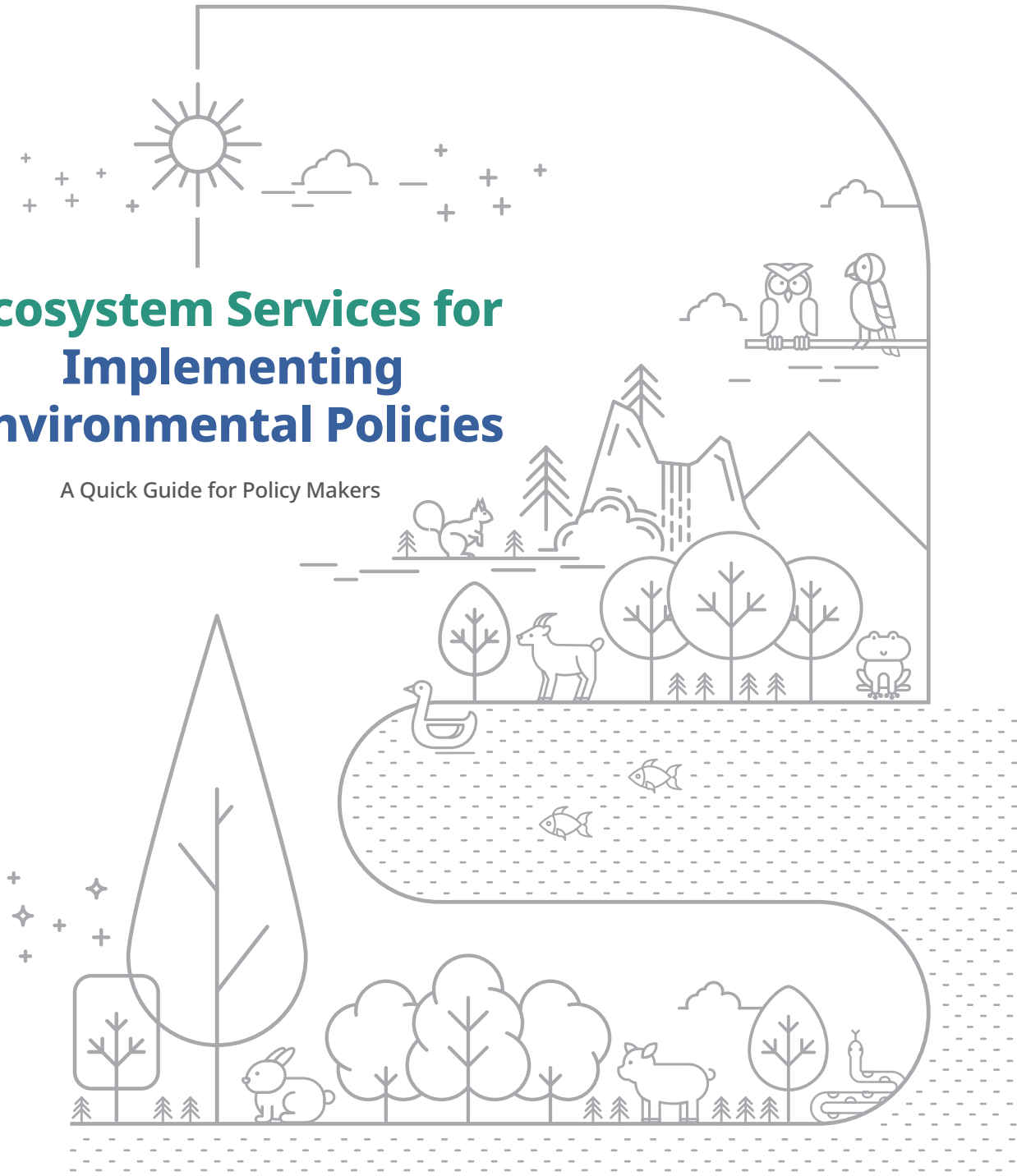
Ecosystem Services for Implementing Environmental Policies

A Quick Guide for Policy Makers



NATIONAL INSTITUTE OF ECOLOGY

ESP
Ecosystem Services Partnership
Asia Regional Office

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Foreword

Nature offers many benefits, such as clean air and water, food, medicines, and other resources and non-material benefits such as recreation that are important to human health and welfare. These benefits provided by nature are called ecosystem services, and a lot of research is being conducted worldwide to promote this concept. The National Institute of Ecology (NIE) has conducted research on ecosystem services to effectively manage the benefits of nature in Korea.

This quick guide was formulated to show how policymakers could effectively establish regional plans and implement integrated policies that deliver the benefits of ecosystem services to the public. The guide is in an easy to understand format covering the concept of ecosystem services, key points of the economic valuation process, and policy cases with practical examples. Both public officials and policy practitioners will find this guide a helpful starting point to further expand their understanding of ecosystem services approaches.

The NIE is committed to conducting scientific assessments, institutionalizing ecosystem services approaches, and improving the integrated practices of ecosystem services. It is incumbent upon the NIE to ensure that the public appreciates and enjoys a healthy and happy life through the multitude of benefits nature offers.

NIE President

Yong-mok Park

Nature's True Value

If you take a walk in the woods or in a park after a stressful day, what do you feel? The beautiful landscape pleases our eyes, the fresh air we breathe cools our skin, the song of a bird makes us feel peaceful and happy: these are just some of the ecosystem services we receive from nature, but unfortunately we don't appreciate their importance and value sufficiently, and we still destroy ecosystems and lose species at an unprecedented rate.

To reduce biodiversity loss, to respond to climate change, and to achieve the sustainable development goals we need better instruments to capture and communicate the 'true value' of nature to our wellbeing, and to the economy, and integrate that value in everyday decision making.

The Ecosystem Services Partnership (ESP) is a global network created in 2008, to further enhance the science, policies and practice of ecosystem services (www.es-partnership.org). In 2016, the ESP Regional Office Asia was established in South Korea, with generous support from the Gyeonggi provincial government and Korean members.

In a short time this office developed many activities and this quick guide is a great example of their efforts and aspirations to engage more people into learning about the importance of ecosystem services and putting the concept into practice to better manage our ecosystems and safeguard nature for the wellbeing and enjoyment of future generations.

ESP Chair

Rudolf de Groot

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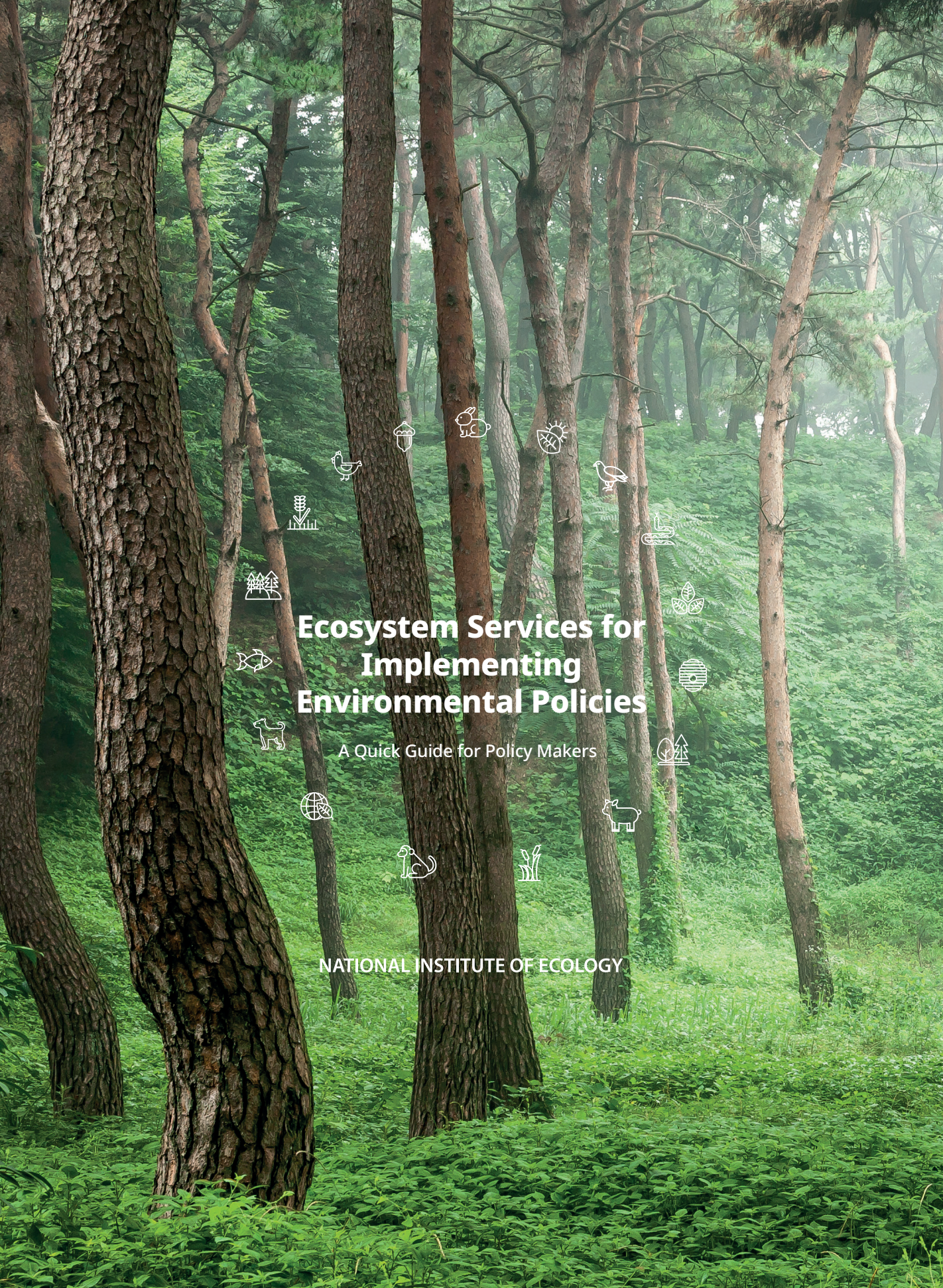

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Background of This Quick Guide

Objective of the guide

South Korean government suggests the implementation of ecosystem services through *National Biodiversity Strategies, Basic Plans to Conserve the Natural Environment, Consolidated National Plan for the Environment, Basic Plans for Sustainable Development* and other fundamental plans for the application of ecosystem policies. To implement fundamental plans for the ecosystem service policies, we not only need the support from the central government but also education and awareness programs for public officials who plan and carry out the regional policies. This guide was developed to promote the public officials' understanding of ecosystem services and to strengthen the capacity of policymakers.

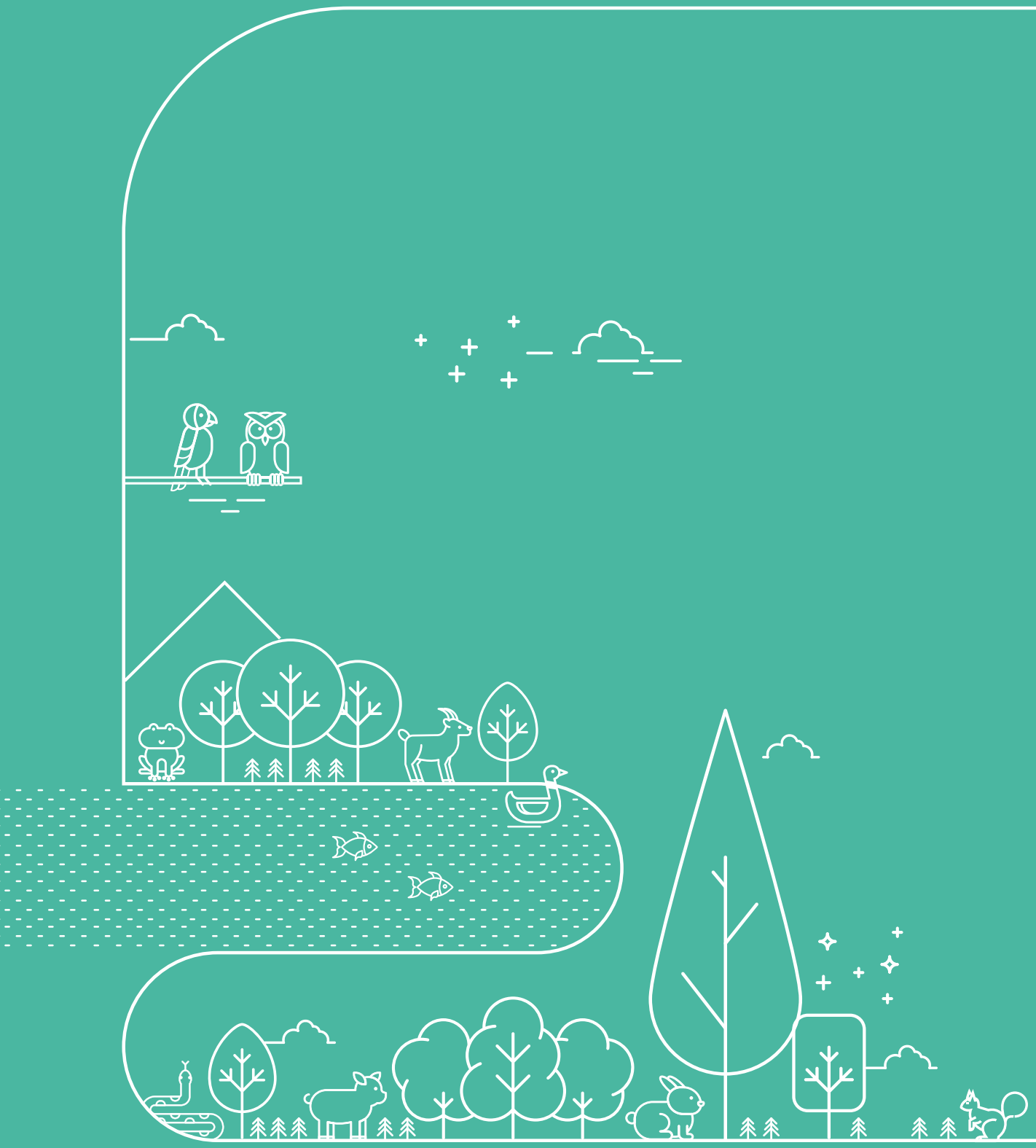
Contents of the guide

This guide provides training materials focusing on environmental issues related to ecosystem services for policymakers. In 2018, we conducted pilot training in Gyeongsangnam-do, Gangneung-si, Siheung-si, and Ansan-si, along with 4-hour and two-day training sessions that were carried out with modified modules to better-fit local circumstances.

The three modules cover "Understanding Ecosystem Services, Valuating Ecosystem Services, and Utilizing Ecosystem Services." Included in these contents are key questions, case studies, exercises, and references to ensure comprehension.

Application of the guide

The term "Ecosystem Services" remains unfamiliar to most people and even educators have difficulties understanding how ecosystem services can be practiced to capture their true value in our daily lives. However, this concept is gaining growing recognition of importance by government officials and other members of society because people started to see the real value of our nature around us. We recommend you to use this guide as online courses and/or for group training if there is a time constraint. Those who wish to capture main ideas quickly are invited to read the case studies and do the exercises first to approach to major issues of ecosystem services.



Module 01

Understanding of Ecosystem Services

1 Concept and Type of Ecosystem Services

2 Ecosystem Changes and Their Costs

3 Climate Change and Ecosystem Services

4 Ecosystem Services for Sustainable Development

1 Module Understanding of Ecosystem Services

Key Questions

- What comes to mind when you think of ecosystem services?
- How are the benefits of nature different for various ecosystems?
- How can ecosystem services policies affect pending environmental issues such as the response to biodiversity loss and climate change?

1 Concept and Types of Ecosystem Services

Concept of Ecosystem Services

☑ Ecosystem services are defined as multiple benefits nature provides to humans. It is a very comprehensive concept that includes all activities such as relaxing and obtaining artistic inspiration from nature, as well as clean air and water, wood to build houses, foods such as rice, beans and fruit, and medicinal herbs.
If you can explain the interdependence and connection between nature and humans, you already understand the basic concept of ecosystem services.

☑ Biodiversity loss and ecosystem degradation are closely related to human welfare. "Ecosystem Services" is a very useful tool in explaining nature's impact on our society in economic terms and making nature's value more visible with scientific findings.
"Ecosystem Services" are also called "Natural Capital," in that they reflect the economic values of nature. People utilize this concept to emphasize that nature conservation is a worthwhile investment for our lives in the future even from the perspective of economic cost-benefit analysis.

Types of Ecosystem Services

"Ecosystem Services" may be divided into Provisioning Service, Regulating Service, Cultural Service, and Supporting & Habitat Service. Provisioning service refers to benefits humans receive directly from the ecosystem such as food, water, wood, and medicinal resources. Regulating Service refers to the benefits generated by the regulation of ecosystem processes, such as controlling air and water quality, climate regulation, erosion control, and pollination. You can easily understand cultural services such as the aesthetic beauty of nature, spiritual inspiration from nature such as meditation or prayer, education, leisure, and tourism. The things that support these three services to function, such as biodiversity and the gene pool, are called "Supporting Services."

Types of Ecosystem Services

Classification	Ecosystem services (examples)
Provisioning Services	Food, Water, Wood, Medicinal resources
Regulating Services	Air quality control, Water quality control, Climate regulation, Erosion control, Pollination
Cultural Services	Recreation and tourism, Educational value, Spiritual value, Artistic inspiration
Supporting & Habitat Services	Biodiversity, Nursery

In-depth Learning

Ecosystem Service Research Trend

The Millennium Ecosystem Assessment (MA) of the United Nations Environment Program (UNEP), which was published in 2005, was an important milestone in establishing the concept of ecosystem services as a policy agenda. The MA report showed how changes in ecosystem functions caused by biodiversity degradation influenced human welfare and made a scientific foundation to support environmental policies managing ecosystem services given by nature in a sustainable way.

Since then, ecosystem services research and concept development has been actively conducted, and the UN has promoted a follow-up plan called the Economics of Ecosystems and Biodiversity (TEEB) with the support of each country.

The TEEB research has brought about an integrated paradigm shift that explains the importance of environmental preservation policies with economic terms. It enabled comparison of figures between the economic value the ecosystem contributes to human welfare and economic losses in human society caused by damages to the ecosystem. The concept of ecosystem services has been further developed with economic implications of ecological values. Now, policymakers are showing interest in institutionalizing economic incentives to design market-based tools to drive environmental policies, and the recent trends in ecosystem services research reflect this trend.

☑ Earth's ecosystems are divided into seven types : forest, river (wetland), urban ecosystem, arable land area, grassland, coast, and sea. The ecosystem services vary depending on the ecosystem. The products originating from forests are different from the food that a mud flat provides. The demand for clean air and water is bigger among city residents than dwellers in mountain areas. Depending on people's needs, a detour can be created to protect wildlife habitats, or a local park where citizens can relax and walk can be built. Some people want to engage in educational and recreational activities in nature while others want pristine forests or nature reserves where they can rest and relax. The type and amount of ecosystem services vary depending on the characteristics of the ecosystem, and the priority and value also vary depending on the preference and needs of residents.

Case

"Nature takes care of us."

The following is an excerpt from an article published in the Korean edition of the National Geographic in 2016.

Let's think about types of ecosystem services people are experiencing in their daily lives.

Nature cheers us up.

When we become close to nature, whether it is a nature conservation area or a tree, our brains, which have been stressed out, are healed. [···] According to the attention restoration theory, if we spend time in nature, the stress and mental fatigue caused by "Orientation Attention," which is required by work and city life, are relieved. Nature can improve our creativity by up to 50%.

Walking in a forest reduces one stress hormone by as much as 16%. [···] Compared to people who live in areas where the view from a window is desolate, people who live in an area where greenery is seen tend to recover faster in hospitals and have better grades in school.

Also, their frequency of violence is low despite being in crime-prone areas. According to figures on stress hormones, breathing, and heart rate, not only activities in nature for a short time, but also looking at photographs of nature relaxes the mind and body and improves mental capacity. [···] Some countries promote nature experiences as part of public health policies.

(Excerpt: National Geographic Korean Edition, January 2016, p.32-45)

In-depth Learning

History of Ecosystem Services

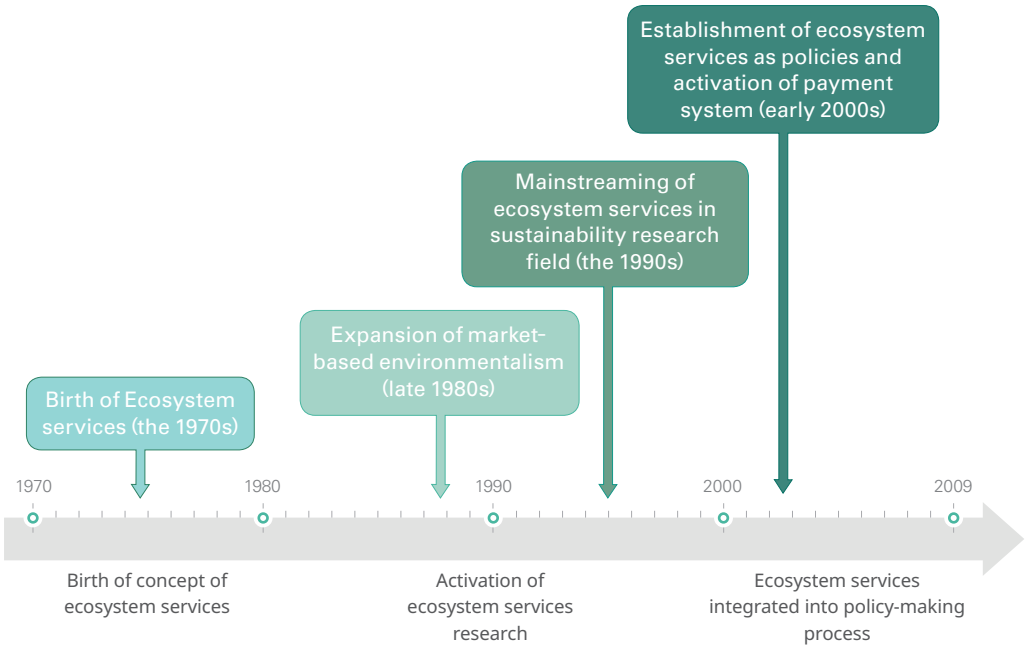
- Concerns about sustainable development emerged due to environmental problems caused by pollution in the 1960s and the side effects of economic development in the 1970s. People claim that the environment is important, but in practice, it is often sidelined by economic development. The concept of ecosystem services makes true value of nature more visible and explains the benefits from nature in economic terminologies for stakeholders. Therefore, it enables us to compare damages done to the nature with the benefits gained from the development of an area.

- <The value of the world's ecosystem services and natural capital>, published in Nature in 1997, showed the economic value of worldwide natural capital by converting the direct and indirect benefits the ecosystem gives to human society into quantitative economic units. The value of the ecosystem was announced to be about USD 33 trillion a year, which was more than the global GDP at that time (which was 27 trillion), triggering worldwide interest in the use of ecosystem services research and forming the foundation of ecological economics in the 1990s. Since then, ecosystem services research has been used in environmental policy strategies such as the response to biodiversity loss and climate change.

- The 1970s, when the term "Natural Capital" was first used, is viewed as the period when the concept of ecosystem services was born. In the 1980s and 1990s, the economic aspects of the ecosystem services were further developed by the science community. In the 2000s, two UN-supported global assessments, the Millennium Ecosystem Assessment (MEA) and the Economics of Ecosystems and Biodiversity (TEEB), put the ecosystem services on the policy agenda. In 2012, the Convention on Biological Diversity (CBD) adopted an ecosystem services strategy for protecting biodiversity and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was created.

- Recently, many countries have implemented Payments for Ecosystem Services (PES) to institutionalize economic incentives for environmental preservation, and industries are using an ecosystem services approach in evaluating the influence of production processes on the ecosystem and creating sustainable business models.

Chronological Trends in Ecosystem Services



(Source: Reorganized after Gomez et al. 2010)

Exercise

Types of Ecosystem Services

01 The direct benefits that humans obtain from ecosystems are called provisioning services. Which of the following is NOT a provisioning service provided by nature?

1 

2 

3 

4 

5 

02 The aesthetic, spiritual, educational and psychological benefits humans obtain from ecosystems are called cultural services. Which of the following is NOT a cultural service provided by nature?

1 

2 

3 

4 

5 

03 The following is an explanation of the ecosystem services of a village forest. Please fill in the blanks with corresponding benefits that match the services.

1	It enables various living things to live harmoniously. The stream running through a small patch of grass and trees feeds aquatic and other insects, while providing a habitat for them.	
2	It was "Guardian Forest." The villagers heaped up stones and made a wish, and observed a ritual on the first day of the seventh lunar month every year.	
3	If people became exhausted while working in the hot midsummer sun, they would lie in the shade.	
4	The ancestors used the forest between the sea and the village as a fence to protect the village from the harsh sea wind.	
5	Forests drop the temperature in the village or let a cool breeze blow.	
6	Trees designated as protectors by the village also make it look more beautiful.	

(Source: Sihwaho Lake Life Protector, 2009, Reorganized)

Exercise

Ecological Assets and Ecosystem Services of Our Region

01 Please write three major ecological assets in your region that you can be proud of by classifying them into habitats and species.

Habitat	*Species*

02 Select a specific ecosystem you think is the most important in your region (e.g., Upo Wetland, Ansan Reed Marsh, Seocheon Tideland, etc.) and describe in detail which ecosystem services the ecosystem provides.

Classification			
Provisioning Services	Food, Water, Wood, Medicinal resources		
Regulating Services	Air quality control, Water quality control, Climate regulation, Erosion prevention, Pollination		
Cultural Services	Recreation and tourism, Educational value, Spiritual value, Artistic inspiration		
Supporting & Habitat Services	Biodiversity, Nursery		

2 Ecosystem Changes and Their Costs

- If flowers bloom late and trees cannot bear fruit, the price of seasonal food goes up. The gradual lengthening of summers and winters and the shortening of spring and fall affects the residential lives as well. Citizens going to work these days check the fine dust index as well as the weather. Changes in the ecosystem is having a greater effect on our food, clothing, and shelter.

- A 2016 World Wildlife Fund (WWF) report warns that the structure and function of ecosystems have changed radically over the last 50 years and the species extinction rate has occurred about 100 to 1,000 times faster than the expected natural extinction. Crop species diversity has declined by nearly 75% in the last 100 years, and about 50% of marsh lands, whose biodiversity value is high, have disappeared at an alarming rate worldwide since the 1900s.

- The economic cost of this ecosystem degradation is reportedly USD 8 trillion as of 2013, and will increase to USD 28 trillion by 2050 (PBL, 2016). As a result of land degradation, which accelerates desertification, 25% of the land in the world has been damaged and lost, and the Intergovernmental Platform on Biodiversity & Ecosystem Services (IPBES) announced that global land degradation is responsible for undermining the welfare of 3.2 billion people.

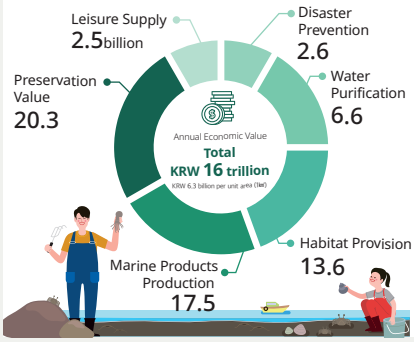
Tip **Ecosystem services under the Convention on Biological Diversity (CBD)**

The 10th Conference of the Parties (COP10) of the Convention on Biological Diversity (CBD) in Nagoya, Japan, agreed to the Aichi Target of preserving and restoring ecosystem services with a strategy to conserve biodiversity and set ecosystem services as a policy agenda. In particular, it explicitly adopts the ecosystem services strategy to achieve awareness of the value of biodiversity and sustainably use by 2020 as Aichi Target 1. And it integrates the values of ecosystem services into development and planning procedures and accounting systems as Aichi Target 2. The Korean Ministry of Environment also explicitly expressed the implementation of ecosystem services policies as the third national biodiversity strategy when it enacted the Act on the Conservation and Use of Biological Diversity.

Case

What is the value of an ecosystem?

The Value of Tidal Flats

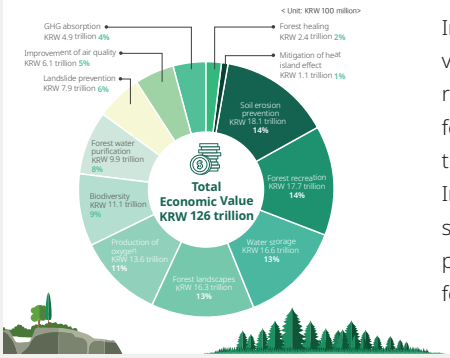


More than 3 billion people get protein from fish and receive provisioning services of about USD 4.5 - 6.7 trillion from the marine ecosystem.

The Ministry of Oceans and Fisheries announced that the value of tidal flats is KRW 16 trillion per annum (KRW 6.3 billion per 1 km^2) and declared it would push forward a tidal flat ecosystem restoration project by 2023 of which value will be KRW 19.5 billion (3 km^2) annually.

(Source: Press release from the Ministry of Oceans and Fisheries, July 9, 2018)

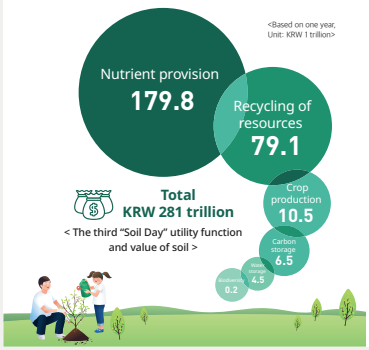
The Value of Forests



In 2008, the Korea Forest Service (KFS) announced that the value of forests was more than KRW 7.3 trillion, and said the revaluation amount in 2014, which included the functions of forest healing, forest landscapes, and biodiversity, was KRW 126 trillion, which equaled a benefit of KRW 2.49 million per person. In the sixth Basic Forest Plan (2018 - 2037), the KFS included a strategy to improve people's lives and realize "Korea in the forest" project with the continuous management and restoration of forest ecosystem services.

(Source: KFS homepage)

The Value of Soil



According to the Rural Development Administration in 2018, the value of soil amounts to KRW 281 trillion, and the organization announced that it would enhance research in response to climate change by improving ecosystem services functions such as soil carbon sequestration.

(Source: Press release from the Rural Development Administration, March 8, 2018)

- The ecosystem services approach assesses today's current economic development and environmental policies that do not properly reflect the value of natural resources and warns of future dangers. There is a growing consensus that the natural environment must be managed for nature to maintain ecological resilience and continue delivering vital ecosystem services, which are important to human life. With the weakening of natural health and subsequent inability to adapt to climate change and reduce the frequency and intensity of natural disasters, the social and economic burden of handling the resulting damage from heat and cold waves, typhoons, and other unpredictable weather extremes and natural disasters increases. There is great concern about the impact of changes in the ecosystem on the health of regional residents as well as damage to vital food crops.

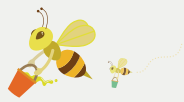
Case

What if bees disappear?

The animation “Bee Movie” shows a desolate world where bees have disappeared, showing how bees play a vital role in the ecosystem. Indeed, the population of native Korean bees has been reduced by 95%, and many countries including the United States have designated bees as endangered species. If bees disappear, it is said that a third of the human food supply will be disrupted and 85% of plants will not bear fruit. If the bee population decreases rapidly and flower blooming time is delayed due to abnormal weather and cold shock, the dependence on artificial pollination will be higher in the future.

How much is the value of one bee in a time when bees are disappearing?

It is said that the price of a hive that contains one queen bee and 60 - 80 working bees is KRW 75,000 - 85,000 in 2018, and one hive can pollinate a 650 to 1,000m^2 cherry tomato field. Depending on the size of the field, more workers and equipment may be needed for artificial pollination.



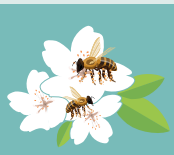
Environment and Ecosystem

To make **1kg** of honey, bees visit **5million** flowers and travel **450,000km**.

A third of crops grow with the pollination of insects, and **80%** of the pollinating insects are bees.

Function

Going to various plants to obtain honey, their hairs are coated with pollen.



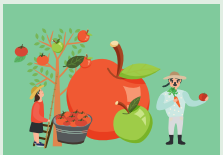
Service

They help the pollination of fruit in orchards. Without bees, humans must put in the time and effort to obtain and deliver pollen.

Social/Economic System

The symphony “Flight of the Bumblebee” was composed by Nikolai Rimsky-Korsakov, who was inspired by the sounds of bees.

The value of U.S. crops that depend on pollinating insects is estimated to be USD **15.1 billion.** (as of 2009)



Benefits

Pollination enables the harvest of marketable fruit.

The production and quality of fruit vary depending on the frequency of bee visits.

Value

The value of harvested fruit is converted to monetary units through sales at a market.

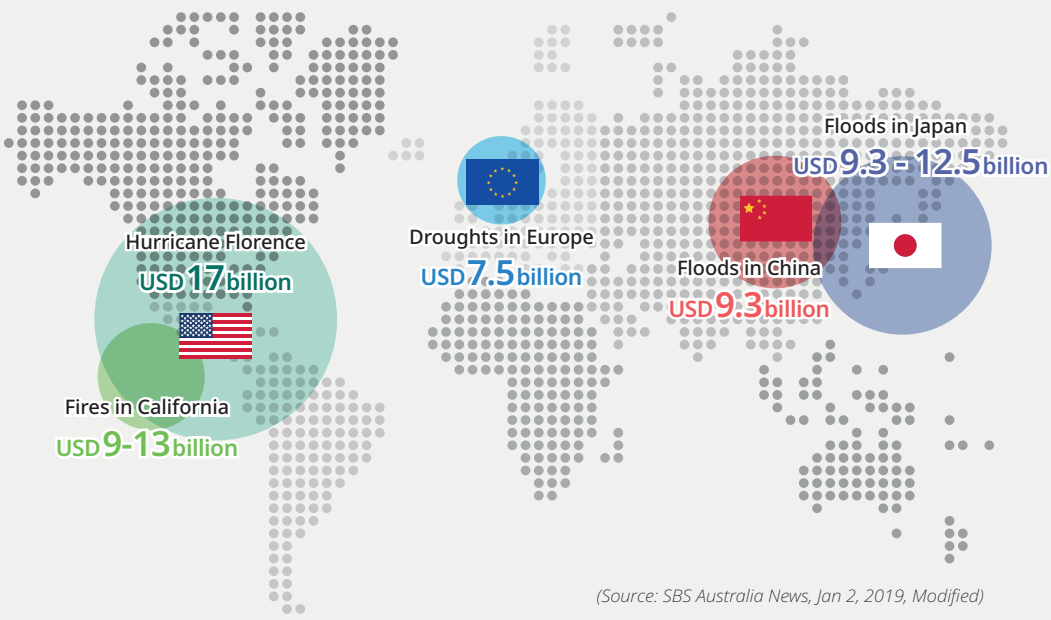
3 Climate Change and Ecosystem Services

- The life and history of humankind have been greatly influenced by climate change. Small island nations are on the brink of becoming submerged due to climate change, and the movement of displaced people caused by catastrophic natural disasters leads to regional conflicts. The renowned cultural anthropologist Jared Mason Diamond has explained the conjunction of problems with the environment and natural resources with the rise and fall of civilizations.

- Regulating services such as carbon capture, mitigation of heat island effect, coastal erosion control, and natural disaster control relieve climate change and help humans adapt to global warming. If crop production is reduced due to weather extremes and living spaces disappear due to natural disasters, people try to look for food and wood in forests. Generally, provisioning and regulating services of forests in developing countries are very important for the livelihood of low-income

Case

Economic damage of natural disasters in 2018



(Source: SBS Australia News, Jan 2, 2019, Modified)

individuals who are most sensitive to the impact of climate change. Maintaining and restoring ecosystem services are closely linked to our ability to adapt to climate change. This explains the correlation between climate change adaptation and ecosystem services.

- The Intergovernmental Panel on Climate Change (IPCC) predicts that the Earth's average temperature will go up if the concentration of greenhouse gases (GHG) increases and will rise by 1.8~3.7°C in 2100 over the average temperature in 1986-2005. Humankind is experiencing unpredictable natural disasters every year due to climate change and the annual global economic loss resulting from natural disasters amounts to USD 1.58 trillion, which is three times higher compared to 40 years ago (Park et al. 2017).

- To respond effectively to climate change, the world adopted the Kyoto Protocol, which set a binding GHG reduction target, in the third Conference of the Parties (COP3) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Japan in 1997. Since the adoption of the Kyoto Protocol, the carbon market system, in which carbon credits are traded, provided an opportunity to convert environmental agreements into economic agreements. The 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris in 2015 created a binding climate agreement for all 196 countries.

- The project Reducing Emissions from Deforestation and forest Degradation (REDD+) is an example of a climate change adaptation applying ecosystem services approaches to forests, which naturally absorb and sequester GHG. Korea has also established a forest carbon management system that uses the carbon absorption function of forests as a major strategy in responding to climate change and the Korea Forest Service (KFS) is participating in an afforestation business to combat the desertification of Mongolia and makes efforts to secure carbon credits and reduce international climate change with the REDD+ pilot project in Cambodia, Myanmar, and Laos.
  Domestically, Gyeongsangbuk-do was certified in 2018 as the first local government external business operator of a GHG emission trading system with the Millennium Forest, an urban forest park created in a new town.

4 Ecosystem Services for Sustainable Development

- In 1972, the Club of Rome predicted that the Earth would no longer be able to sustain a growing population in the early 21st century. Standards mentioned as being used to predict the Planetary Boundary included climate change, destruction of the ozone layer, ocean acidification, reduction of biodiversity, use of freshwater, change in land use, and nitrogen phosphorus cycle. The development of fresh and underground water resources has already reached its limit and green and red tides have become more severe. Many biologists agree that biodiversity loss becomes unrecoverable. If population and consumption continue to increase at the current pace, can ecosystem services be maintained?

- Sustainable development means the balanced development of the economy, society, and environment within a range where the natural resilience that supports human life is preserved. It is a goal that can be achieved only when conservation and development reach a balance so that the needs for current development do not undermine the availability of resources for future generations. The UN set 17 goals to be achieved by 2030 for the sustainable development of human society. Among them, the goals that can be achieved with the maintenance and restoration of ecosystem services are health and welfare, clean water and hygiene, clean energy, sustainable cities, climate change response, and marine and land ecosystems. Goals that are indirectly associated with ecosystem services are the eradication of poverty, zero hunger, and economic growth.

- The ecosystem services approach is an important and useful tool for understanding the impact of ecosystems on human society and serve an important role in activating the implementation of policies for conserving nature, such as Natura2000 in Europe. It is also an important index for measuring the impact of environmental policies that connect the environment, society, and economy, and sustainability of our society we live in.

UN Sustainable Development Goals and Ecosystem Services

Module 02

Valuation of Ecosystem Services

1 What is the Valuation of Ecosystem Services?

2 Ecosystem Services Mapping

2 Module Valuation of Ecosystem Services

Key Questions

- Why is the valuation of ecosystem services needed?
- How can the result of valuation or mapping of ecosystem services be integrated in the policy decision-making process?

1 What is the Valuation of Ecosystem Services?

Valuation of Ecosystem Services

- Ecosystem services valuation is the process of recognizing the "values" of natural resources, and integrates ecosystem services into the environmental policy decision-making process by comprehensively assessing changes and their impact of ecosystem services on human welfare. In case of conflicts between development and preservation, it provides a scientific basis to support the decision-making of stakeholders by analyzing scenarios about which circumstances will bring more benefits and/or reasonably estimating the "investment cost" needed for preservation.

- Ecosystem services valuation is categorized into biophysical assessment, economic assessment and social assessment. Biophysical valuation of ecosystem services examines the biophysical structural characteristics, processes, functions, and interactions, so its outcome can be visibly displayed as an ecosystem services map reflecting spatial data to quantitatively measure biophysical amounts. The social valuation of ecosystem services is to assess the dependence of specific stakeholders on respective ecosystem services and its impact on human lives. Stakeholders, both beneficiaries and suppliers of ecosystem services, are encouraged to participate in this process. Methods such as surveys, interviews and focus group debates can be applied.

The economic valuation of ecosystem services can be calculated by converting it into monetary units. A monetary unit value can be calculated using methods of market price analysis, damage cost avoided method, contingent valuation, etc. However, it is not easy to provide monetary value to ecosystem services of nature and there are still critical views on valuing ecosystem services in monetary terms as seen in the cases of many countries that promote or plan ecosystem services policies.

Case

Participatory valuation of ecosystem services with local residents

The National Institute of Ecology has been conducting participatory valuations of ecosystem services since 2016 in which local stakeholders join to establish ecosystem services-based regional plans reflecting their needs in their region.

The participatory valuation of ecosystem services has six steps: identifying regional issues, selecting stakeholders, conducting a survey, assessing recognition of ecosystem services, analyzing collected data, and integrating outcomes into land-use planning. For example, the results of a participatory valuation of ecosystem services in Seocheon Tidal Flat is said to have created a scientific basis for stakeholders to bridge gaps under discussion, share different ideas and cooperate on using limited natural resources.

(Source: The National Institute of Ecology, 2016)

Economic Valuation Methods of Ecosystem Services

The economic value of ecosystem services can be calculated into monetary units using the market price method, revealed preference,cost-based method, contingent valuation, or value transfer method.

- The market price method estimates value using the market sales price of wood or materials or by considering changes in productivity such as an increase in fishery income resulting from improved water quality.

- Revealed preference is a method to calculate the total cost of travel including expenses that travelers want to pay, admission fees, and value of consumption when they visit beautiful environment, or value of landscape resulting in the high price of houses near a green space or hotel rooms with a good view.

- There is also a cost-based method for calculating the cost of recovery from flooding due to wetland degradation, the replacement cost of artificial water purification system corresponding to natural water purification function of a healthy ecosystem, and cost of increased disease resulting from air pollution.

- There are also contingent valuation methods that evaluate voluntary payments to preserve a protected area or forest and an alternative modeling approach that estimates the effects of policy decisions by policymakers according to different scenarios of ecosystem services.

- The value transfer method is often used in the initial evaluation phase when there is insufficient data. This method calculates the value of a subject area using the monetary unit of economic valuation in other regions with similar characteristics. Although this is a low-cost method of estimating monetary values, there are concerns that the results may not be reliable.

Valuation Methods of Ecosystem Services

Biophysical assessment

Biophysical structural characteristics, processes, functions and interactions

Method Biophysical quantitative measurement, spatial data, modeling, indices, mapping

Social assessment

Participation of stakeholders, dependence of specific stakeholders on ecosystem services and its impact

Method Social surveys, interviews, focus group debates

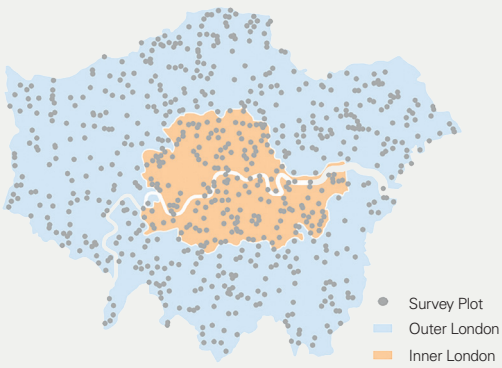
Economic valuation

Assessing the value of certain ecosystem services by converting them into monetary units

Method Market price method, cost-based method, contingent valuation, value transfer method, etc.

Case

Valuation of urban forest with the largest number of citizens



Map showing survey points inside and outside London

In London, the UK, a public-private partnership conducted the world's largest i-Tree eco-project with volunteers in 2014. With information on the biodiversity of trees in London collected in this participatory way, the benefits of ecosystem services such as reduction of air pollution, carbon dioxide capture, and reduction of rainfall runoff were able to be quantified.

The results of this, the largest citizen eco-project in the world, are being used as an example to describe the environmental strategy of the City of London with ecosystem services valuation data, and a ground for establishing green infrastructure.

(Source: Treeconomics, 2015)

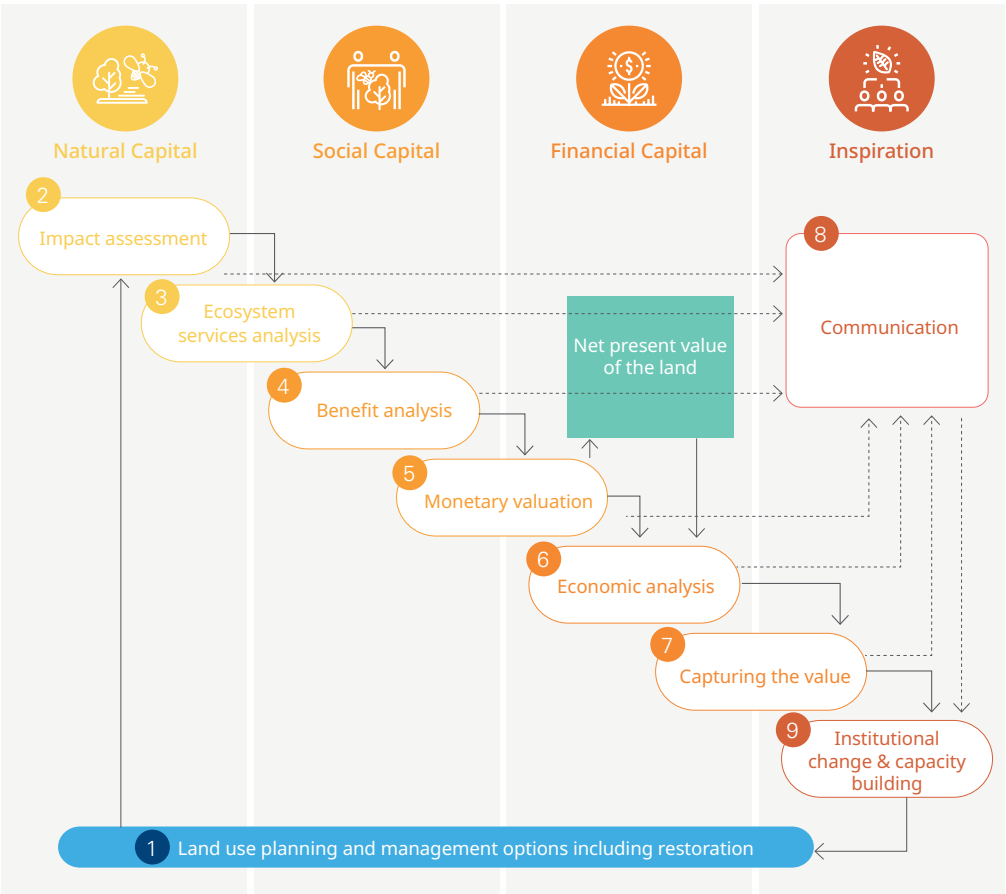
In-depth Learning

Integrated Ecosystem Services Assessment for Ecosystem Restoration

- The integrated ecosystem services assessment for ecosystem restoration means that stakeholders understand the impact of land use changes through this assessment, prepare measures to maintain values of ecosystems at a target area and make institutional changes incorporating ecosystem services approaches.

  Based on the results of such evaluation, ecosystem services for the subject area can be maintained or restored, the health of natural resources can be restored ("recovery of natural capital"), the life and culture of local communities can be solidified ("recovery of social capital"), and institutions that drive new economic vitalization ("recovery of financial capital") can be found.

Framework for Integrated Ecosystem Services Assessment



(Source: De Groot et al, 2018)

Exercise

Valuation of Ecosystem Services

The National Institute of Meteorological Sciences announced a research result that the economic value of rainwater was KRW 20 billion in 2012. Read the news release below for 10 minutes and organize the major ecosystem services of rainwater. Also, write how to assess the economic value of each ecosystem service.

Chosun Biz: "Spring rain this year is worth KRW 20 billion"

[...] Not too long ago, the value of rainwater was underestimated because it was not drinkable and was cited as the cause of flooding. However, research has recently overturned these misconceptions. Rainwater plays the role of a natural air purifier that washes dirt and dust from the air. The concentration of dust and nitrogen dioxide in the air decreases to less than half after rain. There was an experiment where participants drank rainwater, tap water, and mineral water in bottles while their eyes were closed, and most respondents said rainwater was the most delicious.

[...] The total amount of rainwater in Korea is 129.7 billion tons annually. Of this, the amount that evaporates into the air is 54.4 billion tons and the amount that flows into the sea is 42 billion tons. The usable amount is only 26% of the total amount, or 33.3 billion tons.

[···] The value of spring rain this year is estimated to be more than KRW 21.26 billion. In terms of securing water resources, 1 mm of rain this spring in Korea is worth KRW 700 million, and there is also an air quality improvement effect of more than KRW 20.5 billion a day. [···]

(Source: Chosun Biz, May 16, 2012)

Type of Ecosystem Services	Economic Value			Total Economic Value	Method of Value Evaluation
	Direct Market Value	Indirect Market Value	Non Market Value		
Provisioning Service				Sum of monetary value	Market selling price, etc.
Regulating Service				Sum of monetary value	Replacement cost, contingent valuation methods, value transfer, etc.
Supporting & habitat Service				Sum of monetary value	value transfer, etc.
TOTAL ECONOMIC VALUE				TEV	

2 Ecosystem Services Mapping

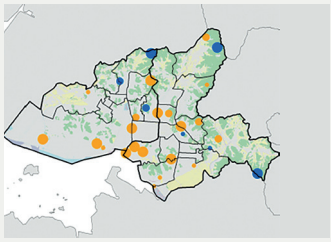
Ecosystem Services Map

- Mapping is a convenient way to easily grasp the spatial distribution of certain phenomena, states, and regional differences. A map with the quantitative evaluation results of ecosystem services indicated on it is called an ecosystem services map.

- A map of ecosystem services evaluation created by reflecting the supply of ecosystem services in the subject area and the demands of ecosystem services stakeholders is shown below.

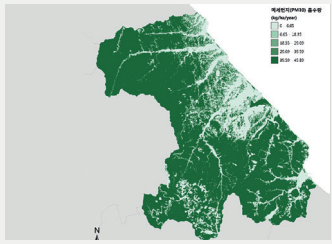
Case

Example of mapping ecosystem services



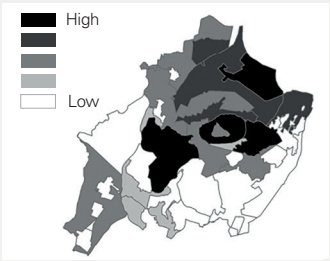
Distribution chart of cultural services (●) and regulating services (●) in Ansan-si

(Source: The National Institute of Ecology)



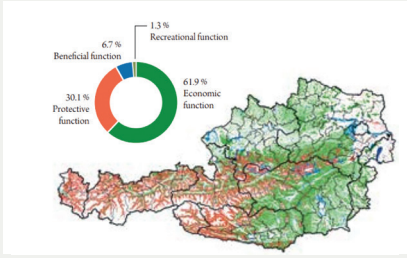
Map of regulating service in Gangneung (absorption of fine dust)

(Source: Hyuk-soo, Kwon 2018)



Map of biosphere reserve cultural services in Sachsen, Germany (Educational value)

(Source: Plieninger et al., 2013)



Map of forest ecosystem services in Austria

(Source: BMLFUW, 2015)

- To improve air quality, a basis of policy judgment can be prepared considering statistics of air pollution occurrence or the carbon dioxide storage capability of planted trees as well as existing land use levels to decide which areas have priority for improvement or should be protected. When a land-use plan or ecosystem restoration plan is made, policy priority is decided by overlapping various types of ecosystem services maps because sociocultural factors such as the impact the policy decision has on residents in the subject area and what residents prioritize should also be considered.

- Ecosystem services maps are convenient for visually understanding the characteristics of ecosystem services in a region. Since they show differences in the distribution of ecosystem services that are provided and which services are needed in the region, maps are being used as a communication tool for policy-making decisions.

- Since various kinds of biophysical, economic, and social data are needed for an accurate ecosystem services map, users need to be mindful of the uncertainties. Depending on the purpose of the map, use existing ecosystem services maps or draw a separate ecosystem services map to evaluate improvements of land use plans in the targeted region.

Tip **Ecosystem services map of EU**

The EU asked each member country to complete ecosystem services assessment and mapping work by 2014. Four ecosystems, farmland, forest, freshwater, and ocean were already evaluated as a pilot project and ecosystem services maps are being used as a tool to support agricultural policy, water resource management, the development of sustainable urban regions, forest management, etc.
The EU will integrate the results of these evaluations of ecosystem services into national accounts and reporting system by 2020 (EU, 2014).

Case

Exemplary tools with models for mapping ecosystem services

InVEST

InVEST
integrated valuation of ecosystem services and tradeoffs

There are different models of ecosystem services maps that contain biophysical, economic, and social statistical values.

https://naturalcapitalproject.stanford.edu/invest/

Costing Nature

Co$ting Nature

You can see the regional differences in the map where estimated ecosystem services (transferred) values are indicated.

http://www.policysupport.org/costingnature

TESSA

tessa

Experts and local stakeholders assess ecosystem services together using local data and create a participatory map reflecting its outcome.

http://tessa.tools/

Exercise

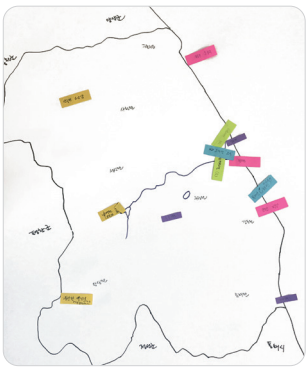
Participatory Mapping of Ecosystem Services in My Region

Which place have you often visited this year? Please mark the places of photos on the map stored in your phone for good memories of the place you visited. What news articles appear when you search for the place you visited? Please write three major keywords.

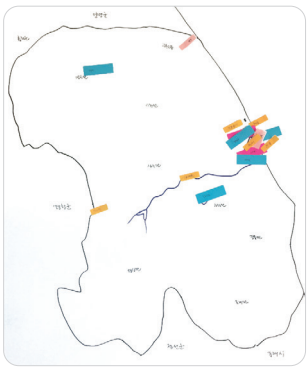
(※ When you practice in groups, you can understand the places members marked the most and distribution areas by connecting them in terms of supply and demand of ecosystem services and discuss the policy implications, including differences.

Example Results of practice of demand distribution by ecosystem services type in Gangneung (2018)

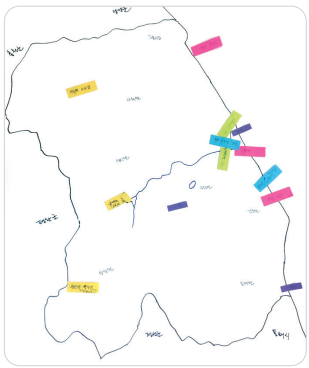
Group A



Group B



Group C



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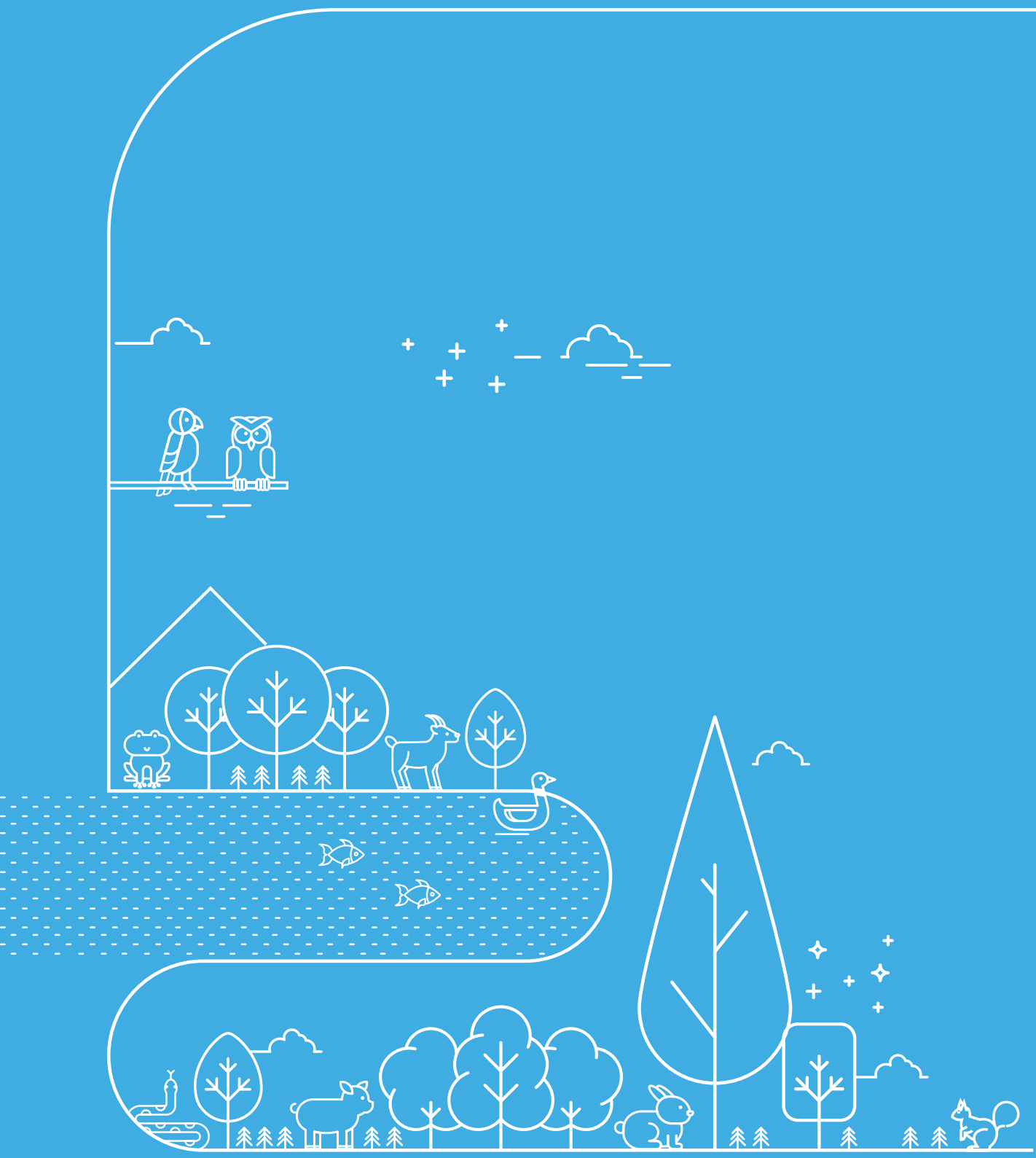


Module 03

Application of Ecosystem Services Approaches

1 Why Ecosystem Services?

2 Internalization of Environmental Costs : Payments for Ecosystem Services (PES)

3 Module Application of Ecosystem Services Approaches

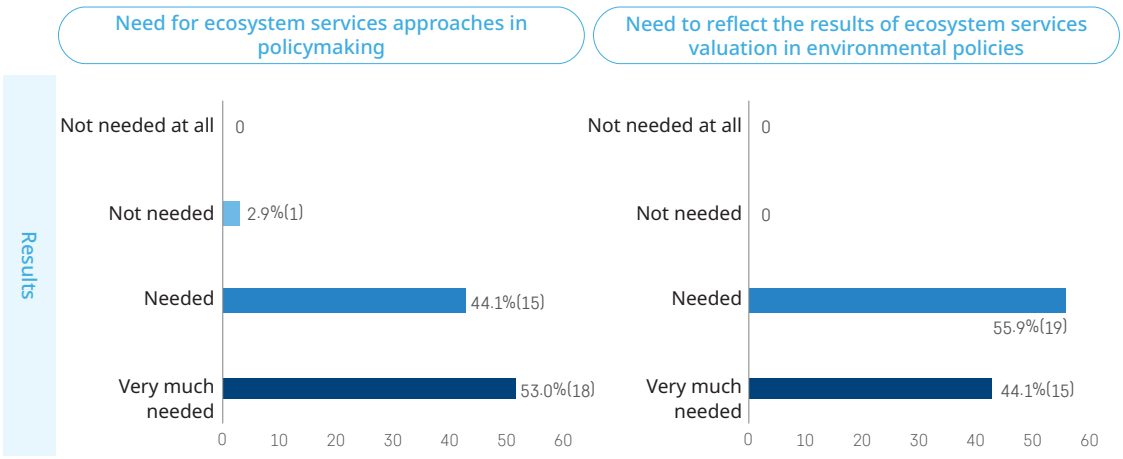
Key Questions

- Why are ecosystem services approaches needed in environmental policies?
- What kind of ecosystem services policy can you try in your region?

1 Why Do We Talk about Ecosystem Services?

In 2018, 34 public officials who joined the ecosystem services training were questioned, "Is the ecosystem services concept needed when establishing policies for the conservation of the ecosystem and effective management of natural resources?" Most of them replied that it is needed, and all agreed to reflect the results of the valuation of ecosystem services in policies. Do you agree?

Perception of Ecosystem Services for Policy Implications



(Source: Homepage of ESP Asia Regional Office)

Quantification and Visualization of Value of Natural Resources

☑ Using ecosystem services approaches, the impact of ecosystem degradation on human welfare or benefits of nature preservation can be shown visually and numerically. The Korean government also promotes the importance of natural resources by quantifying the value of nature, such as a forest value of KRW 126 trillion, tidal flat value of KRW 16 trillion, and soil value of KRW 281 trillion, to attract public attention and form a consensus on nature conservation. Ecosystem services mapping is a tool to help you understand visually the flow of demand and supply of local ecosystem services, and it is also helpful for land use planning.

Participatory Governance for Natural Resource Management

☑ The supply and demand for ecosystem services changes in accordance with the distribution of regional ecological resources and the use and management of land. Such differences affect conflicts and cooperation between suppliers who manage ecosystem services and beneficiaries of those services. There is a need to analyze which stakeholders are most affected by changes in ecosystem services, whether the benefits and maintenance cost of ecosystem services are distributed equitably among stakeholders, and whether potential conflict factors are considered.

It is also important to establish and manage participatory governance to share the economic, social and environmental benefits of natural resources and for the sustainable management of ecosystem services. Ecosystem services valuation includes the process of analyzing the impact between stakeholders who supply and receive benefits from ecosystem services.

Stakeholder Engagement and Participatory Governance

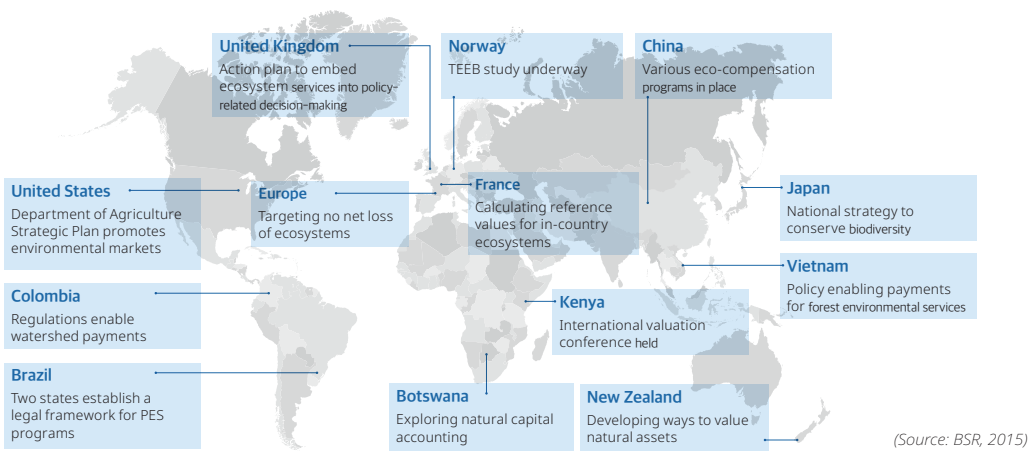
Stakeholder impact	Comparison of benefits	Communication and decision-making
• Understanding of dependence and impact of stakeholders on ecosystem services • Comparison of gains and losses among different stakeholders	• Benefit Analysis by comparing benefits and costs of development in terms of ecosystem services • Analysis of changes in ecosystem services according to land use planning	• Cost versus Investment • Consideration of "use rights" of future generations and socially vulnerable members of society • Capturing values of nature

Ecosystem Services Policy Trends in Global Public Sector

- Business for Social Responsibility (BSR), an international nonprofit organization, published the report "Global Public Sector Trends in Ecosystem Services" in preparation for the new regulations related to ecosystem services as worldwide interests increased in governmental sectors. The report, which investigated ecosystem services policy trends in countries from 2009 to 2014, predicted that ecosystem services would lead new policies and institutional mechanisms. The study focused on how the results of economic valuation of environmental areas will affect land use conditions of private sectors and how to be integrated into economic growth accounts like GDP, and what impact it will have on industries. Globally, eighteen countries including the EU are participating in "Wealth Accounting and the Valuation of Ecosystem Services (WAVES)," and Vietnam and China are implementing the "Payments for Ecosystem Services (PES)" mechanism to realize ecosystem service into practice.

- The Ministry of Environment Korea also leads and carries out national ecosystem services assessment by actions such as establishing the National Institute of Ecology in 2013; it focuses on the research on ecosystem services and implementation of its policies. The Korea Forest Service is also contributing to institutionalizing ecosystem services approaches by conceptualizing forest ecosystem services and placing them as key elements of the forest policy framework in the sixth Basic Forest Plan.

Policy Trends of Ecosystem Services in the Global Public Sector



(Source: BSR, 2015)

2 Internalization of Environmental Cost : Payment for Ecosystem Services (PES)

What is the Payment for Ecosystem Services (PES)?

- Since the 1990s, the study and discussion of the economic valuation of ecosystem services have grown along with interest and research to find nature-based solutions to derive economic incentives for environmental preservation. Payment for Ecosystem Services (PES) is one of representative movements among others.
  Payment for Ecosystem Services (PES) is a concept intended to promote the sustainable use of natural resources through economic incentives, with the notion that beneficiaries of ecosystem services pay reasonable costs of services to service providers. This is being actively discussed among governments pushing for ways to cover the environment preservation costs, entities managing protected areas, institutions executing restoration projects, etc. Overseas, more than 300 PES-related programs are being conducted in the areas of river basin management, forest conservation, and biodiversity. Also, in Korea, the 'beneficiary pays' principle" of PES could be incorporated into such mechanisms as biodiversity management contracts, water use charges, and ecosystem conservation funds.

- Recently, as the number of visitors to national parks has soared, the introduction of PES for the management of protected areas is being actively discussed. Discussions on charging and raising higher admission fees for nature reserves are in line with this.

Tip **The world's largest PES? REDD+**

REDD+ refers to the efforts of each country to reduce GHG emissions from deforestation and forest degradation, to preserve forests, to manage forests sustainably, and to increase the forest carbon storage. Deforestation is the second-largest cause of global warming, accounting for 15% of GHG emissions and also the same cause of the problems in Brazil and Indonesia. Currently, the most effective way to reduce GHG emissions is by preventing deforestation and forest degradation.

(Source: Mark Everard, 2017)

Prior to designing the PES, principles must be established about the types of ecosystem services that can be quantified and traded, the seller (supplier) to provide ecosystem services, the buyer, the geographical size, the contract period, committed activities, the broker, payment method, etc. To make PES a viable mechanism, there is a need for sufficient discussion and trust-building between the trading parties about what benefits are obtained with the PES system, how long it will take to see the benefits, the minimum payment level that is acceptable, and when the selected ecosystem services will be provided. (DEFRA, 2013)

Overseas Case

New York's Catskill basin management, the drinking water source management contract of Vittel, a mineral water company in France, the Bush Tender of Victoria, Australia, and the forest management system for a hydroelectric power plant basin in Costa Rica are all well-known examples of PES. Here, we will look at the case of Vietnam that is being promoted on a large scale in Southeast Asia.

Payment for Forest Environmental Services (PFES) of Vietnam

- Vietnam, which runs from north to south on the Indochina Peninsula, consists of northern highlands, mountains, and deltaic coasts and is the first Southeast Asian country to introduce Payment for Forest Environmental Services (PFES) as a national strategy and policy. The Vietnamese government designated the prevention of soil erosion, water regulation, carbon capture, protection of the natural landscape and preservation of biodiversity, and aquaculture production as forest ecosystem services that can be transacted. And it regulates the trade system between users of ecosystem services (hydroelectric power plants, water companies, industrial production facilities, tourism business operators, aquaculture farmers, etc.) and suppliers of ecosystem services (forest owners, households, individuals, communities, forest protection contract companies, etc.).

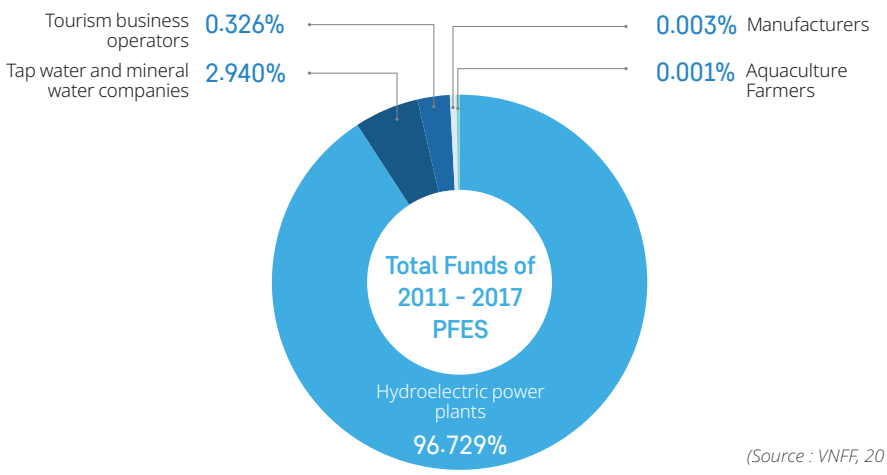
  Forty-two local governments are implementing this mechanism, and the Forest Protection and Development Fund (FPDF) serves as an intermediary organization.

Types and Rates of PEFS in Vietnam

Service Users	Forest Ecosystem Services	Payment Unit (Vietnam Dong)
Hydroelectric power plants	Prevention of soil erosion, prevention of river sedimentation, water regulation	36VND kWh^{-1}
Tourism business operators	Protection of natural landscape and preservation of biodiversity	1-2% of profit
Tap water and mineral water companies	Maintenance and management of clean water resources	52VND m^{-1}
Manufacturers	Maintenance and management of water resources	Varies depending on region
Aquaculture farmers	Maintenance of aquaculture farms and habitats	20,000VND/m^3/pond/year

☑ It is said that after the implementation of PEFS, the funds paid by users account for 22.3% of the budget for the forest sector, and the budget could be used for forest conservation activities for areas that account for 25 to 30% of Vietnam's existing forest area. Also, the system is evaluated by the residents who participated in the agreement to have good results such as job creation and household income. Since the pilot project of PFES in 2008, Vietnam has continuously improved the system in cooperation with U.S. and German international cooperation organizations to amend legislations, to create monitoring and evaluation framework, and to reform payment methods.

Fund Structure of Payments for Forest Ecosystem Services (PES) of Vietnam



(Source : VNFF, 2018)

Domestic cases

Several studies have been conducted in the fields of water management, forestry, biodiversity, agriculture, and protected area management to introduce the PES mechanisms in Korea. In particular, a lot of interest is shown in applying PES to improve biodiversity management contracts, to reform water use charges, to restructure governmental subsidies for environmentally sustainable farming practices, and to develop sustainable eco-tourism measures. In the case of the introduction of the environmental conservation fund in Jeju-do in 2018, the public-private partnership, consultations, public hearings, and trials and errors at diverse stages of the planning process have many implications.

Introduction of Environmental Conservation Fund in Jeju-do

- Jeju-do is a representative eco-tourism region with the Jeju Island Biosphere Reserve certified in 2002, UNESCO World Heritage Site in 2007, and Global Geopark in 2010. However, as a result of severe after-effects such as garbage, sewage treatment and traffic congestion due to a rapidly increased number of tourists, the public-private partnership was launched to solve such environmental problems and open-ended public discussions had been promoted since 2016.

- The "environmental conservation fund" mechanism, which Jeju-do found after lots of discussion and many research results, is a method to impose the cost of daily waste and sewage treatment, air pollution and traffic congestion on the users. If this mechanism is implemented, business operators of accommodations will pay KRW 1,500 per person based on one day, rental car operators KRW 5,000 for passenger cars and KRW 10,000 for vans, chartered bus operators a 5% use fee, and travelers about KRW 14,500 considering accommodation and car charges. In this case, an environmental conservation fund of about KRW 140.8 billion can be collected every year. This is another way of applying 'the polluter pays principle' in perspective of maintaining ecosystem services in Jeju island.

Exercise

Payments for Ecosystem Services (PES) in Our Region

In May 2018, Yanggu-gun, Gangwon announced it would charge admission to the Yanggu Eco Park, where previously visitors were admitted free of charge. Damyang-gun has also been embroiled in controversy because it said it would charge an admission fee for Metasequoia Road, which is said to be a representative eco-tourism destination, by amending a local government operational ordinance. Can the use of admission fees by local governments for preserving and managing the natural environment be introduced in your region as part of ecosystem services policies for the sustainable use of natural resources? Read the Yonhap News article below from 2016 and think about how admission fees can be calculated if they are imposed for nature reserves in your region.

[... Currently, admission to Hallasan National Park is free, while the admission fee for Seongsan Ilchulbong Peak is KRW 2,000.

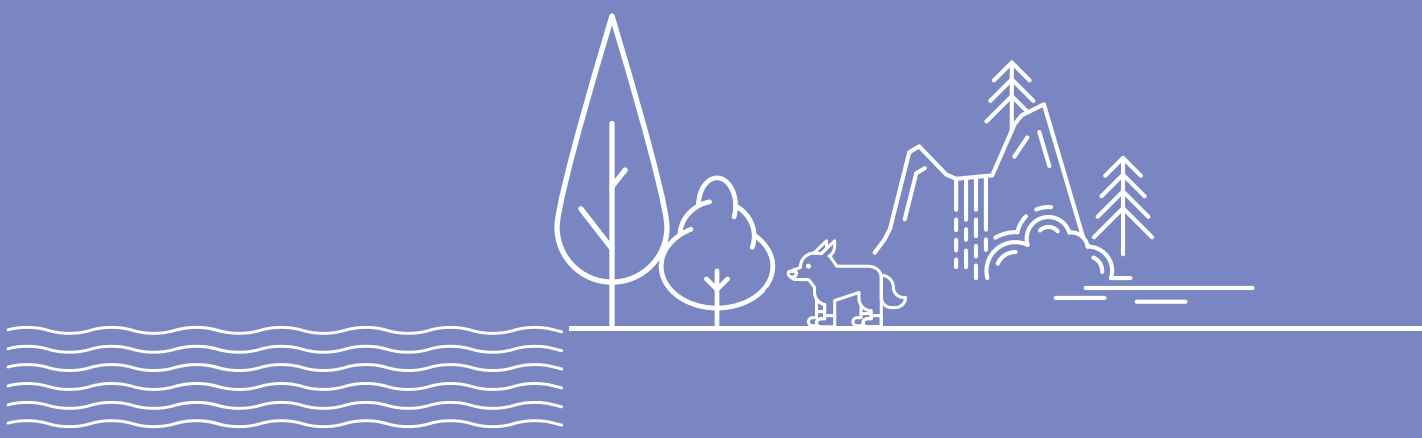
However, it seems you should also pay an admission fee to enter Hallasan National Park starting next year. The fee suggested by a working group consisting of experts is as much as KRW 20,000, and the fee for Seongsan Ilchulbong Tuff Cone will be also raised to KRW 10,000. They claim that they can preserve the value of the environmental assets of Hallasan Mountain and improve the quality of tourist culture by controlling demand.

According to the working group, the average admission fee of 40 world natural heritage sites is KRW 24,000. The admission fee for Huangshan, China is about KRW 38,000, while that for Yellowstone National Park in the United States is about KRW 33,000. Grand Canyon National Park in the United States and Iguazu National Park in Argentina also receive KRW 17,000 and KRW 16,000 respectively.

However, there are a lot of opposing views. Raising the admission fee for Hallasan Mountain to KRW 20,000 will place quite a burden on tourists. Also, group visitors such as school trips and Alpine clubs will be sharply reduced. This can also damage nearby merchants. Jeju-do will collect opinions and begin receiving admission fees from the second half of next year.

(Source: Yonhap News Press Release Dec. 17, 2017)

Appendix



1 Glossary

Biodiversity

Article 2 of the Convention on Biological Diversity states that "Biodiversity means variability among living things in all fields including land, marine, and other aquatic ecosystems and the complex ecosystems these ecosystems constitute. This includes diversity of species, diversity among species, and ecosystem diversity." This concept includes genomic diversity, species diversity, and ecosystem diversity.

Convention on Biological Diversity (CBD)

An environmental convention adopted in the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992 for the purpose of the sustainable use of biological resources and fair distribution of benefits from biological resources. About 194 countries are members of the Convention.

Cultural Service

The immaterial benefits that humans gain from ecosystems including aesthetic, educational and psychological benefits such as landscape beauty, education, leisure, and recreation.

Ecological Footprint

The cost of food, clothing and shelter, which are necessary for human life, energy, facilities, and waste treatment is expressed in land area (ha) or the earth count and converted into figures by individual or country. The higher the number, the greater the damage done to nature by human beings.

Economic Valuation

An evaluation process that calculates the value of goods or services that an ecosystem provides as monetary value.

Ecosystem

A generic term for groups of organisms and the non-biological inorganic environment surrounding them.

Ecosystem Services

This refers to goods and services the natural environment provides for human welfare. Provisioning services, regulating services, cultural services, and supporting services, which were classified by the Millennium Ecosystem Assessment, are widely used.

Intergovernmental Panel on Climate Change (IPCC)

A consultative group among governments under the UN consisting of government officials and experts of each country established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to assess the impact and risk of global warming and prepare international measures.

Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

An international body that supports the implementation of the ecosystem service policies of each country based on research results related to biodiversity and ecosystem services. Its establishment was led by the United Nations Environment Programme (UNEP) in 2012.

Natural Capital

The concept of capital was expanded to environmental materials and services. This can be said to be an accumulation of ecosystem components that enables the continuous supply of valuable ecosystem goods and services in the future.

Payments for Ecosystem Services (PES)

This is a system to promote sustainable resource use through economic incentives with the notion that the beneficiaries of ecosystem services should pay a reasonable price for the services provided by ecosystem service suppliers.

Planetary Boundary

This is a concept used in estimating the critical point where natural resources cannot support human society any more in the reality of increasing population and decreasing ecosystem resilience resulting from climate change, destruction of the ozone layer, ocean acidification, biodiversity, freshwater use, nitrogen-phosphorus cycle, and changes in land use, which are being used to set a standard that measures the limit of earth's resources.

Provisioning Service

The direct benefits humans obtain from an ecosystem such as food, water, wood, medicinal herbs, and other goods and materials.

Reducing Emissions from Deforestation and Forest Degradation (REDD+)

REDD+ refers to the efforts of each country to reduce GHG emissions caused by the conversion of forest and forest degradation. Since the Industrial Revolution, conversion of forest and forest degradation has been the second-largest GHG emission source after fossil fuels.

Regulating Service

The benefits of regulating ecosystem processes include air quality control, water quality control, climate regulation, and erosion prevention.

Supporting Service

Services necessary for the production of other ecosystem services, such as biodiversity, gene pools, etc.

Sustainable Development

The United Nations Conference on Environment & Development (UNCED) in 1992 specified that sustainable development includes economic, social, and ecological sustainability.

Sustainable Development Goals (SDGs)

In 2015, the UN General Assembly set 17 goals that should be achieved by 2030 for global sustainable development. They are the eradication of poverty, zero hunger, health and welfare, quality education, gender equality, clean water and sanitation, clean energy, good jobs and economic growth, industry/innovation/infrastructure, removal of discrimination, sustainable cities and communities, sustainable consumption and production, climate change response, marine ecosystems, land ecosystems, Peace-justice-strong institutions, and global partnerships.

Total Economic Value (TEV)

The monetary sum of direct use, indirect use, and non-use values. It is difficult to calculate the total economic value accurately in reality.

Trade-off

This refers to an exchange act in which you choose one of two preferred ecosystem services, and at the same time give up the other.

UN Framework Convention on Climate Change (UNFCCC)

To prevent global warming and respond to climate change by regulating GHG emissions, this convention was signed at the United Nations Conference on Environment & Development in 1992 and currently has 196 member countries.

Value Transfer

A value evaluation method that employs other research results of an ecosystem service whose value has already been calculated to use as value estimation results for ecosystem services with a similar size and type.

Willingness-to-pay (WTP)

To estimate the economic value of ecosystem services that are difficult to put a market price on, the ecosystem contingent valuation method (CVM) is used, where the number of people who is willing to pay are surveyed and an assessment of value is made.

2 References

Ecosystem Services Training Courses

Reference Sites

Domestic Sites

- Forest Training Institute of the Korea Forest Service https://forest.nhi.go.kr/opencrs/gocw/gOcwGuideView.do
- National Institute of Environmental Human Resources Development, Ministry of Environment https://ehrd.me.go.kr

Overseas Sites

- Business Ecosystems Training (BET, WBCSD) https://www.wbcsd.org/Programs/Redefining-Value/Business-Decision-Making/Measurement-Valuation/BET/Business-Ecosystems-Training
- Ecosystem Services and Environmental Impact Assessment (Ecosystems Knowledge Network) https://ecosystemsknowledge.net/2016/12/15/training-ecosystem-services-environmental-assessment
- Ecosystem Services Entrepreneurship : from Ideas to Business (Ecostar) https://www.ecostarhub.com/e-learning-course/
- Ecosystem Services for Site Managers (Eurosite) https://www.eurosite.org/events/training-ecosystem-services-site-managers/
- Ecosystem Services for Sustainable Development (University of Geneva) https://www.coursera.org/learn/ecosystem-services
- Measuring Ecosystem Services (Tropical Biology Association) http://www.tropical-biology.org/specialist-course/past-specialist-course-test/
- NCP 101 (Natural Capital Project) https://www.naturalcapitalproject.org/training-program/
- Overview of ES Training Courses (ESP) https://www.es-partnership.org/services/training-education/training-education-repository/
- TEEB Training Package (TEEB) http://www.teebweb.org/resources/training-resource-material/
- The Economics of Land Degradation (ELD) https://gc21.giz.de/ibt/var/app/wp342P/1844/index.php/contents/
- Values Training Courses (GIZ) http://aboutvalues.net/trainings/

Major Domestic Courses

Course Name	Operating Institute	Period	Method
Ecosystem Service Course	National Institute of Environmental Human Resources Development	Three Sessions	Online
REDD+ Basic Course	Forest Training Institute	2 Days	Workshop
REDD+ Expert Training Course	Forest Training Institute	5 Days	Workshop
Urban Forest Training for Local Government Officers	Forest Training Institute	2 Days	Workshop
Understanding of Forest Ecosystem Course	Forest Training Institute	15 Sessions	Online
Urban Forest Creation and Management Course	Forest Training Institute	16 Sessions (2 Days)	Online

Major Foreign Courses

Course Name	Operating Institute	Period	Method
Basics on Ecosystem Services	GIZ	2~5 Days	Workshop
Principles of Ecosystem Services Assessments for Policy Impacts	GIZ	2~5 Days	Workshop
Economic Valuation of Ecosystem Services – Principles, Approaches & Applications	GIZ	2~5 Days	Workshop
Payments for Ecosystem Services	GIZ	4~5 Days	Workshop
Integrating Ecosystem Services into Development Planning	GIZ	2~5 Days	Workshop
Ecosystem Services for Site Managers	Eurosite	2 Days	Workshop
TEEB Training for National Level Implementation	TEEB Office	27.5 Hours	Workshop
Measuring Ecosystem Services(TESSA)	Tropical Biology Association	4 Days	Workshop
Ecosystem Services in Sustainable Development	University of East Anglia	6 Days	Workshop
Business Ecosystems Training (BET)	WBCSD	2.5 Days	Workshop
Incorporating Ecosystem Services and Natural Capital into Environmental Assessment	Ecosystems Knowledge Network	1 Days	Workshop
Valuing and Capturing the Benefits of Ecosystem Restoration	ESP	1~2 Days	Workshop
The Economics of Ecosystem Services and Biodiversity: Valuation of Protected Areas in Eastern Europe	BfN	5 Days	Workshop
The Economics of Land Degradation (ELD)	ELD	11 Weeks	Open online course
Ecosystem Services: a Method for Sustainable Development	Coursera, University of Geneva	5 Weeks	Open online course
Ecosystem Services Entrepreneurship: from Ideas to Business	Ecostar	150 Hours	Online course
NCP 101	Natural Capital Project, Stanford University	No limit (Self-directed Time Management)	Online course

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