by local communities and those accruing to external investors and large private-sector operators.

Limited Stakeholder Partnerships

- Local communities often perceive that they receive limited benefits from conserving natural resources, while those who derive the greatest economic gains do not contribute proportionately to their protection. This has resulted in weak partnerships between local communities and tourism operators in the shared management of natural resources.

Recommendations

The recommendations arising from the **Natural Capital Accounting (NCA)** project in Krabi Province emphasize the use of economic evidence to strengthen planning, budgeting, and decision-making at both provincial and national levels.

1. Recommendations on Budgeting and Development Planning

The project seeks to integrate **Natural Capital Accounting (NCA)** into public sector planning and management through the following recommendations:

Use of Economic Evidence to Support Budget Allocation

- Economic valuation of natural resources, including marine ecosystems and seawater, should be used as evidence to support provincial development planning and inform budget allocation decisions.

Adjusting Budget Allocation to Address Environmental Threats

- The valuation results should be used to engage provincial authorities in considering whether public expenditure should be reallocated to address key environmental threats, particularly wastewater pollution and solid waste management. The analysis indicates that relatively modest increases in investment for environmental protection could generate substantially greater economic returns through the preservation of marine ecosystem services.

Tailoring Project Outputs to Provincial Needs

- The project team should work closely with provincial authorities to identify how the economic valuation results can best support provincial planning and decision-making, ensuring that project outputs respond directly to local policy needs.

2. Recommendations on Financial Instruments

To strengthen the sustainable financing of natural resource management, the project recommends the development of financial mechanisms capable of generating long-term revenue for conservation.

Strengthening Local Revenue Generation

- Appropriate financial instruments should be explored to enable local governments to generate additional revenue dedicated to natural resource conservation and environmental management.

Tourism-Based Financing

- Consideration should be given to allocating a portion of tourism-related expenditures or visitor charges to finance the conservation and maintenance of beaches and marine ecosystems. At present, most

tourism revenue is retained by private operators, while relatively limited funding is reinvested in the protection of the natural resources that support the tourism industry.

3. Recommendations for Addressing Environmental and Economic Challenges (Particularly Wastewater Management)

Given that wastewater pollution represents one of the most critical environmental challenges facing Krabi Province, the following actions are recommended:

Strengthening Legal and Regulatory Enforcement

- Existing legal and regulatory mechanisms should be strengthened to improve compliance among tourism operators, particularly hotels, where wastewater treatment systems are reportedly not operated consistently and may only be activated during official inspections. Regulatory measures should also be expanded to include restaurants and small-scale businesses that are currently not required to install wastewater treatment systems.

Strengthening Collaboration on Wastewater Management

- Greater cooperation should be promoted among public authorities and private operators to facilitate connection to centralized wastewater treatment systems. Existing challenges, including reluctance among some operators to share treatment costs, should be addressed through appropriate institutional and financial arrangements.

4. Recommendations on Sustainable Tourism and Stakeholder Participation

Diversifying Tourism Opportunities

- Where visitor numbers cannot be effectively controlled in environmentally sensitive areas, tourism products should be diversified by promoting ecotourism, mountain tourism, and community-based tourism in inland districts beyond the five coastal districts. This would help reduce visitor pressure on fragile coastal ecosystems while creating broader economic opportunities across the province.

Strengthening Partnerships

- Stronger partnerships should be established between local communities and tourism operators to promote shared responsibility for natural resource management. Current perceptions that local communities receive limited benefits from conservation while private beneficiaries contribute insufficiently to resource protection should be addressed through more equitable benefit-sharing mechanisms and collaborative governance arrangements.

Strengthening the Responsibility of External Tourism Operators

- Appropriate policy measures should be introduced to encourage tourism operators based outside Krabi Province, who bring visitors to local attractions, to share responsibility for conserving the natural resources upon which their businesses depend. Such measures would promote a more equitable distribution of conservation responsibilities among all beneficiaries of Krabi's tourism resources.

Figure 5 consult and discuss on "Sustainable conservation of natural resources and economic development of Krabi Province"

Image source by the author

3.3 To consult and discuss on the Development of Market-Based Instruments (MBIs) for resource conservation in Krabi Province

Date: 27 November 2025, 15.00 – 16.00

Location: Online Meeting

Attendees: 11 people

EnLive Foundation

1. Ms. Jarintip Kaewklam
2. Ms. Sunisa Makyod
3. Ms. Mujalin Prathummas
4. Mrs. Jaruwan Kaewmahanin Enright

Thailand Development Research Institute (TDRI)

5.	Dr. Adis Israngkura	Project Leader
6.	Ms. Thippawan Keawmesri	Senior Researcher
7.	Ms. Prinyarat Leangcharoen	Senior Researcher
8.	Ms. Panida Phranphanat	Researcher
9.	Mr.Peerawat Suriyaburaphakul	Researcher
10.	Ms. Pichamon Keakij	Researcher
11.	Ms. Ms.Ramida Hansaward	Project Coordinator

Main Discussion

Information on Local Areas and Community Groups

1. Waste Management

- **Khlong Haeng Subdistrict, Krabi Province:**
  The community collects and sorts waste. Income from selling recyclables is contributed to the Khlong Haeng Mosque Fund, which operates similarly to a "waste bank" (Tha Phlu area).
- **Khlong Prasong Subdistrict, Krabi Province (Wongpanit Team):**
  Although this group is not directly supported by the EnLive Foundation, the community sorts recyclable waste and sells it as a source of income for the village fund. Most members are Muslim women residing near the beach area.
- **Other related groups in nearby areas:**
  - **Bang Fad – Tha Khlong Subdistrict (route to Koh Lanta):** A women's group collaborating with Save Andaman Foundation (Trang Province) on products made from crabs.
  - **Bang Yalid:** Produces herbal products derived from mangrove forests.
  - **Bang Mu (Nakhon Si Thammarat Province):** A community group with strong internal management capacity.

Challenges and Constraints

- **Non-recyclable waste:**
  - **Marine debris (orphan waste):** Efforts have been made to collaborate with hotels and the Wongpanit waste management group, but limitations remain.
  - **Logistics challenges:** Transportation of waste poses major difficulties due to the island or semi-island geography.
  - **Waste disposal:** Marine debris is often burned due to lack of alternatives.

2. Potential Areas for Tool Development

2.1 Waste Management

Waste management is a key focus of the community. Many groups have ongoing activities that can be expanded into economic mechanisms, such as village funds financed by recyclable sales and mosque-based waste bank systems.

2.2 Development of Birdwatching Routes

- A local birdwatching club has been established within the community.
- The EnLive Foundation provides technical knowledge and aims to develop youth capacities—particularly secondary school students—as birdwatching guides.

- TikTok is actively used for communication and tourism promotion within the community (Khlong Prasong Village received equipment support from Samsung).
- **Kidthung Cottage** may serve as a base for activities or as a hub for the club.
- **Site selection and tools:**
  Khlong Prasong Village, Khlong Prasong Subdistrict, Mueang Krabi District, is suitable as a pilot site due to its diverse resource management and community activities, including waste management and birdwatching. The area is well-positioned for developing economic tools to support birdwatching tourism and natural resource conservation.
- **External collaboration:**
  There are connections with **Pankan Foundation** and **Taejai.com**, which may serve as funding or support channels for future conservation or community initiatives.

Figure 6 consult and discuss on Development of Market-Based Instruments (MBIs)

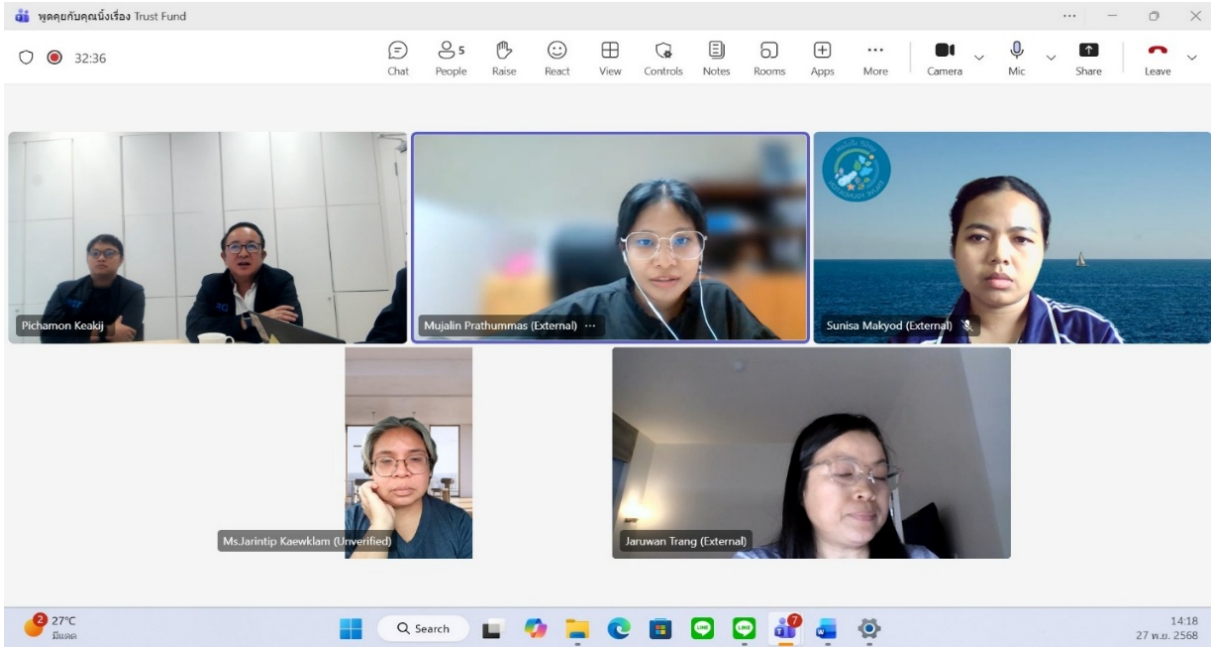


Image source by the author

3.4 To consult and discuss on "The public–private collaboration in jointly monitoring wastewater management and treatment practices of establishments in Ao Nang Sub-district, Krabi Province."

Date: 18 December 2025, 13.30 – 14.30

Location: Provincial Office of Natural Resources and Environment Krabi

Attendees: 15 people

Provincial Office of Natural Resources and Environment, Krabi Province

1.	Mr. Pairat Limprasert	Director of the office of natural resources and environment Krabi
2.	Mr. Surachai Kuntong	Director, Environmental Division
3.	Mrs. Mayura Rotjanamno	Director, Strategy Division
4.	Mr. Praphat Praditkan	Environmental Specialist
5.	Ms. Thanchira Ittipanyakul	Project Coordination Officer
6.	Ms. Sriwilai Thongkhao	Technical Officer, Level 4

Wastewater Management Office, Krabi Branch

7.	Mr. Amornchai Hirunrat	Manager of Wastewater Management Office, Krabi Branch

Krabi Hotel Association

8.	Ms. Katsamaporn Limpanpongthep	President of the Krabi Hotel Association
9.	Mr. Akara Sriraksa	Vice President of the Krabi Hotel Association
10.	Ms. Sirirat Jeeraphiwat	Manager, Krabi Hotel Association

Thailand Development Research Institute (TDRI)

11.	Dr. Adis Israngkura	Project Leader
12.	Ms.Thippawam Keawmesri	Senior Researcher
13.	Ms. Kanjana Yasen	Senior Researcher
14.	Mr. Peerawat Suriyaburaphakul	Researcher
15.	Ms. Pichamon Keakij	Researcher

Main discussion

- A consultative meeting was held with relevant personnel at the Provincial Office of Natural Resources and Environment Krabi to discuss and exchange views on issues concerning public–private collaboration in the joint monitoring of wastewater management and treatment practices of establishments in Ao Nang Sub-district, Krabi Province. The key informants for this consultation included Mr. Phairat Limprasert, Director of the Provincial Office of Natural Resources and Environment; Mr. Surachai Kuntong, Director of the Environmental Division; Mrs. Mayura Rotjanamno, Director of the Strategy Division; Mr. Praphat Praditkan, Environmental Technical Officer; Mr. Amornchai Hiranrat, Manager of the Krabi Branch of the Wastewater Management Office;

Ms. Gatsamaporn Lipnaphongthep, President of the Krabi Hotel Association; Mr. Akkhara Srirak, Vice President of the Krabi Hotel Association; and Ms. Sirirat Jeeraphiwat, Manager of the Krabi Hotel Association

- **The objective of this meeting** was to address the fact that, in the past, wastewater management had involved the appointment of a committee responsible for conducting on-site inspections of wastewater quality at establishments. However, these inspections had been suspended for several years due to budgetary constraints. The Thailand Development Research Institute (TDRI) therefore sought to provide project-based support to stimulate the resumption of wastewater management and monitoring activities
- **In 2018**, an Appointment of operating team on wastewater and solid waste management was formally established in Krabi Province. This team was chaired by the Vice Governor of Krabi Province, with heads of relevant agencies serving as committee members. The Provincial Office of Natural Resources and Environment Krabi acted as the secretariat, with division directors serving as assistant secretaries
- **Following the establishment of this Appointment of operating team in 2018**, Provincial Office of Natural Resources and Environment Krabi submitted a request for provincial funding to support the implementation of its activities. Budget approval for the project was granted in 2020. Under this initiative, the task force conducted training programs for local establishments focusing on wastewater discharge practices, emphasizing the principle that each operator is responsible for managing wastewater generated by their own activities. After the training sessions, random inspections of establishments were carried out in accordance with the standards set by the Pollution Control Department (PCD). These inspections served partly as an incentive to encourage improved wastewater management practices among operators and partly as an enforcement mechanism, although they did not involve the application of legal penalties. Following the most recent round of activities, no further budget was allocated to continue this program
- In 2020, Provincial Office of Natural Resources and Environment Krabi developed a new project proposal to request provincial funding and subsequently received an annual budget of approximately 300,000 THB. This budget covered both capacity-building activities for establishment operators and random inspections of establishments. However, these activities were implemented only once per year
- Wastewater management challenges are not limited to Ao Nang, similar issues have also been identified on Koh Lanta. Consequently, the operations of the Krabi Provincial Task Force on Wastewater and Solid Waste Management were divided into two operational zones: Ao Nang and Koh Lanta. Capacity-building activities were conducted in both areas, with training programs provided to local stakeholders in each zone. Similar training activities will also be conducted in Koh Lanta, with approximately 100 participants selected to attend the training sessions organized by the relevant agencies
- The implementation procedures of this project comprised the following steps: (1) An initial consultative meeting was convened among all committee members to determine a coordinated approach for inter-agency implementation. Following this discussion, the relevant agencies jointly formulated an operational plan and timetable for field activities. (2) Field activities were subsequently conducted to deliver training programs on wastewater and solid waste management for establishment operators, with training sessions organized approximately twice per year (3) Random inspections of establishments were then carried out. After the training sessions, the agency responsible informed operators in advance that random inspections

would be conducted; however, no prior notice was given regarding the specific establishments to be inspected or the timing of inspections. Based on past implementation, inspections primarily targeted restaurants and hotels (4) If, following inspection, wastewater discharge levels were found to exceed the standards prescribed by the Pollution Control Department (PCD), the Provincial Office of Natural Resources and Environment (PONRE) issued an initial warning. This was followed by a subsequent re-inspection, conducted without prior notification to the establishment concerned.(5) Members of the inspection team and the committee then jointly deliberated on the application of appropriate legal provisions as illustrative regulatory measures to ensure that operators complied with proper wastewater management practices, with the ultimate objective of ensuring that wastewater in both Ao Nang and Koh Lanta is adequately treated prior to discharge into natural water bodies

- The outcomes of previous implementation indicated that the provincial budget of 300,000 THB was allocated to field inspections of restaurant and hotel establishments located in Phi Phi Island, Railay Beach, and Koh Lanta. These inspections focused primarily on the preliminary wastewater management systems of establishments, with particular attention to the installation of grease traps and on-site wastewater treatment systems. The findings revealed that, although grease traps had been installed at many establishments, the majority were not installed in accordance with proper technical standards. This was largely attributable to inappropriate system integration, as grease traps must be installed in conjunction with suitable piping systems. In the case of hotel establishments, even where kitchen grease traps were present, further assessment was required to determine whether the hotel operated an internal wastewater treatment system prior to discharging effluent into public water bodies. In accordance with the policy direction of the Deputy Governor of Krabi Province, a stepwise regulatory approach was adopted. This approach ranged from issuing warnings to establishments that failed to meet the standards of the Pollution Control Department (PCD), to the enforcement of legal measures by local administrative organizations in cases of repeated non-compliance. Enforcement under the Cleanliness and Orderliness Act at the sub-district administrative level could be undertaken directly. In contrast, enforcement under Thailand's Public Health Act requires the collection of wastewater samples for laboratory analysis and the completion of official reporting procedures prior to taking legal action against non-compliant establishments. The Provincial Office of Natural Resources and Environment Krabi considered this latter process to be relatively time-consuming and operationally slow. Nevertheless, field-based monitoring and inspections conducted by The Provincial Office of Natural Resources and Environment Krabi played a significant role in encouraging greater awareness and improvements in wastewater management practices among operators. As a result, water quality in the affected areas demonstrated a clear trend towards improvement. However, from the COVID-19 period to the present, no further on-site wastewater quality inspections at establishment sources have been conducted. During the COVID-19 period, water quality was observed to be relatively good due to the suspension of economic activities. These observations underscore the effectiveness of systematic wastewater quality inspections conducted by The Provincial Office of Natural Resources and Environment Krabi in contributing to positive environmental outcomes
- Accordingly, in the initial phase, the Thailand Development Research Institute (TDRI) will provide financial support and serve as a catalyst to facilitate the resumption of this project. If the project delivers positive outcomes and generates satisfaction and favorable impressions among both provincial authorities and tourists,

it is expected to provide strong justification for budget approval. Implementation will initially commence in the Ao Nang area

- At present, Krabi Province contains several designated special areas subject to oversight by multiple agencies, including pollution control zones and provincially protected areas. The pollution control zone was designated in the Phi Phi Islands in response to wastewater and solid waste management challenges; however, the Pollution Control Department, in collaboration with the Provincial Office of Natural Resources and Environment Krabi, and relevant agencies, is currently considering revoking this designation due to the establishment of an effective wastewater treatment system in the area. With respect to solid waste management, sub-district administrative organizations have acknowledged the issues and are continuing to advance implementation efforts. A meeting of the Pollution Control Zone Committee and its subcommittees is expected to be convened in January 2026, chaired by the Deputy Governor of Krabi Province, to review progress and to deliberate future management approaches
- In summary, the current status of implementation remains at the stage of awaiting coordination by the Provincial Office of Natural Resources and Environment Krabi to determine a suitable date and time when the committee and relevant agencies are available to convene and jointly deliberate on the project concerning wastewater quality inspections. Under the existing committee structure, representatives from the private sector, specifically the Hotel Association are already included. However, the private sector has proposed expanding committee membership to include representatives from the Restaurant Association, Tourism Association, Spa Association, and laundry service operators. For laundry service establishments, which operate under permits issued by local administrative organizations, it is recommended that the Sub-district Administrative Organization coordinate the participation of relevant permit holders in training sessions or meetings. The private sector associations will jointly consider and select the most appropriate associations prior to submitting the proposed list of representatives, which will be communicated through designated representatives to PONRE Krabi for further action
- The Vice President of the Krabi Hotel Association provided observations regarding the training content, noting that small-scale restaurants and small accommodation facilities that do not fall under the legal definition of hotels are not currently required, under existing regulations, to install dedicated wastewater treatment systems. Nevertheless, in practice, these establishments collectively constitute a major source of wastewater, accounting for approximately 80% of total wastewater generation. In addition, many buildings were originally designed for residential use but have been repurposed for commercial activities, resulting in wastewater discharges that exceed the capacity of the original infrastructure, which typically consists of septic tanks or outdated cement pipe systems. Accordingly, it was recommended that the training programs place greater emphasis on providing practical knowledge and guidance on upgrading wastewater treatment systems that are easy to install, cost-effective, and do not impose excessive burdens on operators. Proposed options included the installation of additional holding tanks or infiltration pits in conjunction with grease traps to reduce wastewater loads prior to discharge into public sewer systems, with an estimated reduction of approximately 30–40% in wastewater volume. Given that many operators are tenants and face limitations with respect to excavation or

structural modifications, it was further suggested that specialists play an active role in designing and recommending appropriate above-ground wastewater treatment solutions

- For large-scale establishments, it was recommended that priority be given to verifying whether the wastewater treatment systems declared during the permitting process have been properly installed and are being operated in accordance with the approved designs, as well as whether such systems are adequately maintained and remain fully functional. Only in cases where clear non-compliance is identified should wastewater samples be collected for laboratory analysis to support legal enforcement, as this step requires additional financial resources. It was further noted that implementing preventive measures and undertaking preliminary system improvements could help reduce both short- and long-term budgetary burdens, with the primary costs associated with field operations such as travel, accommodation, and subsistence. Moreover, for establishments that are legally required to conduct regular wastewater quality monitoring, the most recent analytical results within the preceding six months may be utilized as supporting information for initial assessment. If these results are found to be inconsistent with on-site conditions, supplementary sampling from alternative sources should then be conducted to ensure data accuracy and reliability. Finally, it was proposed that the budget be structured into two separate projects to enhance operational clarity and overall efficiency
- The primary legal instruments applied are the Public Health Act enforced by the Sub-district Administrative Organizations (SAOs) and the Provincial Public Health Act, which provide clear legal authority for immediate enforcement in cases of observable non-compliance. During previous inspection rounds, there were several instances in which SAOs issued official orders directly to establishments
- Provincial Office of Natural Resources and Environment Krabi will expedite the revision of the relevant administrative order in accordance with the views and recommendations discussed during this meeting. Implementation will initially commence in the Phi Phi Islands; however, the revised document will explicitly include both the Phi Phi Islands and Koh Lanta
- Operational constraints associated with random inspections were identified, particularly during the high tourist season, when on-site inspections are difficult to conduct due to high occupancy rates at establishments and the large number of committee members involved, which may cause inconvenience and disrupt tourist activities. In response, inspection procedures have recently been adapted by dividing inspection teams into smaller units of approximately four members per team and distributing inspections across different locations, thereby minimizing impacts on establishments and avoiding unnecessary concern among guests and tourists
- A preliminary implementation plan discussed and jointly agreed upon may be summarized as follows:

(1) January 2026: A committee meeting will be convened to deliberate on the implementation of the plan and to identify an appropriate timeframe for operational activities. During this meeting, revisions to the committee membership will also be made to incorporate newly proposed representatives into the official appointment document.

(2) February 2026: Capacity-building and training programs will be conducted for various groups of establishment operators, focusing on wastewater and solid waste management practices.

(3) March 2026: Random inspections of establishments will be carried out in the Ao Nang area

- The Krabi Hotel Association recommended that public communication focusing solely on wastewater quality inspections may create negative perceptions and excessive pressure on operators, and therefore proposed complementing regulatory measures with positive, incentive-based approaches. These include the introduction of awards or recognition schemes for establishments demonstrating effective wastewater management and compliance with prescribed standards, such as certification symbols or endorsement stickers displayed at establishments, as well as certification signage in common areas or facilities managed by local administrative organizations. Such measures would inform tourists and encourage support for environmentally responsible businesses, thereby enhancing voluntary improvements in wastewater management. Public communication could be implemented through multiple channels, including on-site signage, local government and private sector media, social media platforms of relevant associations, and provincial media networks in Krabi, using both online and on-site formats in public spaces and key tourist destinations to promote broader awareness and strengthen the province's image as a sustainable tourism destination
- Mr. Surachai Kuntong, Director of the Environmental Division, noted that issues related to public communication would be included on the agenda of the forthcoming meeting. At present, there is no province-wide public communication strategy in place; however, once provincial-level communication is initiated, responsibility for further dissemination would be formally assigned to the relevant public relations units
- The Krabi Hotel Association proposed budgetary planning approaches, suggesting that upon completion of the pilot project, the "Ao Nang Model," the outcomes should be utilized as supporting evidence for the preparation of a provincial budget proposal for the 2029 fiscal year, commencing during the provincial budget planning cycle after April. Furthermore, should contingency or unallocated funds be available under the authority of the Governor during the 2026–2027 period, the project could be included as a Tier 2 (reserve) project to enable immediate implementation in the event that additional funding in the range of 500,000–1,000,000 THB becomes available
- With regard to target implementation frequency, the Association considered quarterly monitoring to be an appropriate approach; however, the operational readiness of relevant agencies must be taken into account. Certain areas face constraints in human resources, particularly local administrative organizations in the Ao Nang area, which have limited personnel and substantial workloads related to licensing procedures. Accordingly, a more practical approach would be to conduct monitoring activities at least twice per year per area, with inspections scheduled around the transition from the late low tourism season to the early high season (October–November) and during the early low tourism season (April–May). Depending on local context and institutional capacity, some areas—such as Phi Phi Islands and Koh Lanta—may be monitored once per year, while Ao Nang may be monitored twice per year, in order to align implementation with site-specific conditions and the capacity of responsible agencies. In addition, Mr. Amornchai Hiranrat, Manager of the Krabi Branch of the Wastewater Management Office, provided a progress update on project implementation, noting that on 28 November 2025, a follow-up meeting was held at the Ao Nang Sub-district Administrative Organization to review wastewater management issues. During this period, the Wastewater Management Office and the Ao Nang SAO considered the development of a Memorandum of Agreement (MOA), on which the Sub-district Chief Executive expressed two key observations

(1) **Cost considerations:** Concerns were raised regarding the relatively high projected costs outlined in the MOA. The management of the Wastewater Management Office acknowledged this concern and agreed to review and assess the estimated annual operational costs

(2) **Contract duration and termination conditions:** The MOA between the Wastewater Management Office and the Sub-district Administrative Organization is proposed to have a duration of 15 years. In the event of early termination initiated by the Sub-district Administrative Organization, the latter would be required to reimburse construction costs to the Wastewater Management Office. Given that the total construction cost of the project is estimated at approximately 800 million THB, this provision was considered to represent a substantial financial burden

(3) **Land allocation for construction:** The project requires designated land for construction, located opposite the sports stadium. This aspect has largely been resolved, with only two outstanding matters pending formal approval: (i) the signing of the MOA between the Wastewater Management Office and the Sub-district Administrative Organization, and (ii) the formal handover of the project site

Figure 7 Consult and discuss on PPPs in Krabi province

Image source by the author

3.5 Joint Public and Private Sector Committee for Economic Problem Solving (JPPCC) in Krabi Province

Meeting Minutes of Joint Public and Private Sector Committee for Economic Problem Solving (JPPCC) in Krabi Province **on 26 May 2026** (10.00 – 12.00 AM) at Phanom Bencha Conference Room, 5th Floor, Krabi Provincial Hall , Krabi Thailand, **Attendees: 46 agencies**

1. Governor of Krabi Province
2. Deputy Governor of Krabi Province (assigned)
3. Chairman, Krabi Chamber of Commerce
4. Chairman, Krabi Federation of Thai Industries

5. Chairman, Krabi Tourism Industry Council
6. Chairman, Krabi Thai Bankers' Association
7. Krabi Provincial Treasury Office
8. Krabi Provincial Commerce Office
9. Krabi Provincial Industry Office
10. Krabi Provincial Agriculture and Cooperatives Office
11. Krabi Provincial Tourism and Sports Office
12. Krabi Provincial Local Administration Office
13. Krabi Provincial Public Relations Office
14. Mr. Wattana Thanasakcharoen, Expert in Economics
15. Mr. Chuan Phukaoluan, Expert in Social Affairs
16. Deputy Rector, National Sports University, Krabi Campus
17. Krabi Provincial Public Works and Town & Country Planning Office
18. Director, Marine Department Regional Office, Krabi Branch
19. Chief, Krabi Provincial Office
20. Secretary-General, Krabi Chamber of Commerce
21. Secretary-General, Krabi Federation of Thai Industries
22. Secretary-General, Krabi Tourism Industry Council
23. Secretary-General, Krabi Thai Bankers' Association
24. Head, Strategic and Provincial Development Planning Group, Krabi Provincial Office
25. Permanent Secretary of Krabi Province
26. Provincial Chief Medical Officer, Krabi
27. Director, Krabi Hospital
28. Director, Krabi Provincial Office of Natural Resources and Environment
29. Director, Krabi Rural Highway District
30. Director, Krabi Highway District
31. Krabi Provincial Transport Office
32. Director, Krabi Irrigation Project
33. Treasury Office, Krabi Area
34. Krabi Provincial Energy Office
35. Director, Krabi Airport
36. Director, Provincial Waterworks Authority, Krabi Branch
37. District Chief, Mueang Krabi District
38. President, Krabi Tourism Business Association
39. President, Krabi Hotel Association
40. Director, Tourism Authority of Thailand (TAT), Krabi Office
41. President, Krabi Provincial Sports Association
42. Mr. Phuwatip Prechanon

43. President, Krabi Provincial Administrative Organization
44. Mayor, Krabi Municipality
45. President, Ao Nang Subdistrict Administrative Organization
46. President, Thailand Development Research Institute (TDRI)

Main Discussion

Participation in the JPPCC meeting of Krabi Province was undertaken with the objective of communicating the results of natural capital accounting to stakeholders involved in provincial economic development, including government agencies, private sector representatives, and actors engaged in tourism and natural resource management. The meeting served as an important platform to demonstrate that natural capital accounts can be employed as evidence-based inputs for strategic provincial planning, particularly in relation to nature-based tourism, water security, wastewater management, and the conservation of ecosystems that constitute the province's revenue base. TDRI was honored to be invited to participate in this meeting, with the official invitation letter from the Krabi Provincial Office presented in Appendix 1.

The discussions highlighted the necessity for Krabi Province to employ information that systematically integrates economic, social, and environmental dimensions in order to support provincial development planning and the prioritization of future projects. This need arises from the province's economic structure, which is directly dependent on natural resources and ecosystems, especially the tourism sector that relies on the quality of natural attractions, coastal ecosystems, marine resources, freshwater bodies, and landscapes as critical factors in attracting visitors and generating income. Within this context, degradation of natural resources and ecosystems—whether of natural tourist sites, coastal and nearshore marine systems, or water quality and wastewater issues—would inevitably affect the province's capacity to accommodate tourists, the revenues of local enterprises, the quality of life of residents, and the long-term image of Krabi as a premier nature-based tourism destination. Consequently, Natural Capital Accounting (NCA) plays a vital role as an informational instrument that enables the province to clearly perceive both the economic benefits of ecosystems and the costs or risks associated with natural resource degradation.

Following the presentation of Krabi's natural capital accounts under the SEEA framework, together with related activities such as youth birdwatching camps, seagrass conservation and restoration, conservation diving, and the wastewater issues particularly in Ao Nang Subdistrict, as well as five project proposals, feedback and recommendations were received from participants. Several key points emerged. First, experts and participants emphasized that the research findings on Krabi's natural capital accounts are highly significant, as they reveal both the economic benefits derived from ecosystems and the degradation of natural resources that may undermine the province's revenue base, particularly tourism income. Such information can therefore be used to inform rational and evidence-based approaches to the conservation and restoration of Krabi's natural resources.

Second, the meeting recommended that research results be communicated and disseminated in more accessible formats to reach wider audiences, such as through visual summaries or infographics, thereby enabling

government agencies, private sector actors, communities, and the general public to understand the importance of natural capital accounts and to recognize practical ways of applying this information in resource management and provincial development.

Third, the Governor of Krabi observed that the establishment of natural capital accounts has already provided the province with a critical data foundation, and stressed the importance of continuing and expanding this work to ensure that the information becomes comprehensive and can sustainably support provincial development planning in the long term. This perspective underscores the need for natural capital accounts to evolve beyond being a temporary research output into a permanent information system integrated with provincial planning and budgeting processes.

Fourth, the meeting discussed water resource challenges in Krabi, encompassing both wastewater discharged into the sea and seasonal water shortages. Observations were made regarding groundwater flows into the sea that remain underutilized. The research team clarified that relevant agencies, particularly the Royal Irrigation Department, have plans to implement projects that will enhance the capacity of medium-scale water sources, which are expected to significantly improve water storage potential. This discussion highlighted the necessity of considering water resource management holistically, including water quantity, quality, utilization, and impacts on coastal ecosystems.

Fifth, the research team explained that TDRI can support Krabi Province in drafting project proposals for budget allocation requests, as the team possesses data on the costs, benefits, and economic efficiency of natural resources and ecosystem services, and has received guidance from budgetary agencies on how to prepare proposals with clarity to increase the likelihood of approval. Such support would enable provincial project proposals to be grounded in robust data, articulated with clear policy rationale, and reflective of the necessity of investment in conservation and restoration of natural resources.

Sixth, the meeting inquired about the approximate budgetary requirements of the five proposed projects. The research team clarified that the projects involve estimated budgets in the range of tens of millions of baht. The Governor of Krabi remarked that this level of funding is feasible for provincial budgetary support, indicating that project proposals derived from natural capital accounts are practically implementable and can be integrated into the provincial budgeting process.

Seventh, in relation to wastewater management, particularly the proposed inspection of wastewater in key areas, recommendations were made that such activities should adopt constructive and advisory approaches with enterprises rather than punitive measures. This approach would foster collaboration among government agencies, private sector actors, and communities in addressing wastewater problems, especially in major tourism areas such as Ao Nang and Phi Phi Island, which are vital to both the tourism economy and coastal ecosystems of the province.

In conclusion, the meeting underscored that Krabi's natural capital accounts have strong potential to serve as a critical instrument for shaping provincial development directions, prioritizing projects, and supporting budget allocations for the conservation and restoration of natural resources. This is particularly relevant to tourism,

water resources, upstream ecosystems, coastal ecosystems, and nearshore marine ecosystems. Applying this information in provincial development plans and the Medium-Term Expenditure Framework will enable Krabi Province to formulate policies and projects that are consistent with its natural capital base and will support sustainable economic development in the long term.

Figure 8 Joint Public and Private Sector Committee for Economic Problem Solving (JPPCC) in Krabi Province

Image source by the author

3.6 Convening a focused expert consultation to gather feedback on linking natural capital accounts to the provincial development plan and the Medium-Term Expenditure Framework (MTEF) on 5 June 2026

Meeting Minutes of the convening a focused expert consultation to gather feedback on linking natural capital accounts to the provincial development plan and the Medium-Term Expenditure Framework (MTEF) **on 5 June 2026** (10.00 – 12.00 AM) at the Aree Meeting Room, 2nd Floor, Centara Ao Nang Beach Resort & Spa, Krabi Province, Thailand **Attendees: 28 people**

Krabi Provincial Energy Office

1. Ms. Sirikan Kongthong — Energy Officer, Senior Professional Level

Krabi Provincial Local Administration Office

2. Mr. Thammarat Mengbut — Local Administration Promotion Officer, Professional Level

Krabi Technical College

3. Ms. Jirapha Boonchuay — Deputy Director

Krabi Provincial Industry Office

4. Ms. Metta Somrup — Industrial Technical Officer, Professional Level

Krabi Land Development Station

5. Mr. Supakorn Chusongsaeng — Agricultural Technical Officer

Hat Noppharat Thara–Mu Ko Phi Phi National Park

6. Ms. Supawadee Wangsap — Forestry Technical Officer
7. Mr. Phichaya Sonsrisang — Forestry Technical Officer

Krabi Provincial Office

8. Mr. Anuchit Watruchikrit — Policy and Plan Analyst

Tourism Authority of Thailand (TAT), Krabi Office

9. Ms. Natthaya Onniam — Deputy Director

Krabi Provincial Fisheries Office

10. Ms. Benrat Kaewkampang — Fisheries Technical Officer

Provincial Waterworks Authority, Ao Luek Branch

11. Mr. Wittaya Kamphon — Manager

Office of Marine and Coastal Resources No. 10

12. Acting Sub Lt. Chonthis Saethan Boat Master

Marine Security Center, Krabi Province

13. Mr. Wanurahon Hempatama — General Administrative Officer

Krabi Provincial Public Works and Town & Country Planning Office

14. Mr. Kulpat Ruekjumnong — Town Planning Analyst, Senior Professional

Krabi Provincial Office of Tourism and Sports

15. Ms. Hasniya Damhai — Krabi Tourist Assistance

Ao Nang Subdistrict Administrative Organization

16. Mr. Apisit Suknui — Environmental Technical Officer
17. Ms. Afnee Chaladoh — Intern
18. Ms. Yasmeen Usen — Intern
19. Ms. Merisa Sribuathong — Assistant Environmental Technical Officer

Krabi Provincial Agriculture and Cooperatives Office

20. Ms. Atchara Sukkerd — Analyst, Professional Level

Krabi Provincial Community Development Office

21. Mr. Amarin Kaewpitak — Community Development Officer, Professional Level

Krabi Provincial Statistical Office

22. Ms. Juthamas Sangnoi — Senior Statistical Officer

Office of Natural Resources and Environmental Policy and Planning (ONEP)

23. Ms. Wannapha Maneekul — Policy and Plan Analyst
24. Ms. Supravee Kuhatanasathien — Policy and Plan Analyst

Thailand Development Research Institute (TDRI)

25. Assoc. Prof. Dr. Adis Israngkura — Project Leader
26. Ms. Thippawan Kaewmeesri — Senior Researcher
27. Mr. Peerawat Suriyaburaphakul — Researcher
28. Ms. Ramida Hansaward — Project Coordinator

Main Discussion

During the consultation, participants from relevant agencies provided additional comments on the application of natural capital accounts to support the development of Krabi's provincial plan and the Medium-Term Expenditure Framework (MTEF), as well as the preparation of environmental project proposals. The feedback covered issues of waste management, wastewater treatment, island ecosystem conservation, national park management, provincial planning and budgeting, and institutional and legal constraints.

The research team shared lessons learned from environmental projects in Krabi, particularly in waste and wastewater management in major tourism areas. These experiences underscored that addressing environmental problems in tourism destinations requires a combination of empirical data, management measures, and legal considerations.

On waste management, reference was made to a pilot project modeled on Japanese practices, which introduced semi-transparent garbage bags with specific logos in Ao Nang to encourage waste separation and facilitate source identification. However, the project was discontinued due to legal and enforcement limitations. Local governments could not fully mandate the use of designated bags, while still being responsible for collecting general waste in standard black bags. This reduced incentives for some operators to adopt the system. The lesson highlighted the need to design waste management measures in tourism areas with careful consideration of legal feasibility, incentive mechanisms, and the roles of local authorities.

On wastewater treatment in Ao Nang, the research team emphasized the urgency of addressing wastewater discharged into the sea, which threatens marine water quality, coastal ecosystems, the image of tourist destinations, and long-term tourism capacity. Collaborative work with the Krabi Provincial Office of Natural Resources and Environment involved site inspections and advisory visits to 40 hotels, using a cooperative approach to encourage environmental improvements rather than punitive enforcement. In partnership with King Mongkut's University of Technology Thonburi, water sampling revealed that BOD levels in some areas exceeded the standard of 4 mg/L by several times, confirming the severity of the issue. This evidence can strengthen wastewater management project proposals for inclusion in provincial plans and annual budgets.

Regarding island-level conservation, plans were discussed for small-scale wastewater treatment systems in Koh Sriboya to prevent community and tourism-related wastewater from affecting seagrass meadows and dugong habitats, which are ecologically valuable and culturally significant. Similar plans were proposed for Koh Lanta to accommodate future increases in tourist numbers, particularly after the completion of a connecting bridge. These initiatives illustrate that wastewater management should be viewed as preventive investment to support economic and tourism development without damaging nearshore marine ecosystems.

Representatives from Hat Noppharat Thara–Mu Ko Phi Phi National Park provided information on measures for managing high-value natural tourism areas. These included zoning, defining carrying capacity, and developing data systems to support management. The park has implemented seasonal closures, such as closing Koh Yung and Maya Bay for two months during the monsoon season, to allow ecosystems to recover from tourism pressures. This reflects the necessity of managing natural attractions based on ecological limits rather than maximizing visitor numbers.

For carrying capacity, the park set a limit of 375 visitors per round at Maya Bay. Once the quota is reached, boats must wait offshore until the current group departs. This mechanism exemplifies controlled access to balance tourism with ecosystem conservation. The park is also developing an online ticketing system (E-ticket) and QR code scanning checkpoints to improve visitor management and data accuracy. Such systems can support tourism-related natural capital accounts and future assessments of the relationship between visitor numbers, tourism revenues, and ecosystem pressures.

On local fisheries, the park designated zones where communities may harvest resources or conduct small-scale fishing, provided activities remain at least one kilometer away from coral reefs. This approach reflects efforts to balance marine conservation with local livelihoods, a key dimension of sustainable coastal and island development in Krabi.

Representatives from the Krabi Provincial Office highlighted constraints and opportunities in advancing environmental projects within provincial plans and budgets. They noted that environmental projects are often ranked lower in priority compared to tourism or infrastructure projects. To secure funding, conservation, wastewater management, or ecosystem restoration projects must be clearly incorporated into provincial development plans. Natural capital accounts can elevate environmental projects by linking them directly to economic development goals, framing them not merely as conservation expenditures but as investments in

maintaining the resource base that generates provincial income, particularly through tourism and quality of life improvements.

They also emphasized that land tenure and legal permissions are major obstacles in implementing environmental infrastructure projects such as wastewater treatment systems, nature trails, or conservation facilities. Projects in public lands, forests, national parks, or multi-agency jurisdictions require early verification of land status and legal permissions to avoid delays or risks of non-implementation despite budget approval.

Representatives from the Krabi Local Administration Office and Ao Nang Subdistrict Administrative Organization provided insights into waste management, particularly efforts to develop cluster-based waste transfer and disposal infrastructure. A key initiative is the waste transfer station in Ban Klang Subdistrict, designed to handle waste from Ao Luek and Plai Phraya districts before disposal at a private waste-to-energy facility. This reflects the need for inter-local cooperation and private sector involvement in final waste treatment. However, Krabi Municipality still bears responsibility for waste from 23 local governments, prompting attempts to establish additional cluster-based disposal centers. Some projects have faced public opposition, resulting in reliance on private landfills that do not meet scientific standards. These challenges reveal that waste management in Krabi is not merely technical but involves governance structures, system capacity, public acceptance, and environmental oversight. From the perspective of natural capital accounts, inadequate waste management can affect coastal ecosystems, water resources, tourism image, and long-term environmental costs.

In summary, participants agreed that advancing the use of natural capital accounts in Krabi must proceed alongside urgent local problem-solving, including wastewater management in tourism areas, island wastewater treatment systems, waste management, defining tourism carrying capacity, and balancing conservation with community livelihoods. To achieve policy impact, NCA data must be integrated into provincial planning and budgeting processes from the outset, particularly through project proposals supported by evidence on costs, benefits, efficiency, ecosystem impacts, and alignment with provincial development strategies. At the same time, legal conditions, land tenure, stakeholder participation, and local agency readiness must be considered to ensure effective implementation.

Figure 9 consultation to gather feedback on linking natural capital accounts to provincial plans

Image source by the author

4. Joint Meetings of Three Agencies (UNEP, ONEP, TDRI)

4.1 The 3 parties coordination meeting for NCA Project (UNEP-ONEP-TDRI) Project "Integration of Natural Capital Accounting in Public and Private Sector Policy and Decision-making for Sustainable Landscapes"

Date: 20 December 2024, 14.00 – 16.00

Location: Online Meeting

Attendees: 6 people

Office of Natural Resources and Environmental Policy and Planning (ONEP)

1. Dr. Benchamaporn Wattanatongchai Environmentalist, Senior Professional Level
2. Ms. Somawan Sukprasert Environmentalist, Senior Professional Level
3. Ms. Wannapa Maneekul Plan and Policy Analyst

Thailand Development Research Institute (TDRI)

4. Dr. Adis Israngkura Project Leader
5. Ms. Thippawan Keawmesri Senior Researcher
6. Ms. Panida Phranphanat Researcher

Main discussion

In the past, TDRI focused on thinking of the concept of creating SEEA and making templates to analyze the results and present the analyzed data to policy-level agencies to be integrated into the work plan. Therefore, we had to analyze the data in both quantitative terms, with maps and impacts, so that the agencies would see that our tools were useful, but might not be in line with the project results (output). So, we followed the advice of Ms. Anouska, which was to go back and follow the output table in PRODOC. Therefore, we would like to clarify and understand the output with Ms. Kavita because there were some outputs that we still did not understand.

The issues we would like to discuss start with the NCA of the study area in Krabi Province, but in the output table that appears in the PRODOC, NCA should be included in the Tourism Satellite Account and Water Resource Satellite Account, which are only available at the national level, but not at the provincial level (Krabi), including NCA in the I/O Matrix, which is the natural capital of Krabi Province, but the I/O Matrix is at the national level, which is not done at the provincial level because it is too detailed. So we will consult with UNEP about what this output means, whether to include it in concept or to include numbers as well.

What is overlooked is that there needs to be a meeting of expert groups to finalize the economics Instrument or market-based instruments (MBI) to be used. There are 4 instruments (linked to seawater quality):

(1) Collect waste fees from municipal waste bags by changing from the current monthly waste disposal fee to a waste disposal fee per bag, with each local government area responsible for implementing the mechanism. This mechanism will create incentives for people to separate waste and reduce the amount of

waste, which will alleviate the burden of waste disposal on local government organizations (LGOs) and generate income for LGOs. This mechanism will help reduce the problem of pollution from landfills that flow into and spread into nature and the sea.

(2) Support coastal communities to install small-scale wastewater treatment systems. The project will develop household-level small-scale wastewater treatment systems for coastal communities that currently do not treat wastewater before discharging it into public water sources. Since small-scale wastewater treatment systems are required expense, which would affect low-income families, the project proposes a Cross Subsidization tool by having local administrative organizations that earn more income from land and building taxes join in providing some support for installing small-scale wastewater treatment systems for households, in order to reduce wastewater discharged into the sea and beaches.

(3) Donation or fee system from tourists to generate income for groups/clubs conserving natural resources in the area, such as dugong and sea grass planting conservation groups, coral reef conservation groups, etc. This financial mechanism will help develop funds and be a source of income for activities conserving sea grass, coral reefs and dugongs, which are important natural capital of Krabi province.

(4) Establish a fund for the conservation of Nong Thale water sources (water production source), in which income into this fund will be based on the Payment for Ecosystem Services (PES) principle, whereby those who benefit from using water from Nong Thale water sources will pay into the fund according to the amount of water used. Income into the fund will be used to develop the Nong Thale water sources for sustainability.

According to the TOR or PRODOC, this project must develop about 1-2 MBI or Economics Instruments as outputs to be used in the Krabi area. While developing the MBI, it also conducted the NCA of Krabi Province (extent account table, condition account table, service account) in parallel. The main focus of the project is the development of natural capital to be used in writing policies/plans at both the central and provincial levels.

ONEP is concerned that TDRI does not need to focus on MBI or Economics Instrument because of the limited time available. It should therefore focus on NCA, perhaps using existing or already prepared data such as Ocean Economy Satellite Accounts, Tourism Satellite Accounts (TSA), and would like a report on what has been done for each component 1-3 in the past 2 years.

TDRI is currently creating the SEEA of NCA, which has completed the extent accounts table and is currently creating the condition accounts and service accounts table. As for creating the NCA Scenario or simulating the situation (e.g. if there are more tourists, what will be the impact on the quality of the sea water?), TDRI has coordinated with GISTDA to form a team that will work to answer the NCA Scenario.

ONEP asked 2 questions: (1) Is there a tendency to include NCA data of Krabi province in the national Satellite Accounts? (In the past, TDRI asked UNEP and UNEP answered that it could be included as a recommendation.) However, ONEP wants to include it at the national level, which is better, for example, we have a natural capital account for water management to include in the national water management account. (2) The pilot area is to try out real tools or accounting calculations, since Krabi province has never had Satellite Accounts for both tourism and water resources. As mentioned, TDRI must prepare tourism accounts and water resources accounts

for Krabi province, but the PRODOC states that Krabi NCA data must be included in the national Tourism Satellite Account (TSA) and the national Water Resources Satellite Account (WRSA). Therefore, TDRI will have to ask UNEP about this issue.

ONEP proposes to create Satellite Accounts at the provincial level, namely Krabi Tourism Satellite Account (TSA) and Krabi Water Resources Satellite Account (WRSA), but there must be recommendations for the national level as well.

Since the I/O Matrix is only done at the national level (every 5 years), because the I/O Matrix comes from the provincial GPP to be calculated as the national GDP and then calculated as the national I/O, will ask UNEP regarding this.

In the past, Thailand has implemented I/O Matrix only on a sector-by-sector.

TDRI will make a report to present the results of the past 2 years, stating what each component has done / has not done / and what will be done next, with attached documents. And summarize the 5-year plan, stating what is not yet completed and what will be done next, and what TDRI is still unsure about, such as whether it is necessary to include NCA in the national satellite account or not, then ask for opinions from the PSC.

4.2 Tripartite meeting (UNEP, ONEP, TDRI) to follow up on NCA project progress

Date: 2 April 2025, 13.30 – 14.30

Location: Online Meeting

Attendees: 9 people

United Nations Environment Programme (UNEP)

1.	Ms. Kavita Sharma	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia

Office of Natural Resources and Environmental Policy and Planning (ONEP)

2.	Dr. Benchamaporn Wattanatongchai	Environmentalist, Senior Professional Level Director of Biodiversity National Focal Point Subdivision, Biodiversity Management Division
3.	Ms. Somawan Sukprasert	Environmentalist, Professional Level Biodiversity Management Division
4.	Ms. Wannapa Maneekul	Environmentalist, Biodiversity Management Division

Thailand Development Research Institute (TDRI)

5.	Dr. Adis Israngkura	Project Leader
6.	Ms. Thippawan Keawmesri	Senior Researcher
7.	Ms. Prinyarat Leangcharoen	Senior Researcher
8.	Ms. Panida Phranphanat	Researcher
9.	Mr. Peerawat Suriyaburaphakul	Researcher

Main Discussion

1. Updates from ONEP

- ONEP informed that after receiving the work plan submission from TDRI, it has been approved, and formal letters have been sent back to TDRI. UNEP can now proceed with the next step in preparing the budget.
- ONEP requested TDRI to take responsibility for preparing the meeting minutes.
- ONEP emphasized the importance of documenting the meeting to track the progress for reporting to the Project Steering Committee (PSC).

2. Progress Report from TDRI

Developing Natural Capital Accounting (NCA):

- Extent Account: Development of a matrix table covering water and tourism classified by ecosystem types.
- Condition Account: Water Quality Index (WQI) developed in collaboration with the Pollution Control Department, in accordance with SEEA guidelines.
- Supply and Demand Account: Assessment of ecosystem services and economic activities by ecosystem types, covering provisioning, regulating, and cultural services. Target completion: July 2025.
- Output 2.3 and Related Outputs:
    - Suggesting working with the State Audit Office of the Kingdom of Thailand on legal aspects related to fee collection at the sub-district administrative and Municipality since they must wait for the department of local administration to issue relevant policies that enable the adoption of garbage collection fees (e.g., per bag charge).
- Output 3.1 – Market-Based Instruments (MBI):
    - Garbage bag fees (to be discussed with the OAG regarding legislation, revenue collection, and fund usage by government agencies).
    - Small-scale wastewater treatment systems.
    - Collecting donations from tourism.
    - Freshwater conservation fund (e.g., "Baan Nong Thalea" area).
- Project Reporting:
  TDRI is compiling the technical report, including progress on components and pilot implementations.

3. Upcoming Meetings

- PWG (Project Working Group): Expected to be scheduled in June 2025.
- PSC (Project Steering Committee): Second meeting scheduled in August 2025.

ONEP Suggestions:

- PWG should ideally convene in May or early June, with the second PSC meeting possibly moved up to August.
- An additional technical meeting may be arranged in late June, especially to support Component 3, ensuring sufficient dialogue and information-sharing with stakeholders.

4. Feedback and Suggestions

From ONEP:

- Market-Based Instruments:
  The provincial governor should be informed about the project as there are multiple initiatives in Krabi. The MBI pilot should not be delayed, as its effectiveness must be tested.
- Emphasized the importance of raising awareness and having dialogues with National / local stakeholders for NCA implementation.

From UNEP:

- There is a need to ensure integration of Component 3 into provincial-level policy, particularly regarding garbage fees and prioritization.
- The extent account, ecosystem condition accounts, ecosystem services flow accounts and the monetary ecosystem asset accounts should align with SEEA guidelines and clearly identify required variables.
- The spatial aspect of data will enhance communication and understanding at the provincial level.
- UNSD is currently piloting SEEA implementation in five countries, which can provide useful references.

Final Reporting:

- UNEP confirmed that a final report will be produced, including both technical and financial aspects, with third-party review.

5. Additional Notes

- ONEP expressed concern regarding PSC engagement. Since the PSC decided to meet twice a year, clarity is needed on the second PSC meeting schedule.
- TDRI confirmed the 2nd PSC meeting is scheduled for August 2025.

4.3 Tripartite meeting (UNEP, ONEP, TDRI) to follow up on NCA project progress

Date: 12 May 2025, 13.30-14.30

Location: Online Meeting

Attendees: 9 people

United Nations Environment Programme (UNEP)

1.	Ms. Kavita Sharma	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia

Office of Natural Resources and Environmental Policy and Planning (ONEP)

2.	Dr. Benchamaporn Wattanatongchai	Environmentalist, Senior Professional Level Director of Biodiversity National Focal Point Subdivision, Biodiversity Management Division
3.	Ms. Somawan Sukprasert	Environmentalist, Professional Level Biodiversity Management Division
4.	Ms. Wannapa Maneekul	Environmentalist, Biodiversity Management Division

Thailand Development Research Institute (TDRI)

5.	Dr. Adis Israngkura	Project Leader
6.	Ms. Thippawan Keawmesri	Senior Researcher
7.	Ms. Prinyarat Leangcharoen	Senior Researcher
8.	Ms. Panida Phranphanat	Researcher
9.	Mr. Peerawat Suriyaburaphakul	Researcher

Main Discussion

1. Update from UNEP

- UNEP informed that there will be a new UNEP officer to join the project who is from the Asia-Pacific region during the leave of Ms. Kavita

2. TDRI Presentation

- TDRI delivered an update on ongoing work related to natural capital accounting outputs, consisting of **Output 2.1.2 - 2.3.5**

1) Output 2.1.2: Tourism situation assessment

2) Output 2.1.4: Water resources situation assessment

3) Output 2.1.3 & 2.1.5: Ecosystem Extent Account and Ecosystem Condition Account

4) Output 2.2.1: Integrate provincial NCAs into Tourism Satellite Account (TSA) and integrate provincial NCAs into Water Resource Satellite Account (WRSA)

5) Output 2.3.1: Selecting Market-based instrument

6) Output 2.3.2: Trust Fund

7) Output 2.3.3: Conserve, mitigate impacts and restore degraded habitats in watershed forests and coastal marine ecosystems

8) Output 2.3.4: Financial mechanisms for Green Fins

9) Output 2.3.5: Small scale wastewater treatment

3. Discussion and question

- UNEP inquired about the net change in the extent account, particularly whether it referred to changes in plantation stock, specifically rubber and palm oil. UNEP also asked why TDRI did not apply the Travel Cost Method, which is now recommended in the SEEA framework. TDRI clarified that the observed change in the extent account was indeed related to rubber and palm oil plantations. Regarding the Travel Cost Method, TDRI explained that it was not used due to the requirement for data on the frequency of visits, which is often difficult to obtain accurately.
- UNEP emphasized that water quality is a critical attribute of ecosystems, particularly for services such as water purification and nursery functions, which are relevant in the context of Krabi Province. UNEP recommended framing water quality benefits in terms of regulating services, such as flood control
- UNEP suggested consulting with Carl from the IDEEA Group for technical advice on the Tourism Satellite Account and the Water Resource Satellite Account (WRSA), particularly to ensure alignment with the condition account.
- UNEP highlighted the importance of communicating the impacts of wastewater discharge and the benefits of improving water quality. UNEP recommended engaging with the municipality regarding the installation of wastewater treatment systems, particularly in areas such as fish landing sites and jellyfish habitats, and ensuring these are included in project planning.
- ONEP raised a question about TDRI's selection of a relatively small area for installing the wastewater treatment system and whether it would be representative of the broader Krabi province. TDRI responded that this is a pilot area, chosen for its manageability in the initial phase. The intention is to use this site as a starting point for future expansion. TDRI also proposed raising this topic in the upcoming PWG meeting to gather feedback on the wastewater treatment installation.
- ONEP recommended including garbage management as an agenda item in the next PWG meeting.

4. Next Steps

- Follow up on the PSC meetings planned for August and September.
- Revisions to the budget and workplan must be communicated to Kavita (UNEP).

4.4 Tripartite meeting (UNEP, ONEP and TDRI) to follow up on NCA project progress

Date: 20 November 2025, 13.30 – 15.00

Location: Meeting Room 1001, Office of Natural Resources and Environmental Policy and Planning (ONEP), Tipco Tower 2

Attendees: 12 people

United Nations Environment Programme (UNEP)

1. Ms. Allyson Anne Tinney Rivera — Task Manager for Asia's portfolio
2. Mr. Peerayot Sidonrusmee — Programme Management Assistant

Office of Natural Resources and Environmental Policy and Planning (ONEP)

3.	Dr. Benchamaporn Wattanatongchai	Environmentalist, Senior Professional Level
4.	Ms. Wannapa Maneekul	Plan and Policy Analyst
5.	Ms. Suprawee Kuhatanasatian	Policy and planning analysis officer

Thailand Development Research Institute (TDRI)

6.	Dr. Adis Israngkura	Project Leader
7.	Ms. Thippawan Keawmesri	Senior Researcher
8.	Ms. Prinyarat Leangcharoen	Senior Researcher
9.	Ms. Kanjana Yasen	Researcher
10.	Mr. Peerawat Suriyaburaphakul	Researcher
11.	Ms. Pichamon Keakij	Researcher
12.	Ms. Ramida Hansaward	Coordinator

Presentation

Asso. Prof. Dr. Adis Israngkura presented progress updates of the activities the research team has completed or almost completed, categorized into its respective component as follows:

Component 1

Output No.	Activity
1.1.1	Establish and maintain the inter-agency national working group (NWG) • 4 meetings
1.1.2	Draft the 'National framework for NC accounting inThailand'
1.2.1	Host the national sectoral roundtable meetings • 11 meetings with various stakeholder groups (academics, government agencies, etc.)
1.2.2	Assess the inter-dependencies of the tourism sector onNC and ecosystem services • Report can be found in the drive
1.2.3	Assess the inter-dependencies of the water resourcessector on NC and ecosystem services • Report can be found in the drive
1.2.5	Opportunistically integrate emerging NC information into the national Tourism Satellite Account (TSA) • Should be complete in December 2025
1.2.6	Opportunistically integrate emerging NC informationinto the national Water Resources Satellite Account (WRSA) • Should be complete in December 2025
1.2.9	Update the water resources and tourism-related policies,plans and regulations to improve the conservation and sustainable use of NC
1.2.10	Improve and strengthen EIA procedures to ensure thatthe financial impact of developments on NC and ecosystem services are adequately assessed
1.2.11	Evaluate alternative market-based instruments (MBI), and select one viable instrument for further development

Main limitations

- 1.1.2 still in process but the report was redirected by Kavita's advice, which will include the policy and legal structure of Thailand (which will be the backbone of the activities in this project)
- 1.2.5 as the account is reduced to the provincial level, a few (national) accounts were eliminated as advised by Dr. Carl (consultant) due to difficulties measuring Krabi's genuine population and visitors. But the account is almost completed (national and provincial).
- 1.2.11 legal challenges of the garbage bag option but working to find a solution

Component 2

Output No.	Activity
2.1.1	Establish and maintain the inter-agency provincial working group for Krabi province
2.1.2	Conduct a tourism situation assessment for Krabi Province • Report can be found in the drive
2.1.3	Develop and maintain a comprehensive provincialTourism sector NCA for Krabi province
2.1.4	Conduct a water resources situation assessment for Krabi province • Report can be found in the drive
2.1.5	Develop and maintain a comprehensive provincial Water Resources NCA for Krabi province
2.2.7	Identify opportunities for PPPs in conserving, mitigatingimpacts, and restoring degraded habitats in watershed forests and coastal marine ecosystems
2.2.8	Assess the water tariff rates to ensure that the costs associated with the management and protection ofwatersheds is adequately reflected in the price
2.3.3	Conserve, mitigate impacts and restore degraded habitats in watershed forests and coastal marine ecosystems (total area of 40,000 ha in Krabi province)
2.3.4	Develop, test and implement sustainable financingmechanisms for the GreenFins program in Krabi province • Report can be found in drive
2.3.5	Provide technical support to the installation of small- scale wastewater treatment technologies in small-scaletourism enterprises • Only 6% of wastewater is treated before going into the ocean • Collected wastewater samples as evidence of tourism impacts

Main limitations

- 2.2.7 we hope to see more concrete results by the end of the year (conducted interviews and meetings), the last meeting participants expressed that monitoring wastewater inspection/monitoring was lacking in the past 3-4 years. The Muslim group (of housewives or Muslim women) were considered to possibly participate with the trust fund, but we are still examining feasibility

Component 3

Output No.	Activity
3.1.2	Meetings, briefings and presentations to/with target individuals/groups and institutions • Total of 14 meetings
3.1.3	Production and distribution of fact sheets, pamphlets,brochures, newsletters and media inserts
3.1.4	Project performance monitoring and reporting
3.2.1	Develop, host and maintain an online knowledge portal
3.2.3	Facilitate exchange programs for NC accounting decision-makers, manager and/or researchers • Current proposed location is Kinabalu, Malaysia

Main limitations

- 3.2.1 adding enough content to update the website
- 3.2.3 where to decide to go

Main discussion

Ms. Allyson's Comments

- For output 1.1.2, when do you expect to complete this?
  - TDRI answer: the deadline is December of this year
- For output 1.1.3, has the team begun to identify resources on how to find potential sources for the trust fund?
  - TDRI answer: we're still looking but could it link with MBI
  - Ms. Allyson said that it could since the output can be interpreted in a few ways
- For output 1.2.4 is there any updates?
  - TDRI answer: we have begun meeting with the National Budget Agency, but after meeting Krabi on this, they suggested we go to meet with Central Budgeting (agency/office) increase Krabi's budget, which we plan to go meet after finish preparing materials (such as an excel sheet to demonstrate economic impacts of NCA; lower economic costs from tourism) to present the project
  - Ms. Allyson's additional comments: this could also link with output 1.2.7 and 1.2.8
- For output 1.2.9, have there been proposal developed? And what has been achieved on this output?
  - TDRI answer: we have started on this but, we're hoping to further clarify with Kavita what is meant by "update", but the report will have all the basic policies
  - Agreed that "update" can be providing [policy] recommendations
- For EIA processes Ms. Allyson inquired if ONEP could help facilitate. It was explained that TDRI will provide recommendations to the current EIA procedure [how to incorporate natural capital accounting into the EIA process]
- For output 1.2.11, which one (out of the four) will the team be pursuing?
  - TDRI answer: we have tested the four mechanisms but now we are concentrating on the first option (garbage bags) but still deciding whether to charge an additional fee of 5 baht per bag or implement monthly fee price differentiation (similar to what Bangkok Administration has implemented). The fee price differentiate seems to be more viable, however, a legal sub-analysis is needed to finalize which

option is most appropriate (feasible). The governor of Ao Nang municipality launched a garbage bad initiative in the past but failed, so we have their support to revive (improve) the program.

- This also is relevant to 1.2.12
- It was also agreed that all MBI should also have (policy) recommendation

- For output 2.2.1, [TDRI asked] what it the tangible outcome for this output?
  - Allyson explained that it would depend on the data source
  - The team should clarify with Kavita (what is meant by "annually integrate") and other unclear outputs
- For outputs 2.2.2 and 2.2.3 TDRI asks on how to manage keeping contact with Provincial personnel for seamless cooperation
  - Dr. Benchamaporn explains that due to the government personnel rotation system, it is difficult to know who will assume the position, however, we can make use of the PWG to have constant meetings and make contact with "newcomers" to explain the project to alleviate this issue.
- For output 2.2.7, could it be possibly linked with the trust fund (1.1.3) in terms of additional funding? And for the water tariffs (2.2.8), what comes next after the assessment?
  - TDRI answer: yes, we've been looking for potential groups for the trust fund. As for the analysis, water tariffs will help with wastewater fee (economic wastewater costs) as more tourists visiting Krabi increases. The wastewater costs more than fresh water (rice) irrigation. These numbers would be useful for the Central Budget Agency to see the hidden costs of wastewater and demonstrate the value of more wastewater facilities.
- For output 2.3.2, is there a criteria or capacity in implementing the MBI
  - TDRI answer: we are eyeing the Muslim group, however, we still need to finalize the chosen MBI first (to overcome the legal constraints) and assess whether the group will be around to continue interest in this issue
- Ms. Allyson clarified that the trust fund will not have any seed money (seed money was not allocated/designated in the project's budget)
- For output 2.3.3, where there any restoration [impacts] after the implementing activities?
  - TDRI answer: seagrass restoration was done (by Enlive) often but we do not have the current numbers in front of us (the number is included in the report and is over the benchmark written in the ProDoc)
- For output 2.3.5, did TDRI help with the costs of installation?
  - TDRI answer: we only provided the technical information from our expert, but from meeting local stakeholders they wanted to increase random inspections of wastewater disposal (which can incentivize the importance of wastewater system installations to properly treat their water)
  - Ms. Allyson suggested that supporting installations of wastewater treatment systems can be counted as co-finance in the project's budget

- For output 3.1.1, has there been any approaches?
    - TDRI answer: there are two levels, the central government and the local government. The local government seems to work quite well (they came to join our activities since it is good for the province), but we have not really worked with the central government yet
    - Ms. Allyson pointed out that meeting with hotel associations and tourism operators (to disseminate information) also counts towards this output i.e., meetings with local stakeholders.
- For output 3.1.3, who will take care of (host) the website post-project?
    - It was agreed that TDRI would take care of the website until ONEP is ready to take over (due to the volume of international projects ONEP is handling)

Dr. Benchamaporn's Comments

- Clarified the deadline of the project (June 2026)
- Choose 1 MBI and report its results to PWG (as the previous meeting when the 4 MBIs were presented, some were controversial i.e. the garbage bag option)
- We should decide when the next PSC should be held
    - Consult with Kavita (aiming to have the PSC mid or late January 2026)
- How to simplify results [of the project/component 3] for the general public to understand NCA to ensure application/implementation
    - How to communicate with NCA for the public to understand
    - Also providing the information in Thai as well

4.5 Tripartite meeting (UNEP, ONEP, TDRI) to follow up on NCA project progress

Date: 8 January 2026, 11.00 – 12.00

Location: Online Meeting

Attendees: 14 people

United Nations Environment Programme (UNEP)

1.	Ms. Kavita Sharma	Task manager for UNEP's GEF portfolio on biodiversity and land degradation in Asia
2.	Mr. Peerayot Sidonrusmee	Programme Management Assistant

Office of Natural Resources and Environmental Policy and Planning (ONEP)

3.	Dr. Benchamaporn Wattanatongchai	Environmentalist, Senior Professional Level
4.	Ms. Wannapa Maneekul	Plan and Policy Analyst
5.	Ms. Suprawee Kuhatanasatian	Policy and planning analysis officer

Thailand Development Research Institute (TDRI)

6.	Dr. Adis Israngkura	Project Leader
7.	Ms. Thippawan Keawmesri	Senior Researcher
8.	Ms. Prinyarat Leangcharoen	Senior Researcher

9.	Ms. Kanjana Yasen	Researcher
10.	Mr. Peerawat Suriyaburaphakul	Researcher
11.	Ms. Panida Phranphanat	Researcher
12.	Mr. Promphat Bhumiwat	Researcher
13.	Ms. Pichamon Keakij	Researcher
14.	Ms. Ramida Hansaward	Project Coordinator

Main Discussion

1. Brief presentation on outputs 2.2.6 (Develop a business case for the piloting of the selected market-based instrument in Krabi Province) and 3.2.3 (Facilitate exchange programs for NC accounting decision-makers, manager and/or researchers)

- For output 3.2.3, TDRI presented the proposed location for the exchange program trip as Kinabalu, Malaysia with information about its ecosystems (that were comparable to Krabi Province), national and state (provincial) policies related to environmental conservation and proposed a tentative itinerary. The team consulted Ms. Kavita whether the location is appropriate, so preparations can begin.
- For output 2.2.6, TDRI presented the previous market-based instrument(s) that were changed due to limited feasibility and proposed a new instrument: payment for ecosystem services through a bird watching tour package in Khlong Prasong area in Krabi. To sustain the initiative after the project ends, a small group of local students (with interests in the environment and/or birds) from the primary level (year 4 to year 6) and the secondary level (sophomores to seniors) will be trained to be tour guides for this initiative. And if they are passionate when they graduate from school, they can work as full-time guides.

2. Upcoming meetings

- PWG (Project Working Group): scheduled for January 20th, 2026
- PSC (Project Steering Committee): scheduled for January 29th, 2026

3. Feedback and Suggestions

From UNEP

- For output 3.2.3, Ms. Kavita has concerns about whether Malaysia would be an appropriate choice because their experience with NC accounting is unclear and would prefer to visit another site that has experience with NC accounting as Thailand (this project), which has some experience with NC accounting. She also reminded the team to consider the budget for this output and the gender balance of participants. Additionally, Ms. Kavita advised TDRI to conduct further research on which countries (within the ASEAN region) have NCA experience or similar natural capital evaluation experience. TDRI will do so and send updates within 10 days.

- For output 2.2.6, Ms. Kavita enquired on whether there would be issues with involving children to be tour guides (child labor laws) and suggested that teaching children the practical skills to become (bird watching) guides should fall under community awareness instead of MBI related outputs. She also suggested that PES for bird watching tours should clearly identify buyers and sellers. Ms. Kavita mentioned that the buyer is the tourists and that the seller is the community that does restoration (where the tourists are paying for the ecosystem service).

From ONEP

- Dr. Benchamaporn enquired to Ms. Kavita on whether budgets from unfinished outputs would be returned to UNEP or GEF. And Ms. Kavita confirms that the remaining funds will go back to GEF via UNEP. On this point, Ms. Kavita suggested that reallocation of the budget can be made for documents to be translated into Thai or to produce PR media. It should also be noted that the project's budget may not be used after the end date of the project, July 31th, 2026.
- She also asked for summaries on the outputs of the project (as dissemination of information) to be translated into Thai for Thai government officers and local residents. This is to have tangible products (of the project) to be further used after the project ends.
- Dr. Benchamaporn asked TDRI, how many MBIs will be presented at PWG meeting and asked the team to prepare the reason for the MBI change as well. TDRI responded that one MBI (bird watching tour) will be presented to the PWG Committee and will have the justification for choosing this MBI.

4. Additional Notes

- TDRI gave brief updates on supporting Krabi's provincial office to relaunch a task force to conduct more on-site inspections in Ao Nang Sub-district to ensure compliance of wastewater treatment from local enterprises. This initiative aims to tackle Ao Nang's wastewater issue (polluted water discharged into the ocean) before it further damages surrounding ecosystems and to advocate the importance of water monitoring.
- It was clarified that there will be no seed money to set up the trust fund, however, Ms. Kavita advised that reallocation of the budget is possible if a proposal is made and sent to UNEP (very soon) to approve. For instance, some of the activities for community outreach can be reallocated from component 3 activities. TDRI added that they will find a method to raise funds for the trust fund if no seed money is allocated from the project. Additionally, the trust fund needs to have the internal mechanisms and governance structure (board of trustees) in place, along with a manual for the operation of the trust fund.
- Dr. Adis presented a mechanism to build sustainable collaboration for the trust fund by including the private sector such as hotel businesses to contribute co-financing as a form of Corporate Social Responsibility (CSR). The co-finance would be used as seed money for the trust fund's activities as cash can not be directly accepted as seed money, the project will raise funds via co-funding and other co-financing means from the private sector or send tourists with bird-watching interests to use the bird-watching tour service.

4.6 The 3 parties coordination meeting for NCA Project

Date: 20 April 2026, 14.00 – 16.30

Location: Office of Natural Resources and Environment Policy and Planning, Tipco Tower 2

Attendees: 10 people

Office of Natural Resources and Environment Policy and Planning (ONEP)

1. Ms. Nareerat Panmanee — Deputy Secretary-General of ONEP
2. Mrs. Katunchalee Thammakul — Director of Biodiversity Management Division
3. Ms. Benchamaporn Wattanatongchai — Director of Biodiversity National Focal Point Section
4. Ms. Wannapa Maneekul — Policy and Planning Analyst
5. Ms. Supawin Kuhathanasathian — Policy and Planning Analyst

United Nations Environmental Programme (UNEP)

6. Ms. Kavita Sharma — Task Manager
7. Mr. Peerayot Sidonrusmee — Programme Management Assistant

Thailand Development Research Institute (TDRI)

8. Assoc. Prof. Dr. Adis Israngkura — Project Manager
9. Mrs. Thippawan Keawmesri — Senior Researcher
10. Ms. Ramida Hansaward — Project Coordinator

Topic 1 Revising the Key Deliverables

Activity (Output)	KEY DELIVERABLES	Meeting Resolution	Opinions (Feedback)
Component 1 **Activity 1.1.3** Raise funding to co-finance development of nationalwater resource and tourism sector NCAs	Additional funding committed to development of NCAs	**Remains the same** however, a clarification note needs to be added to explain that "co-finance" refers to synergizing similar projects with other agencies such as the NSO or other tourism-related projects, not starting a new fund. The objective is to have at least 2 sources (agencies) to co-finance	The Project Manager informed that finding "co-financing" sources to support NCA can not be done due to budgetary constraints from the public sector The Deputy-Secretary General informed that receiving budget allocations from the public sector for the NCA project can not be done at this time, due other environmental issues that are impacting citizens such as PM 2.5, forest fires, and climate change take priority. The Task Manager clarified that the wording of "co-financing" is rather vague and can be interpreted in many ways. The benefits (results) of

Activity (Output)	KEY DELIVERABLES	Meeting Resolution	Opinions (Feedback)
			implementing the NCA project that contribute to other public sector projects or collaboration with the NCA PSC members can be considered as "co-finance". The activity aims to mainly contribute to other public sector projects, rather than finding additional sources to monetarily fund the project.
Component 1 **Activity 1.2.4** Update the National Budget policy	Budget policy revision	**Revise to** "provide policy recommendations to demonstrate the importance of natural capital accounting"	The Project Manager informed that revising existing policies is difficult and proposed to provide policy recommendations instead, to demonstrate the importance of natural capital to the Budget Bureau.
Component 1 **Activity 1.2.7** Link NC information for tourism and water resources with the development of MTEFs and the 13th NESDP	Revised MTEFs and 13th NESDP	**Revise to** "Revised MTEFs and 14th NESDP"	The Project Manager requested to revise providing recommendations for the 14th NESDP instead of the 13th NESDP, to align with the current plan.
Component 1 **Activity 1.2.9** Update the water resources and tourism-related policies,plans and regulations to improve the conservation and sustainable use of NC	Policies, plans and regulations that: (i) Endorse green GDP reporting (ii) Promote more sustainable management of NC (iii) Remove "perverse incentives"	**Remains the same** "Policies, plans and regulations that: (i) Endorse green GDP reporting (ii) Promote more sustainable management of NC (iii) Remove "perverse incentives" *however, additional information needs to be added relating to policies, plans, and regulation instead of formulating new policies, plans or regulations	The Task Manager 1. suggested that reviewing the current plans and providing recommendations would be more feasible than modifying existing plans 2. proposed that any policies (national and provincial levels) that have been implemented since the NCA project began such as green GDP reporting, sustainable management of natural capital, and removing perverse incentives can be used to show correlations of this project on government initiatives relating to natural capital accounting (to

Activity (Output)	KEY DELIVERABLES	Meeting Resolution	Opinions (Feedback)
			demonstrate the benefits and/or impacts). These projects can include but not limited to forests, marine, watersheds, and ecosystem projects. The Task Manager informed that Krabi has their "Krabi Goes Green" Strategy and currently in collaboration with the Sub-District Administration Organization of Ao Nang on their wastewater management. The Director of Biodiversity National Focal Point Section believes that this activity does not need revision but should add information to show the connection with policies and plans of the tourism and water resources sectors.
Component 1 **Activity 1.2.10** Improve and strengthen EIA procedures to ensure thatthe financial impact of developments on NC and ecosystem services are adequately assessed	Revised EIA regulations	**Revise to** "Provide recommendations to incorporate NCA into the EIA guidelines (of the relevant sectors such as water source development projects or projects that impact ecosystem services"	The Project Manager informed that EIA process is enforceable by law and has many procedural steps (if revisions were to be done), thus it was requested to revise the deliverable to provide recommendations to consider incorporating NCA into the EIA guidelines for the related projects such as water sources development, mining, and commercial buildings The Director of Biodiversity Management Division suggested that if the step or process in the EIA guidelines where NCA can be incorporated can be identified, then the process to implement the recommendation more convenient and enhance the potential for further applications.

Activity (Output)	KEY DELIVERABLES	Meeting Resolution	Opinions (Feedback)
Component 1 **<u>Activity 1.2.12</u>** Build political support, institutional capacity and private sector for introducing the selected market-based instrument into the national policy mix	Enabling policy for the preferred MBI	**Revise to** "Provide recommendations from MBI assessment experience (previous MBIs studied) and include the lessons learned and the challenges of implementing MBIs in Thailand"	<u>The Project Manager</u> informed that while studying the MBI(s) to pilot in Krabi Province, challenges and legal constraints were encountered. Thus, the MBI has been changed to bird watching (community level) instead <u>The Task Manager</u> suggested that the challenges and lessons learned from the previously proposed MBIs to analyze the weaknesses and constraints as to why they are not feasible to implement. Also, before a policy is implemented it should be tested (piloted). Thus, providing policy recommendations would be more appropriate.
Component 2 **<u>Activity 2.2.4</u>** Promote the adoption of SEA in the preparation of municipal/district spatial development plans in Krabi province	Provincial SEA regulations	**Revise to** "Provide provincial recommendations (namely Krabi Province) demonstrating the spatial hotspots (of wastewater generated) and cost-effectiveness data (GPP-based) for the province to utilize in their provincial development plan"	<u>The Project Manager</u> informed the following points: 1. Collaboration with NESDC is needed, as the SEA is under the NESDC's responsibility. A map identifying the hotspots of where wastewater is generated (in Ao Nang Sub-District) will be presented as a part of a policy recommendation to manage wastewater in Krabi's Provincial Development Plan meeting (with the Governor of Krabi), which will also include recommendations for budget allocation and guidelines on SEA) 2. a report on how to improve Krabi (namely Ao Nang) with spatial aspects, using maps demonstrating the hotspots of wastewater generated by tourist-related businesses and data displayed in graphs, will

Activity (Output)	KEY DELIVERABLES	Meeting Resolution	Opinions (Feedback)
			be prepared for the province to use for practical applications.
Component 2 **<u>Activity 2.2.5</u>** Assist in the development and testing of EIA-based toolsfor assessing financial impacts of proposed developments on NC	EIAs using NC accounting tools to assessfinancial impacts of developments	**Revise to** "Provide recommendations or guidelines for Krabi Province to utilize Provincial NCA as a tool for local decision-making"	<u>The Task Manager</u> emphasized that the main objective of the activity (output) is to integrate NCA data into the process or guidelines of EIA (provincial level), to demonstrate the monetary loss or cost of a construction (development) project; not just the amount of resources sacrificed, to show clearly show the impacts. This activity is a continuation from activity 1.2.10, which aims to provide recommendations specifically tailored to the province's spatial context such as recommendations for the tourist sector or for provincial development projects <u>The Deputy-Secretary General</u> observed that in practice, revising the regulations or process of EIA at the provincial level is difficult. However, with the original benchmark stating that EIAs should be completed, it was suggested to revise the deliverable to provide recommendations instead. Nevertheless, these recommendations should emphasize utilizing the provincial NCA information to demonstrate how Krabi differs from other provinces.

* Task Manager informed that although all components of the benchmark may not be fulfilled, there should be justifications explaining why some components can not be implemented.

Topic 2 Additional Topics of Discussion

Activity (Output)	เรื่องเสนอ	**Meeting Resolution**	**Opinions (Feedback)**
Component 3 **Activity 3.2.3** Facilitate exchange programs for NC accounting decision-makers, manager and/or researchers	Site visit to the Republic of Philippines. The project consultant has coordinated with ONEP to determine the trip schedule and agencies to include	No objections to the site-visit and schedule the visit for June	The Task Manager has no objects to the drafted agenda to visit the Philippines, as the project consultant has presented. But emphasized the importance of participation of national level agencies such as ONEP and provincial agencies in Krabi to utilize and apply knowledge (from the visit) in their respective jurisdictions The Deputy-Secretary General proposed to limit participants to be 10 – 12 people and will review the list of relevant agencies. The proposed location of the site visit will also be reviewed to ensure optimal suitability and value. The Director of Biodiversity Management Division proposed to schedule the site-visit to June, due to scheduling conflicts of ONEP (during May 18th - 20th 2026, ONEP is responsible for hosting activities for International Biological Diversity Day)
Component 2 **Activity 2.3.1** Pilot the implementation of the selected market-based instrument in Krabi province	Proposed to approve budget allocation of approximately 1,000,000 baht to expand (scale-up) implementation of youth camps.	Approved the budget allocation of approximately 1,000,000 baht to expand implementation of youth camps (in Krabi) after the project's end date,	The Project Manager requested a budget allocation of approximately 1,000,000 baht to expand implementing additional youth camps in 2-3

		however, budget disbursement must be done before June	schools (in Krabi) after the project's end date. However, budget disbursement will be done before June The Director of Biodiversity Management Division proposed that since migratory bird-watching as an eco-tourist activity has seasonal constraints (around 3 months per year), additional eco-tourist activities should be considered to add diversity and to enable year-round activities for sustainability The Director of Biodiversity National Focal Point Section additionally suggested that the remaining funds should be allocated to produce materials to promote and disseminate knowledge from the project (under component 3) to make use of the project's results for future applications.

Figure 1 The 3 parties coordination meeting for NCA Project on 20 April 2026

Image source by the author

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

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