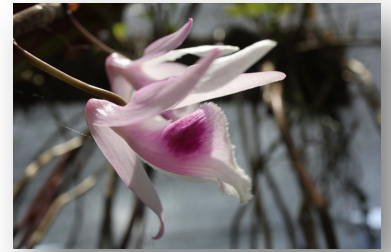


Kingdom of Cambodia

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NATIONAL ECOSYSTEM ASSESSMENT SCOPING REPORT

DEVELOPED BY:

GENERAL SECRETARIAT OF THE NATIONAL COUNCIL FOR SUSTAINABLE
DEVELOPMENT AND ROYAL UNIVERSITY OF PHNOM PENH

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List of Acronyms

BTWG:	Biodiversity Technical Working Group
CHM:	Clearing House Mechanism
CI:	Conservation International
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
GSSD:	General Secretariat of the National Council for Sustainable Development
FAO:	Food and Agriculture Organization of the United Nations
IBAT:	Integrated Biodiversity Assessment Tool
ILK:	Indigenous and Local Knowledge
IPBES:	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPLC:	Indigenous people and Local Community
IUCN:	International Union for Conservation of Nature
KII:	Key Informant Interview
MoE:	Ministry of Environment
NAP:	National Adaptation Plan
NBSAP:	National Biodiversity Strategy and Action Plan
NCP:	Nature's Contributions to People
NEA:	National Ecosystem Assessment
NFTP:	Non-timber Forest Product
NSDP:	National Strategic Development Plan
REDD+:	Reducing Emissions from Deforestation and Forest Degradation, Foster Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks
RGC:	Royal Government of Cambodia
RS:	Rectangular Strategy
RUPP:	Royal University of Phnom Penh
SDG:	UN Sustainable Development Goals
PEMSEA:	Mekong River Commission or the Environmental Management for the Seas of East Asia
UNCBD:	United Nations Convention on Biological Diversity
UNCCD:	United Nations Convention to Combat Desertification
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment Programme
UNFCCC:	United Nations Framework Convention on Climate Change
UNESCO:	United Nations Educational, Scientific and Cultural Organization
WCMC:	World Conservation Monitoring Centre
WCS:	Wildlife Conservation Society
WWF:	World Wildlife Fund
6NR:	Sixth National Report

1. Introduction

The National Ecosystem Assessment (NEA) will update the information gathered in the 6th National Report (6NR), which covers the period between 2014 and early 2019. Targeting especially policy- and decision-makers, the NEA scope will go beyond the National Biodiversity Strategy and Action Plan (NBSAP).

The overall scope of the NEA is to assess the status, trends, drivers and responses regarding biodiversity, ecosystem functions and ecosystem goods and services and their interlinkages in a rapidly changing and interconnected world for long-term human wellbeing and good quality of life. The assessment will analyse the contributions of biodiversity and ecosystem services to the implementation of the Sustainable Development Goals (SDG), recognizing synergies and trade-offs associated with meeting multiple goals, and the need for balanced integration between the social, economic, and environmental dimensions of sustainable development. Supporting SDG, the assessment will enable the country to graduate from low-middle income to upper middle-income within three dimensions, i.e. social economic and environmental, in an integrated manner (RGC, 2018). With this in mind, the objective of the NEA is to strengthen the science-policy interface on biodiversity, ecosystem functions and ecosystem goods and services at all spatial scales. The assessment will assess the state of knowledge on past, present and future interactions between people and nature, including by highlighting thresholds, feedbacks, synergies, and trade-offs.

Biodiversity and associated ecosystems¹ provide goods and services needed for socioeconomic development and good quality of life. Some people consider biodiversity and the ecosystems as nature, and the goods and services from ecosystems as nature's contributions to people.

Some countries have undertaken the NEA to respond to decision makers' need for information. The NEA synthesizes and communicates complex information and can thus inform and influence policy- and decision-making processes. In particular, they identify and describe the value of ecosystem services in ways that increase decision makers' understanding of how their actions might change these services. Bearing in mind the multiple factors impacting biodiversity and ecosystem services, the NEA provides critical judgement of options and uncertainty enabling policy- and decision-makers to choose options that would sustain the appropriate mixtures and levels of services.

Cambodia is among the 12 countries supported by UNEP-WCMC to build capacities at the national level to undertake the national ecosystem assessments, identify country's ecosystems requiring particular attention and supporting the uptake of the assessments into decision-making. The NEA is expected to raise awareness of biodiversity values and improve

¹ 'Biodiversity' has been defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and of ecosystems" and 'ecosystem' as a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (UNCBD Article 2). Thus, biodiversity is a generic term that includes all the plants, animals and microorganisms considered at the genetic level (e.g., the different varieties of a crop or different strains of), species level (e.g., the multiples species of birds or insects found in a national park or species of trees found in a forest, or different microorganisms used for fermentation in breweries) and at the ecosystem level (e.g., the different landscapes found in a province).

information systems that characterize the linkages between the environment and society, most of which are yet to permeate decision-making.

A first step in this process is to draft a scoping document which presents (i) the assessment scope, geographic areas, rationale and utility as well as the assumptions regarding in particular availability of expertise and financial resources for the preparation and implementation of the assessments; (ii) a description of the methodologies, including assessment approaches, drivers and knowledge systems, uncertainty, target areas, indicators, and limitations and knowledge gaps; (iii) the chapter outlines; (iv) the relevant datasets from a wide range of sources, including but not limited to scientific literature, research projects and indigenous and local knowledge; (v) strategic partnerships and initiatives that will ensure a fruitful assessment; (vi) a description of the structures to be put in place to operationalize and best deliver the assessment; (vii) the process to be used and its timetable; (viii) an estimate of the cost of conducting the assessment and preparing the assessment reports, including the summary for policy-makers; (x) a communication and outreach strategy; and (xi) ways and means to strengthen the human, institutional and financial capacities needed as well as the capacities that will be built in the country for future national, regional and global assessments.

2. Scope, Geographic Areas, Rationale, Utility and Assumption

2.1 Scope

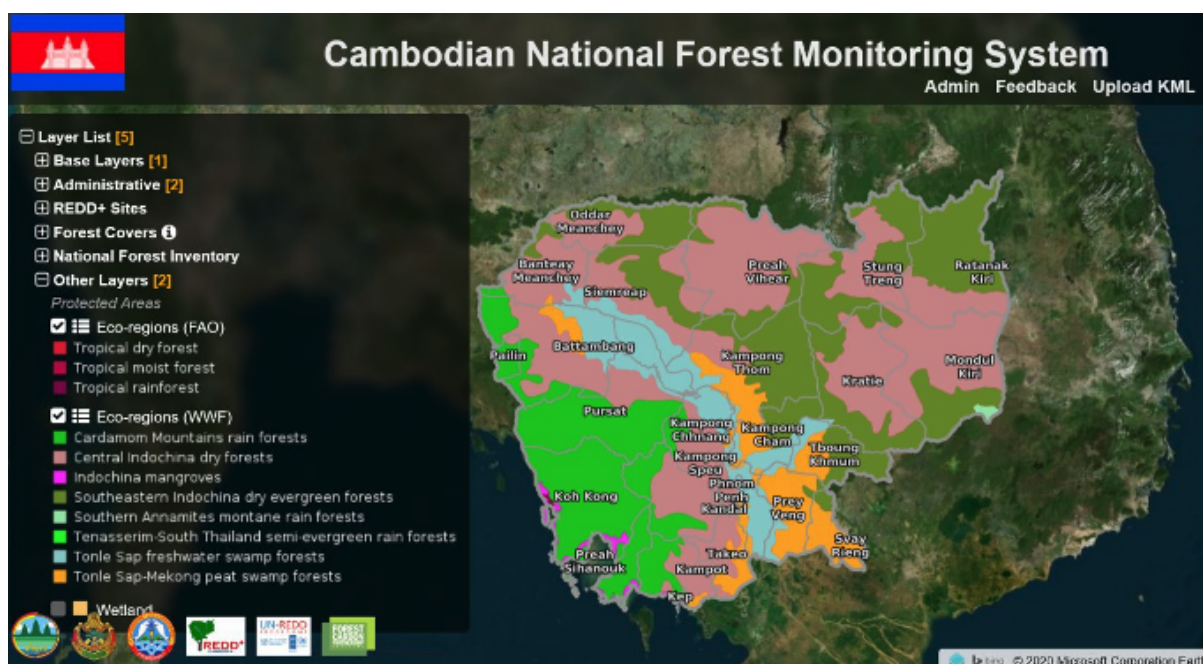
The objective of this assessment is to strengthen the science-policy interface on biodiversity, ecosystem functions and ecosystem services at the national level. We shall analyse the state of knowledge on past, present and future interactions between people and nature, including by highlighting/presenting messages that will inform and inspire decision and policy-making processes at all levels in the country in relation to sustainable development. The assessment messages will be in phased to contribute to the Rectangular Strategy Phase IV, the National Environment Strategy and Action Plan 2016 -2023 and the Green Growth Roadmap. They will be relevant to the implementation of the Sustainable Development Goals (2015–2030), the NBSAP², the Paris Agreement on Climate Change through Cambodia’s Nationally Determined Contributions and National Adaptation Plans (NAP), the National Voluntary Land Degradation Neutrality Targets under the UNCCD and other plans and programmes relating to biodiversity and ecosystems services. The assessment will also identify gaps in knowledge needed by decision-makers and thus guide future scientific research.

The overall scope of this assessment is thus to assess, in line with the IPBES conceptual framework (Annex 1), the status, past trends and future dynamics of the biodiversity found in Cambodia, including ecosystem services and their interlinkages; the contribution of biodiversity, ecosystem functions and ecosystem services to the good quality of life or the wellbeing of the people in Cambodia; as well as the direct and underlying drivers of biodiversity loss and the responses to the threats to biodiversity described in the NBSAP and other related strategies and action plans. Future dynamics will cover the target year 2030 in

² Accessible at <http://www.chm.gdanpc-moe.org/publications/national-biodiversity-strategy-and-action-plan.html>

line with UNSDGs and the new biodiversity global framework, and 2050 in line with the UNCBD vision.

The assessment will address terrestrial, freshwater, coastal and marine biodiversity, ecosystem functions and ecosystem services. Taking into account the 24 themes and the 20 national biodiversity targets (see Annex 4) covered in the NBSAP, the thematic assessment priorities will include the food-energy-water-livelihood nexus; combined pressures from land degradation, climate change and invasive alien species on livelihoods, food security; socioeconomic value of selected biodiversity components e.g., forests and REDD+, protected areas and tourism; and environmental health and zoonotic diseases, including pandemics.



Cambodia Eco-region Map

2.2 Key Policy Questions

The assessment will address the following policy-relevant questions approved by the Biodiversity Technical Working Group (BTWG) during the inception meeting held on December 24, 2019:

- a. How do biodiversity and ecosystem functions and services contribute to the economy, livelihoods, food security and good quality of life in Cambodia, and how can they contribute in the post-COVID-19 pandemic period? What are the interdependences among these contributions? And how has the knowledge of biodiversity value contributed to the best policies and decisions for improved human well-being?
- b. What is the status, trends and potential future dynamics of biodiversity, ecosystem functions and ecosystem services that affect the economy, livelihoods and well-being in Cambodia? And what are the actual and potential consequences/impacts of the observed changes in biodiversity and associated ecosystem services on the economy, livelihoods and well-being in Cambodia?

- c. What are the factors driving the changes in the status and trends of biodiversity, ecosystem functions, ecosystem services and good quality of life in Cambodia?
- d. What policies and interventions, including in particular for bringing about the transformational changes needed in biodiversity management to meet the goals enshrined in the Rectangular Strategy and related strategies, plans and programmes, on biodiversity, ecosystem functions and ecosystem services could be considered to ensure the sustainability of the economy, livelihoods, food security and good quality of life in Cambodia?
- e. What are the gaps in knowledge and the capacity building needs that should be addressed to better understand and tackle the drivers, impacts and responses of changes to biodiversity, ecosystem functions, ecosystem services in Cambodia and bring about the transformational changes in adequate biodiversity management?

2.3 Geographic Boundaries of the Assessment

The status and trends of biodiversity in Cambodia reflect the country's geography, history and awareness of the value of this natural asset. Cambodia – influenced by monsoon climate pattern and the biodiversity is considered at the ecosystem, species and genetic levels, and includes plants, animals and microorganisms although there is a large discrepancy in availability of data for each component.

With a total land area of 181,035 Km², along the Gulf of Thailand and a population estimated at over 16 million in 2018 and growing at an average annual rate of 1.46 percent - among the highest in Southeast Asia – Cambodia consists of low-lying plains in the central part of the country surrounded by mountainous and highland regions in the northern, eastern and western parts. The largest area of the country falls within the Mekong River Basin crossed by the Mekong River and its tributaries such as the Tonle Sap River that joins the Tonle Sap Lake.

Cambodia is divided into four eco-regions, including a) the Annamite range moist forest, b) the Cardamom Mountain moist forest, c) the Central Indochina dry deciduous forests, and d) the Mekong freshwater ecoregion³. The NEA just focuses on the specific geographical area includes land, inland waters, and marine and coastal regions in the country. The Tonle Sap lake is situated in the centre of the central plain in Cambodia; this plain has an elevation of 10-30 meters above the sea level and covers about 75% of the country (Carbonnel, 1963). It consists of six provinces, covering 1,158 villages of the floodplain areas, and 170 floating villages (Keskinen, 2006). The lake's ecosystem is defined as a permanent core area of the great lake and surrounded by natural floodplain, within the boundaries constituted by the upper flood lines. The lake is an essential part of the Mekong River system, with some regarding it as the beating heart of the whole hydrological system because of its annual fluctuations. The Mekong River system dominates the hydrology, cultural life and the livelihoods of the people in the Lake area. The natural flood levels are not always clear from year to year in the areas where flood and rainwater retention structures have been built. With the variability of ecosystems, the Lake has been considered as a rich source of fish and rice for people living nearby and essential for the entire country.

³ MoE/GSSD. (2019). The 6th National Report to the UNCBD Secretariat.

In the southwest, Cambodia has a coastline of about 443 km in the provinces of Koh Kong and Kampot, and the cities of Sihanoukville and Kep. Less than 10% of the country's total population lives in this region. Even though the population is low, but Cambodia coastal fisheries play an important role in the national economy. Also, marine biodiversity is a main source of local livelihoods, especially for coastal communities. According to the country report in 2006, the inland and coastal water is rich in fishery resources, and these resources was valued about USD252 million, corresponding to about 8.4% of GDP. Fishery sector provides substantial employment opportunities to the rural and coastal population⁴. The majority of Cambodians live in the area associated with the Mekong River Basin, which covers more than 86% of the country's territory.

However, in this NEA – Cambodia team will focus on three main areas, the eastern plain, the northern parts of Tonlé Sap lake, and coastal and marine areas (see section 3.4).

2.4 Rationale

In 2019, Cambodia submitted its 6NR on biodiversity to the Secretariat of the UNCBD. The report summarized information on assessed progress in the implementation of the national biodiversity targets adopted in the NBSAP and provided an updated profile of biodiversity in Cambodia. The national biodiversity targets have been adopted in line with the RS Phase IV, the National Environment Strategy and Action Plan 2016 -2023 and the Green Growth Roadmap. They were also in phase with the national action plans for the Sustainable Development Goals. The report covered the period between 2014 and 2019.

In overall, Cambodia made significant progress on all the targets and exceeded expectations in establishing new protected areas, terrestrial as well as marine, and corridors to ensure that the protected area system is well connected. The report highlighted the need to pursue work on valuation of biodiversity and ecosystem services and thus provided the type of information needed particularly when choices have to be made between biodiversity conservation and other land uses. The report also noted the need for information on future dynamics of biodiversity required in modeling or projecting future management of biodiversity in the context of sustainable development and Cambodia's vision to graduate by 2030 from the low-middle income to the upper middle-income country.

Amid the COVID-19 pandemic, the assessment will recognize synergies and trade-offs associated with meeting multiple goals, and the need for balanced integration between the social, economic, and environmental dimensions of sustainable development. In particular, the NEA will assess different scenarios and projections on status and dynamics of biodiversity and ecosystem services and identify and describe the value of ecosystem services in ways that increase decision makers' understanding of how their actions might change these services. In this context, the NEA will contribute to raising awareness of biodiversity values and improving information systems that characterize the linkages between the environment and society.

⁴ MOE (Ministry of Environment) (2013). 3rd State of the Coastal Environment, Climate Change and Socio-Economy Report 2013.

By synthesizing and communicating complex information needed for policy- and decision-making, the NEA will strengthen the science-policy interface on biodiversity, ecosystem functions and ecosystem goods and services at all spatial scales. Bearing in mind the multiple factors impacting biodiversity and ecosystem services, the NEA will provide critical judgement of options and uncertainty enabling policy- and decision-makers to choose options that would sustain the appropriate mixtures and levels of services.

Development of the NEA report and the Summary for policy- and decision-makers will bring together many experts and will thus be scientifically more authoritative with information presented with their confidence levels.

The NEA provides an opportunity to build capacities at the national level for ecosystem assessments, the uptake of the assessments into decision-making and communicating information on biodiversity and ecosystem services.

2.5 Assessment's Utility

Many efforts have been made to reduce the effects of natural and development pressures on national biodiversity in Cambodia, but there has been minimal consideration of national and sub-national assessment scale on the current biodiversity as well as a lack of focus on building resilience and adaptive capacity of natural biodiversity. Given this context, this project will undertake an intensive national ecosystem assessment on biodiversity contributions to social economic development and human well-being which will include several concerned government institutions, academics, IOs and NGOs, communities and private companies as partners. The national assessment will provide clear information, with a credible, legitimate, authoritative, holistic and comprehensive analysis based on the current state of biodiversity and natural resources in Cambodia.

In September 2015, the UN General Assembly adopted the new 2030 Agenda for Sustainable Development. This contains 17 items (169 targets) known as the UN-SDGs, including the following themes: no poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation, and infrastructure, reduced inequality, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on water, peace, justice and strong institutions, and partnerships for the goals.

Also, the RGC released the RS Phase IV as a comprehensive policy framework for formulating of National Strategic Development Plan (NSDP) 2019-2023. One of the most important objectives of the RS Phase IV is to ensure a high level of annual economic growth (above 7%), with sustainable, inclusive and equitable reduction of the poverty, and resilience to shocks; accomplished by diversification, improved competitiveness and maintaining macroeconomic stability.

Therefore, the NEA is a follow-up to the preceding section on 'Rationale.' It will be possible to write this section to provide:

1. Better understanding of the ecological and mainly socioeconomic values of biodiversity and ecosystem services in Cambodia. This information is urgently needed not only by

- decision- and policymakers in all sectors of the society, but also by all the stakeholders. This information will help transform the way people in Cambodia interact with nature;
2. The assessment will strengthen the science-policy interface by providing the information needed to take the best-informed and necessary actions to curb the loss and restore biodiversity and ecosystem services through knowledge-based solutions and sustainable practices. While the assessment will provide optional recommendations, it will not make prescriptions, which are the prerogative of the government;
 3. Bearing in mind the IPBES Asia Pacific regional assessment completed in 2018, this NEA will consider aspects of biodiversity and ecosystem services that are highly specific to Cambodia and that were not included/highlighted in the Regional Assessment (e.g., endemic species and genetic diversity of cultural, ecological and economic importance, and ecosystems such as the Tonle Sap, which is of critical importance to the lives of Cambodians);
 4. Like the Asia-Pacific regional assessment, this NEA will fully embrace the recent global appeals for inclusive knowledge synthesis in scientific assessments. It will consider insights from modern scientific knowledge, Indigenous and Local Knowledge (ILK), and other knowledge systems/practices to develop integrative and practical policy options;
 5. The NEA will provide the most recent information for spatial planning and related data cutting across ecoregions and provinces i.e. based on ecosystem approach/ecosystem-based approaches or landscape approach;
 6. The NEA will try to find inspiring success stories and examples of failures to be used in decision- and policy-making processes and to be used in the development of key messages that will resonate with different target groups;
 7. The strong participation of Indigenous People and Local Community (IPLC) that is planned in the project will ensure that recommendations take into account both top-down command-and-control instruments (which, combined with a poor involvement of local communities, have often yielded negative conservation outcomes) and bottom-up, participatory and collaborative community-driven efforts (which have often created some positive conservation outcomes); and
 8. Highlighting the importance of the NEA for implementation of other strategies, plans and programmes, including 3Rio Conventions.

2.6 Assumptions

The National Ecosystem Assessment will be based, in line with IPBES guide on the production of assessments⁵, on existing data, scientific literature, and other published information, including reports from government agencies (such as national reports under UN-CBD, UNCCD, and UNFCCC, reports from statistical offices, strategic documents, and research proposals submitted for funding), reports from national as well as international organizations (such as the following United Nations organizations: FAO, UNEP, UNDP, UNESCO; sub-regional organizations such as the Mekong River Commission and Asian Development Bank;

⁵ <https://ipbes.net/guide-production-assessments>; also see IPBES/3/INF/4

and national as well as non-governmental organizations), indigenous and local knowledge, and grey literature.

It is thus assumed that:

(a) Regarding data/information:

- (i) Relevant information and data, including from recent localized assessments and from indigenous and local knowledge, will be available in usable/published formats (e.g.: success story will be translated into local languages and disseminated through awareness raising session);
- (ii) In accordance with IPBES' data and information management guide, data and metadata will be properly archived with information on the geographical location and temporal reference of the underlying data as well as the scientific protocol with which they were collected and through an interoperable process to ensure comparability in space and time i.e. between regions/ecosystems across the country and with future assessments;
- (iii) Selected experts will be familiar with the IPBES conceptual framework and the IPBES guide on producing and integrating assessments (see IPBES/3/INF/4). Their expertise will cover all the country's ecoregions, all the components of biodiversity, and not only biological sciences but also social sciences and economics;

(b) Regarding experts:

- (i) Cambodia will have sufficient, qualified experts willing to contribute to the NEA;
- (ii) Those experts are of capacity to conduct the NEA; and
- (iii) Experts involved in the assessment are able to work closely with a variety of sources of knowledge, including indigenous and local knowledge systems to ensure that the multiple sources of knowledge are drawn upon;

(c) Regarding support:

- (i) Experts involved in the NEA will work closely with MoE and RUPP – including selected pilot study sites to ensure that multi-sources of knowledge and information are well-represented and collected;
- (ii) Relevant institutions in Cambodia will provide full cooperation and share data and information for report development;
- (iii) BTWG will be of enough capacity and be willing to provide technical support and direction for report improvement;
- (iv) Full collaboration and engagement will be possible between stakeholders, including government institutions, local authorities, academia, local communities and indigenous peoples for the NEA;
- (v) There will be full cooperation and support from national and international experts; and
- (vi) Close collaboration will be possible between country members of the NEA.

3. Methodological Approaches

3.1 Assessment Approach

Based on availability of IPBES methodologies, this assessment will adopt the ones used by the Asia-Pacific Regional Assessment described in section 1.3. These include the following:

- (i) The use of the **IPBES Conceptual Framework** (see Annex 1 below) to highlight how biodiversity and ecosystems services contribute to the economy, livelihoods, food security and good quality of life for human being. The IPBES Conceptual Framework describes how human actions (i.e. anthropogenic drivers) and natural processes (i.e. natural drivers) can push ecosystem change, and how this change affects the flow of ecosystem services, in other words, the flow of nature contributions to people (NCP) (see Annex 2), which is closely related to ecosystem services, that ultimately affect good quality of life;
- (ii) The **seven guiding principles** (see Annex 3);
- (iii) **The units of analysis and classification system** i.e. four major units (terrestrial, inland freshwater and wetlands, coastal and marine areas with islands and mountains forming an additional special unit) and 23 sub-units (see section 1.3.3 in the IPBES Asia Pacific Regional Assessment). This choice of units of analysis will facilitate comparisons with findings in other Asia-Pacific countries and in the IPBES Asia Pacific Regional Assessment. The Cambodia NEA will focus on three main areas of ecosystems as unit of analysis and classification (see section 3.4 below);
- (iv) **Data collection and interpretation.** The NEA will use both secondary and primary data sources where appropriate. The primary data will additionally be collected from the targeted ecoregions of Cambodia (mentioned below) in support to analysis units whose secondary data are unavailable. Appropriate secondary data, information and evidence will be gathered/compiled from publications i.e. published scientific and grey literature, as well as appropriate ILK sources (for which workshops could be organized so that unpublished information can be compiled and written in some form with the approval of the IPLC). Data and information should cover evidence from different knowledge systems (e.g. modern scientific knowledge, ILK), lessons learnt through good conservation practices, as well as existing data/information/knowledge from national reports under biodiversity-related MEAs and from various regional, sub-regional, national and local institutional sources such as national biodiversity strategy and action plan (NBSAP), national policy reports and data portals, UN organizations active in Cambodia and/or publishing information/data on Cambodia biodiversity (e.g. IBAT, UN Biodiversity Lab), funding agencies, government research institutes and non-governmental organizations; and
- (v) Secondary data will be obtained from the analysis of statistics and interpreted through various analytical approaches such as modeling, ecosystem service mapping, participatory discourse analysis, and multi-criteria analysis. Modelling on future changes of ecosystem services will be particularly used to project the future of biodiversity and ecosystem services. In this respect, three important modelling methods are primarily suggested and will be adopted as the following:

- **Land-Use Change**: will be used to explore the human influence on habitats; including the land cover conversion and its impacts on ecosystem or changes in the spatial landscape. Within this model, we will observe the agro-ecosystem – through the intensification of agricultural management or forest harvesting and its impacts on the natural forest ecosystem.
- **Correlative Models**: will be used to find out the underlying relationship between biodiversity and environmental variables; including the richness, abundance and distribution of the species. By using this model, the information on biodiversity patterns and the responses to drivers of change will be discovered through the empirical study and observations. The model could also be used for assessing the impacts of human activities on ecosystem and biodiversity, and its future impacts on the environmental changes.
- **Community-Level Models**: will be used for broader prediction of the environmental change impacts. There are three approaches in this model identified by Ferrier and Guisan (2006)⁶. Firstly, “assemble first, predict later” – meaning that all species data are combined in classification and resulting accumulations are modelled. Secondly, “predict first, assemble later” – meaning that the distribution of individual species will be modelled first, and potential species distribution then combined. Lastly, “assemble and predict together” – meaning that all the multiple species will be modelled using environmental predictors and the cooccurrence patterns.

In general, an expert-based approach to decision support will be used where modelling cannot be appropriate due to lack of reliable data. The expert-based approach aims to develop consensus between experts over several rounds of deliberation on the assumption that combining the expertise of several individuals will provide more reliable results than consulting one or two individuals.

3.2 Integration of Diverse Values and Knowledge Systems

Bearing in mind principles 4 and 5 (see Annex 4) of the IPBES’s Asia-Pacific Regional Assessment Report and as mentioned in section 1.3.5 of that report, integration of diverse values and knowledge systems into the NEA is of great importance. It will ensure accuracy and acceptability of the NEA report by various concerned stakeholders. The integration will be made through consolidation workshops and special meetings among concerned stakeholders based on the data collected from field and available data from the secondary sources like published books and other relevant materials. In addition, external reviewers of NEA report will also help ensure the integration of diverse values and knowledge systems.

⁶ Ferrier and Guisan (2006). Spatial modelling of biodiversity at the community level. *Journal of Applied Ecology*: 43, 393–404.

3.3 Communication of Uncertainty

The four IPBES confidence terms will be used as follows:

- “well established” (robust evidence and high level of agreement);
- “unresolved” (robust evidence but low level of agreement);
- “established but incomplete” (low quantity and quality evidence but low level of agreement); and
- “inconclusive” (low quantity and quality of evidence and low level of agreement).

3.4 Target Areas

To represent the ecoregions in Cambodia for this NEA, Cambodia team will focus on three main areas, the eastern plain, the northern parts of Tonlé Sap lake, and coastal and marine areas. Below are reasons for selecting the above eco-regions:

- (i) These areas will provide insights on how priority ecosystem services could be affected by different interventions (policies/actions) in the future, by producing maps of these ecosystem services according to different future scenarios. The spatial data will be gathered from MoE and MAFF on forest cover and land-use;
- (ii) The eastern plain such as Mondulkiri and Ratanakiri can provide an important platform to explore how to facilitate a balanced and green development pathway for Cambodia, especially highlighting the balanced development within the country, and their differences connecting between mountain and plateau, and flood plain areas;



Bosra waterfall, Mondulkiri province



- (iii) The important commercial resources in the northern parts of Tonle Sap lake, which provide more than half of the fish consumed in Cambodia and a harmony of Tonle Sap lake with the specialized ecosystems, the human occupations at the edge of the lake is similarly distinctive - floating villages, towering stilted houses, huge fish traps, and an economy and way of life deeply intertwined with the lake, the fish, the wildlife and the cycles of rising and falling waters, and ecotourism;



Preak Toal, Tonlé Sap lake



- (iv) The coastal and marine areas, particularly Koh Kong province are predominantly covered by a broad-leaved forests (Evergreens) scattered throughout the areas, including coastal mountains, islands and highlands. The mangroves are scattered in low-lying areas of Peam Krasop estuary, Botum Sakor National Park and Dong Peng Multiple Use Area in Koh Kong; Ream National Park in Preah Sihanouk; and in the coastline of Kampot province.⁷



Backlang beach, Koh Kong province



Peam Krasop fishing communities, Koh Kong province

In order to receive concrete and information and data about biodiversity and ecosystem functions and services, the Cambodia NEA Team will conduct scoping and site visit to each selected site – as primary collection and observation. Key Informant Interview (KII), Households Survey and Validation Consultation will be used in this NEA. The primary data will be collected from the aforementioned regions through field scoping visit, field survey, meeting and consultation workshops.

⁷ Ali Raza Rizvi and Uwe Singer “Cambodia Coastal Situation Analysis” IUCN 2011.

3.5 Setting up of Indicators

Regarding **indicators**, the NEA will use as much as possible the “core” and “socio-economic” indicators recommended by IPBES (see appendices to section 1 of the IPBES Regional Assessment for Asia and the Pacific published and also IPBES (2017b)⁸. Core indicators include key environmental variables developed at the global scale by various international and national organizations. These are supplemented with a set of “socio-economic indicators” particularly related to the ecosystem services or NCP, Good Quality of Life and Institutional Driver elements of the IPBES conceptual framework. The use of these IPBES recommended indicators allows a comparison with other NEAs and with future assessments if the same indicators are used.

3.6 Limitations and knowledge gaps of the National Ecosystem Assessment

Although there is plenty of assessment methodologies prepared by IPBES, limitations and knowledge gaps for the NEA continue to exist. As a requirement to develop the country and to meet the immediate needs of people, Cambodia’s policy makers most often form the policies without completed scientific data and information. Therefore, the NEA may not provide all that is needed by policy and decision-makers. The available data can help improve policies decisions and raise more awareness. NEA will also highlight the gaps in knowledge and help reorient more research. In addition, the impact of COVID-19 on human health, ecosystems and social and economic status of Cambodia is yet to be studied, but it has to be carefully taken into account particularly when it is assessing future dynamics of biodiversity and biodiversity management options in different scenarios. As mentioned earlier, the Cambodia’s NEA mostly relies on secondary sources of information, with all their limitations. The completeness and timeliness of this information poses some substantial limitations for achieving perfectly the seven principles that guide this assessment (Section 1.3.1 of Asia-Pacific Regional Assessment Report).

First of all, due to the variable quality and completeness of used the datasets (as well as the political/security sensitivity that sometimes accompanies them), it has not been always possible to access reliable data from all ecoregions. Some areas are particularly under-researched and data-deficient such as coastal zones and islands, and some areas in the eastern plains.

Second, while there were active efforts to integrate and synthesize ILK with modern science (Section 1.3.5), this was not always feasible. For example, several ILK practices and practical information generated through the implementation of local, participatory and community-led conservation/management approaches are not well-documented (Young et al., 2014). In addition, many of these practices have been confined to their local contexts and have not been scaled up. As a result, the NEA might not do full justice to some of the successful community-based natural resource management models and practices encountered throughout Cambodia.

⁸ IPBES. 2017b. “Update on the IPBES Classification of Nature’s Contributions to People; Document IPBES/5/INF/24.”

3.7 Respect and integration of indigenous and local knowledge

Local communities and indigenous ethnic minorities have been involved and continue to be involved in several consultations for payment for ecosystem services including REDD+ projects, the zoning of protected areas, mapping and valuing ecosystem services. Their perceptions on some of measures taken to protect biodiversity and ecosystem services are being studied by many university researchers to inform policy and decision-makers. However, there is still a need to document and learn more about indigenous, and to find ways to integrate them into the strategies, plans, and programmes for natural resources management. Being a member of the intergovernmental Science-Policy Platform for biodiversity and Ecosystem Services (IPBES), Cambodia gained experience in the best ways for integrating indigenous and local knowledge (ILK) into policy and decision-making.⁹

4. Chapter Outlines

The main objective of this NEA is to provide a state-of-art assessment of the status and trends of Cambodia's rich biodiversity, its value and contributions to people, and the benefits that its conservation and sustainable use will have for the good quality of life of the people in the country. This assessment will update the findings reported in the 6NR to the UN Convention on Biological Diversity¹⁰ with a specific emphasis on assessing the value of biodiversity and nature contributions to people at a time when the whole world will be focusing on rebuilding economies after the COVID-19 pandemic. Using different scenario archetypes to evaluate the different implications that the synergistic effects of drivers, policies and actions can have for biodiversity and ecosystem functions and services contributions to the economy, livelihoods, food security and good quality of life in Cambodia. The NEA will also (i) propose feasible and practical options for good governance and ecosystem management to optimize the contribution of biodiversity to sustainable development and good quality of life for all in Cambodia as well as (ii) policy and institutional options to promote approaches that will support the ongoing progress towards sustainable development and transition towards RGC's objective to become an upper middle-income country by 2030. This assessment will also build, when appropriate, on the other assessments carried out under IPBES, in particular the Asia-Pacific regional assessment of biodiversity and ecosystem services¹¹, the global assessment¹², and the land degradation and restoration assessment¹³.

⁹ 6th National Report (2019)

¹⁰ <http://www.chm.gdancp-moe.org/publications/national-reports.html>

¹¹ <https://ipbes.net/assessment-reports/asia-pacific>

¹² <https://ipbes.net/global-assessment>

¹³ <https://ipbes.net/assessment-reports/ldr>

This NEA will have six chapters.

4.1 Chapter 1: Setting the Scene

This chapter will describe the rationale, objectives and scope of the NEA. The rationale will be articulated around Cambodia's socioeconomic situation and measures under way towards sustainable development on the road to become an upper middle-income nation by 2030 and a high-income nation by 2050. The objectives will be expressed in the form of the six policy-relevant questions agreed by the BTWG. The scope will highlight specific themes and areas that will be emphasized. This chapter will also highlight the methodology and key principles that will guide the entire assessment, including how the assessment will identify and address uncertainties and gaps in data and knowledge.

4.2 Chapter 2: Biodiversity and Ecosystem Services: Socio-economic Development and Human Well-Being

Cambodia is known as a nation with rich natural resources that contribute to the wellbeing of its population and the country's economy. National Biodiversity Target 1¹⁴ complemented by National Target 3¹⁵, both of which are about raising consciousness about biodiversity values and their integration in national development planning and strategies so as to influence behavioral transformation towards better management of natural resources. It is a prerequisite to the implementation of all the other biodiversity measures taken by Cambodia for sustainable development. It is expected that increased awareness of biodiversity value and socioeconomic impacts of biodiversity loss will ultimately lead to behavioural changes by individuals, organizations and governments and influence them in the kind of actions they can take to conserve and use biodiversity sustainably. The 6NR on biodiversity found that research on valuation of ecosystem and their services was gaining momentum in Cambodia and that the results were needed for policy and decision-making.

This chapter will thus compile what we know about the value of biodiversity and its contributions to the well-being of the Cambodian people as well as to the National Sustainable Development Goals. It will describe the ecological and socioeconomic values of biodiversity at all 3 levels of biodiversity organization i.e. at the genetic, species and ecosystem levels and for plants, animals and microorganisms, and will specify where the biodiversity components referred to are located. More specifically, the chapter will provide the following information, as much as possible:

- (i) spatial and temporal trends of valuation studies in Cambodia i.e. number of studies/year/unit of analysis or ecosystem or ecosystem services;
- (ii) value estimates by ecosystem types and/or ecosystem services; and
- (iii) valorisation of biodiversity and ecosystem services i.e. ways and means Cambodia adds value to its raw biodiversity (e.g. through processing, drying or smoking etc.) and

¹⁴ See Annex 4

¹⁵ See Annex 4

ecosystem services or biodiversity components e.g., by developing ecotourism infrastructure, payment for ecosystem services¹⁶.

4.3 Chapter 3: Status, Trends and Future Dynamic of Biodiversity and Ecosystems Services Underpinning Nature's Benefits to People

Chapter 3 will assess what is known about the past and current status, trends, and future dynamics of biodiversity and ecosystems, which contribute to the socio-economic development in Cambodia. The chapter will also cover the positive and negative effects of the changes in biodiversity and ecosystem status on key ecosystem services and their contributions to human well-being identified in chapter 2. In line with the IPBES regional assessment for Asia and the Pacific, biodiversity status and trends will be assessed and described under the following major biomes: terrestrial, freshwater and inland wetlands, and coastal and marine ecosystems. Agroecosystems and urban environments will be dealt with separately. The assessment will focus in particular on the 3 priority areas (see section 3.4) identified during the BTWG.

These analyses will use multiple evidence bases, including natural and social sciences and indigenous and local knowledge. The chapter will be based on the review of recent publications and reports as well as indigenous peoples and local communities' knowledge. Datasets will be drawn from a wide range of sources, including global, regional, national and local institutions such as the 6NR on biodiversity, reports from other ministries, NBSAP, project documents submitted for funding and reports on completed projects, government research institutes and non- or inter-governmental organizations, in particular IUCN Red List, IBAT and UN Biodiversity Lab¹⁷ etc. Forecasts on current trends will also be outlined based on published data and expert-based approach.

4.4 Chapter 4: Direct and Indirect Drivers of Change in Biodiversity and Ecosystem Services to Socioeconomic Development and Human Well-Being

Chapter 4 will describe the drivers of change in biodiversity and ecosystem services. The drivers will consist of (i) threats to biodiversity, including direct threats and underlying factors, as well as (ii) measures taken to address the threats. This chapter will also highlight positive changes in biodiversity and ecosystem services.

In Cambodia, the 6NR on biodiversity described the threats and various measures taken. It will thus be an important source of data and information on threats and measures taken. The direct threats include climate change; ecosystem fragmentation and ecosystem conversion to other land uses; invasive alien species; unsustainable uses, including overharvesting, overgrazing and overfishing; pollution; and natural disasters. Indirect/underlying factors consist of changes in population, technology and socioeconomic situations; policies; international trade; capacity to enforce legislation; institutional and governance arrangements, as well as cultural and spiritual factors.

¹⁶ Linkages to food security, energy security, water security, livelihood, resilience to climate change and to land degradation will be important. Examples of trade-off in case of mining, land conversion for farming, dam or road constructions etc. will be useful.

¹⁷ <https://www.unbiodiversitylab.org/about.html>

Cambodia is implementing many measures to address these drivers, in particular the threats to biodiversity loss, with a strong programme on protected areas, measures to ensure sustainable use in forestry, fisheries and agriculture, and ecosystem restoration projects. These measures are supported by strong mobilization of funds, and the strengthening of human and institutional capacity with various other supporting measures such as training, awareness raising, and information exchange. This chapter will review these measures taken and their effectiveness.

Finally, the interrelations between and among direct drivers and indirect drivers will be established.

4.5 Chapter 5: Scenario of current and future interactions between biodiversity, including ecosystem services and socioeconomic development and human well-being

Chapter 5 is expected to help identify possible pathways to achieve Cambodia's vision of becoming an upper-middle income country by 2030 and a high-income country by 2050 through the valuation, conservation, restoration where necessary, wisely use and management of biodiversity and ecosystem services so as to ensure equitable economic prosperity and improved quality of life for all in the country.

The chapter will make use of scenarios and modelling, using the IPBES scenarios and models, to assess future state of biodiversity and ecosystem services by focusing on the key issues that society is expected to face over the next 30 or more years. It will include integrated and cross-scale analysis of these dynamics, including feedback, synergies, time lags, tipping points, resilience, cross-regional interrelations and trade-offs.

Simulation models will be used to explain the complex interactions among the different direct and indirect drivers of biodiversity loss in Cambodia taking into account the impact of the COVID-19 pandemic. The chapter will explore various paths towards sustainable development. This will involve exploring changes in the trajectories of multiple drivers and the role played by synergies, trade-offs and adaptive behavior. By exploring applicable and effective scenarios to deal with the national circumstances, the chapter will provide relevant decision support tools to policymakers to evaluate the different implications that the synergistic effects of drivers, policies and actions can have for biodiversity and nature's contributions to people at the national and subnational levels.

4.6 Chapter 6: Options for Policies, Governance and Institutional Arrangements for Biodiversity and Ecosystem Management

Building on all the previous chapters, chapter 6 will examine different policy ideas, institutional arrangements and possible options for decision-makers in response to the drivers and scenarios set out in previous chapters. Explorations of options will be policy relevant, but not policy prescriptive, as outlined in the IPBES principles. Options explored will include different policy instruments, market tools, conservation and management practices and international and regional agreements. The chapter will look at options at different hierarchical spatial and temporal scales, from the national level to local and indigenous communities and households. It will explore options for policy mixes and alignments in polycentric governance

systems¹⁸, assess the effectiveness of such options and consider who would gain or bear their cost. The chapter will analyze future challenges for sustainable use and conservation in key sectors in each region that it will be selected 3 sites and assess options for integrating biodiversity, ecosystem function and ecosystem services into poverty reduction strategies and national accounting. The analyses will include incentives, subsidies harmful to biodiversity, positive incentives for the conservation and sustainable use of biodiversity, ecosystem function and services, as well as measures taken to achieve sustainable production and consumption of biodiversity, ecosystem function and services and rights-based approaches to address biodiversity conservation.

The chapter will also identify the enabling environments and limitations for policy uptake and lessons learned, including solutions and methods for ensuring success and capacity-building needs. The 6NR on biodiversity contains elements that can be considered under this chapter.

5. Key Datasets

The NEA will draw on a wide variety of datasets addressing all the specific components of the IPBES conceptual framework, including those arising from ongoing and planned activities, from a wide range of sources, including global, regional and national institutions and organizations, as well as research projects, analysis of the scientific literature, and indigenous and local knowledge. The 6NR on biodiversity is one of important sources of recent information on biodiversity.

The common framework on data standards developed by the IPBES knowledge and data task force will be applied¹⁹ in order to facilitate intra-national comparisons and comparisons at higher levels and in time. Ways and means to capture indigenous and local knowledge will be developed building on the experiences of the IPBES task force on indigenous and local knowledge systems.

The capacity to perform these tasks will be strengthened through training, knowledge-sharing and collaborations between institutions within the countries, and at the sub-regional and global levels.

6. Strategic Partnerships and Initiatives

The NEA is implemented by the Royal University of Phnom Penh (RUPP) as the science partner and the General Secretariat of National Council for Sustainable Development (GSSD) as the political partner. The GSSD will coordinate work on policy, strategy and scenario development while RUPP will be in charge of stock-taking, data analysis and report writing.

RUPP and GSSD will establish a strategic partnership in order to (i) avoid duplication and promote synergies; and (ii) coordinate and harmonize scientific, technical and administrative

¹⁸ Cambodia applied both hierarchical and polycentric governance systems

¹⁹ IPBES Task force (Vichuta will complete)

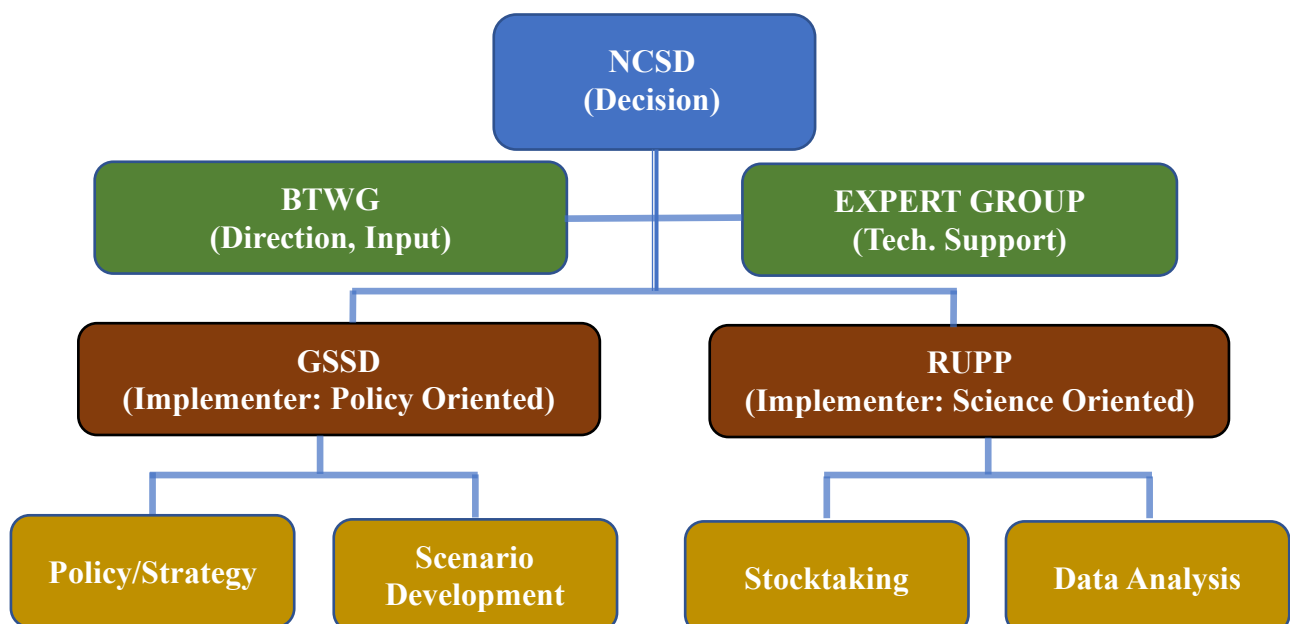
support, datasets collection and report writing, capacity-building, outreach and networking, experience in bridging science and policy as well as experience working with indigenous and local knowledge systems.

Strategic partnerships will be formal and informal, and attention will be paid to ensuring geographic and possibly sectoral balance in their development. As a starting point, members of the Biodiversity Technical Working Group (BTWG) comprising 36 representatives from line ministries, academic institutions and local communities (see list in annex 5) will be invited to participate. The existing BTWG will be used as scientific and technical advisory body for direction and validation the NEA. Experts from other national organizations, including representatives of the other Rio Conventions and other biodiversity related conventions as well as the NGOs Forum and international organizations, including for example sub-regional organizations such as the Mekong River Commission or the Environmental Management for the Seas of East Asia (PEMSEA), Conservation International, Wildlife Conservation Society, BirdLife, IUCN and WWF will be invited to participate in this assessment.

7. Operational Structure

- The National Council for Sustainable Development (NCS D) takes overall decisions on the National Ecosystem Assessment;
- The Biodiversity Technical Working Group guides and provides input on the overall work on the NEA report;
- The Expert Group, including national and international experts provides technical support for the NEA report;
- The General Secretariat of National Council for Sustainable Development (GSSD) will coordinate work on policy, strategy and scenario development;
- The Royal University of Phnom Penh will coordinate work on stock-taking, data analysis and report writing.

Figure 1: Implementation Organization

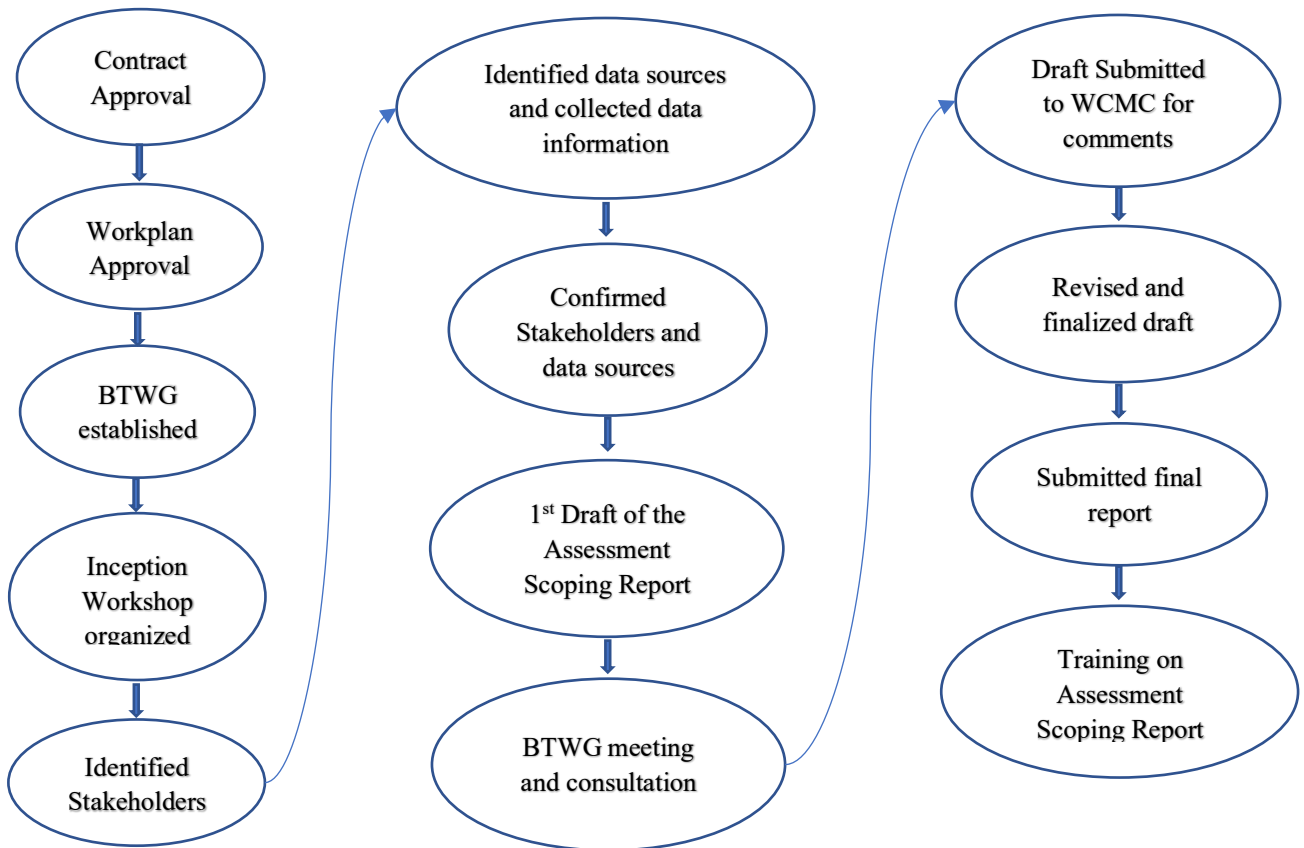


8. Process and Timetable

Based on the IPBES process, the Cambodian NEA team designed a detailed one for its national ecosystem assessment as shown in Figures 2 and 3:

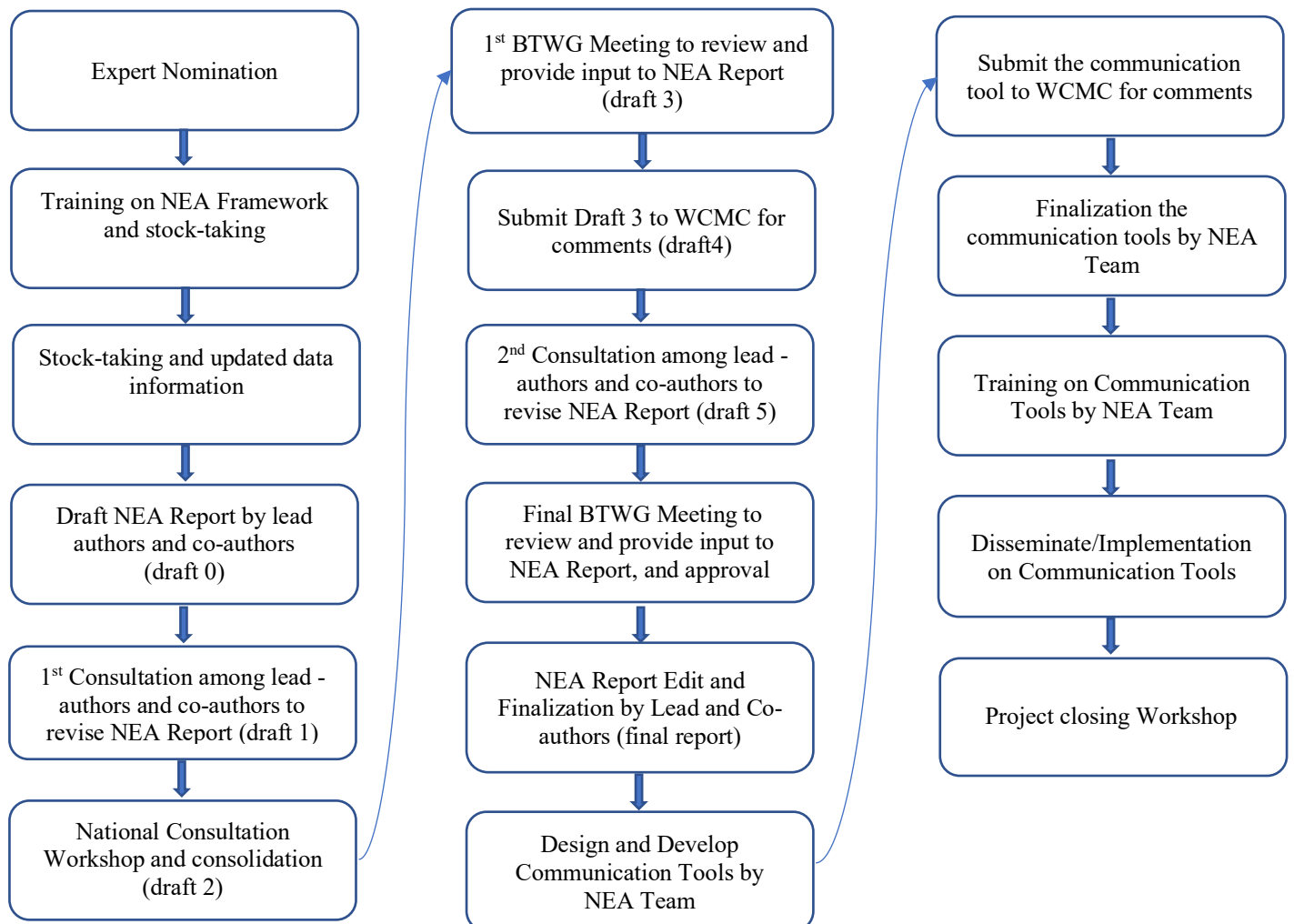
The Scoping Assessment Process

Figure 2: Scoping Assessment Process



8.1 National Ecosystem Assessment Process

Figure 3: National Ecosystem Assessment Process



8.2 Timetable

Key Activities	YEAR 1												YEAR 2												YEAR 3												YEAR 4											
	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Scoping																																																
Desk review and stock taking																																																
Project scoping report																																																
TWG Workshop																																																
Adoption of project scope																																																
Design																																																
Methodologies																																																
Policy Question																																																
BTWG Workshop on approval of methodologies																																																
Implementation																																																
Capacity building of data collection, data analysis and reporting																																																
Carry-out field work																																																
Produce report																																																
Review																																																
Internal team review																																																
BTWG Workshop for review																																																
External review																																																
Consultation and Validation workshop																																																
Dissemination workshop of assessment findings																																																
Communication																																																
Prepare plans and develop communication and media tools																																																
BTWG Workshop on approval of communication plan																																																
Organize training workshop on integrating the assessment findings																																																
Closing project workshop																																																
Project Management (according project guideline)																																																

9. Cost Estimates

No.	Activities	2019	2020	2021	2022
Project preparation					
1	Staff recruitment				
2	Development of BTWG ToRs				
3	Establishment of BTWG				
4	Development of Workplan and Budget				
5	Conduction of Inception Workshop	1,000.00			
6	BTWG meeting	500.00			
Development Scoping Report					
1	Desk Review and Stock-Taking				
2	Meeting with Stakeholders (field visit)	2,000.00	3,000.00		
3	Attend international Conference/Exchange visit to WCMC	5,000.00			
4	Design Methodologies				
5	Report writing				
6	BTWG meeting for consultation and adoption		500.00		
Development of National Ecosystem Assessment Report					
1	National Experts Recruitment		8,000.00	8,000.00	8,000.00
2	Capacities Building of data collection, data analysis and reporting (including Transportation and DSA)		5,000.00	5,000.00	
3	Meeting Stakeholders and data collection		30,000.00	30,000.00	
4	Attend international conference/Exchange visit to WCMC and countries members of NEA		5,000.00	5,000.00	5,000.00
5	National Stakeholders Workshop (6 times)		16,525.00	10,000.00	
6	BTWG meeting (4 times)		500.00	1,000.00	500.00
7	Report Produce (Draft)				
8	Review				
9	Consultation workshop and validation			6,525.00	
10	Printing				2,002.00
Communication					
1	Prepare plans and develop communication and media tools (field work)				8,000.00
2	Organize training workshop on integrating the assessment findings				2,450.00
3	Webinars				526.00
Operational and Management Cost					
1	PMU	67,906.00	67,906.00	67,906.00	61,122.00
2	Overhead Cost	9,168.72	16,371.72	16,011.56	10,512.00
<i>Total Per Year</i>		<i>85,574.72</i>	<i>152,802.72</i>	<i>149,441.56</i>	<i>98,112.00</i>
Total Budget for 4 years					485,931.00

10. Communication and Outreach

One of the objectives of the NEA is to respond to decision and policymakers' need for credible and robust information and raise general awareness about the linkages between biodiversity/ecosystem management and the attainment of socioeconomic development and better quality of life. Communication of the NEA findings is thus key in progressing toward

this objective and other national strategies (e.g.: next NBSAP). Communication and outreach strategies used for other purposes in MOE to reach ranges of users with different specific interests can be applied after some adjustments.

The NEA report and its summary for policy-and decision-makers will be published in electronic format. The summary for policy- and decision-makers and extracts of key messages will be translated in Khmer and will be widely disseminated through the Clearing House Mechanism (CHM), university websites and other social media such as Telegram and Facebook, which are commonly used by government officials, students and the civil society, as well as in printed copies during national, regional and local events, including workshops, conferences, forums and seminars. Furthermore, the report findings will be used for educational purposes, including to update curriculum and course materials.

11. Capacity-Building

Implementation of this NEA provides an opportunity to build Cambodia's capacity to strengthen its science-policy interface for the best management of biodiversity and ecosystem services as well as the capacity to undertake future national assessments and national reports on biodiversity, and to contribute to regional and global assessments. The capacity to uptake the NEA findings effectively will also be strengthened. Of particular importance is the capacity for effective contributions of indigenous and local knowledge systems to assessments such as monitoring tools, traditional indicators and measurement mechanism.

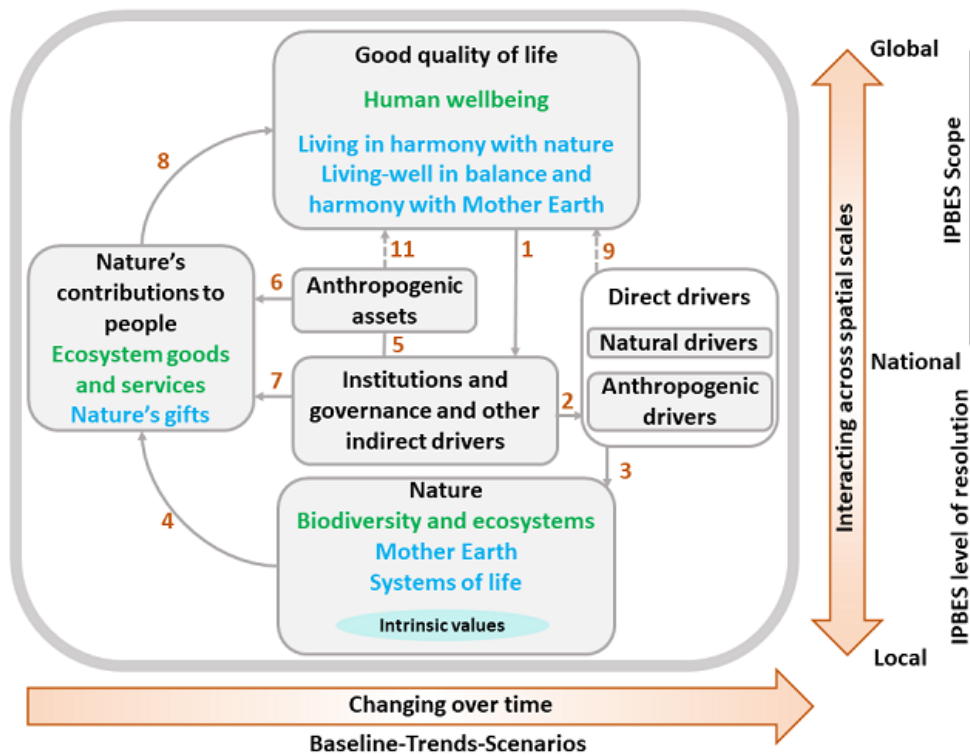
Capacity will be built through various means, including by informing or training all the participants in the production of the assessment using the IPBES Guide on the Production of Assessments (IPBES/5/INF/6). The IPBES Guide on production and integration of assessments²⁰ contains step-by-step information and advice on key points such as:

- Assessment scoping process;
- Nomination of experts;
- How to develop executive summaries for chapters and the summary for policymakers;
- Writing suggestions for assessment reports; and
- The four-box model for the qualitative communication of confidence.

The IPBES guide will be disseminated, and relevant workshops and webinars organized. External resource-persons will be invited, as needed, to assist with this training, bearing in mind that there is a lack of people with experience in the production and integration of biodiversity assessments in the country. More focused training will be needed on specific topics such as valuation of biodiversity and ecosystem services as well as scenarios and modelling.

²⁰ https://ipbes.net/sites/default/files/180719_ipbes_assessment_guide_report_hi-res.pdf. Also see CBD/COP/14/INF/28

Annex 1: IPBES conceptual framework²¹



Díaz et al., 2015

²¹ <https://ipbes.net/conceptual-framework>

Annex 2: Nature's Contributions to People System

(Reproduced from Appendix IV of IPBES/5/INF/6)

The table below shows the 18 reporting categories of the IPBES Nature's Contributions to People System.

	Reporting categories of nature's contributions to people	Brief explanation and some examples
1	Habitat creation and maintenance	Formation and continued production, by ecosystems or organisms within them, of ecological conditions necessary or favourable for organisms important to humans, e.g. nesting, feeding, and mating sites for birds and mammals, resting and overwintering areas for migratory mammals, birds and butterflies, nurseries for juvenile stages of fish
2	Pollination and dispersal of seeds and other propagules	Facilitation by animals of movement of pollen among flowers, and dispersal of seeds, larvae or spores of organisms important to humans
3	Regulation of air quality	Regulation (by impediment or facilitation) by ecosystems, of CO ₂ /O ₂ balance, O ₃ for UV-B absorption, levels of sulphur oxide, nitrogen oxides (NO _x), volatile organic compounds (VOC), particulates, aerosols Filtration, fixation, degradation or storage of pollutants that directly affect human health or infrastructure
4	Regulation of climate	Climate regulation by ecosystems (including regulation of global warming) through: Positive or negative effects on emissions of greenhouse gases (e.g. biological carbon storage and sequestration; methane emissions from wetlands) Positive or negative effects on biophysical feedbacks from vegetation cover to atmosphere, such as those involving albedo, surface roughness, long-wave radiation, evapotranspiration (including moisture-recycling) Direct and indirect processes involving biogenic volatile organic compounds (BVOC) Regulation of aerosols and aerosol precursors
5	Regulation of ocean acidification	Regulation, by photosynthetic organisms (on land or in water), of atmospheric CO ₂ concentrations and seawater pH, which affect associated calcification processes by many marine organisms important to humans (such as corals)
6	Regulation of freshwater quantity, location and timing ²²	Regulation, by ecosystems, of the quantity, location and timing of the flow of surface and groundwater used for drinking, irrigation, transport, hydropower, and as the support of non-material contributions (NCP 15, 16, 17) Regulation of flow to water-dependent natural habitats that in turn positively or negatively affect people downstream, including via flooding (wetlands including ponds, rivers, lakes, swamps) Modification of groundwater levels, which can ameliorate dryland salinization in unirrigated landscapes
7	Regulation of freshwater and coastal water quality	Regulation – through filtration of particles, pathogens, excess nutrients, and other chemicals – by ecosystems or particular organisms, of the quality of water used directly (e.g. drinking) or indirectly (e.g. aquatic foods, irrigated food and fibre crops, freshwater and coastal habitats of heritage value)

²² Hydrological NCP are fundamentally conceived as regulating NCP, because the primary impact of ecosystems on water is the modification of its flows, not the creation or breakdown of water molecules.

8	Formation, protection and decontamination of soils and sediments	Sediment retention and erosion control, soil formation and maintenance of soil structure and processes (such as decomposition and nutrient cycling) that underlie the continued fertility of soils important to humans. Filtration, fixation, degradation or storage of chemical and biological pollutants (pathogens, toxics, excess nutrients) in soils and sediments that are important to humans
9	Regulation of hazards and extreme events	Amelioration, by ecosystems, of the impacts on humans or their infrastructure caused by e.g. floods, wind, storms, hurricanes, seawater intrusion, tidal waves, heat waves, tsunamis, high noise levels Reduction, by ecosystems, of hazards like landslides, avalanches
10	Regulation of organisms detrimental to humans	Regulation, by ecosystems or organisms, of pests, pathogens, predators, competitors, etc. that affect humans, plants and animals, including e.g.: Regulation by predators or parasites of the population size of non-harmful important animals (e.g. large herbivore populations by wolves or lions) Regulation (by impediment or facilitation) of the abundance or distribution of potentially harmful organisms (e.g. venomous, toxic, allergenic, predators, parasites, competitors, disease vectors and reservoirs) over the landscape or seascape Removal of animal carcasses and human corpses by scavengers (e.g. vultures in Zoroastrian and some Tibetan Buddhist traditions) Regulation (by impediment or facilitation) of biological impairment and degradation of infrastructure (e.g. damage by pigeons, bats, termites, strangling figs to buildings)
11	Energy	Production of biomass-based fuels, such as biofuel crops, animal waste, fuelwood, agricultural residue pellets
12	Food and feed	Production of food from wild, managed, or domesticated organisms, such as fish, beef, poultry, game, dairy products, edible crops, mushrooms, bushmeat and edible invertebrates, honey, edible wild fruits and tubers Production of feed for domesticated animals (e.g. livestock, work and support animals, pets) or for aquaculture, from the same sources
13	Materials and assistance	Production of materials derived from organisms in crops or wild ecosystems, for construction, clothing, printing, ornamental purposes (e.g. wood, fibres, waxes, paper, resins, dyes, pearls, shells, coral branches). Direct use of living organisms for decoration (i.e. ornamental plants in parks and households, ornamental fish), company (i.e. pets), transport, and labor (including herding, searching, guidance, guarding)
14	Medicinal, biochemical and genetic resources	Production of materials derived from organisms (plants, animals, fungi, microbes) used for medicinal and veterinary purposes Production of genes and genetic information used for plant and animal breeding and biotechnology
15	Learning and inspiration	Provision, by landscapes, seascapes, habitats or organisms, of opportunities for the development of the capabilities that allow humans to prosper through education, acquisition of knowledge and development of skills for well-being, scientific information, and inspiration for art and technological design (e.g. biomimicry)
16	Physical and psychological experiences	Provision, by landscapes, seascapes, habitats or organisms, of opportunities for physically and psychologically beneficial activities, healing, relaxation, recreation, leisure, tourism and aesthetic enjoyment based on the close contact with nature. E.g. hiking, recreational hunting and fishing, birdwatching, snorkeling, gardening

17	Supporting identities	<p>Landscapes, seascapes, habitats or organisms being the basis for religious, spiritual, and social-cohesion experiences</p> <p>Provisioning of opportunities by nature for people to develop a sense of place, purpose, belonging, rootedness or connectedness, associated with different entities of the living world (e. g. cultural and heritage landscapes, sounds, scents and sights associated with childhood experiences, iconic animals, trees or flowers)</p> <p>Basis for narratives and myths, rituals and celebrations provided by landscapes, seascapes, habitats, species or organisms (e.g. sacred groves, sacred trees, totem animals)</p> <p>Source of satisfaction derived from knowing that a particular landscape, seascape, habitat or species exist in the present</p>
18	Maintenance of options	<p>Capacity of ecosystems, habitats, species or genotypes to keep human options open in order to support a later good quality of life.</p> <p>Examples include:</p> <p>Benefits (including those of future generations) associated with the continued existence of a wide variety of species, populations and genotypes</p> <p>Future benefits (or threats) derived from keeping options open for yet unknown discoveries and unanticipated uses of particular organisms or ecosystems that already exist (e.g. new medicines or materials)</p> <p>Future benefits (or threats) that may be anticipated from on-going biological evolution (e.g. adaptation to a warmer climate, to emergent diseases, development of resistance to antibiotics and other control agents by pathogens and weeds)</p>

Annex 3: The seven guiding principles formulated by the Asia-Pacific Regional Assessment

Principle	Some description
Principle 1: Adopt a coupled social-ecological systems (CSES) approach	Social and ecological systems are strongly interlinked and form coupled social-ecological systems (CSESs). CSESs are nested, multilevel systems that provide essential provisioning ecosystem services to society (e.g. food, fibre, energy, drinking water), as well as other critical supporting, regulating and cultural ecosystem services (Berkes & Folke, 1998). A CSES approach can help elucidate how human actions affect the structure and functions of such systems and ultimately the multiple benefits that humans derive from them (Berkes & Folke, 1998; Berkes <i>et al.</i> , 2000; Binder <i>et al.</i> , 2013; McGinnis & Ostrom, 2014; Ostrom, 2009). Adopting a CSES approach is highly appropriate in the Cambodian context considering the long history of human dependence on (and management of) social-ecological systems as collected, among others, by the International Partnership for the Satoyama Initiative (IPSI) (Duraiappah <i>et al.</i> , 2012; Ichikawa, 2012; Takeuchi, 2010), and community-based natural resources management movements.
Principle 2: Unravel the effects of multiple drivers of ecosystem change	Multiple anthropogenic and natural drivers contribute to ecosystem change and biodiversity loss across the country. These drivers can be direct (e.g. natural hazards, pollution, land use change) or indirect generated outside ecosystems by different institutions and governance systems (e.g. poverty, inequality, globalization) (Diaz, Demissew, Carabias, <i>et al.</i> , 2015; Diaz, Demissew, Joly, <i>et al.</i> , 2015; Thompson, 2015; Zarandian <i>et al.</i> , 2016).
Principle 3: Conduct integrated cross-scale analysis	CSESs are highly interlinked over space and time (Binder <i>et al.</i> , 2013; Kohsaka, 2010). In order to understand how the multiple drivers of ecosystem change affects biodiversity and ecosystem services (and ultimately good quality of life) it requires an integrated cross-scale analysis across different spatial and temporal domains (Baral, Keenan, Fox, Stork, & Kasel, 2013; Baral, Keenan, Sharma, Stork, & Kasel, 2014).
Principle 4: Consider multiple value systems	There are diverse ways to conceptualise the multiple values associated with biodiversity and ecosystem services (Martin-Lopez <i>et al.</i> , 2014), including social, cultural and spiritual values (Bhatta <i>et al.</i> , 2015; Chan <i>et al.</i> , 2012; van Oort <i>et al.</i> , 2015) (see Section 1.3.5, Chapter 2).
Principle 5: Integrate multiple sources of knowledge	The importance of (and need to) integrate insights from different knowledge systems is acknowledged, including modern scientific knowledge, ILK and other knowledge systems both from in-situ and ex-situ sources (Kohsaka <i>et al.</i> , 2015; Thaman, 2013a; van Oort <i>et al.</i> , 2015; Zarandian <i>et al.</i> , 2016). ILK is particularly pertinent in Cambodia considering the long history of indigenous and sustainable ways to manage biodiversity and ecosystem services utilised by various indigenous groups throughout the country
Principle 6: Acknowledge the importance of institutions and governance mechanisms	Both formal and informal/traditional institutions ¹² affect, and are affected by, the biophysical systems within which they are embedded (Anderies & Janssen, 2013). This Assessment views institutions and governance mechanisms as the interface of CSES.
Principle 7: Relation to the Guiding Principles of other IPBES Deliverables	This Assessment is in line with the thematic and the regional coupling framework of the IPBES. Overarching thematic topics of the IPBES such as Land Degradation and Pollinators are integrated in a relevant and contextual manner.

Annex 4: National Biodiversity Targets

Target 1	Target 1 (Aichi Target): by 2020, every Cambodian Is conscious about the environmental, economic, health, social and cultural value of the services derived from ecosystems, in particular the value of protected area systems as well as the value of terrestrial and aquatic animal and plant resources including animal wildlife, livestock, agricultural, forest, freshwater and marine resources, and the biomass used for energy production, and Integrates this knowledge in the way they deal with these ecosystems and resources.
Target 2	Target 2 (Aichi Target 20): By 2020, at the latest, the national budget allocation for biodiversity conservation and sustainable use (including NBSAP implementation) has increased by 20% through the development and implementation of a resource mobilization strategy based on identified needs and taking into account international and national guidance and policies
Target 3	Target 3 (Aichi Target 2): by 2020, at the latest, biodiversity values have been integrated into national and sub-national development and poverty reduction strategies and planning processes.
Target 4	Target 4 (Aichi Target 6): by 2020, freshwater fisheries and aquaculture are managed sustainably by addressing their constraints, and by reducing and preventing their possible negative impact on fish stocks and on aquatic threatened species and vulnerable ecosystems.
Target 5	Target 5 (Aichi Target 7): By 2020 the majority of areas unde agriculture, animal production, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity, sustainable development, poverty eradication and improved well-being
Target 6	Target 6: By 2020, 10 % of those protected areas, conservation areas, agroecosystems and forest ecosystems including mangroves that have been under a lot of pressures in recent years are in an advanced state of restoration and are providing enhanced services, particularly to local communities' and indigenous ethnic minorities' women, old persons and children.
Target 7	Target 7 (Aichi Target 4): By 2020, the Government, the private sector and other stakeholders have taken steps to reduce the negative impacts on ecosystems and their services caused by unsustainable production and consumption activities.
Target 8	Target 8 (Aichi Target 11): In 2020, at the latest, existing protected areas and conservation areas, including community-based natural resource management areas, have management plans and have started effective implementation. By 2020, the coverage of marine and coastal protected areas and freshwater protected areas has at least doubled as compared to the 2010 levels; Currently unprotected areas of particular importance for biodiversity and ecosystem services that are under a lot of pressures from human activities are identified and integrated in the protected area system; and Protected areas and conservation areas have been valued, are part of a well-connected protected area system and have been integrated in national sustainable development goals and national green growth strategies, plans and programmes. By 2029, protected forest covers 3.0 million hectares, in line with the objectives of the National Forest Programme 2010-2029.
Target 9	Target 9 (Aichi Target 3): By 2020, Payment for Ecosystem Services (PES) is used throughout the country as an incentive for the conservation and sustainable use of biodiversity.
Target 10	Target 10 (Aichi Target 12): By 2020, all species of fauna and flora threatened at national level have been identified and their status has been improved significantly as a result of applying measures to address their respective threats.
Target 11	Target 11: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and restoration of degraded ecosystems, focusing in particular on degraded forests, protected areas and conservation areas, thereby contributing to climate change mitigation and adaptation and to combating desertification.
Target 12	Target 12 (Aichi Target 5): By 2020, the rate of loss of natural forests, coral reefs and other natural habitats is at least halved; and habitat degradation and fragmentation, pollution, overharvesting, introduction of invasive alien species and their impacts are significantly reduced.
Target 13	Target 13: By 2015, Cambodia has designated a national focal point and one or more competent national authorities for the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS), and established a functional ABS Clearing-House as part of the clearing-house mechanism; By 2020, Cambodia has developed and is enforcing a legislation and national policies on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization.
Target 14	Target 14 (Aichi Target 17): By 2015, the National Biodiversity Strategy and Action Plan (NBSAP) have been updated and adopted, and have commenced to be implemented effectively.

Target 15	Target 15 (Aichi Target 10): By 2020, anthropogenic pressures (pollution, exploitation, sedimentation ...) on coral reefs and vulnerable ecosystems impacted by climate change have been significantly reduced.
Target 16	Target 16 (Aichi Target 8): By 2020, pollutant pressures on terrestrial and aquatic ecosystems are substantially reduced to levels that are not detrimental to ecosystem function and biodiversity.
Target 17	Target 17 (Aichi Target 18): By 2020, the traditional knowledge, innovations and practices of indigenous ethnic minorities and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are Respected, subjected to national legislation and relevant international obligations, and Fully integrated and reflected in the implementation of the Convention and the NBSAP with the full and effective participation of these communities, at all relevant levels
Target 18	Target 18 (Aichi Target 9): By 2020, major invasive alien species (IAS) and their pathways have been identified and prioritized, and the prioritized IAS and pathways are controlled.
Target 19	Target 19 (Aichi Target 19): By 2020, an interoperable and user-friendly information system containing data and information on biodiversity (including its associated ecosystem services) values, functions, status and trends, and threats, and the consequences of its loss has been established and maintained in the responsible institutions for wide sharing among stakeholders.
Target 20	Target 20 (Aichi Target 13): By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals, as well as the genetic diversity of their wild relatives is protected and conserved <i>in-situ</i> and <i>ex-situ</i> .

Annex 5: Members of the Biodiversity Technical Working Group (BTGW)

No.	Institutions	Position
1	NCSD/Ministry of Environment	Chair
2	NCSD/Ministry of Environment	Permanent Vice Chair
3	DBD/Ministry of Environment	Second vice Chair
4	GDANCP Ministry of Environment	Third Vice Chair
5	GDLC Ministry of Environment	Member
6	GDEKI Ministry of Environment	Member
7	GDEP Ministry of Environment	Member
8	Ministry of Justice	Member
9	Ministry of National Defense	Member
10	Ministry of Foreign Affairs and International Cooperation	Member
11	FiA Ministry of Agriculture, Forestry and Fisheries	Member
12	Ministry of Land Management and Urban Development	Member
13	Ministry of Rural Development	Member
14	GDCAM Ministry of Commerce	Member
15	Ministry of Commerce	Member
16	Ministry of Education, Youth and Sport	Member
17	Ministry of Transport and Public works	Member
18	Ministry of Planning	Member
19	FA Ministry of Agriculture, Forestry and Fisheries	Member
20	GDA Ministry of Agriculture, Forestry and Fisheries	Member
21	FA Ministry of Agriculture, Forestry and Fisheries	Member
22	Ministry of Tourism	Member
23	Ministry of Water Resource and Meteorology	Member
24	Ministry of Women's Affairs	Member
25	Ministry of Information	Member
26	Ministry of Economic and Finance	Member
27	Ministry of Interior	Member
28	CNMC	Member
29	Ministry of Health	Member
30	CARDI Ministry of Agriculture, Forestry and Fisheries	Member
31	Royal University of Phnom Penh	Member
32	Royal University of Agriculture	Member
33	NCDD	Member
34	CCC	Member
35	Indigenous Community of MRD	Member
36	DBD/GSSD	Member

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