



**Project:” Conservation of the Mangroves of the Eastern Tropical Pacific”**  
Governments of Colombia, Ecuador, Costa Rica and Panama.

**Scoping Report: A rapid viability evaluation for application of  
Experimental Ecosystem Accounts for Mangroves in the ETPS+  
countries of Costa Rica, Panamá, Colombia, Ecuador and Perú.**

DRAFT DO NOT SHARE

**April 2018**

**Authors:** César Viteri, Mahbubul Alam, Montserrat Albán, Cecilia Gutiérrez, Daniela Masís, Ricardo Montenegro, Yahaira Orellana, Gabriela Paige, Marco Quesada, Jorge Ramos, Angela Rojas, César Ruiz.

## **Acknowledgements.**

We would like to express our deepest appreciation to all those who provided us the possibility to make this workshop a success. A special gratitude to the member of the Group of Experts on Mangroves of the Permanent Commission of the South Pacific (aka CPPS): Chile: Dr. Victor Marin; Colombia: Paola Saenz, Julio Cesar Rodriguez; Costa Rica: Rotney Piedra, Luis Villalobos; Ecuador: Xavier Santillan, Caroline Icaza; Panama: Jorge Jaen; Peru: Elmer Ordinola. Our gratitude to the General Secretariats of the CPPS: Capitan Julian Reyna (2016-2017); Embajador Mentor Villagomez (ongoing). We want to express our appreciation for the support provided by the Technical Director of the CPPS, Dr. Fernando Félix. A special thanks to our colleagues Stuart Banks (CI), Emily Pidgeon (CI), and Ana María Rodriguez who provided valuable ideas and insights at different stages of this project.

DRAFT DO NOT SHARE

This document was elaborated in the context of the Project: "Conservation of the Mangroves of the Eastern Tropical Pacific" executed by Conservation International in collaboration with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the Permanent Commission of the South Pacific (CPPS), thanks to the financial support of the Global Environmental Facility (GEF) and the technical assistance of the WWF-GEF Agency.

All views and opinions expressed in this document are those of the authors, and do not necessarily reflect the opinions of UNESCO, CPPS, Conservation International, GEF or WWF-GEF.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	4
INTRODUCTION .....	6
ADVANCES OF INDIVIDUAL COUNTRIES ON THE DEVELOPMENT OF NATURAL CAPITAL ACCOUNTING .....	8
Costa Rica .....	8
Colombia: .....	9
Panamá: .....	9
Ecuador .....	10
Perú.....	10
INSTITUTIONAL ARRANGEMENTS FOR FACILITATING THE IMPLEMENTATION OF EEA FOR MANGROVES. ....	11
Costa Rica:.....	11
Colombia: .....	11
Panamá: .....	12
Ecuador.....	13
Perú:.....	13
DATA AVAILABILITY AND ECONOMIC STUDIES .....	14
Costa Rica .....	14
Colombia: .....	15
Panamá: .....	15
Ecuador: .....	15
Perú:.....	16
CONCLUSIONS AND RECOMENDATIONS. ....	16
REFERENCES .....	18
APPENDIX.....	<b>Error! Bookmark not defined.</b>
Appendix 1: Regional Overview, Advances on the development of Natural Capital Accounting and Opportunities for Mangrove's EEA. ....	<b>Error! Bookmark not defined.</b>

## EXECUTIVE SUMMARY

Natural Capital Accounting (NCA) is a means by which to measure the stock of natural resources, both renewable and non-renewable, and estimate the flow of benefits they provide. Through the use of these methods it is possible to measure changes in ecosystems and their capacity to provide goods and services to societies. The information provided by NCA can help decision makers improve their understanding of ecosystems, for instance they can help to dimension the economic contribution of coastal and marine ecosystems to society, and they can be used to evaluate in economic terms the benefits of public investments on conservation and natural resource management.

The countries of the ETPS+ region (Costa Rica, Panamá, Colombia, Ecuador and Perú) have been working for several years on applying the natural capital accounting methodologies; they show progress in the implementation of the System of Economic and Environmental Accounts, and its Central Framework. These advances are not homogenous among countries:

- Costa Rica and Colombia are ahead in the construction of several satellite accounts such as energy and forest accounts, and both countries record an important progress on elaborating the experimental ecosystem accounts for forest and water basins to measure the contribution of these special ecosystems to their national economies.
- Perú is working in the application of several satellite accounts, and this country has been particularly successful in constructing an experimental ecosystem account for the rainforest of the San Martín region.
- Ecuador and Panamá have worked in the implementation of some satellite accounts, particularly Ecuador has progressed in the elaboration of the following accounts: energy and gas, forest, air emission and government expenditure. Panamá has been successful to create and regularly update the fresh water account. Intermittent political support in both countries has limited progress.

A common denominator of the progress among the ETPS+ countries is all these advances have a strong bias towards inland ecosystems. It is curious to note that despite the countries having coast lines in one or both oceans (Pacific and Atlantic), they do not have any experience in the application of analogous methodologies for coastal and marine ecosystems. Nonetheless, some of the government officials contacted state that there is an increasing government interest to develop such methodologies for coastal and marine ecosystems.

Regarding information available to develop an ecosystem account for mangroves, the region has an important base of economic studies to value in economic terms the ecosystem services provided by mangroves. Particularly, Costa Rica and Colombia are the leaders in the production of scientific literature on economic valuation for services provided by this ecosystem.

Conversely, Panamá, Ecuador and Perú have a limited number of economic studies on valuation of mangrove ecosystem services, and the existing studies focus their efforts on valuing services provided by mangroves such as raw material, food and fire wood supply, and they neglect the valuation of other important services such as carbon sequestration and coastal protection. Most of the studies were academic in nature with limited coordination with government agencies, which limits their impact in the policy-making process. These countries do show interesting experiences in the implementation of government projects to promote the conservation of mangroves, such is the case of the “Socio Manglar” Program in Ecuador. Such projects and initiatives can encourage the development of ecosystem accounts given that they also benefit from the information generated.

In general, the ETPS+ countries have the institutional infrastructure to support a process of adoption of the experimental ecosystem account for mangroves. For example, the Central Bank of Costa Rica has an Environmental Statistics Unit, and there is a growing interest among governments of the region and multilateral agencies to develop such instruments for mangroves. Furthermore, countries are aware about the importance of having economic data available, especially those generated by ecosystem economic valuation studies which can be used to improve the management and conservation of mangroves. The countries are also aware of the need to improve institutional mechanisms within the government structure that standardize, validate and guarantee the quality of data generated for experimental ecosystem accounts and, that ensure that the resulting analyses serve to inform decision-making processes.

## INTRODUCTION

Coastal and marine ecosystems provide a range of goods and services that contribute to the welfare of local populations living in their surroundings, and in most of the cases they are key to sustain national economies. Yet these ecosystems are subject to several human driven pressures such as: pollution, overfishing, climate change, and habitat destruction, which diminish their capacity to keep providing benefits, and threaten their long-term conservation.

Conventional methods to track economic activity, such as the United Nations System of National Accounts were not designed to record both the economic contribution of these ecosystems to national economies, and the cost associated with the loss and degradation of these ecosystems due to human and economic activities. Natural Capital Accounting (NCA) is a means by which to measure the stock of natural resources, both renewable and non-renewable, and estimate the flow of benefits they provide. The United Nations System of Environmental-Economic Accounts (SEEA) incorporates natural capital information using what they term a Central Framework (CF); this is a set of standards for building accounts for resources such as water, energy, minerals, forest and other resources. Through these accounts the SEEA makes explicit the interactions between environment and economy. The SEEA also includes the Experimental Ecosystem Account (EEA) which is a statistical framework that focuses on ecosystems as a whole, unlike the CF that treats natural resources solely as inputs to the economy. Thanks to the EEA the SEEA is able to measure changes in ecosystems and their capacity to provide goods and services to societies. The joint information provided by the CF and the EEA can help decision makers improve their understanding of ecosystems i.e. the economic contribution of coastal and marine ecosystems to society can be dimensioned. Such tools are now globally recognized as having much potential to support well-informed decisions that influence the long-term conservation ecosystems. Due to this potential, Conservation International and the Permanent Commission of the South Pacific (aka CPPS acronym in Spanish) proposed an initiative that builds on pilot economic, governance and social (EGS) valuation work in the GEF-Blue Forests project and Wealth Accounting and the Valuation of Ecosystem Services program ( WAVES ), as well as opportunities for collaboration afforded through the GEF-IW ETPS mangroves project and Mangrove Expert Advisory Group<sup>1</sup> (aka GEM acronym in Spanish) of the CPPS.

---

<sup>1</sup> The Group of Experts on Mangroves of the CPPS is an intergovernmental body of experts created within the CPPS to advise in the implementation of the Regional Action Plan for the Conservation of Mangroves in the South-Eastern Pacific (Regional Plan for Mangroves). It is constituted by experts designated by the CPPS countries plus Costa Rica. The aforementioned country is not a signatory member of the CPPS but decided to support the implementation of the Regional Plan for Mangroves through its Ministry of Environment and Energy on December 2016.

As a first step in this process CI and the CPPS have collaborated in a joint scoping exercise to better understand the current position and state of understanding of NCA across the ETPS+ countries with a special focus on the mangroves ecosystem. The scoping in the ETPS+ countries was performed in two stages. The first stage comprised an extensive literature review of grey, published literature, and web site reviews concerning the development of NCA in each country of the region, and studies about economic valuation of mangrove ecosystem services. The second stage involved a questionnaire given to national experts on NCA and coastal ecosystems. The questionnaires were applied to focal points designated by each CPPS-GEM ETPS+ country, with national designations channeled through the GEM-CPPS and the CPPS secretariat<sup>2</sup>. The questionnaire applied contained different sections requesting (1) information regarding the process of application of NCA in each country, (2) information about the institutional framework relevant to both: NCA and mangroves, (3) data availability to apply EEA for mangroves, and (4) identifying opportunities to accelerate the process of application of EEA for mangroves.

This document highlights the main findings of individual scoping reports undertaken for each country of the ETPS+, and opportunities identified to advance the adoption of NCA for mangroves. For country detailed country reports please refer to: Gutiérrez et al. (2018), Masis et al. (2018), Orellana et al. (????), Paige et al. (2018), and Rojas et al. (2018). This document is also based on the results of the work meeting held at Duke University (USA) on February 2018 with the consultants who applied the scoping questionnaire in each country (See: Viteri et al., 2018). The main result of this report underscores the ETPS+ region show great progress in the implementation of NCAs methods<sup>3</sup>. This progress is not homogenous among countries, and all the advances in the application of these methods have a strong bias towards in-land ecosystems leaving the countries behind in the application of NCAs for coastal and marine ecosystems, but it is important to highlight currently there is an increasing interest of the countries to develop the ecosystem accounts for mangroves or for other coastal and marine ecosystems.

The document is organized in five sections including this introduction. The second section describe the advance each country has in the application of the NCA, in particular advances in the application of the System of Economic and Environmental Accounts and the Central Framework approach. The third section describes the institutional arrangements existing in the

---

<sup>2</sup> Colombia did not name an official focal point. In this case, the researchers identified a group of local experts to collect information from them.

<sup>3</sup> Hereafter this study uses the term Natural Capital Accounts (NCA) to refer to the methods designed by the United Nations System of Economic and Environmental Accounts (SEEA) comprised by the central framework methodology, including the so-called satellite accounts, and the experimental ecosystem accounts, so-called also pilot ecosystem accounts. When needed, we will refer in particular to each of part of this methodology.

region that facilitate the implementation of the NCA and identify opportunities that could support the adoption of EEA for mangroves. The fourth section describe briefly the state of the data availability relevant to develop EEA for mangroves, and the final section formulates some conclusions and recommendations.

## **ADVANCES OF INDIVIDUAL COUNTRIES ON THE DEVELOPMENT OF NATURAL CAPITAL ACCOUNTING**

In this section we describe briefly some of the most important progresses in the adoption of NCA methods in each country.

### Costa Rica

There are important progresses in the implementation of the NCA in Costa Rica. In fact, this country has already advanced in the developing of NCA following the guidelines of the SEEA. Currently, Costa Rica has available the following satellite accounts: water, forest, energy and emissions, while the satellite account for environmental expenditures is in the process of being constructed. This country has developed standardized research methodologies which guarantee the rigor of the information and the consistency with the national accounts. These methods also define a theoretical framework, data analysis and data gathering systems, verification procedures and mechanism to disseminate information. The process of creating the satellite accounts required an institutional mechanism for coordination and data exchange. That role was designated to the National Council of Environmental Accounts of Costa Rica (CNCA acronym in Spanish), this council was ratified officially through the “Regulations for the creation and functioning of the CNCA” (to be gazetted). The regulations state that the CNCA be led by the Ministry of Environment and Energy (MINAE acronym in Spanish), and be constituted by the Ministry of Finance, the Ministry of National Planning and Economic Policy; the National Institute of Statics and Census (INEC acronym in Spanish), and the Central Bank of Costa Rica (BCCR acronym in Spanish). This last agency is technically responsible for building the environmental satellite accounts. To further the process, the BCCR created the Environmental Statistics Area as a specialized unit within the structure of the BCCR, responsible for generating the environmental satellite accounts to also guarantee that accounts are continuously updated. In relation to the development of the EEA, Costa Rica has taken some steps forward to implement ecosystem accounts for the rainforest, which aim to dimension the ecosystem services of carbon sequestration and tourist amenities. Costa Rica has also prepared an

exploratory study of the country's aquatic resources. This work advises creation of experimental ecosystem accounts for Costa Rica's aquatic ecosystems.

### Colombia:

There are important advances towards adopting NCA methodologies in this country. In recent years Colombia has developed several accounts following the SEEA guidelines and as a result made available the following satellite accounts: water, energy, forest, agriculture, waste and environmental expenditure. Colombia has also implemented standardized research methodologies consistent with the National Account System to guarantee the rigor and robustness of the information produced. The methodologies designed define a theoretical framework along with analytical and gathering data protocols, corroboration processes, and dissemination mechanisms. Under the leadership of the National Administrative Department of Statistics (DANE acronym in Spanish) there are a set of inter-agency agreements that facilitate collaboration with the Ministry of Environment and Sustainable Development (MADS acronym in Spanish), the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM acronym in Spanish); the National Planning Department (DNP acronym in Spanish); the Ministry of Energy and Mining (MME acronym in Spanish); the Unit of Mining and Energy Planning (UPME acronym in Spanish); the Superintendence of Public Utilities (SSPD acronym in Spanish), and others. These agreements formalize technical cooperation channels and establish information flows among the government agencies. Furthermore, there are highly trained technical teams responsible for the application of the SEEA methods, and there are formal mechanisms that inform the decision-making process<sup>4</sup>; furthermore, Colombia has elaborated the EEA for the Orinoquia Watershed Basin. This instrument permits understanding of how the watershed basin contributes to each economic sector, and how these sectors impact on the state of the ecosystem.

### Panamá:

The progress of Panamá in the application of NCA methodologies is limited. This country has developed one fresh water resources satellite account to date. This account is updated recurrently although there are challenges to do so. The elaboration of this account was originally supported by a project of the Inter-American Development Bank in 1999. The project included a study: "Economic valuation of the natural resources and design of the system of

---

<sup>4</sup> WAVES (2016), Annual Report: Wealth Accounting and Valuation of Ecosystem Services.

environmental satellite accounts within the framework of the National Accounts of Panamá". This activity was aligned with the objectives contained in the Environmental National Plan at that time as led by the National Environmental Authority, the Ministry of Environment (MINAMBIENTE). In addition to the elaboration of the fresh water resources account the project started to elaborate a forest account and protected areas account. These were not finalized and they have not been updated since then. The fresh water account is updated periodically in a multi-agency process that is led collaboratively by MINAMBIENTE and the Institute of Statistics and Census (INEC acronym in Spanish). Other agencies that participate in this process are the Institute of National Aqueducts and Sewerage (IDAAN acronym in Spanish), the Ministry of Agriculture Development (MIDA acronym in Spanish), the Panamá Channel Authority (ACP, acronym in Spanish) and the Electric Transmission Company (ETESA acronym in Spanish). This account delivers a very interesting result; it revealed that 96% of available water is used for power generation and the operation of the Panamá Channel. The process of updating this account faces several challenges that include lack of statistical information, absence of interagency coordination, limited experience in developing the account, and that there is currently no demand for the information produced by the satellite accounts.

### Ecuador

All though to date there are exploratory studies for various accounts (oil and gas, forest, soil, and air pollutants) the country continues working in the developing of the satellite accounts. The process to elaborate the accounts is headed by the Commission for the development of the Environmental Account System created in 2009. This commission is made up by: The Ministry of Environment (MAE acronym in Spanish), the Central Bank of Ecuador (BCE acronym in Spanish), the National Secretariat for Planning and Development (SENPLADES, acronym in Spanish), and the National Institute on Statistic and Census. (INEC acronym in Spanish).

### Perú

Progress in developing NCA in this country is as yet limited. Most of the efforts undertaken are in a planning stage with intention to develop the following satellite accounts: fresh water, forest and timber, and expenditures on environmental protection. Perú has been successful developing the experimental ecosystem account for the rainforest of the San Martin Region. The information generated by this account has been used to orientate regional development plans and the environmental policy. The importance of this instrument is reflected in the last decision taken by the Regional Government of San Martin (April 2018) where it sets as main objectives the development of a regional environmental accounting system in the following 5 years, and the definition of a roadmap for valuing the natural capital of the region by the end of 2018. The adoption of the

EEAs methods is an important accomplishment given that it can guide application to similar examples in other national ecosystems. The process of elaboration of the NCAs in Perú is directed by a technical committee. That committee is led by the National Institute of Statistics and Information (INEI, acronym in Spanish), the committee comprises 32 government agencies at national, regional, and local level, as well as academia. The satellite accounts currently under development are being supported by three government agencies: The National Authority of Water (ANA, acronym in Spanish), the Forest Service (SEFOR, acronym in Spanish), and the Ministry of Environment (MINAM, acronym in Spanish).

## **INSTITUTIONAL ARRANGEMENTS FOR FACILITATING THE IMPLEMENTATION OF EEA FOR MANGROVES.**

This section describes for each country the existing institutional arrangements for the adoption of NCA's, identifies institutions which should be involved in the adoption of NCA 's for mangroves, and points out opportunities that could facilitate this process.

### Costa Rica:

The entity responsible of the application of NCA's is the National Council of Environmental accounts. This council is made up by: The Ministry of Energy and Environment (this is the political leading institution and secretariat); the Ministry of Finance; the Ministry of National Planning and Economic Policy; the Central Bank of Costa Rica (this is the technical leading institution); and the National Institute on Statistics and Census. Then following this political structure, the potential implementation of the EEA for mangroves should be led by the BCCR, through the National Council of Environmental Accounts, with the support of the MINAE in coordination with the System of Natural of Conservation Areas (SINAC acronym in Spanish) and the National Wetlands Program. This process could get some traction for implementation by demonstrating how the EEA for mangroves can provide valuable information to the Payment for Environmental Service Program, the National Development Plan, the Forest Development Plan, the National Strategy of Biodiversity, the Climate Change Strategy, the Carbon Market, the Neutral Carbon Initiative, the Climate Change Adaptation Fund, and, the National Policy for Wetlands.

### Colombia:

In this country the decision making regarding the application of NCA's is delegated to the National Commission for NCAs. This commission is made up by the Ministry of Environment and Sustainable Development, the Department of National Planning, the Office of the Comptroller General, the Institute of Environmental Studies and Meteorology (IDEAM), and the National Department on Statistics (DANE)). This commission has the technical support of the Ministry of Mining and Energy, and the Ministry of Agriculture. The IDEAM and DANE play the role of data generators, and DANE is responsible to analyze the data. For the development of the different satellite accounts and the EEA; the DANE has assumed a leading role promoting inter-agency agreements facilitate cooperation and flow of information among agencies. This should be also the case if the National Commission decide to adopt the EEA for mangroves in Colombia. Then besides the DANE, the other agencies which should be involved in this process are the Ministry of Environment and Sustainable Development in coordination with the Department of Coastal and Marine Affairs and Aquatic Resources, and institutes such as the IDEAM, the Institute for Marine and Coastal Research (INVEMAR acronym in Spanish), and the Regional Autonomous Corporations (CARs, acronym in Spanish). The CARs are entities responsible for the management and zoning of territories in a decentralized fashion, currently there are 17 CARs that have mangroves within their jurisdictions, so it is mandatory for them to develop instruments for managing this ecosystem. The process to develop EEA for mangroves could profit from the design and implementation of "CONPES Colombia Potencia Bi – Oceánica 2030", which is a national policy aiming to promote the development of economic activities related to oceans for the next 12 years in Colombia. The information generated by the EEA will be useful to keep track of the progress in the application of this national policy.

### Panamá:

The process of implementation of the NCAs in Panamá is governed by an agreement signed in 2009 by the Ministry of the Environment formerly known as the National Environmental Authority, the General Comptroller of the Republic (CGR, acronym in Spanish), and the Ministry of Finance. Currently the National Institute on Statistic and Census (INEC acronym in Spanish), as part of the CGR, in collaboration with the Ministry of the Environment are in charge of implementing the environmental accounts. Ultimately, the development process for the mangroves EEA should be led by the CGR through the INEC, and the Ministry of the Environment. Within this Ministry, an interviewee advised, there should be a coordinated effort among the departments of Protected Areas and Wildlife, Coasts and Seas, and Forestry; and, the units of Economics, and Climate Change. Furthermore, the interviewees identified that

the information generated by the EEA for mangroves could contribute to the development of the National Policy for Wetlands.

### Ecuador

In this country the process to implement the NCA's is managed by the Commission for the development of the Environmental Account System. This commission is made up by: The Ministry of Environment (MAE, acronym in Spanish) which has the leading role, the Central Bank of Ecuador, the National Secretariat for Planning and Development (SENPLADES, acronym in Spanish), and the National Institute on Statistic and Census. (INEC acronym in Spanish). The process to implement the EEA for mangroves should be handled through this commission with the leadership of the Ministry of the Environment and in collaboration with the Ecuadorian Navy. These two agencies are responsible for managing mangroves given that the Navy grants concessions for the management of these ecosystems, and the MAE is responsible for the management of the protected areas containing mangroves, including ongoing programs that support the management of mangroves by local communities such as the "Socio Manglar" initiative. Indeed, this program could benefit from the data generated by the EEA for mangroves, as it can demonstrate the contribution of this ecosystem to the welfare of local population and help justify the sizeable government investments through this program in terms of returns and benefits to user communities. Other process that could benefit from the development of NCA is the "Bioeconomy initiative", an initiative championed by the MAE with the aim of prompting a shift in the national economic model from an economy based in the exploitation of fossil fuels to an economy based on the sustainable use of biodiversity. Again, the information generated by NCA, for example the EEA for mangroves, can track and monitor the metrics of such a transition.

### Perú:

There is a technical committee for the elaboration of environmental accounts; this committee is led by the National Institute of Statistics and Information (INEI, acronym in Spanish), and it comprises 32 government agencies at national, regional and local level, and academia. The satellite accounts currently under development are being supported by three government agencies: The National Authority of Water, the Forest Service, and the Ministry of Environment (MINAM, acronym in Spanish).

Given that institutional arrangements be created for the development of NCA, if the government decides to create the EEA for mangroves it should be undertaken through the

technical committee created for this purpose. Within this committee the INEI should take the lead in collaboration with the Marine Institute of Perú, and the Peruvian Park Service as most of the mangrove area has been declared protected area and is Park administrated. There were three processes identified that can provide support to the process of development of the EEA for mangroves: The Green Growth Strategy, The Low Carbon Economy Plan, and the Ecosystem Services Law. All of these processes require instruments to support and keep track of their implementation.

## **DATA AVAILABILITY AND ECONOMIC STUDIES**

The data availability and economic studies for ecosystems services and values provided by mangroves are key elements to build the EEAs for mangroves. The countries of the region show some progress in the developing of economic valuation studies for mangroves, even though compared with other regions, for instance Asia, this progress can be considered modest. There are also some limitations that need to be tackled in regard to the economic literature about mangroves, for example: the methodologies applied in these studies should be more robust and standardized in order to have comparable results among countries; several of the studies developed in the region rely on the benefit transfer method which has several limitations and generates results that can be easily contested; most of the studies put more attention on valuing the provision services of mangroves (i.e. provision of raw material and food) disregarding other key services such as carbon sequestration and climate change mitigation; and finally, another limitation is the small, or no impact of these types of studies on the policy-making process. Most of the academic researchers who author these studies interact in a limited fashion with mangrove's stakeholders.

Regarding the existing conditions to develop economic studies about mangroves, there are some challenges that government should be aware of. These include lack of coordination among government agencies, bureaucracy and complexity for accessing data and information.

Next, we present a brief overview of the availability of data and information for mangroves in each country detailing the type of information and the agencies that generate these data.

### Costa Rica

In this country SINAC has land cover maps (areas, species and other basic indicators for conservation areas); the Fisheries and Aquaculture Institute publishes information collected from fishermen's surveys (i.e. landings); universities such as the National University and the University of Costa Rica (Center of Research on Marine and Limnology Sciences) collect

biophysical data from mangroves. It is worth noting that SINAC is the only agency that can certify the information collected. Costa Rica also has a good base of existing economic literature on the valuation of mangroves ecosystem services.

### Colombia:

In the case of Colombian mangroves, there are several institutes that manage biophysical information as well socio-economic information, for instance: INVEMAR, The Humboldt Institute, the Colombia Natural National Parks, the Environmental Research Institute of the Pacific, the CARs, and several universities. All these entities have the capacity to provide data and studies to contribute to the building of the EEAs for mangroves. It is noteworthy that when compared to the wider region, Colombia has an important number of mangrove's economic valuation studies. These studies cover several mangrove forests located in different regions of Colombia but mainly in the Caribbean coast, with relatively sparser data for the mangrove forest located in the Pacific.

### Panamá:

In Panamá, there are several institutions that handle data which could be relevant for the developing of EEA for mangroves. Those government agencies include the Ministry of Environment, the Ministry of Public Health in conjunction with the Technological University of Panamá, the National Secretariat of Science and Technology, INEC, and the Authority on Aquatic Resources. There are other agencies that are also working in mangroves and generate important information, for example UNDP, The Panamá's Audubon Society, the Smithsonian Tropical Research Institute, Wetlands International, Conservation International and the Technological University of Panamá. In regard to the economic literature available in Panamá, there are only a few economic studies (4) about the valuation of mangrove's ecosystem services.

### Ecuador:

TO BE COMPLETED

Coastal land-use maps from 60s, 80s, 90s 2006 and 2016. Economic valuation for three ecosystem services to be developed this year (2018).

## Perú:

Peruvian mangroves being a relatively small ecosystem in the extreme north of the country, may explain why there is little attention by government agencies and institutes to better understand the ecosystem. For instance, the Ministry of Environment generates a National System of Environmental Information which handles information on natural resources, but it does not have a section about marine and coastal ecosystems. In regard to the economic literature, there are a few studies on economic valuation of mangroves ecosystem services, although such studies are scattered.

## **CONCLUSIONS AND RECOMENDATIONS.**

In the appendix 1 we present a matrix that summarizes the most relevant elements for the adoption of the EEAs for mangroves. For instance, it shows the advances recorded in the countries in regard to the application of NCA's methods. Furthermore, the matrix shows the opportunities identified that could encourage the development of EEAs for mangroves in each country.

The main observation evident from this matrix is the lack of progress in the application of NCA's methods for marine and coastal ecosystems. This underscores the urgency to start working in developing NCA's for these ecosystems, as they have a key role in the national economy of these countries (i.e. 10% of the Colombian GDP), and foremost they contribute greatly to the economic welfare of local communities located in the surroundings of these ecosystems for instance mangroves. NCA methods provide valuable information to mainstream biodiversity on policy-making, ignoring the contribution of these ecosystems does not just put on risk the welfare of millions of people living in their surroundings, but also it misses the potential of these ecosystems to be economic drivers to bring prosperity to the regions where they are located.

The adoption of the system of economic and environmental accounts in the countries of the region is not a novelty. ETPS+ countries have developed at least one satellite account for a natural resource following the guidelines of the SEEA central framework. Colombia and Costa Rica are leading this process and they are able to guide through this process to other ETPS+ countries. There are similarities in the ETPS+ technical agencies and government structures that can facilitate an easier exchange of knowledge and lessons learned among the ETPS+ countries.

There is among the governments of the ETPS+ the willingness to implement the ecosystem accounts for mangroves. This willingness is based in the strong conviction of the government

officials that the information of these accounts is useful for: i) Orientating policy making to improve the conservation and management of this ecosystem. ii) Keeping track of the advance of national plans and strategies. And. iii) Evaluating the compliance of national and international commitments for the protection and management of this ecosystem.

The ETPS+ countries show also a modest development of scientific literature on the economic valuation of ecosystem services of the mangrove, with some countries leading the creation of this kind of studies. This gives an advantage to the region on the development of NCAs for mangroves as the availability of information is the foundation for the implementation of NCAs.

Even though there could be interest among government officials in the implementation of the NCA methods, in some countries this support is intermittent, and it depends most of the times upon upper level decision makers. There is a need to implement political mechanisms that assure a continuous support to the adoption of NCAs and shield the process against changes in governments.

As we mentioned the development of the satellite accounts is predominant for terrestrial ecosystems often ignoring marine and coastal ecosystems. Currently, no NCAs methods exist to include mangroves or other coastal or marine ecosystems. There should be abundant investment of resources on the generation of biophysical and socio-economic data to properly quantify the flow of ecosystem services from mangrove forests in the region. Investments should also be done to create coordination mechanisms among government agencies to avoid data dispersion and disorganization.

There is not a clear appraisal of the financial effort required to implement NCAs in the countries of the region. The general perception is that NCAs methods will require an abundant amount of financial resources during their implementing process, and subsequent updating processes.

There are opportunities related to novel concepts such as blue economy and blue carbon. Their emergence could provide some traction to the process to implement NCA methods for mangroves. Certification processes (i.e. fisheries, aquaculture and carbon) can create also opportunities to partner with private sector to contribute with the process to implement NCA methods. The important role that mangroves play in the mitigation of climate change effects could be used to engage global agencies such as the Green Climate Fund to support the implementation of NCAs methods for this ecosystem. There are regional intergovernmental platforms such as the Group of Experts on Mangroves of the CPPS, that could be used to support the adoption of NCAs for mangroves in a political manner.

## REFERENCES

Gutiérrez Cecilia y Viteri César. (2018). Evaluación rápida de las condiciones para la implementación de las Cuentas Ecosistémicas Experimentales de Manglar en Perú. Informe Técnico para Conservación Internacional. Lima (Perú).

Masis Daniela, Quezada Marco y Viteri César. (2018). Evaluación rápida de las condiciones para la implementación de las Cuentas Ecosistémicas Experimentales de Manglar en Costa Rica. Informe Técnico para Conservación Internacional. San José (Costa Rica).

Orellana Yahaira, Albán Montserrat y Viteri César. (2018). Evaluación rápida de las condiciones para la implementación de las Cuentas Ecosistémicas Experimentales de Manglar en Ecuador. Informe Técnico para Conservación Internacional. Quito (Ecuador).

Page Gabriela, Montenegro Ricardo y Viteri César. (2018). Evaluación rápida de las condiciones para la implementación de las Cuentas Ecosistémicas Experimentales de Manglar en Panamá. Informe Técnico para Conservación Internacional. Ciudad de Panamá (Panamá).

Rojas Angela, Ruiz César y Viteri César. (2018). Evaluación rápida de las condiciones para la implementación de las Cuentas Ecosistémicas Experimentales de Manglar en Colombia. Informe Técnico para Conservación Internacional. Bogotá (Colombia).

Viteri César, Ramos Jorge and Mahbubul Alam (2018). Exchange Workshop on: Economic valuation for mangrove's ecosystem services and Natural Capital Accounting (NCA). Workshop Report for Conservation International. Durham, NC (USA).

# APPENDIX

## Appendix 1

### (A): Regional Overview, Advances on the development of Natural Capital Accounting and Opportunities for Mangrove's EEA.

Regional Overview: Advances on the development of Natural Capital Accounting methods and Opportunities for Mangrove's EEA		
Elements	Costa Rica	Colombia
Existence of an institutional arrangement that implements the NCA	There is the National Council of Environmental accounts. This council is made up by: the Ministry of Energy and Environment (MINAЕ acronym in Spanish, this is the political leading institution ad secretariat); the Ministry of Finance; the Ministry of National Planning and Economic Policy; the Central Bank of Costa Rica (BCCR acronym in Spanish; this is the technical leading institution); and the National Institute on Statistics and Census.	There is a National Commission for running the process of implementaion of NCA. This commission is made up by the Ministry of Environment and Sustainable Development, the Department of National Planning (DNP, acronym in Spanish), the Office of the Comptroller General, the Institute of Environmental Studies and Meteorology (IDEAM, acronym in Spanish), and the National Department on Statistics (DANE, acronym in Spanish). This commission has the technical support of the Ministry of Mining and Energy, and the Ministry of Agriculture. The IDEAM and DANE play the role of data generators, and DANE is responsible to analyze the data.
Leading Institution	Ministry of Energy and Environment	Department of National Planning.
SEEA: Central Framework advances	This country has develop the following satellite accounts: water, forest, energy and air pollutant emissions.	This country has develop the satellite accounts for water, energy, forest, agriculture, waste and expenditures for environmental protection.
SEEA: Experimental Ecosystem Accounts advances	The development of an expriemental ecosystem account for forest is in process. It looks for measuring the contribution of this ecosystem to the tourism industry and the carbon sequestration services.	This country have developed the experimental ecosystem account for the river basin of the Orinoquía.
Is the information produced by NCA used on policy making? How?	The BCCR publishes the results in a regular basis and informs to the Council on Enviromental Account about the latest findings. There is also a regular press release to the public announcing the publication of the NCA results.	The National Development Plan 2014-2018 includes in its green growth strategy the recomendation to develop natural capital accounts to conserve and guartantee the sustainable use of the country's natural capital (land and marine). The data from the satellite accounts are not yet used to guide the government budgeting process as they are still preliminary.
Institutions that could be involved in the development of EEA for mangroves	The BCCR, through the National Council of Environmental Accounts, with the support of the MINAЕ in coordination with the System of Natural of Conservation Areas (SINAC, acronym in Spanish) and the National Wetlands Program.	DANE, the Ministry of Environment and Sustainable Development in coordination with the Department of Coastal and Marine Affairs and Aquatic Resources, and institutes such as the IDEAM, the Institute for Marine and Coastal Research (INVEMAR acronym in Spanish), and, the Regional Autonomous Corporations.
National policies or plans that could give traction to the implementation of EEA for Mangroves	The Payment for Enviromental Service Program, the National Development Plan, the Forest Development Plan, the National Strategy of Biodiversity, the Climate Change Strategy, the Carbon Market, the Neutral Carbon Initiative, the Climate Change Adaptation Fund, and, the National Policy for Wetlands.	"CONPES Colombia Potencia Bi – Oceánica 2030" This is a national policy aiming to promote the development of economic activities related to oceans for the next 12 years in Colombia.
State of data availability and economic studies that could contribute to the implementation of EEA for mangroves	SINAC has land cover maps (areas, species and othe basic indicators for conservation areas). The Fisheries and Aquaculture Institute (INCOPECA acronym in Spanish) publishes information collected from fishermen's surveys(i.e. landings). Universities such as the National University and the University of Costa Rica (Center of Research on Marine and Limnology Sciences ) collect biophysical data from mangroves. Worth to note, SINAC is the only agency that can certify the information collected. This country have a good number of studies on economic valuation of magroves ecosystem services.	The availability of information is still a challenge to develop the NCA, there is the need of inter-institutional coordination among government agencies and the need to include Universities and research institutes. For the case of mangroves, institutes such as the INVEMAR, Humboldt, Natural National Parks, Universities, Environmental Research Institute of the Pacific (IIAP acronym in Spanish), and the Regional Autonomous Corporations should be involved. It is important to highlight that relative to the region Colombia has an important number of mangrove's economic valuation studies.

Source: Country Scoping reports Costa Rica, Panama, Colombia, Ecuador and Peru. See: Masis et al. (2018), Rojas et al. (2018), Paige et al. (2018), Orellana et al. (????), and Gutiérrez et al. (2018).

## Appendix 1

### (B): Regional Overview, Advances on the development of Natural Capital Accounting and Opportunities for Mangrove's EEA.

Regional Overview: Advances on the development of Natural Capital Accounting methods and Opportunities for Mangrove's EEA			
Elements	Panama	Ecuador	Perú
Existence of an institutional arrangement that implements the NCA	There is an agreement (2009) to elaborate the environmental accounts, it was signed among the Ministry of the Environment formerly know as the National Environmental Authority (ANAM acronym in Spanish), General Comptroller of the Republic (CGR, acronym in Spanish), and, the Ministry of Finance. Currently the National Institute on Statistic and Census (INEC acronym in Spanish), as part of the CGR in collaboration of the Ministry of the Environment are in charge of implementing the environmental accounts.	In 2009 is created the Comission for the development of the Environmental Account System". This comission is made up by: the Ministry of Environment (MAE acronym in Spanish), the Central Bank of Ecuador (BCE acronym in Spanish), the National Secretariat for Planning and Development (SENPLADES, acronym in Spanish), and the National Institute on Statistic and Census. (INEC acronym in Spanish)	There is a technical committee for the elaboration of the environmental accounts. This committee is leading by the National Institute of Statistics and Computing (INEI, acronym in Spanish), the committee comprises 32 government agencies at national, regional and local level, and the academia. The satellite accounts currently under development are being supported by three government agencies: the National Authority of Water (ANA, acronym in Spanish), the Forest Service (SEFOR, acronym in Spanish), and the Ministry of Environment (MINAM, acronym in Spanish).
Leading Institution	Ministry of Environment	Ministry of Environment	INEI
SEEA: Central Framework advances	This country, has developed, and, updated recurrently the satellite account for water. Although it is a satellite account, the information is not used to adjust the National Accounts or the GDP. The satellite account for forest resources and protected areas were designed but not implemented.	Exploratory studies have been done for the development of the following satellite accounts: oil and natural gas, water, forest and timber, soil, air pollutant emissions, and expenditures on environmental protection. Just the water account has not yet being developed.	There is a plan to develop the following satellite accounts: water, forest and timber, and, expenditures on environmental protection.
SEEA: Experimental Ecosystem Accounts advances	No advance	No advance	This country has developed the EEA for the forest and other important ecosystems of the region of San Martín.
Is the information produced by NCA used on policy making? How?	The information generated by the water account since 2001 has been used by the Ministry of the Environment for managing the water resources, it provided major inputs to prepare the National Plan on Water Security 2015-2050.	No info.	Recently, the Regional Government of San Martín updated their Regional Environmental Policy (this is a document that guides the environmental management of the region) and included the promotion and implementation of a Regional Environmental Accounting System that integrate ecosystem services as the main objective for the next 5 years. It also included as Government objective to define roadmap to value the natural capital of the region at the end of 2018.
Institutions that could be involved in the development of EEA for mangroves	The CGR through the INEC, and the Ministry of the Environment in coordination with the departments of: Protected Areas and Wildlife, Coasts and Seas, and Forestry; and the units of: Economics, and Climate Change.	The Comission for the development of the Environmental Account System, (MAE, BCE, SENPLADES and INEC).	The technical committee for the elaboration of the environmental accounts (INEI and other government agencies ) in collaboration with the Marine Institute of Peru (IMARPE acronym in Spanish). Other agency to be involved should be the Peruvian Park Service (SERNANP acronym in Spanihs), as most of the mangrove area is a protected area managed by SERNANP.
National policies or plans that could give traction to the implementation of EEA for Mangroves	The National Policy for Wetlands.	Bioeconomic Initiative. National Development Plan. Socio Manglar Incentives Program.	The Green Growth Strategy and the Low Carbon Economy Plan. Ecosystem services law and regulations.
State of data availability and economic studies that could contribute to the implementation of EEA for mangroves	There are several institutions that could contribute to collect data relevant for the EEA for mangroves. For instance, Ministry of Environment, UNDP, Authority on Aquatic Resources (ARAP acronym in Spanish), INEC, Panama's Audubon Society, and the Ministry of Public Health in conjunction with the Technological University of Panama (UTP acronym in Spanish) and the National Secretariat of Science and Technology (SENACYT acronym in Spanish). There are very few economic studies on valuation of mangrove's ecosystem services.	Coastal land-use maps from 60s, 80s, 90s 2006 and 2016. Economic valuation for three ecosystem services to be developed this year (2018).	The Ministry of Environment has the National System of Environmental Information. It has information on natural resources but it does not have a section about marine and coastal ecosystems. There a few studies on economic valuation of mangroves ecosystem services, and these studies are scattered.
Source: Country Scoping reports Costa Rica, Panama, Colombia, Ecuador and Peru. See: Masis et al. (2018), Rojas et al. (2018), Paige et al. (2018), Orellana et al. (????), and Gutiérrez et al. (2018).			