Guide to the Economic Valuation of Marine and Coastal Ecosystem Services

in Central America and the Dominican Republic

Bio-Bridge Initiative
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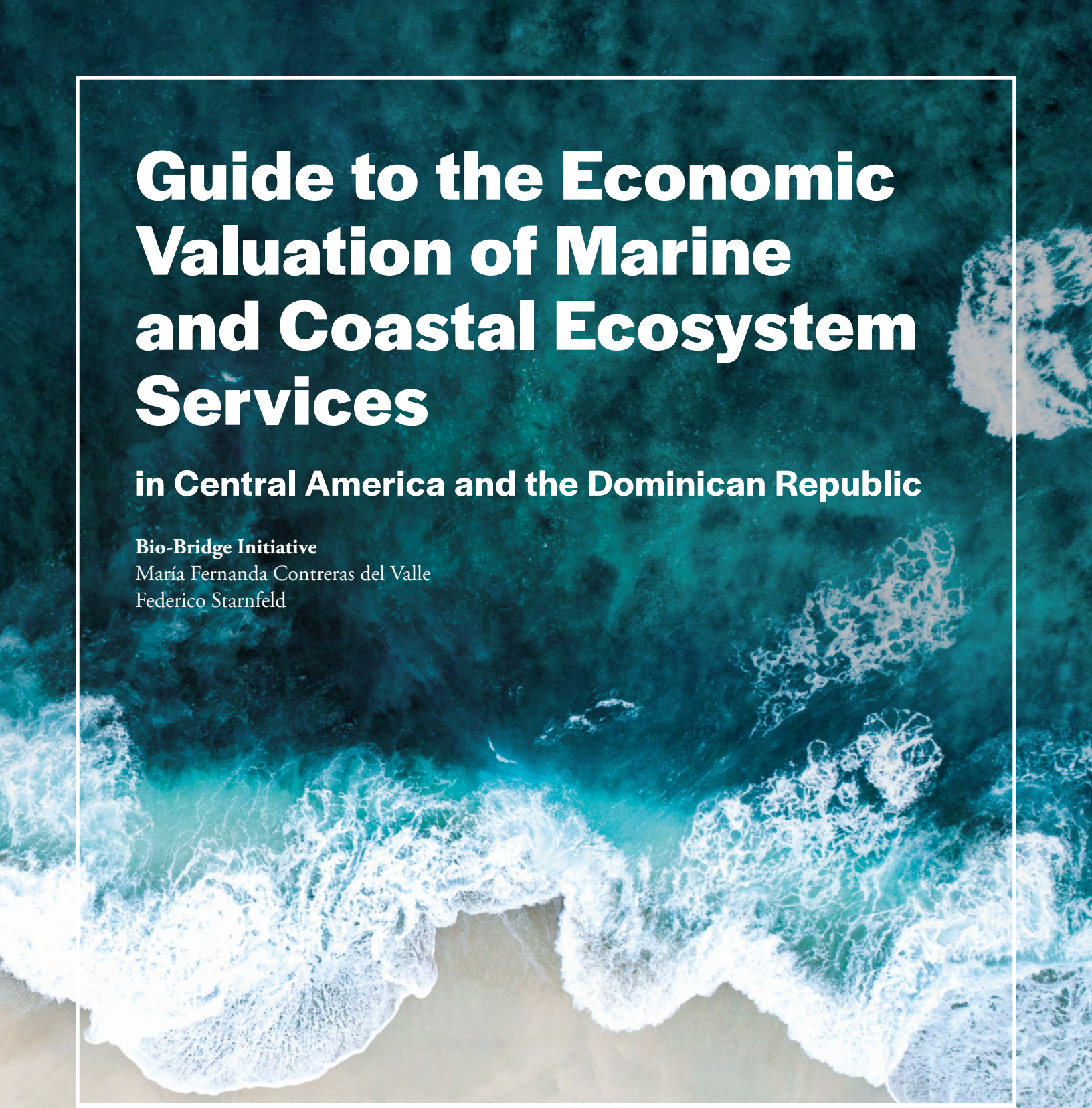

MINAE Ministerio de Ambiente y Energía
Energía, Recursos Naturales, Ambiente y Minas
Gobierno de la República Dominicana — Medio Ambiente
CCAD Comisión Centroamericana de Ambiente y Desarrollo
SICA Sistema de la Integración Centroamericana
Bio-Bridge Initiative
Convention on Biological Diversity
Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Bio-Bridge Initiative

Context
This guide was prepared for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) in the context of the project 'Cooperation for a Coordinated Economic Valuation of Marine Ecosystems to Strengthen Restoration and Sustainable Management Efforts in Central America and the Dominican Republic' under the Bio-Bridge Initiative of the Convention on Biological Diversity (CBD). This project was implemented in close collaboration with the Ministry of Natural Resources and the Environment of Honduras, the Ministry of Environment and Energy of Costa Rica and the Ministry of Environment and Natural Resources of the Dominican Republic. The counterpart at the regional level has been the Central American Commission for Environment and Development (CCAD).

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Abbreviations

ASP	Protected wildlife area (Costa Rica)
BMUV	German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
CBD	Convention on Biological Diversity
CCAD	Central American Commission for Environment and Development
CICES	Common International Classification of Ecosystem Services
CONANP	National Commission of Protected Natural Areas (Mexico)
CSF	Conservation Strategy Fund
EEA	European Environment Agency
ES	Ecosystem service
ESV	Ecosystem service valuation
ESVD	Ecosystem Services Valuation Database
EVRI	Environmental Valuation Reference Inventory
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IKI	International Climate Initiative
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment (2005)
MAR	Mesoamerican Reef System
MCES	Marine and coastal ecosystem service
MESV	Marine and coastal ecosystem service economic valuation
MiAmbiente+	Ministry of Natural Resources and the Environment (Honduras)
MIMARENA	Ministry of Environment and Natural Resources (Dominican Republic)
MINAM	Ministry of Environment (Peru)
Minambiente	Ministry of Environment and Sustainable Development (Colombia)
NGO	Non-governmental organisation
NOAA	United States National Oceanic and Atmospheric Administration
RESPA	Rapid Ecosystem Services Participatory Appraisal
SICA	Central American Integration System
SINAC	National System of Conservation Areas (Costa Rica)
TEEB	The Economics of Ecosystems and Biodiversity
UNEP	United Nations Environment Programme

Introduction

The valuation and integration of ecosystem services (ESs) has globally gained prominence as a useful tool for guiding public policy and private strategy processes towards the conservation and sustainable use of ecosystems. As with any tool, its application involves a sequence of steps which, in this case, form a process to assess and value the services provided by marine and coastal ecosystems in a meaningful way.

This guide, developed under the Bio-Bridge Initiative of the Convention on Biological Diversity (CBD), with support provided by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) within the framework of the International Climate Initiative (IKI), aims to provide step-by-step guidance on how to implement a typical process for the valuation and integration of marine and coastal ecosystem services (MCESs). Given the global importance of this topic, the guide has been prepared with reference to the many sophisticated methodological developments in this field.

> The guide begins with a conceptual exploration of ecosystem services with a focus on MCESs.

It then describes the general steps for the design and implementation of a marine and coastal ecosystem service economic valuation (MESV) and integration of the results (Figure 1).

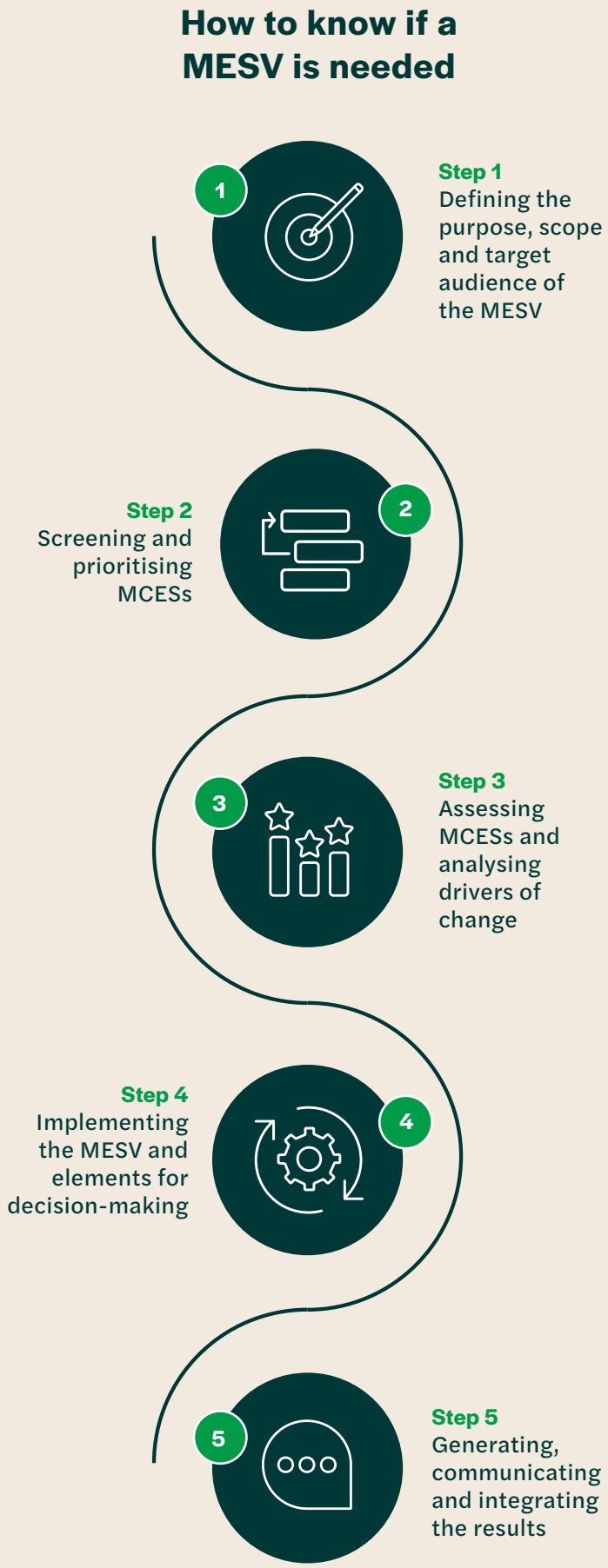


Figure 1. Process for MCES valuation and integration

Background: Bio-Bridge Initiative

The Bio-Bridge Initiative promotes and facilitates scientific cooperation to help implement the CBD and its protocols.[1]

In support of the Bio-Bridge Initiative and the achievement of its goals, the BMUV has provided technical and financial resources for scientific cooperation through a project proposal. This proposal was prepared by the project 'Strategic Environmental Dialogues', the programme 'Business Cooperation and Biodiversity in Central America and Dominican Republic' and the 'PANORAMA – Solutions for a Healthy Planet' initiative, all implemented by GIZ, together with a number of partners: the Central American Commission for Environment and Development (CCAD) of the Central American Integration System (SICA), the Directorate General for Biodiversity of the Honduran Ministry of Natural Resources and the Environment (MiAmbiente+), the Vice-Ministry of Coastal and Marine Resources of the Dominican Republic's Ministry of Environment and Natural Resources (MIMARENA), and the Vice-Ministry of Waters and Seas of the Ministry of Environment and Energy and the National System of Conservation Areas (SINAC) of Costa Rica.

The core goal of the project 'Cooperation for a Coordinated Economic Valuation of Marine Ecosystems to Strengthen Restoration and Sustainable Management Efforts in Central America and the Dominican Republic' is to foster regional dialogue and cooperation on MESV and strengthen restoration, conservation and sustainable management efforts.

As part of this initiative, two regional workshops were held on 28 and 30 September 2021, bringing together over 40 selected experts and decision-makers from Costa Rica, the Dominican Republic and Honduras. The purpose of the workshops was to:

- provide insights into MESV processes in Central America and the Dominican Republic;
- share lessons learned, success factors, good practices, methodologies, etc. relating to MESV in Central America and the Dominican Republic;
- initiate a dialogue on the usefulness of MESV in Central America and the Dominican Republic;
- gather data for the development of a manual or guide on MESV in Central America and the Dominican Republic.

This regional guide on MESV has been developed as a complementary output based on the discussions and outcomes of the regional workshops. It has been designed as a tool to guide the different tasks involved in conducting an MESV and is not intended as a comprehensive manual covering all the technical and methodological aspects of an MESV.

The guide sets out the elements required to connect the different steps, referencing more detailed publications that have been developed by other initiatives over the years.

1 More information on the Bio-Bridge Initiative can be found at https://www.cbd.int/biobridge/projects.

CHAPTER 1.

About the guide

Purpose of the guide

The main objective of this publication is to provide general guidance on designing and implementing MESV for the Central American region and the Dominican Republic.

In addition to defining concepts relevant to MESV, this includes providing guidelines on:

1. defining the purpose, scope and target audience of the MESV;
2. screening and prioritising the key ecosystem services;
3. assessing conditions and trends and analysing drivers of change;
4. selecting and implementing valuation methodologies;
5. using the results to generate information and develop strategies to improve decision-making.

The intention is that users will be able to apply the recommendations provided in this guide at the local, national and regional level.

Scope of the guide

There are a variety of guides, manuals and tools currently available that provide information on how to conduct an ecosystem service valuation (ESV), many of them with a focus on MESV. This guide draws on those resources considered relevant for the implementation of MESV processes that are framed and designed to influence decision-making.

While the guide does not provide exhaustive and detailed information on how to conduct an MESV, users will find concise, useful, relevant and practical information on the subject as well as references for further reading on the topics covered.

Who the guide is for

The guide is intended for:

- decision-makers and policy-makers, including ministry officials responsible for the environment, planning, tourism, fisheries and protected areas, who can commission and use MESV to inform policy-making;
- the personnel of cooperation projects and national and international non-governmental organisations (NGOs) who act as MESV facilitators;
- regional and international experts, representatives of research institutes and academics from universities who can commission and design MESV for decision-makers and policy-makers.

How to use the guide

MESV is one of many tools that can be used to achieve objectives relating to the conservation, restoration and sustainable management of marine and coastal ecosystems. This guide aims to provide guidance and methodological references to help implement MESV processes. It is divided into the following three chapters:

- **Chapter 1:** introduction to the guide, outline of its purpose and how to use it;
- **Chapter 2:** conceptual basis of MESV and integration;
- **Chapter 3:** presentation of the five steps for identifying, valuing and integrating MCESs into decision-making processes.

Serving as a practical tool, the guide provides brief examples of MESVs implemented in the region that illustrate each of the five steps mentioned above. To illustrate step 5 of the process, the guide includes the case of the valuation and integration of the ecosystem services of Cozumel Reefs National Park and Cozumel Island Flora and Fauna Protection Area in Mexico (initiative financed by the BMUV) as a practical example.

CHAPTER 2.

Conceptual basis for marine and coastal ecosystem service valuation

This chapter sets out the theoretical and conceptual basis for ecosystem services and the reasons why they are important for the sustainable management of ecosystems in general and marine and coastal ecosystems in particular. Chapter 2 is particularly important for those who are not familiar with ecosystem services and ESV.

What are ecosystem services?

All of us rely on ecosystems and the services they provide. Ecosystem services are defined as the benefits people obtain from ecosystems (Duraiappah et al., 2005).[2]

> As they are essential for economic activities, livelihoods, wellbeing and culture, the concept of ecosystem services is useful for identifying and recognising the link between nature, people and societies and the resulting dependencies and impacts.

Box 1: Basic concepts relevant in defining ecosystem services

Human wellbeing: the human state is conditional on factors including basic material for a good life, freedom and choice, health, good social relations, security and spiritual experience (Alcamo, J. et al., 2003).

Biodiversity: the variability among living organisms, including diversity within species, between species and of ecosystems (Alcamo, J. et al., 2003).

Ecosystem: a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (Article 2, CBD, 1992; Bateman et al., 2010).

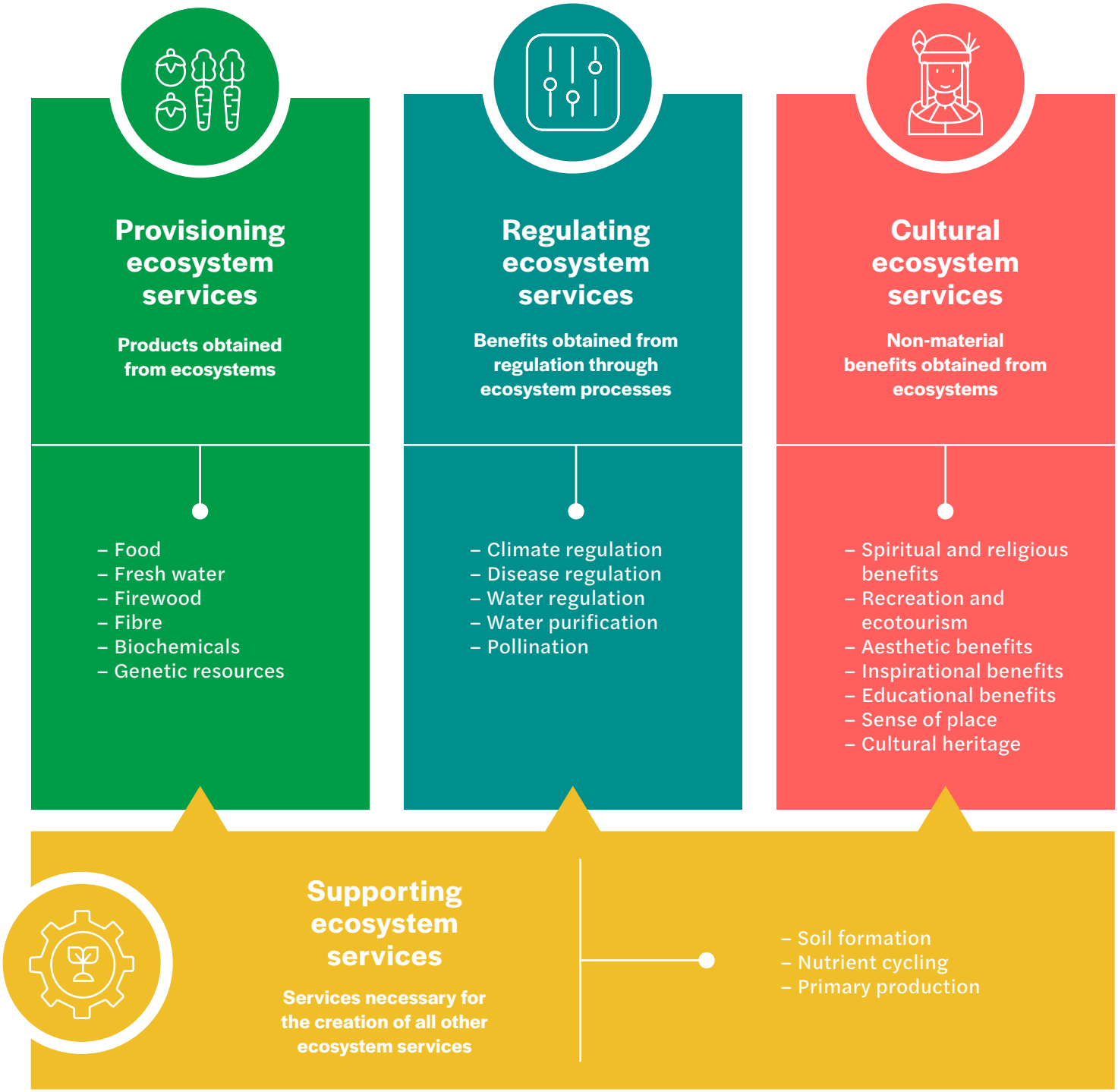
Ecosystem service: the direct and indirect benefits provided by an ecosystem for human wellbeing. 'Everyone in the world depends completely on Earth's ecosystems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfilment, and aesthetic enjoyment' (Duraiappah et al., 2005).

Sources: adapted from Alcamo, J. et al. (2003), Bateman, I.J. et al. (2010), CBD, Duraiappah et al. (2005) and Diaz et al. (2018).

2 There are different views on how to define ESs. According to Carrasco De La Cruz (2021), the definition proposed in the Millennium Ecosystem Assessment (MA) – 'the benefits people obtain from ecosystems' – does not take into account the need for human intervention to benefit from ESs or intermediate (supporting) ESs. The debate continues on whether the ecosystem processes and functions generally classed as regulating or supporting ESs (intermediate services) should in fact be considered ESs or not. This is because they give rise to final ESs but do not necessarily provide benefits. Based on this, Boyd and Banzhaf (2007, cited in Carrasco De La Cruz, 2021) define ESs as 'the end products of ecosystems utilized actively or passively to produce human well-being'. The proposed conceptual framework, definition and classification of ESs for Chile's Ministry of the Environment differentiates between ESs and benefits. The proposal considers ESs as ecosystem interactions and processes that deliver benefits, so that an ES can provide more than one benefit – for example, the provision of wood (ES) gives rise to different benefits such as heating and raw materials for construction (Ministry of the Environment of Chile, 2014). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) uses the broader concept of "nature's contributions to people", which it considers to include ecosystem goods and services, but also knowledge systems and nature's gifts, which are benefits from which people derive good quality of life (IPBES, 2019). The main elements of the concept were agreed on as inclusive categories by all stakeholders involved in IPBES during a participatory process. This guide will use the concept of ESs as benefits or contributions provided by nature. The value of these benefits varies depending on the different perspectives of the individuals and societies that receive them (or feel the effects of their loss).

The classification of ecosystem services most commonly used and considered most practical is the one proposed by the MA, which is shown in Figure 2. It comprises four main categories: provisioning services, regulating services, cultural services and supporting services.[3] Supporting ecosystem services provide the functions necessary for the provision of other ecosystem services.

Figure 2. Classification of ecosystem services according to the MA. Source: Alcamo et al. (2003).

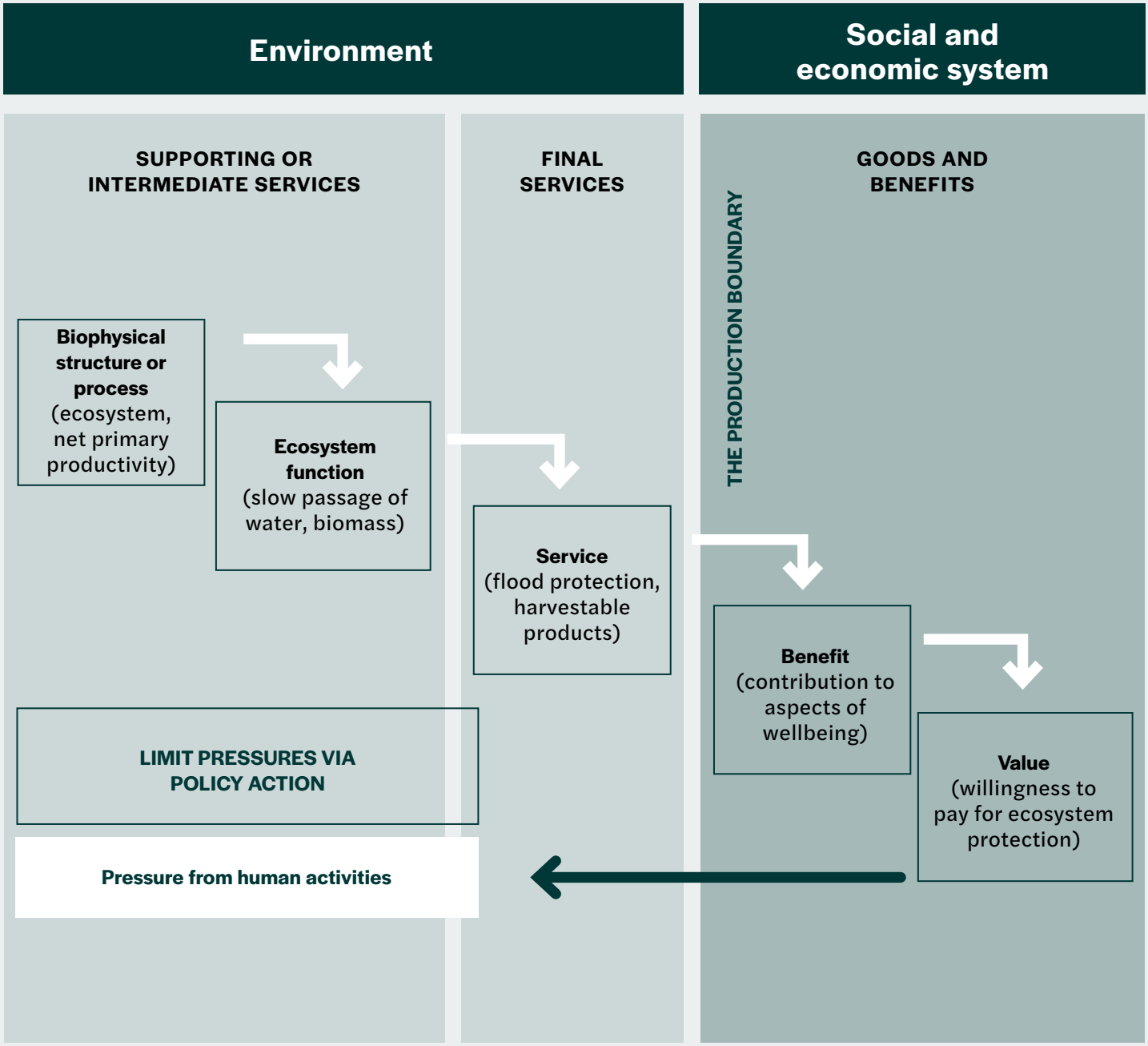


3 Other ES classifications include the Common International Classification of Ecosystem Services (CICES) and the classification proposed by IPBES. This publication presents the MA classification as it is considered to be the one most commonly used.

Figure 3, adapted by Carrasco De La Cruz (2021) from Haines-Young and Potschin (2018), shows the main elements of the ecosystem service model. It illustrates how ecosystem services are the result of biophysical processes, structures and ecosystem functions. The relationship between these processes, structures and functions makes the provision of intermediate or supporting ecosystem services possible, which give rise to final ecosystem services.

The final ecosystem services are received by the beneficiaries, who perceive their value in different ways depending on the context. The figure also shows how the perception of the value of ecosystem services is reflected in decision-making. In turn, the decisions taken have an impact on biophysical processes, structures and functions, leading to changes in the provision of ecosystem services and the beneficiaries receiving them.

Figure 3. Ecosystem service model. Source: adapted by Carrasco De La Cruz (2021) from Haines-Young and Potschin (2018).



Marine and coastal ecosystem services

According to the MA (Duraiappah et al., 2005), marine ecosystems are marine areas located at a depth of more than 50 m, and coastal ecosystems are areas located between 50 m below mean sea level and 50 m above the high tide level. Coastal ecosystems can extend over the continental shelf and inland, up to 100 km from the shoreline.

MCESs depend on the physical, chemical and biological processes of marine and coastal ecosystems and their functioning and structures. Table 1 provides an example of MCESs in some marine and coastal ecosystems and their identification according to the MA classification.

Based on the European Environment Agency (EEA) classification, Table 2 includes examples of MCESs for selected marine and coastal ecosystems.

Table 1. Examples of marine and coastal ecosystems and their services

ECOSYSTEM SERVICES	COASTAL ECOSYSTEMS									MARINE ECOSYSTEMS		
	Estuaries and marshes	Mangrove forests	Lagoon and salt ponds	Intertidal	Kelp forests	Rock and shell reefs	Seagrass beds	Coral reefs	Inner shelf	Outer shelf	Seamounts and mid-ocean ridges	Deep sea
Provisioning services												
Food	x	x	x	x	x	x	x	x		x	x	x
Fibre, timber, fuel	x	x	x						x	x		x
Medicines, other resources	x	x	x		x			x	x			
Regulating services												
Biological regulation	x	x	x	x		x		x				
Freshwater storage and retention	x		x									
Hydrological balance	x		x									
Atmospheric and climate regulation	x	x	x	x		x	x	x	x	x		x
Human disease control	x	x	x	x		x	x	x				
Waste processing	x	x	x	x	x	x	x	x				
Flood/storm protection	x	x	x	x	x							
Erosion control	x	x	x				x	x				
Cultural services												
Cultural and amenity	x	x	x	x	x	x	x	x	x			
Recreational	x	x	x	x	x			x				
Aesthetics	x		x	x				x				
Education and research	x	x	x	x	x	x	x	x	x	x	x	x
Supporting services												
Biochemical	x	x			x			x				
Nutrient cycling and fertility	x	x	x	x	x	x		x	x	x	x	x

Source: adapted from United Nations Environment Programme (UNEP, 2006).

What is ecosystem service valuation and what purpose does it serve?

Despite overwhelming evidence of the importance of ecosystem services, over the last five decades humans have altered ecosystems at a faster pace than at any other time in human history (Cademus et al., 2014; Duraiappah et al., 2005).

For example, according to Costanza et al. (2014), the global value of marine ecosystem services in 2011 (taking into account ocean and coastal ecosystems, including estuaries, seagrass beds and coral reefs) was USD 1,368 per hectare per year, giving a total of USD 49.7 trillion a year. However, the IPBES's 2019 *Global Assessment Report on Biodiversity and Ecosystem Services* warned that '66% of the ocean area is experiencing increasing cumulative impacts, and over 85% of wetlands (area) has been lost'.

More specifically, 50% of salt marshes, 35% of mangrove forests, 30% of coral reefs and 29% of seagrass beds worldwide have already been lost or degraded, due to coastal development, population growth, pollution and other economic activities (Barbier, 2017).

This is because the value of ecosystem services have not been factored into decision-making processes or have been underestimated or because trade-offs have not been managed to good effect (see Box 2). This situation poses a major risk for the provision of ecosystem services on which different beneficiaries depend for economic activities, livelihoods, wellbeing and culture.

Table 2. Examples of MCESs

ECOSYSTEM	PROVISIONING ES	REGULATING ES	CULTURAL ES	SUPPORTING ES
Coastal				
Mangrove forests	Commercial fish species, medicinal products, honey, forest products	Water filtration, climate regulation, flood control, water retention, carbon sequestration	Recreational, spiritual	Habitat for species (including those of commercial interest), primary production
Seagrass beds	Fertilisers, medicinal products	Erosion control, nutrient retention, coastal protection, water purification	Recreational	Habitat for species (including those of commercial interest), production of oxygen
Coral reefs	Commercial fish species, raw materials, medicinal products	Coastal protection, nutrient cycling	Recreational	Habitat and maintenance of species (including those of commercial interest)
Dunes	Raw materials, water retention and purification	Coastal protection, erosion control, prevention of saltwater intrusion	Recreational, spiritual	Habitat and maintenance of species
Marine				
Deep sea and pelagic zone	Commercial fish species, medicinal products, raw materials	Carbon sequestration and storage, climate regulation, nutrient cycling, water filtration, bioremediation	Recreational	Production of oxygen, habitat and maintenance of species, genetic diversity

Sources: Dunn et al. (2011), Santora et al. (2021) and Armstrong (2012).

Box 2. The importance of trade-off analysis

Trade-offs[4] are necessary when one or more development goals, including ecosystem conservation, come into competition or conflict with ecosystem service use or conservation. This competition gives rise to benefits for some and costs for others. For example, when a coastal development plan provides for the construction of new tourist resorts and public amenities and also aims to conserve dune and mangrove areas, trade-offs must be made. The construction of tourist resorts could affect dune and mangrove conservation (and the MCESs these provide, including protection against extreme weather events). At the same time, conserving dunes and mangrove forests might require restrictions to be imposed on the construction of tourist resorts. Such trade-offs can also impact the MCESs that stakeholders in the spatial development plan depend on, such as people living in the area to be developed, fishers, service providers and tourists.

Trade-off analysis is therefore crucial for MESV and its integration into development processes.

The economic valuation of ecosystem services is a process that shows and expresses the value of ecosystem services for the beneficiaries for the purpose of mainstreaming them into decision-making processes. It also helps to identify the trade-offs within decision-making, which allows an estimation to be made of how the environmental and related social, cultural and economic benefits and costs are distributed among stakeholders. This information helps to ensure fairer and more sustainable decision-making.

Figure 4, adapted from Maes et al. (2013), shows the ecosystem services resulting from ecosystem processes and functions. They provide benefits that different groups of beneficiaries value in different ways in the socio-economic system. The value of ecosystem services may or may not be incorporated into decision-making or 'responses', giving rise to 'drivers of change'. For example, failure to include the value of the ecosystem services that mangrove forests provide, such as coastal protection, in the decision-making process could result in a coastal development plan that adopts construction criteria that do not take into account the protection of these ecosystems.

As a result, the development plan could affect the mangrove areas and all the ecosystem services this ecosystem provides (not only coastal protection, but also habitat for commercial fish species, water filtration, nutrient cycling, carbon sequestration, etc.), which would have an impact on various groups: fishers, residents, tourism service providers, etc.

ESV seeks to inform decision-making by providing information on the value of ecosystem services in order to manage trade-offs and thereby minimise the impact on the socio-ecological system.

4 For further information on the concept of trade-offs, see Section 7.2 of the manual developed as part of the training course Principles of Ecosystem Services Assessments for Policy Impacts (Kosmus et al., 2018). See also the publication by Lester et al. (2013) for some specific examples of MESV.

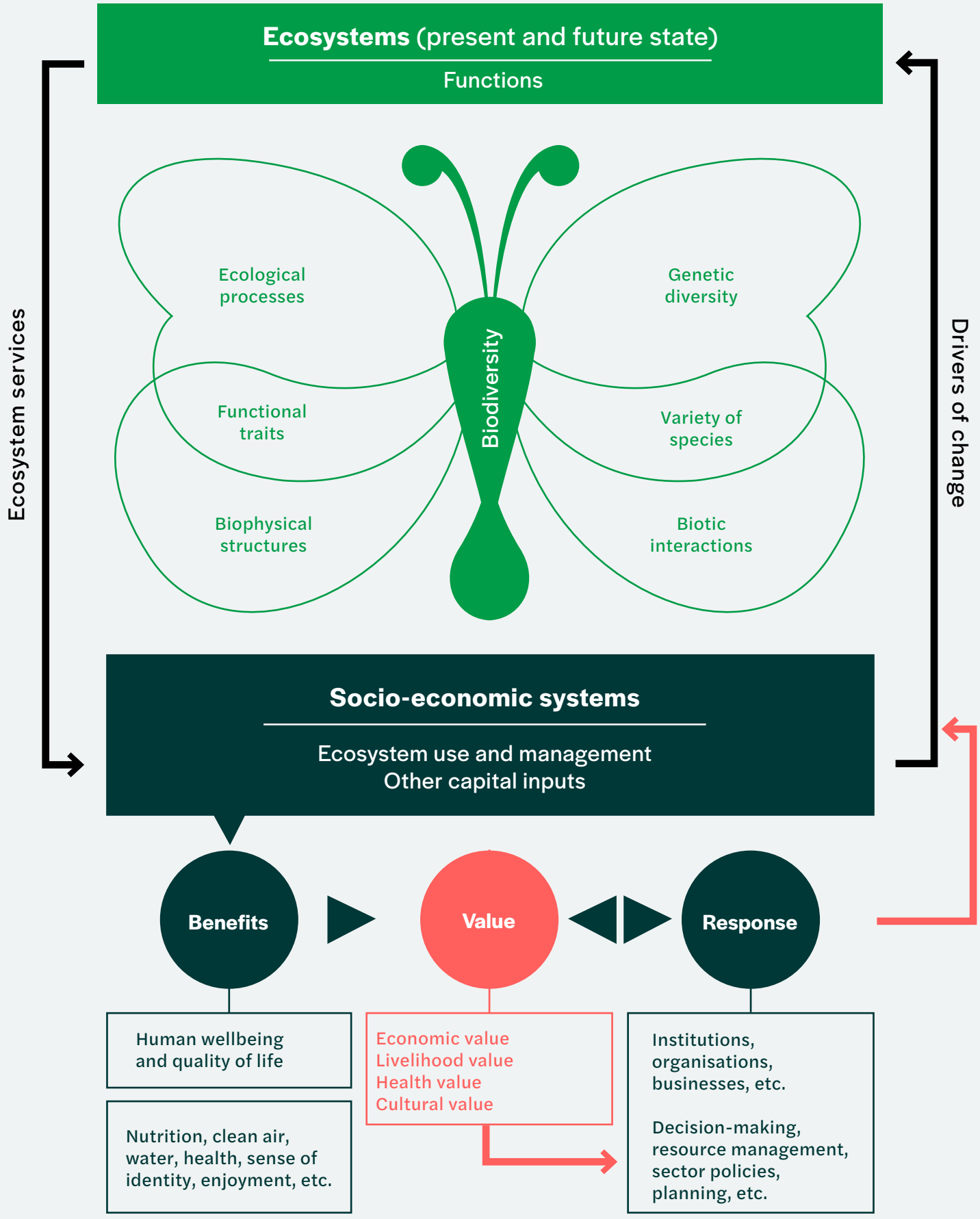


Figure 4. The socio-ecological system and MESV. Source: adapted from Maes et al. (2013).

ESV should therefore be considered as part of a broader decision-making process that seeks to mainstream sustainability. Table 3 shows some examples of decision-making processes and potential MESV uses.

Table 3. Decision-making and potential MESV uses.

DECISION-MAKING PROCESSES IN POLICY AND PRACTICE	POTENTIAL USES
Creation and management of protected areas	**1)** Determine location, size, management category, restrictions and permitted activities. **2)** Include MCES language in declaration documents and establish the MCES as a conservation object. **3)** Identify benefits beyond traditional conservation objects, that is, ways in which protected areas can enhance human wellbeing. **4)** Identify key stakeholder groups that may be affected by the creation of protected areas, showing the economic, social and cultural impacts. **5)** Raise awareness about the value of protected areas to secure wider support from different stakeholders and sectors.
Marine and coastal spatial planning	**1)** Identify economic activities that will have less impact on traditional conservation objects and ensure that spatial planning takes into account the benefits that ecosystems provide for people. **2)** Determine whether there are situations in which the use of MCESs reduces the benefits obtained by other beneficiaries (trade-offs) through different management activities. **3)** Generate information that can be used in the cost–benefit analysis of infrastructure and change-of-use projects.
Design of financing mechanisms for ecosystem conservation and sustainable management	Identify and estimate MCES costs and benefits associated with ecosystem conservation and sustainable management and the integrated management of river basins, coasts and other marine and coastal ecosystems.
Environmental communication and education campaigns	Carry out communication and awareness campaigns aimed at the general public and specific sectors (hospitality, infrastructure development, fisheries, tourism, etc.) on the importance of managing marine and coastal ecosystems sustainably.
Negotiation of conservation budgets	Budgets and sources of financing for conservation are generally limited. MESV can provide very useful information for negotiating an increase in funds earmarked for conservation, for example, by demonstrating the contribution they can make to achieving the development goals of sector agendas or the high cost of not making more funds available for this purpose.
Alignment of subsidies	Subsidies are policy instruments used to promote particular economic sectors. As they are sectoral instruments, their implementation is often uncoordinated (promotion of fisheries and protected areas). MESV provides useful information and data that can be used to align sectoral subsidies (for example, subsidies to promote the capture of invasive species, such as the lionfish, in protected areas).

Source: Prepared by the authors based on the guide for integrating ecosystem services into protected area management, developed as an output of the project Assessment of ecosystem services in natural protected areas (CONANP-GIZ-CSF, 2018).

ESV shows the value of ecosystem services in quantitative, qualitative and monetary terms (Emerton et al., 2019). Although monetary valuation has been crucial in integrating ESV into decision-making, this type of valuation on its own is not enough (Rincón-Ruiz et al., 2014). Its application has a number of advantages and disadvantages.

On the one hand, monetary ESV allows the development of a common language, which affords greater clarity for the target audience on the contributions and impacts of ecosystem services and on the actors involved. It also clarifies the costs and benefits associated with the trade-offs resulting from decision-making.

In spite of this, monetary valuations do not always provide complete information, and robust data may not be available for the methods used to estimate values, which increases the degree of uncertainty. In such valuations, non-monetary stakeholder values are not considered and may not be taken into account in the decision-making processes.

To achieve more balanced decision-making, it is therefore recommended to use a combination of methods in order to show and communicate the full range of values perceived by stakeholders.[5]

Box 3. Difference between the concepts of 'value' and 'price'

Value is not the same as price. The prices paid for goods and services do not always reflect the value that people and society place on them. Firstly, different stakeholders attribute different values to the same ecosystem and the services it provides. For example, the value of a reef is different for tourists visiting it than for fishers who need it as a habitat for commercial fish species or for people who benefit from the protection it provides against extreme weather events. Secondly, the value that people place on the ecosystem may differ from the price they pay for some of the services they receive from it. For example, the price of visiting the reef may be lower than what tourists would be willing to pay. In the case of fishers, the value of the reef is greater than the price they receive for the sale of a certain amount of fish.

This guide focuses on MESV with the understanding that it must be complemented with other quantitative and qualitative methods to determine the value of MCESs from the perspective of all the stakeholders. These estimations provide information that contributes to fairer decision-making.

It should also be remembered that MESV is simply a tool that can prove useful in determining the value of MCESs. How useful it is will depend on the purpose of the decision-making process it is being integrated into, the quality of its design, the information and data used and the effectiveness of implementation and communication.

5 With the intention of providing a methodology that recognises a multiplicity of values and perspectives, Rincón-Ruiz et al. (2014) produced the publication *Valoración integral de la biodiversidad y los servicios ecosistémicos* (Integrated Valuation of Biodiversity and Ecosystem Services). For more information on how to apply the methodology, see Rincón-Ruiz et al. (2019), a publication that documents 21 case studies on integrated valuation experiences in Latin America.

Why the economic valuation of marine and coastal ecosystem services is important for Central America and the Caribbean

As in many other parts of the world, in Central America and the Caribbean, marine and coastal ecosystems provide a multiplicity of benefits for coastal communities and millions of visitors. For example, according to the figures provided for the forests, seas and biodiversity component of the Framework Regional Environment Strategy 2015–2020 developed by the Central American Commission for Environment and Development (CCAD, 2014), Central America is home to 12% of the coastlines of Latin America and the Caribbean, including 567,000 ha of mangrove forest and 1,600 km of coral reef.

> Furthermore, the rate of endemism in the Central American Caribbean is over 90%, making it a biodiversity hotspot (FHB, 2018).

These important ecosystems and their biodiversity are crucial for economic activities, livelihoods and culture in the region. For example, the Caribbean is the region most heavily dependent on tourism for jobs and income. According to CARSEA (2007), in 2004, tourism-related jobs accounted for 15% of all employment in the region (around 1.8 million jobs), and the sector contributed 13% to gross domestic product. The same publication reports that over 1.5 million people in the Caribbean earn a living from commercial fishing and that fish products account for 7% of the protein consumed by people in the region.

Although the importance of MCESs is widely recognised, there is great pressure threatening their provision and therefore the economy and the wellbeing, livelihoods and culture of people living in the region. This pressure includes

- land-use change (huge increase in coastal infrastructure for housing and tourism),
- pollution,
- overfishing,
- climate change
- and the introduction of invasive species.

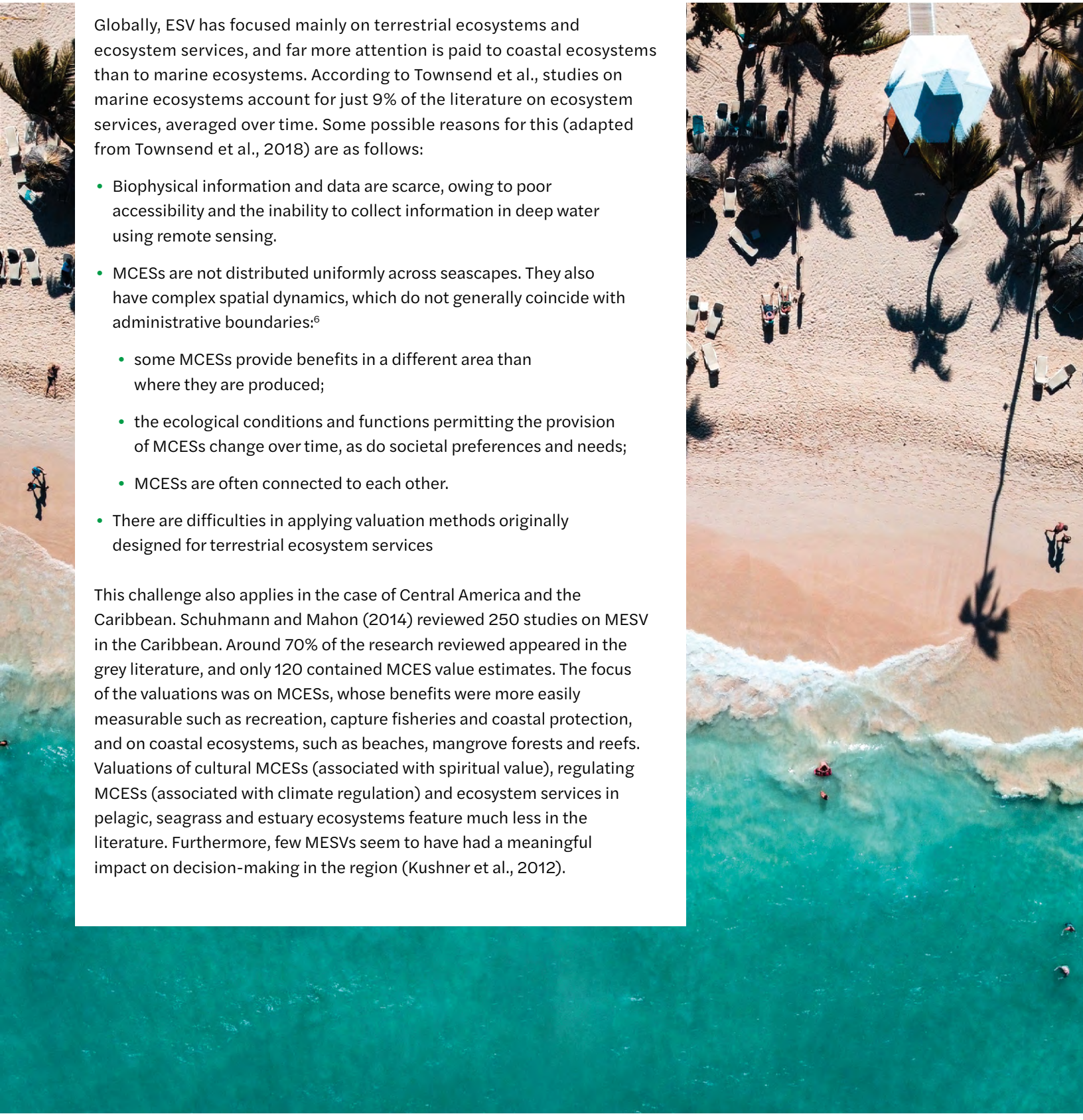
For example, it is estimated that the continued loss and degradation of coral reefs could cost the region between USD 350 and 870 million by 2050, that 70% of beaches are eroding at rates of between 0.25 and 9 m a year and that the ratio of fish caught for each 'unit of effort' declined by up to 70% between 1980 and 1999 (CARSEA, 2007).

By showing the value and contributions of MCESs or the effects and costs of their loss, MESV enables better informed and fairer decisions to be taken on MCES management within the framework of policies, instruments, mechanisms and planning not only for the marine and coastal sector, but also for social and economic issues, such as employment.

A variety of efforts are needed to address challenges associated with MESV implementation and integration (Box 4). First, it is necessary to coordinate efforts and work together to compile the required information and data and identify the methods that can be adapted to better assess the biophysical and socio-economic characteristics of MCESs. Second, in view of the urgent need to show the value of MCESs in addressing sustainable development challenges in the region, it is necessary to draw on available resources, experiences and lessons learned. Third, in order to promote MESVs that can influence decision-making in a meaningful way, the framing and design of the process must be tailored to the specific environmental, social, cultural, economic and political context.

There are various initiatives in the region to promote the use of MESV in decision-making processes. One of the most notable examples is the publication Coastal Capital, in which Richard Waite and other authors (Waite et al., 2014) provide methodological guidelines on incorporating MESV into decision-making processes. It is one of the few studies that analyses the state of MESV in the Caribbean. Complementing this research is a study by Kushner et al. (2012), which describes cases of MESVs that have influenced decision-making in the Caribbean and features success stories and lessons learned.

Box 4. Challenges in MESV implementation and integration



Globally, ESV has focused mainly on terrestrial ecosystems and ecosystem services, and far more attention is paid to coastal ecosystems than to marine ecosystems. According to Townsend et al., studies on marine ecosystems account for just 9% of the literature on ecosystem services, averaged over time. Some possible reasons for this (adapted from Townsend et al., 2018) are as follows:

- Biophysical information and data are scarce, owing to poor accessibility and the inability to collect information in deep water using remote sensing.
- MCESs are not distributed uniformly across seascapes. They also have complex spatial dynamics, which do not generally coincide with administrative boundaries:[6]
  - some MCESs provide benefits in a different area than where they are produced;
  - the ecological conditions and functions permitting the provision of MCESs change over time, as do societal preferences and needs;
  - MCESs are often connected to each other.
- There are difficulties in applying valuation methods originally designed for terrestrial ecosystem services

This challenge also applies in the case of Central America and the Caribbean. Schuhmann and Mahon (2014) reviewed 250 studies on MESV in the Caribbean. Around 70% of the research reviewed appeared in the grey literature, and only 120 contained MCES value estimates. The focus of the valuations was on MCESs, whose benefits were more easily measurable such as recreation, capture fisheries and coastal protection, and on coastal ecosystems, such as beaches, mangrove forests and reefs. Valuations of cultural MCESs (associated with spiritual value), regulating MCESs (associated with climate regulation) and ecosystem services in pelagic, seagrass and estuary ecosystems feature much less in the literature. Furthermore, few MESVs seem to have had a meaningful impact on decision-making in the region (Kushner et al., 2012).

6 For more detailed information on potential challenges that the characteristics of ESs pose in valuations and how to address them, see the publications of Fisher et al. (2007, 2011) and the Manual for Trainers – ***Principles of Ecosystem Services Assessments for Policy Impacts*** (Kosmus et al., 2018), specifically Section 7.1.

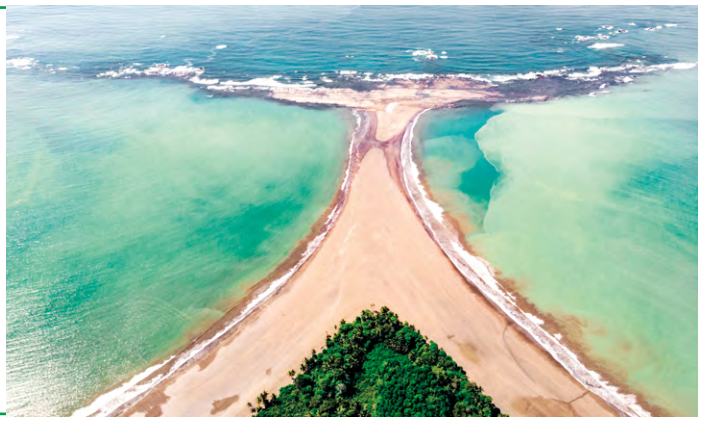
CHAPTER 3.

How to design and implement an economic valuation of marine and coastal ecosystem services

How to know if an MESV is needed?

Box 5. Key questions before starting an MESV

- What are socio-economic issues related to the ecosystem services?
- How are these issues linked to decision-making or policy-making processes?
- What is the policy question associated with these issues in the context of decision-making?
- Could the MESV be useful for addressing these issues and the policy question and generate change?



As mentioned above, MESV is a tool that is used to formulate meaningful social and economic arguments for a better understanding of the effects of decision-making and policy-making on MCESs and to show the impact of changes on the distribution of costs and benefits among stakeholders. This is why it is crucial to embed MESV in a broader decision-making and policy-making context.

Before embarking on an MESV, it is therefore essential to determine how it can contribute to the transition towards a more sustainable scenario in this broader context. Some of the key elements for specifying and framing the purpose of the MESV are examined below.

Identifying the issues associated with the ecosystem services and decision-making or policy-making

Generally speaking, attention is only given to issues associated with marine and coastal ecosystems and the services they provide when they are recognised as such by society. This recognition can be generated through information from biophysical studies, the observance of effects by ecosystem service beneficiaries, media coverage, etc. (Kosmus et al., 2018).

A closer analysis of the issues related to the ecosystems in question outlines how they are linked to decision-making and/or existing policies. It also makes it possible to identify the *entry points* (Box 6) for addressing the issues.

Box 6. Entry points for an MESV

Entry points are windows of opportunity for placing an issue on the political agenda. In Kosmus et al. (2018), it is suggested that entry points be divided into processes and situations.

Processes are pre-existing structures and frameworks that can be used to bring an issue to the attention of the decision-makers concerned. Some examples include policy-making or development planning.

On the other hand, **situations** may be mere opportunities as they do not necessarily persist in the long term and exist for a short time only – for example, media attention about a particular concern.

Box 7. Entry point for highlighting the value of ecosystem services in the Dominican Republic: rethinking the National System of Protected Areas

The study on the economic valuation of the Dominican Republic's National System of Protected Areas by the Santo Domingo technology institute INTEC is a good example of how a window of opportunity can be used to good effect. In this case, the entry point was the rethinking of the National System of Protected Areas in response to the growing social pressure to manage protected areas better and the availability of international support. The approach adopted was to analyse the overall economic value generated for the country by its System of Protected Areas, which involved identifying the provisioning, regulating, cultural and supporting ecosystem services.

The study identified important lessons learned for mainstreaming ecosystem services into policies. For example, it showed that social factors that threaten protected areas and the ecosystem services they provide are linked to high poverty levels and low investment in the surrounding area. This underlines the fact that a focus on the wellbeing outcomes associated with ecosystem services is a crucial element in policy design. In addition, coastal and marine areas offer services that can encourage private sector involvement, for example, through innovative market instruments that aim to improve the capacity to secure financing for conservation and sustainability associated with tourism (Gómez-Valenzuela, 2021).

The table below provides some examples illustrating the identification of issues, their link to decision-making processes and potential entry points.

Table 4. Examples illustrating the identification of issues, their link to decision-making processes and potential entry points

ISSUES RELATED TO MARINE/ COASTAL ECOSYSTEMS	EXAMPLES OF DECISION-MAKING PROCESSES/ ENTRY POINTS	EXAMPLES OF OPTIONS FOR ADDRESSING THE ISSUES
Pollution in mangrove forests and pressure on dunes due to infrastructure construction	Updating of spatial planning for coastal development.	Provide information on more sustainable alternatives during the process of updating spatial planning for coastal development and on the increased vulnerability of coastal areas when these lack ecosystems to protect them from extreme weather events.
	Preparation of public and private coastal infrastructure projects.	Provide information that can be incorporated in cost–benefit analyses for infrastructure projects.
Degradation of reefs within protected areas due to a lack of resources and capacities for the planning, management and maintenance of such areas	Negotiation of national and/or local budgets.	Provide information on the socio-economic 'profitability' of budgets allocated to protected areas.
	Development of corporate social responsibility strategies by tourism companies in the area.	Provide information on the contribution of well-conserved reefs to the profitability of tourism companies in relation to the strategy for investment and donations for protected areas. Carry out a campaign to raise awareness about the importance of reefs for the development of the tourism industry.
	Updating of protected area admission fees.	Provide information on the need for a specific budget and on the willingness of visitors to pay.
Degradation and pollution of marine and coastal ecosystems due to poor river basin management	Negotiation and integrated basin planning based on a ridge-to-reef approach.	Provide information on linkages between basins and marine and coastal ecosystems (e.g. mangrove forests and reefs) and highlight the contribution that well-conserved ecosystems make to economic activities and the socio-cultural benefits they provide.
	Development of corporate social responsibility capacities and strategies by companies operating throughout the basin.	Carry out a campaign to raise public awareness throughout basin areas.
Seabed degradation due to marine aggregate dredging	Process to analyse the environmental impact of marine aggregate dredging.	Provide evidence of the impact on benthic habitats and the ensuing reduction in species that are a crucial part of the food chain for commercially and recreationally important fish.

Source: prepared by the authors.

Framing the policy question

The policy question intends to examine how to address an issue in a particular political, environmental, economic, social and cultural context (Gardner and Stern, 1996, cited in Kosmus et al., 2018). It is generally related to the issue to be solved by decision-makers (Emerton et al., 2019) and seeks to provide different options that can be compared with each other in order to determine which offer the best solutions (Kosmus et al., 2018). Table 5 shows some examples of policy questions.

Once the policy question or questions have been identified, it can then be determined whether MESV could provide useful and meaningful information to answer them.

Table 5. Examples of policy question

CONTEXT-SPECIFIC ISSUE	DECISION-MAKING PROCESS	EXAMPLES OF POLICY QUESTIONS
Pollution in mangrove forests and pressure on dunes due to infrastructure construction	Updating of spatial planning for coastal development	• What future impacts on mangrove forests and dunes could be attributed to the current spatial planning? • What future impacts on the population could be attributed to the current spatial planning? • What alternatives could there be to the current spatial planning? • How could a more equitable distribution of the use of ecosystems and the space they occupy be achieved for the benefit of the population?
Degradation of reefs within protected areas due to a lack of resources for planning, management and maintenance	Negotiation of national and/or local budgets	• What adverse effects would reef degradation risk causing? • What is the annual contribution of reefs to tourism, fisheries and coastal protection and to the population (or the economic impact on them)?
Seabed degradation due to marine aggregate dredging	Process to analyse the environmental impact of marine aggregate dredging	• What adverse effects would seabed degradation risk causing? • What impact would the degradation of the seabed have on local fishers?

Source: prepared by the authors with input from Kosmus et al. (2018) and Waite et al. (2014).

Table 6. Examples of how an MESV can contribute to addressing issues and policy questions.

CONTEXT-SPECIFIC ISSUE	DECISION-MAKING PROCESS	EXAMPLES OF POLICY QUESTIONS	IS THE MESV USEFUL?
Pollution in mangrove forests and pressure on dunes due to infrastructure construction	Updating of spatial planning for coastal development	• What future impacts on mangrove forests and dunes could be attributed to the current spatial planning? • What future impacts on the population could be attributed to the current spatial planning? • What alternatives could there be to the current spatial planning? • How could a more equitable distribution of the use of ecosystems and the space they occupy be achieved for the benefit of the population?	Estimation of the socio-economic effects caused by the impact on the MCESs provided by mangrove forests and dunes under a business-as-usual planning scenario and an alternative scenario (which takes into account the values estimated and a more equitable distribution). Integration of the economic valuation of mangrove and dune ecosystem services into project cost–benefit analysis for coastal development planning to identify the effects on the provision of MCESs and on stakeholder wellbeing in the area.
Degradation of reefs within protected areas due to a lack of resources for planning, management and maintenance	Negotiation of national and/or local budgets	• What adverse effects would reef degradation risk causing? • What is the annual contribution of reefs to tourism, fisheries and coastal protection and to the population (or the economic impact on them)?	Estimation of the socio-economic contribution of the protected areas, with a focus on the value of MCESs that reefs provide for different economic (tourism, fisheries) and public (disaster prevention) sectors and their cultural value, under a business-as-usual scenario and a scenario with improved conservation and management. Calculation of the 'socio-economic profitability' of reefs based on the budget allocated to their protection under different scenarios. Estimation of losses for economic (tourism, fisheries)

Source: prepared by the authors.

Steps for designing and implementing an MESV

The approach described below includes the most important elements to be taken into account for the implementation of an MESV in a decision-making process so as to enhance its integration and influence.

The general framework takes into account the approaches proposed by Renner et al. (2018) and the World Resources Institute (Waite et al., 2014) for integrating ecosystem services into development planning.

Figure 5. General framework for MESV design and implementation. Sources: adapted from Renner et al. (2018) and Waite et al. (2014).

How to know if a MESV is needed

What is the main socio-economic issue associated with MCESs and decision-making or policy-making that needs to be addressed?
How is it linked to decision-making processes?
What is the policy question?
Could the MESV be useful for addressing the issue and the policy question and generate change?

Step 1
Defining the purpose, scope and target audience of the MESV

Which decision-making is to be informed? How does it align with the policy question?

Who are the target decision-makers? What do they need to know to take the decision? What information do you need to communicate to them?

Who are the relevant stakeholders and how should you involve them in the process?

What is the geographic and administrative scope of the process?

Step 2
Screening and prioritising MCESs

Which MCESs are relevant to the decision-making or policy process to be informed and which stakeholder groups are involved?

What MCES assessment and prioritisation criteria are most relevant to the context?

How can you ensure that MCESs are assessed and prioritised in a participatory process in which stakeholders are involved and represented?

Step 3
Assessing MCESs and analysing drivers of change

What are the current conditions in MCES supply and demand? What are the likely future trends under different scenarios relevant to decision-making?

What are the direct drivers and underlying causes of change in MCESs? Which stakeholder groups are behind these drivers and causes of change?

What are the distributional effects of MCES conditions and trends for the different stakeholder groups?

Step 4
Implementing the MESV and elements for decision-making

How do the MCESs c hange under each scenario? How do the benefits change for the different stakeholder groups? How does the value of the MCESs change for the different stakeholder groups?

Which scenario is desirable and feasible?

What changes in decision-making are needed to achieve it?

What combination of methods could help answer these questions?

Step 5
Generating, communicating and integrating the results

What activities are necessary to integrate the MESV results into decision-making?

What are the messages to be conveyed to the target audience and how should they be communicated?

What is the road map or work plan for implementing the activities to integrate MESV results into decision-making?

Step 1.
Defining the purpose, scope and target audience of the MESV

Box 8. Key questions for Step 1: defining the purpose, scope and target audience of the MESV

- Which decision-making is to be informed?
- Who are the decision-makers (target audience)? What do they need to know to take the decision? What information do you need to give them?
- What is the purpose of the MESV process?
- Who are the relevant stakeholders and how should you involve them in the process?
- What is the geographic and administrative scope of the process?

The purpose of the MESV should be aligned with the decision-making process to be informed and with the policy question. It is also crucial to identify the decision-makers the MESV results are intended for and determine the type of information they need to know.

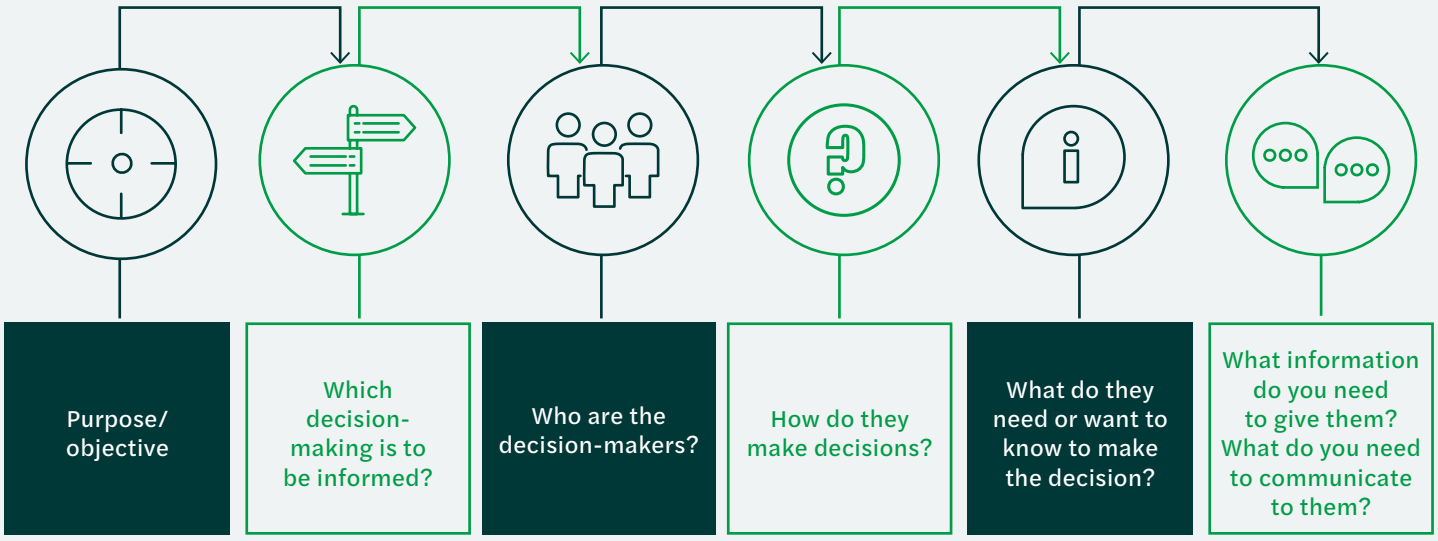


Figure 6. Defining the MESV purpose, target audience and expected results. Source: adapted from Emerton et al. (2019).

In order to establish the scope of the MESV, the geographic and sectoral focus must be determined.[7] This is also the stage of the process in which the time, personnel and resource requirements for the MESV are specified and the work plan for its implementation is formulated. This should include a stakeholder engagement plan and a communication strategy for the whole process (Renner et al., 2018). It is important to remember that each MESV process is unique and that the specific characteristics of the valuation should be taken into account when making these calculations. It is recommended to seek the assistance of experts in MESV design and implementation so that realistic estimates can be made, particularly if it is to be a participatory process.

Lastly, before proceeding with the next steps in the process, it is advisable to review existing studies and valuations conducted in the area in question. Such a review could yield information that will be very useful in the MESV or that could simplify the process.

Identifying relevant stakeholder groups

The MESV design and implementation process must be participatory. As MESV design is a tool that reflects the value of MCESs for different beneficiaries, the perspectives that must be taken into account are diverse in nature. Given that the aim is to drive action to reverse ecosystem degradation, it is important to take into account all stakeholder groups that might be affected. This is why it is essential to identify all stakeholders that need to be involved in the process.

This includes the stakeholders that promote the MESV, some of the beneficiaries of marine and coastal ecosystems and their services and even stakeholders associated with potential entry points and decision-making processes.

It is recommended to map the different levels of participation and engagement of each of the stakeholders in the MESV process. For example, during the MCES screening and prioritisation stage, it is advisable to capture the perspectives of MCES beneficiaries from different industries and of organisations that represent the beneficiary population.

7 For more information on the methods that can be used to define the scope of an MESV, consult the Additional Tools page of the ValuES Methods Navigator available at http://aboutvalues.net/additional_tools/.

In this way, they can express their views on which criteria are most important for their economic activities, livelihoods and wellbeing and can participate in the assessment of MCESs. This will ensure that the ecosystem services prioritised for the MESV are representative. However, stakeholders with a more technical profile should be involved in the process of selecting the valuation methods, as they can provide input on what information and data already exist and what will be required for the application of the methods chosen.

It is important to clarify that the analysis of stakeholder engagement and participation in the MESV process is different from the analysis of the stakeholders the results are intended for (also conducted in this first phase of the process) or the analysis of stakeholders associated with the drivers of change (carried out in the ecosystem service assessment in Step 3).

Some useful questions for the stakeholder analysis are:

- Who will be involved in which part of the process and what for?
- Which stakeholders will not be involved and why?
- What incentives do stakeholders have to participate in the process?
- Who has decision-making powers?
- How will the information and results be validated?
- What are the rules of interaction?

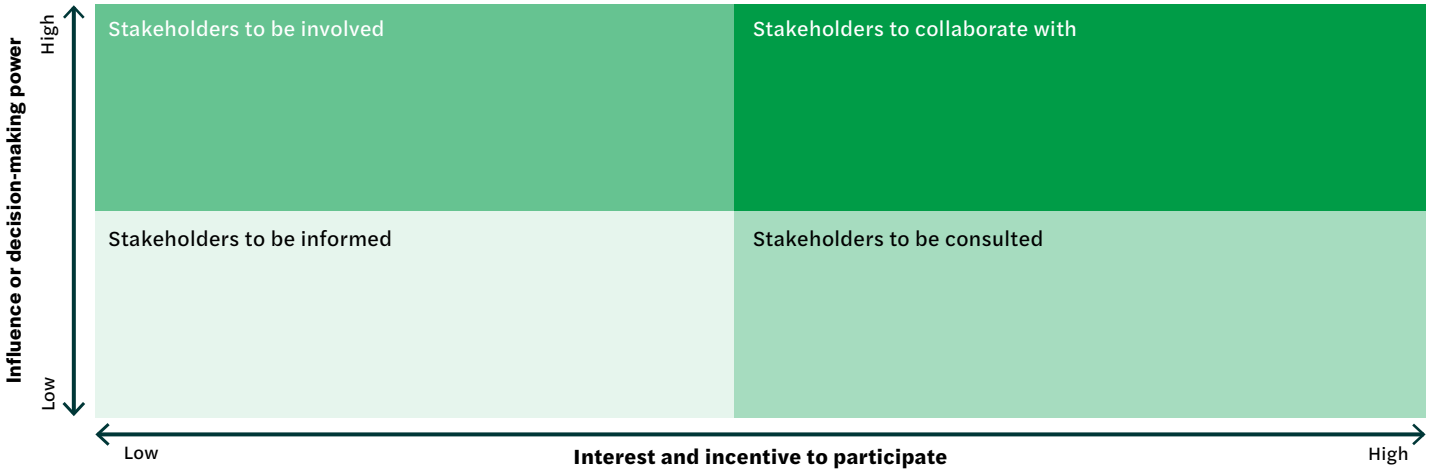
There is a host of sophisticated models for implementing stakeholder analysis. Particularly noteworthy are those put forward in the Manual for Trainers – *Principles of Ecosystem Services Assessments for Policy Impacts* (Kosmus et al., 2018) and in the publication by Zimmermann and Maennling (2007) on stakeholder management.

Table 7. Examples of stakeholder analysis tools

NAME OF TOOL	CHARACTERISTICS AND REFERENCES
Stakeholder mapping	Stakeholder mapping is a tool for identifying the different actors associated with a particular process. They can be grouped or classified in different ways according to the purpose of the mapping. While this tool always has the same basic application, a wide variety of methodologies exist. It is usually necessary to complement the analysis with other tools.
Key stakeholder matrix	This is a tool that displays information using a graph split into quadrants. Interest is plotted on the x axis, and influence in terms of the conservation and/or sustainable management objectives is plotted on the y axis (Figure 7). Stakeholders are placed on the graph according to these objectives, providing an initial idea of target audiences.

Source: prepared by the authors.

Figure 7. Evaluation of stakeholder interest and influence



Sources: CONANP-GIZ-CSF (2017) and Kosmus et al. (2018).

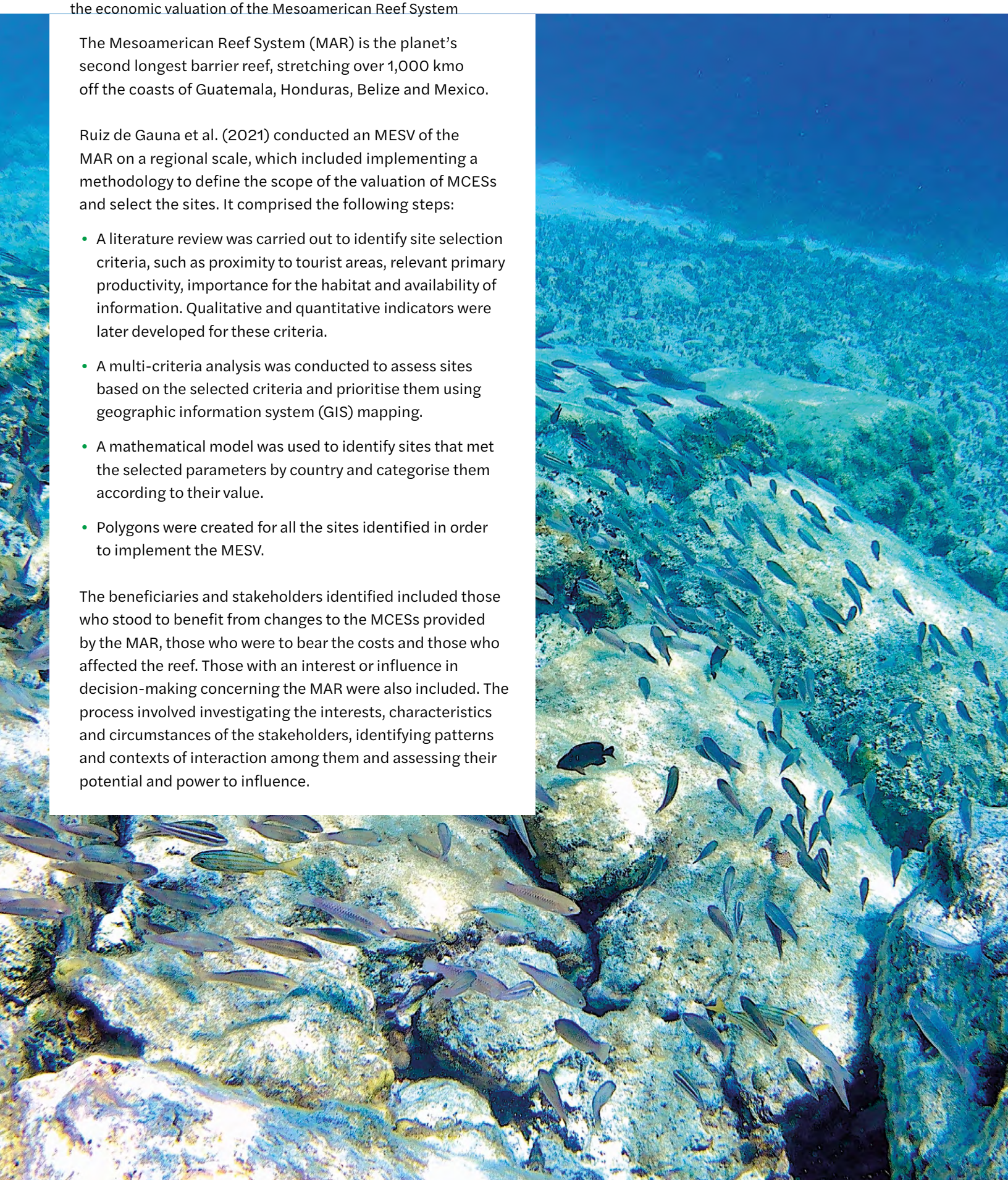
Box 9: Example of site selection and stakeholder identification for the economic valuation of the Mesoamerican Reef System

The Mesoamerican Reef System (MAR) is the planet's second longest barrier reef, stretching over 1,000 kmo off the coasts of Guatemala, Honduras, Belize and Mexico.

Ruiz de Gauna et al. (2021) conducted an MESV of the MAR on a regional scale, which included implementing a methodology to define the scope of the valuation of MCESs and select the sites. It comprised the following steps:

- A literature review was carried out to identify site selection criteria, such as proximity to tourist areas, relevant primary productivity, importance for the habitat and availability of information. Qualitative and quantitative indicators were later developed for these criteria.
- A multi-criteria analysis was conducted to assess sites based on the selected criteria and prioritise them using geographic information system (GIS) mapping.
- A mathematical model was used to identify sites that met the selected parameters by country and categorise them according to their value.
- Polygons were created for all the sites identified in order to implement the MESV.

The beneficiaries and stakeholders identified included those who stood to benefit from changes to the MCESs provided by the MAR, those who were to bear the costs and those who affected the reef. Those with an interest or influence in decision-making concerning the MAR were also included. The process involved investigating the interests, characteristics and circumstances of the stakeholders, identifying patterns and contexts of interaction among them and assessing their potential and power to influence.



Step 2.
Screening and prioritising MCESs

Box 10. Key questions for Step 2: screening and prioritising MCESs

- Which MCESs are relevant to the decision-making process and which stakeholder groups are involved?
- What MCES assessment and prioritisation criteria are most relevant to the context?
- How can you ensure that MCESs are assessed and prioritised in a participatory process in which stakeholders are involved and represented?

The first task in identifying the MCESs is to draw up an exhaustive list of the most important services provided by the ecosystem being analysed and classify them into categories. It is suggested to use one of the validated classification systems that enable identified services to be disaggregated according to the ecosystem providing them. For ecosystem services in general, the systems developed by the MA (Duraiappah et al., 2005), Haines-Young and Potschin (2013) and IPBES (2019) are suggested. For marine and coastal ecosystems in particular, it is recommended to use the classification developed by Liquete et al. (2013), who analysed the classification systems proposed by the MA, CICES, The Economics of Ecosystems and Biodiversity (TEEB) initiative and Beaumont et al. (2007) to develop a comprehensive classification specifically for MCESs. Lastly, Armstrong et al. (2012) developed a comprehensive classification and list of deep-sea ecosystem services.

Once the MCESs have been identified and categorised, an analysis is carried out to determine their links with economic and development activities.[8]

The MCESs are then prioritised to determine which are most relevant to the purpose of the MESV. To carry out this process, it is useful to determine prioritisation criteria, which can include: **(i)** the economic sectors and stakeholder groups that impact and depend on the ecosystems, **(ii)** the level of threat of or exposure to changes of use of the ecosystems in question, **(iii)** the availability and accessibility of references and sources of information, **(iv)** the level of importance in terms of media attention and politics, etc. Various quantitative and qualitative methodologies can be used to rank ecosystem services according to these criteria.[9] As mentioned above, it is advisable for a multidisciplinary team to perform the task of prioritising the ecosystem services, taking into account different stakeholders, to ensure that the assessment is not biased.

Although the estimation and valuation are carried out at a later stage, step 2 already starts identifying the perspectives of the different stakeholder groups in terms of the value they attribute to ecosystem services. For example, the value that a protected area has for a local coastal population is likely to owe more to a strong sense of place and identity, while visitors to such areas tend to value aesthetic enjoyment more highly than other ecosystem services.

Representing ecosystems, ecosystem services and threats graphically – using maps for example – makes it possible to identify the links, dependencies and impacts of economic activities more clearly.

The engagement of stakeholders and those with local knowledge is a factor that contributes to the successful screening and prioritisation of the most important ecosystem services in a given geographic area. Such a participatory selection process can involve interviews, focus groups, working sessions, field visits and workshops.

8 An example of this kind of identification process for tourism and fisheries in Latin American and Caribbean countries can be found in Bovarnick et al. (2010).

9 The manual *Integrating Ecosystem Services into Development Planning* (Renner et al., 2018) is a very useful tool for determining the dependencies and impacts of the different development plan goals on ESs. It can be found at http://www.aboutvalues.net/es/data/six_steps/integr_ecosys_serv_in_dev_planning_en.pdf.

If ecosystem service screening and prioritisation is carried out as a participatory process, it is crucial to validate the methodology and the final results and to clarify what the next steps in the MESV will be. This will contribute to ensuring the representativeness, legitimacy and transparency of the process.

Table 8. Example of an MCES identification process

ECOSYSTEM SERVICES	BENTHIC ECOSYSTEM	PELAGIC ECOSYSTEM
Provisioning		
Food	✓	✓
Fibre		
Freshwater		
Regulating		
Climate regulation	✓	✓
Erosion control		
Water purification	✓	
Pest control		
Cultural		
Recreational fishing		✓
Snorkelling/scuba diving	✓	
Spiritual values		
Supporting		
Primary production	✓	✓
Nutrient cycling	✓	✓

Source: adapted from Werner et al. (2014).

Methodologies for carrying out participatory processes of this kind include the Rapid Ecosystem Services Participatory Appraisal (RESPA), proposed by Rey-Valette et al. (2017); the framework to evaluate participatory research for sustainability, proposed by Blackstock et al. (2007); and the methodology proposed by Boeraeve et al. (2018). For examples specific to MESV, see case studies on this subject such as those developed by Burdon et al. (2019), who used participatory GIS mapping of ecosystem services in marine and coastal protected areas in the United Kingdom to co-produce knowledge, and Medina-Valdivia et al. (2021), who applied the RESPA methodology in an MESV of the Nuxco Lagoon coastal wetlands in Guerrero, Mexico.

Box 11. Example of an MCES screening and prioritisation process in the MESV of Protected Wildlife Areas (ASPs) in Costa Rica

During workshops held in September 2021 as part of the Bio-Bridge Initiative, which promotes this guide, a presentation was given by Virginia Reyes Gatjens on an MESV conducted for the ASPs Playa Hermosa-Punta Mala, Santa Rosa and Cahuita in Costa Rica (Reyes Gatjens, 2021). The presentation described the methodology used for the MESV, including the MCES screening and prioritisation process.

Once the main MCESs in the target ASPs had been identified, they were prioritised using criteria including intensity of use, contribution to income generation, potential for the development of a financing mechanism, vulnerability of the MCES, legal feasibility, number of activities associated with the MCES and presence in protected areas. As a result of the assessment carried out using the selected criteria, the following MCESs were prioritised: artisanal, sport, leisure and semi-industrial fishing, recreation (beach visitation, surfing, wildlife watching, rambling and hiking), erosion control, water purification and waste treatment.

This prioritisation was very useful, once the stakeholders associated with each MCES had been identified, for choosing the most suitable valuation methods.

Step 3.
Assessing the prioritised MCESs and analysing the drivers of change

Box 12. Key questions for Step 3: assessing the prioritised MCESs and analysing the drivers of change

- What are the current conditions in MCES supply and demand? What are the likely future trends under different scenarios relevant to decision-making?
- What are the direct drivers and underlying causes of change in MCESs? Which stakeholder groups are behind these drivers and causes of change?
- What are the distributional effects of the MCES conditions and trends for the different stakeholder groups?

Once the MCESs have been identified and prioritised (in Step 2), Step 3 focuses on analysing the current conditions and likely future trends in supply and demand. This work aims to provide information on what trade-offs might arise and what risks and opportunities could emerge in relation to decision-making.

For the trend analysis, it is determined under what scenarios the MCESs and their biophysical changes will be analysed, and which stakeholders stand to benefit from the changes and which stand to bear the costs.

In general, the basic scenarios under which MCESs and their changes are analysed include a baseline and business-as-usual scenario and an alternative future scenario representing the suggested changes and policy recommendations for achieving the sustainable management of MCESs. Ideally, the scenario analysis will provide crucial biophysical information on changes to the MCESs.

There are a variety of tools for conducting such an analysis including, for example, Multi-Scale Integrated Models of Ecosystem Services (MIMES), Artificial Intelligence for Ecosystem Services (ARIES) and the Integrated Valuation of Environmental Services and Tradeoffs (InVEST).[10] In addition, *The methodological assessment report on scenarios and models of biodiversity and ecosystem services,* published by IPBES (2016), provides information and tools of great use in understanding scenario development in the context of decision-making and modelling the impact of drivers of change on ecosystem services. It is strongly recommended to design scenarios in a participatory process with a multidisciplinary team that can define the scenarios' differential characteristics. This makes it possible to provide an overall picture of the distributional issues associated with the different scenarios and determine which are the fairest and most sustainable. This information is crucial for the stakeholders and the target audience.

Box 13. Example of scenario development for MCES assessment and valuation in Belize

An illuminating example of scenario development is provided in Arkema et al. (2015), who conducted an MESV for the development of an integrated coastal zone management plan in Belize. In addition to stakeholder participation and engagement, the process included the modelling and mapping of changes in impacts on three ecosystem services provided by coral reefs, mangrove forests and seagrass beds: provision of food in lobster fisheries, tourism and coastal protection. These three MCESs were mapped under four different scenarios: business-as-usual, conservation, informed management, and development. The next step was to estimate the values of the MCESs under the different scenarios and identify the one that would be most profitable and at the same time sustainable in the long term. This turned out to be the informed management scenario.

10 The ValuES Methods Navigator, available at http://aboutvalues.net/method_navigator/, provides information on how to apply these and other tools, explains their advantages and disadvantages and gives some examples.

Finally, the assessment of direct and indirect (underlying) causes is a particularly useful analysis for generating influence, and generally conducted at this stage of the process. An analysis of direct causes reveals the drivers that directly cause changes to MCESs, such as unplanned coastal development and overfishing. The aim is to identify which social, economic, environmental and political factors directly affect marine and coastal ecosystems and the ecosystem services they provide and, importantly, to determine which stakeholders contribute to these factors and what incentives influence them.

An analysis of direct and indirect drivers provides crucial information needed to start identifying and formulating proposals and recommendations on interventions in the decision-making process. This information is also key to communication during the process.

This step can be documented by means of a logic chain, which uses a matrix for organising information in a meaningful way to facilitate and guide the process (see, for example, the logic chain for the Cozumel MESV, Annex 1).

This step clearly involves the intensive use of biophysical information, which is why technical personnel with extensive knowledge and experience in marine and coastal ecosystems are needed on site. However, as already mentioned, the collection and availability of the information required to carry out a biophysical assessment of ecosystem services is a major challenge in the case of marine ecosystems (Box 4).

In cases where data and studies are lacking or time or personnel constraints exist, there are other options for conducting qualitative analyses. For example, participatory tools can be used, such as those proposed by Renner et al. (2018) in the guide I*ntegrating Ecosystem Services into Development Planning.*

At this stage in the process, it may be relevant to consider whether the findings of the analysis are sufficient to formulate arguments that can inform the decision-making process.

Box 14. Direct and indirect drivers of change

Direct causes or drivers of change are natural or human-induced factors that directly lead to changes in the biophysical processes and structures of ecosystems. Some examples are land-use change, the introduction of species, water pollution and climate change.

Indirect causes or drivers of change are natural or human-induced factors that contribute to changes in the direct drivers. Some examples are population growth and changes in economic activity.

Table 9. Example of a matrix for organising information from Step 3

Ecosystem(s)	Ecosystem service(s)	Drivers of change	Key stakeholders associated with drivers of change	Impacts caused by drivers of change	Stakeholders benefiting from ESs identified	Stakeholders associated with decision-making

Source: adapted from CONANP-GIZ-CSF (2017).

Step 4.
Implementing the MESV and elements for better decision-making

Box 15. Key questions for Step 4: implementing the MESV and elements for better decision-making

- How do the MCESs change under each scenario? How do the benefits change for different stakeholder groups? How does the value of the MCESs change for the different stakeholder groups?
- Which scenario is desirable and feasible?
- What changes in decision-making are needed to achieve it?
- What combination of methods could help answer these questions?

The next step in implementing the MESV is to estimate the value of the MCESs for the different stakeholders under the different scenarios established (Figure 8). To do this, it is necessary to select the methods and formulate the experimental design.

The estimates resulting from the implementation of the valuation methods should indicate changes in the value of the MCESs and in the wellbeing of the beneficiaries under different scenarios compared to the baseline and business-as-usual scenario. In this way, the target audience of the MESV will be able to appreciate the 'differential' effect of decision-making that factors in MCES values. Ideally, the estimates will also show changes in the distribution of the costs and benefits associated with changes in the value of the MCESs under the different scenarios.

The choice of valuation methods should be determined by the characteristics of the study, including the issues to be addressed, the policy process, MCES screening and prioritisation and the results of the assessment, and by practical, administrative (budget) and logistical aspects. It is advisable to assess the criteria for selecting the methods to be used along with field logistics, available information and data, the team's technical expertise and access to specialist support, the time and effort required to conduct the study, and the available budget.

For the selection of the methods, the following general practical recommendations (adapted from Emerton et al., 2019) should be taken into account:

- There is no such thing as 'the best method'. They all have advantages and disadvantages, and the different methods can provide different types of information, the usefulness of which will depend on the purpose of the MESV process, the target audience and the prioritised MCESs.
- Not all the methods can estimate and value all the MCESs or be used to address the same issues and purposes.
- It is best to use a combination of methods in an MESV process, mainly because different methods are needed to incorporate different perspectives of value.
- It is always advisable to identify and include experts and practitioners in the team who are familiar with the socio-ecosystems in question.
- If the methods used require field visits, it is advisable to check access, logistics and, in particular, site governance and socio-cultural contexts. Where feasible, it is recommended to consider the possibility of the team being accompanied and supported in the field.

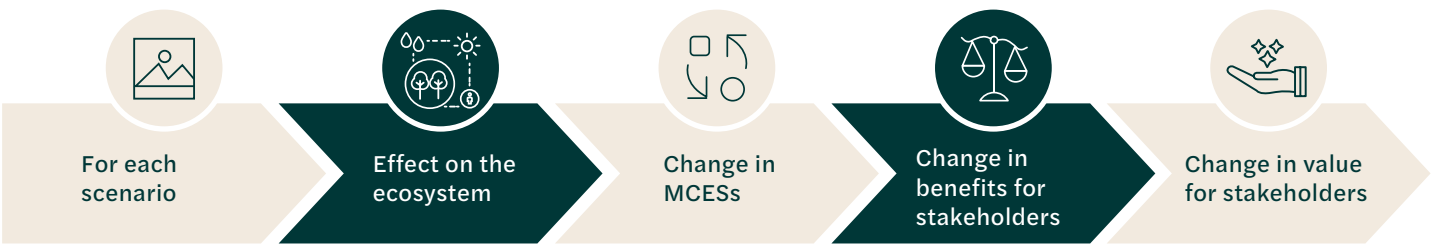


Figure 8. Summary of the MESV process. Source: adapted from Waite et al. (2014).

A detailed list of methods, including a description of their main features, level of human, logistics and financial effort, examples, advantages and disadvantages and many other details, can be found in the Methods Navigator,[11] developed by the ValuES project. The Navigator is one of the most comprehensive and detailed tools, providing users with practical information about available methods and their requirements, according to specific decision-making contexts. More experienced users can also browse the inventory of methods, where they can directly search for available methodologies.

Additionally, there are a number of publications that provide more detailed information on the implementation of ESV methods and relevant examples, such as the methodological guide to the identification and valuation of goods and services provided by biodiversity and natural resources (Moreno Díaz, 2020), the guide to the implementation of environmental economic valuation, produced by the Office for Green and Sustainable Business of Colombia's Ministry of Environment and Sustainable Development (Minambiente, 2018), and the manual for the economic valuation of natural heritage, produced by Peru's Ministry of Environment (MINAM, 2015).

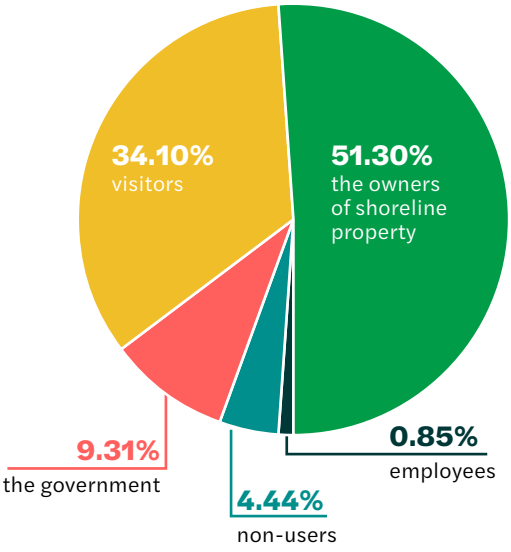
To find out more about which methods are most commonly used for MESV, see the publication by Mehvar et al. (2018), and for a more specific focus on the Caribbean, see Schuhmann and Mahon (2015), The following are recommended as specific guides on implementing some of the methods most commonly used for MESV: *Guidelines for Conducting Economic Valuation of Coastal Ecosystem Goods and Services* (UNEP, 2007); *Guidance manual on economic valuation of marine and coastal ecosystem services in the Pacific* (Salcone et al., 2016); and the publication *Coastal Capital – Ecosystem Valuation for Decision Making in the Caribbean* (Waite et al., 2014).

Box 16: Example of method selection and distributional analysis for the economic valuation of the Mesoamerican Reef System (MAR)

In the study by Ruiz de Gauna et al. (2021) on the economic valuation of the MAR, different methodologies were selected to value the prioritised MCESs. For tourism, recreation and fisheries, the market price method was selected; for shoreline protection, benefit transfer was used; and for historical and cultural and science, knowledge and education values, contingent valuation was the chosen method.

As part of the regional study, quantitative estimations were made of the distribution of the benefits of coral reef ecosystems for each of the countries examined. For example, in the case of Mexico, the benefits from MCESs relating to recreation, fisheries and shoreline protection were distributed as follows: the owners of shoreline property 51.30%; visitors 34.10%; the government 9.31%; non-users 4.44%; and employees 0.85%. The distributional analysis is of great value because it shows how important conservation of the MAR is and what its degradation would mean in terms of potential losses.

In Mexico, benefits from MCESs relating to recreation, fisheries and shoreline protection were distributed as follows:



At this stage in the process, a more detailed analysis can be carried out of the potential effects of the changes promoted by the process and justified via the MESV. To this end, it is recommended to carry out a sensitivity analysis under the different scenarios, which also examines the effects on the implementation of different policies, impacts on the provision of ecosystem services, and distribution of costs and benefits among the key stakeholder groups.

11 The Methods Navigator, developed by the ValuES project, is a digital tool available online at http://aboutvalues.net/method_navigator/.

Step 5.
Generating, communicating and integrating the results

5

Box 17. Key questions for Step 5: generating, communicating and integrating the results

- What activities are necessary to integrate the MESV results into decision-making?
- What are the messages to be conveyed to the target audience and how should they be communicated?
- What is the road map or work plan for implementing the activities to integrate MESV results into decision-making?

Integrating the results of an MESV into decision-making can prove more challenging than the implementation of the valuation itself. It is therefore important for this to be carefully planned from the start of the process.

The table below suggests some typical consultancy activities for integrating the results of an MESV into sector policies.

Table 10. Activities for integrating MESV results into sector policies

STAGE OF THE PROCESS	CONTRIBUTION TO INTEGRATION
Design and collection of context-specific information	• Facilitate meaningful reflection and the establishment of key focus areas for the MESV • Identify existing databases and other sources of information • Provide contextualisation: analysis of stakeholders and the legal and regulatory framework • Analyse sources of information and studies as input for the ecosystem service analysis
Identification and definition of the decision-making process to be informed	• Identify opportunities and formulate preliminary messages • Draw up a menu of options and indicate the implications of each • Identify good practices from other cases in which an MESV has been implemented
Design of the change process	• Support the design of the change process, indicating milestones and key stakeholders • Contribute with strategies to deal with resistance to change • Identify, prioritise and assess ecosystem services • Facilitate the identification of opportunities for alignment with sector and conservation policies and regulations
Implementation and evaluation of change	• Support the correct interpretation of the MESV • Facilitate the development of messages for different target audiences • Facilitate learning and support the institutionalisation of the change • Strengthen mechanisms for dialogue and negotiation

Source: prepared by the authors.

When mainstreaming MCESs and biodiversity into sector policies and/or private strategies, it is useful to consider five different dimensions of biodiversity mainstreaming (Alker and Jung, 2017) as spaces where MESV results can be integrated:

1. Institutional arrangements: MESV results can be used as part of the messages and arguments that facilitate the coordination of policies and regulations for fisheries, sustainable tourism and conservation.
2. Range of topics: the arguments formulated using MESV results can contribute to securing agreements on sustainable ecosystem management (for example, responsible fishing schemes) or influence negotiations on financing for the management of protected areas.

3. Societal anchoring: MESV data can be used in awareness campaigns targeting coastal communities to communicate the importance of mangroves for coastal protection and fish breeding habitats (future use).

4. Instruments: MESV data can, for example, facilitate the establishment of a combination of regulatory instruments (creation of no-take zones) and marine spatial planning, with the identification of opportunities for multi-use zoning agreements.

5. Financial resources: MESV results (for example, on willingness to pay) can contribute to the design and implementation of a tourist tariff as an instrument for financing coral reef conservation and restoration.

In short, the challenge for an MESV is to mainstream the results into one of these dimensions. However, each of these involves both the process itself and mainstreaming, which can take months or even years. It should be noted that even with a well-designed process and robust data, it may turn out that the results cannot be mainstreamed into any policy process or practice. This usually occurs when windows of opportunity close or when the priority of issues changes in the policy agenda. For example, the COVID-19 pandemic, declared in March 2020, obliged governments around the world to focus their efforts on strengthening public health policies and measures. For several months, this global health emergency became an overriding concern that closed windows of opportunity for many other areas of public policy concerning environmental issues.

Elements of communication: types of messages

The critical factor for mainstreaming ecosystem service values is assertive communication. This guide puts forward a number of recommendations that should be taken into account to ensure successful communication.

In the context of ecosystem services, as in many others, messages can easily be misunderstood, reducing the effectiveness of the communication process. There are many barriers to communication, and it is important to address them in the MESV process so they can be avoided. These barriers include selective perception, information overload, emotions, language barriers, differences in culture or gender, political correctness, personal preferences and belief systems (Robbins et al., 2011, cited in Kosmus et al. 2018).

In order to achieve 'empathic communication' (Céntrico Digital, cited in Kosmus et al. 2018), it is suggested that efforts be guided by the following questions:

- Who is the target audience? What are the challenges? What is your position on the MCES issues and the policy question addressed in the MESV and why?
- What do you want to communicate?
- How do you intend to communicate it?

When formulating strategic messages, an important dilemma arises. As the process for the screening, prioritisation and valuation of MCESs is highly resource-intensive (human, technical, financial, etc.), the impulse to communicate everything that has been achieved is understandable. However, to avoid efforts being made in vain, it is recommended to summarise descriptions of procedures and the resulting information so that it is easy for different target audiences to digest, without sacrificing the content or rigour of the analysis. The table below provides examples of communication products for different target audiences.

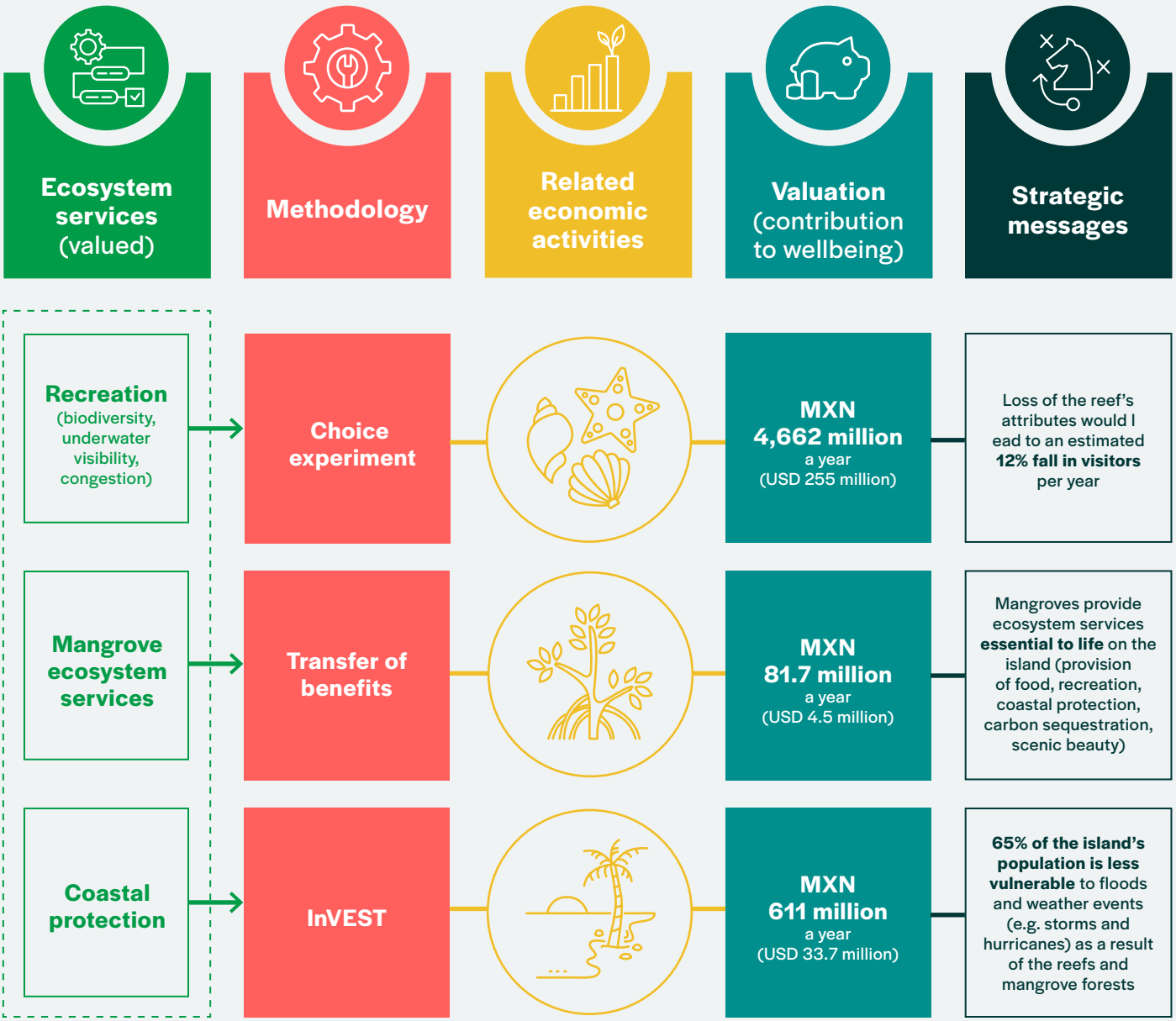
Table 11. Examples of communication products for different target audiences

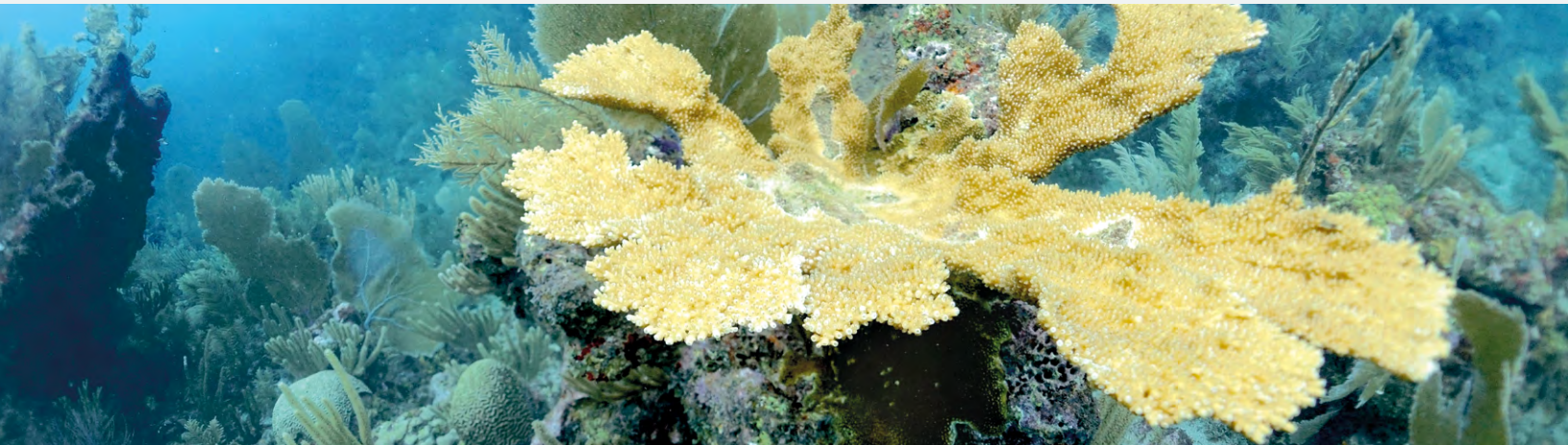
TARGET AUDIENCE	COMMUNICATION PRODUCT
Decision-maker	• Policy briefs • Infographics • Outlines and presentations
Research expert	• Policy briefs • Technical reports • Scientific publications
General public	• Infographics • Video clips • Posts for social networks

Figure 9 provides an example of messages developed on the ecosystem services and values identified during an MESV process carried out in Cozumel, Mexico. These messages were formulated for different decision-makers by a multidisciplinary team and presented as a policy brief.

Figure 9. Valuation of ecosystem services provided by Cozumel Reefs National Park and Cozumel Island Flora and Fauna Protection Area.

Source: CONANP-GIZ-CSF (2017).





MESV with a regional focus[12]

MESVs have generally been carried out at the local level, and there are few experiences of MESVs with a regional focus. A publication by Liquete et al. (2013) reported that 48% of MCES studies were local in scope. Only 8% were conducted at the supranational level, 4% at the continental level and 9% at the global level. On the one hand, this means that the value of MCESs is most likely underestimated because MESVs implemented at the local level consider only a limited number of beneficiaries and perceived values. On the other hand, however, as highlighted by the approach and methodology proposed in this publication, for an MESV to provide useful and meaningful results to inform decision-making at the regional level, it is crucial that it be designed based on the environmental, social, economic and cultural context and, most importantly, on the policy context. At the regional level, this poses a major challenge.

The design and implementation of an MESV for Central America and the Caribbean requires the coordination of regional efforts to identify the common issues, policy questions and entry points at the regional level. In this regard, the role and leadership of SICA, particularly the CCAD, is of paramount importance in strengthening regional governance and the engagement of the different sectors that need to be involved in an MESV process at this level.

Some examples of common issues and entry points at the regional level, for which the implementation of an MESV could be useful, include the region's high vulnerability to climate change and the opportunities provided by joint development projects with funding from the Adaptation Fund[13] (AF) and the Blue Action Fund[14] (BAF); high levels of poverty and initiatives to strengthen Central American small and medium-sized enterprises and their value chains; food insecurity and the implementation of resilient food production strategies; and heavy reliance on tourism as the mainstay of the economy (and on MCESs relating to recreation and aesthetic enjoyment) and integrated coastal management and promotion of a sustainable blue economy.

In addition to regional coordination and governance efforts, other considerations to be taken into account when implementing the steps set out in this guide and applying them at the regional level include the following:

- Adapt the implementation of participatory methods to involve a greater diversity of MCES stakeholders and beneficiaries throughout the process. When they are implemented on a larger scale, a greater range of economic, social and cultural values and contexts must be taken into account. This requires a careful selection of valuation methods and the right balance in terms of the aggregation and disaggregation of perceptions and information in order to achieve transparent and equitable engagement (Small et al., 2017).
- Identify the direct and indirect drivers of change relevant to the process at different scales (Small et al., 2017) and analyse the changes that occur in the MCESs under different scenarios (Step 3). For example, at the local level, there may be drivers of change such as changes in local weather patterns, land use and preferences of the local population. At the regional level, these may include labour markets, existing incentives in national and regional legal frameworks and the effects of climate change.
- Integrate and communicate results that take into account the multiplicity of stakeholders and contexts.

These considerations involve adaptations which can result in a process that is more complicated to implement than a local-level MESV. Consequently, more resources are required, mainly in terms of multidisciplinary teams, joint working spaces, data and information, time and, in particular, organisation and coordination. It is possible to adapt and simplify the MESV process, provided that the choices made are transparent in terms of the process's robustness and legitimacy.

12 For more detailed information on the methodological considerations for a regional MESV, see the study Economic Valuation of the Ecosystem Services of the Mesoamerican Reef, and the Allocation and Distribution of these Values by Ruiz de Gauna et al. (2021).

13 Information about the Adaptation Fund can be found at https://www.adaptation-fund.org/

14 Information about the Blue Action Fund can be found at https://www.blueactionfund.org/

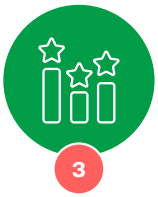
Valuation and integration of ecosystem services in Cozumel Island's protected natural areas

The valuation and integration of the MCESs of Cozumel's protected areas was undertaken as part of the EcoValor Mx project, an initiative financed by the BMUV and implemented by GIZ and Mexico's National Commission for Protected Natural Areas (CONANP).

It involved the implementation of the following steps:

Step 1: defining the purpose, scope, policy question and target audience. This began with the collection of information and identification of the area to be analysed. It also included the identification and mapping of stakeholders with an influence or affected by the threats to the ecosystems.

Step 2: screening and prioritising the MCESs. For the reef ecosystem, the MCESs prioritised were recreation, coastal protection and nutrient cycling, while for the mangrove ecosystem, recreation, coastal protection and carbon sequestration were prioritised. In this step, a database and references for secondary information sources were also compiled.



Step 3: assessing the MCESs. In this step, threats to the provision of MCESs were identified, namely unsustainable mass tourism and unsustainable coastal development (see Annex I).

Step 4: implementing the MESV:

- For the recreational service provided by the reef, choice modelling was used to analyse willingness to pay for maintaining the reef's biodiversity and underwater visibility. Based on the number of direct users, this ecosystem service was valued at USD 255 million a year. It was also calculated that the value of the reef in terms of protection from extreme weather events and nutrient cycling was USD 33.7 million a year.

- The recreational, coastal protection and carbon sequestration services provided by mangroves in Cozumel's protected areas were estimated to have an overall economic value of USD 4.5 million a year.

Step 5: using the results to influence the following decisions:

i. increase the budget for the management of protected areas to ensure that direct users implement good practices;

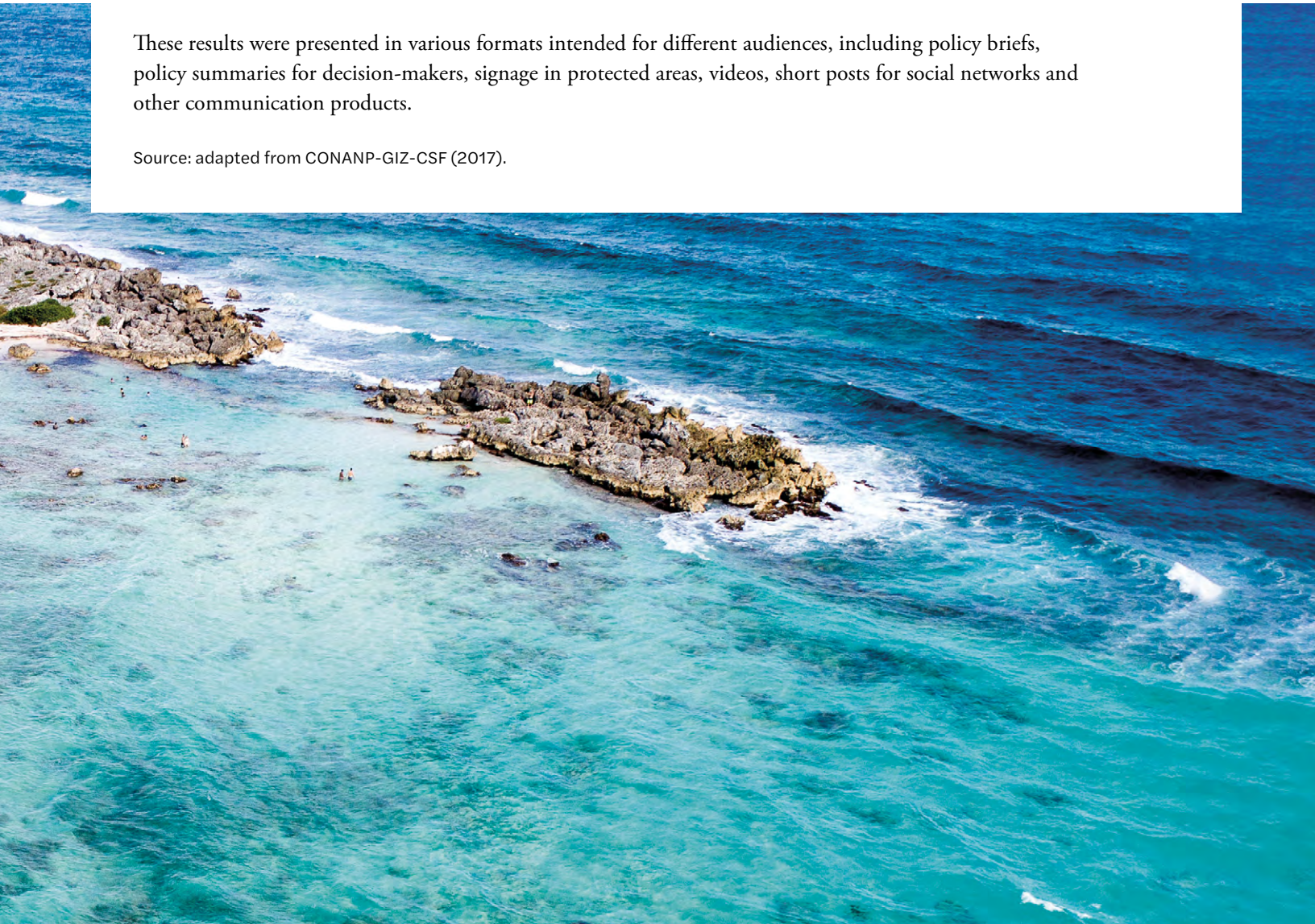
ii. ensure existing environmental legislation is implemented more effectively by strengthening the capacities of the institutions responsible for enforcing it;

iii. inform and enrich the government's Comprehensive Strategic Development Plan;

iv. encourage the private sector to implement good practices in ecosystem use.

These results were presented in various formats intended for different audiences, including policy briefs, policy summaries for decision-makers, signage in protected areas, videos, short posts for social networks and other communication products.

Source: adapted from CONANP-GIZ-CSF (2017).



Concluding remarks

Conceptually, MESV does not differ in any significant way from other identification and economic valuation processes. However, marine and coastal ecosystems and the services they provide do have some specific features that should be taken into account strategy-wise. For example, a very particular characteristic of MCESs is the spatial dynamics between the place where MCESs are provided and the place where the benefits are received. The source regions of an ecological function can be thousands of kilometres away from primary and secondary use regions (Villa et al. 2014). Given these spatial dynamics and the cross-border nature of many ecosystems, such as the MAR, it is only to be expected that these processes involve significant challenges in terms of policy-making and decision-making on a regional scale. MCES identification and valuation at a regional level therefore represents a major methodological, technical and international-cooperation challenge.

> It is also worth recalling that MESV is considered a tool that can be used in different ecosystem management policy processes.

This is important because valuation should be interpreted and planned as a means to achieving a much broader objective. This inevitably means that there must be step-by-step planning and integration according to the context.

In the case of marine and coastal ecosystems, these public policy and strategy processes for ecosystem management are determined by a governance framework that requires institutional arrangements (rules, regulations, and negotiation and cooperation mechanisms) in which there is little experience. In this socio-political dimension, being able to clearly identify the providers and beneficiaries of ecosystem services is a critical factor for the valuation. As marine and coastal ecosystems and the services they provide are often regarded as resources of common use, distinguishing between providers and beneficiaries can be complicated. This, in turn, affects the establishment of institutional arrangements or governance designed to address market or governance failures. This guide offers some practical guidelines for building these considerations into the process.

> Finally, MESV deserves greater attention because it can inform not only marine and coastal ecosystem management policies in Central America to make them more sustainable, but also social and economic policies, such as employment promotion.

This publication therefore seeks to provide guidance not only for the officials and personnel of government institutions responsible for sustainable ecosystem management, but also for those in charge of sustainable tourism policies, protected natural area services and development planning and for advisors on projects promoted by civil society organisations and international cooperation. The stepwise approach and many of the tools are inspired by existing ESV guides. Before and during the ecosystem service valuation and integration process, it is advisable to consult these guides to gain a more comprehensive understanding of the steps involved and the tools available.

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Useful references

USEFUL SOURCES OF INFORMATION AND STUDIES	LINK
Ecosystem Services Valuation Database (ESVD)	https://www.esvd.net/
Environmental Valuation Reference Inventory (EVRI)	https://www.evri.ca/en
Unites States National Oceanic and Atmospheric Administration (NOAA)	https://coast.noaa.gov/digitalcoast/topics/ecosystem-services.html
ValuES: Methods for integrating ecosystem services into policy, planning, and practice	http://aboutvalues.net/

Tools for modelling biophysical indicators applicable to marine and coastal ecosystems

NAME	DESCRIPTION
ARIES – Artificial Intelligence for Ecosystem Services aries.integratedmodelling.org	ARIES is a modelling platform that maps the spatial dynamics of ecosystem services quantitatively, estimating supply, demand and distribution among beneficiaries.
InVEST naturalcapitalproject.stanford.edu/software/invest	InVEST is a suite of models used to map and value ESs. They include: (i) nutrient retention/water purification: maps and models the amount of nutrients that vegetation can remove from river water; (ii) recreation: estimates the time people spend on recreation in nature in a given area and (iii) carbon storage and sequestration: models and maps the amount of carbon stored in different ecosystems.
MIMES – Multi-Scale Integrated Models of Ecosystem Services afordablefutures.com	MIMES provides stock and flow modelling of ecosystem service dynamics for land-use change and marine spatial planning. The model quantifies the effects of land-use change (terrestrial and marine) on ecosystem services.
Open NSPECT coast.noaa.gov/digitalcoast/tools/opennspect.html	This is software that estimates surface water volumes, pollutant concentrations and sediment loads, mapping their spatial distribution on land and at the coastal interface.
SITE – SImulation of Terrestrial Environments ufz.de/index.php?en=19080	SITE is software that combines different datasets to analyse the suitability of a certain region for a specific land use. It is used for regional applications
SolVES – Social Values for ES solves.cr.usgs.gov	This is a GIS tool for assessing, mapping and quantifying the social values of ecosystem services.
SWAT – Soil and Water Assessment Tool swat.tamu.edu	SWAT is a small watershed to river basin-scale model used to evaluate the impact of land-use change on some ecosystem services.

Annex 1.
Example of a logic chain for the valuation of ecosystem services in Cozumel Island

DECISION TO BE INFORMED	Promoting best practices for tourist services provided by the private sector (marine park permit holders, tour operators, hotels, beach clubs)
ISSUE TO BE ADDRESSED	Bad practices on the part of service providers and tourists (e.g. site overuse), leading to degradation of the coral reef
ECOSYSTEM SERVICES	Recreation: physical use of coral reef
METHODOLOGY	Choice experiment
WHO IS TO BE INFORMED	• Ministry of Finance and Public Credit (SHCP); • Ministry of Environment and Natural Resources (SEMARNAT); • National Commission for Protected Natural Areas (CONANP); • private sector through associations of tourism service providers (marine park permit holders, tour operators, hotels, beach clubs, etc.); • tourists
MESSAGE TO BE COMMUNICATED	A well-conserved, healthy coral reef is an attribute valued by tourists. Future income therefore depends on the ability to improve current practices and support initiatives that promote the conservation and sustainable use of the reef.
WHY CONDUCT AN MESV?	It shows that best practices and investment in conservation are in the interest of the stakeholders; demonstrating the economic value of a well-conserved reef should highlight the importance of keeping it in good condition.
POTENTIAL OUTCOMES	• Implementation of good practices in the use of natural resources by tourism service providers. • Greater focus on visitor behaviour towards the environment. • Increased budget for protected natural areas to improve management. • Greater support to strengthen the role of CONANP. • Greater awareness about the economic value of the reef (behavioural

Source: CONANP-GIZ-CSF (2017).

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Ecosystems provide vital services for humans and are essential for economic activities, livelihoods, wellbeing, and culture. Marine and coastal ecosystem services in particular, play a key role in food provision, protection against extreme adverse weather events, income generation for locals, and natural nutrient cycling, to name but a few of their many critical functions. Nevertheless, ecosystems around the world are being altered and destroyed at a faster pace than at any other point in human history.

Ecosystem service valuation (ESV) is a useful tool designed to guide public policy processes for the conservation and sustainable use of ecosystems. An ESV makes it possible to highlight the importance of ecosystem services for their beneficiaries, with the objective of integrating these benefits into decision-making processes. Potential uses include the creation and management of protected areas, the design of financing mechanisms for sustainable ecosystem management, the negotiation of budgets, as well as environmental communication and education campaigns.

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The guide includes relevant, practical and concise information advantageous for decision-makers, policy implementers and regional experts. Focused on Central America and the Caribbean, a region of great importance for biodiversity, the guide offers an overview of marine and coastal ecosystem services, highlighting the relevant steps in designing and implementing economic valuations, and thus aims to contribute to the conservation of these important natural resources.