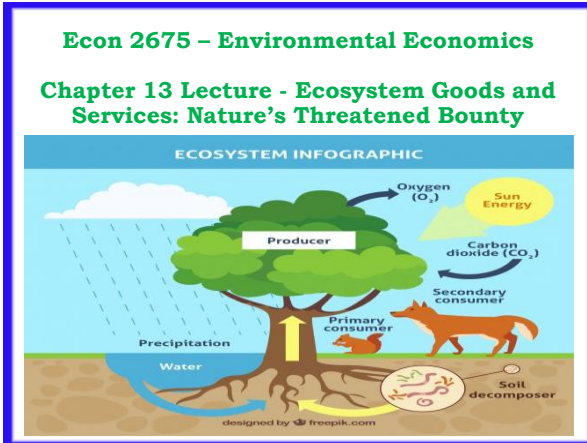


# Chapter 13 Lecture - Ecosystem Goods and Services: Nature's Threatened Bounty



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**The State of Ecosystem Services**

- **Millennium Ecosystem Assessment**
- **Ecosystems have changed rapidly in the last 50 years.**
- **Many of the changes to ecosystems have been at the expense of ecosystem health.**
- **If degradation continues, it will be difficult to achieve many of the U.N. Millennium Development Goals.**
- **Significant changes in institutions and policies are required to reverse the degradation.**

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# Chapter 13 Lecture - Ecosystem Goods and Services: Nature's Threatened Bounty

## The State of Ecosystem Services

### The Economics of Ecosystems and Biodiversity report

- Examines the costs of inaction on the decline of biodiversity worldwide
- Finds that by 2050 under several “business as usual” scenarios an additional 11 percent of remaining biodiversity could be lost, 40 percent of low-impact agriculture could be converted to intensive agriculture, and 60 percent of coral reefs could be gone by 2030.

<https://www.unep.org/topics/teeb>

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## Economic Analysis of Ecosystem Services

- Economic analysis is helpful both in identifying sources of economic degradation and in evaluating possible approaches to maintain and restore these services.
- Valuing service flows can also be useful in benefit cost analysis.
- Commonly used methods:
  - Revealed preference methods
  - Stated preference methods
  - Adjusted market prices
  - Avoidance costs (averting expenditure)
  - Production function methods
  - Damage costs avoided

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### USE VALUE

### NON-USE VALUE

DIRECT USE VALUE	INDIRECT USE VALUE	OPTION VALUE	LEGACY/ ALTRUISTIC VALUE	INTRINSIC VALUE
• Direct market value of natural products (e.g. food, fuel, raw materials)	• Value derived from ecosystem services (e.g. flood control)	• Value of the future potential of a complete and healthy environment (e.g. genetic resources)	• Value of leaving the environment intact for future generations	• Value of nature and its beauty by and for itself

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### Methods for Assigning Monetary Value to Ecosystem Services

Revealed-preference	Stated-preference	Cost-based
<b>Market methods:</b> Valuations are directly obtained from what people must be willing to pay for the service or good.	<b>Contingent valuation:</b> People are directly asked their willingness to pay or accept compensation for some change in ecological service.	<b>Replacement costs:</b> The loss of a natural system service is evaluated in terms of what it would cost to replace that service.
<b>Production approaches:</b> Service values are assigned from the impacts of those services on economic outputs (e.g., increased shrimp yields from increased area of wetlands).	<b>Conjoint analysis:</b> People are asked to choose or rank different service scenarios or ecological conditions that differ in the mix of those conditions.	<b>Avoidance or Damage costs:</b> A service is valued on the basis of costs avoided, or of the extent to which it allows the avoidance of costly averting behaviors, including mitigation.
<b>Travel cost:</b> Valuations of site-based amenities are implied by the costs people incur to enjoy them.		
<b>Hedonic methods:</b> The value of a service is implied by what people will be willing to pay for the service through purchases in related markets, such as housing markets.		

(from Farber et al. 2006, pg. 120)

<https://www.slideshare.net/maggiewinslow/ecosystem-service-valuation-winslow>

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# Chapter 13 Lecture - Ecosystem Goods and Services: Nature's Threatened Bounty

## Coral Reefs

- Coral reefs are an integral part of an extensive and vital landscape of coastal ecosystems.
- Some of the threat to coral reefs is due to pollution, overfishing, climate change (specifically, rising water temperatures).



<http://www.qatarmarine.net/diving-environment/marine-ecology/coral-reef-facts/>

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## Benefits from ecosystem services in coral reef ecosystems

CORAL REEFS		Value of ecosystem services (in US\$ / ha / year – 2007 values)		
Ecosystem Service	Average	Maximum	Number of Studies	
<b>Provisioning services</b>				
Food	470	3,818	22	
Raw materials	400	1,990	5	
Ornamental resources	264	347	3	
<b>Regulating services</b>				
Climate regulation	648	648	3	
Moderation of extreme events	25,200	34,408	9	
Waste treatment / water purification	42	81	2	
Biological control	4	7	2	
<b>Cultural Services</b>				
Aesthetic information / Amenity	7,425	27,484	4	
Opportunities for recreation and tourism	79,099	1,063,946	29	
Information for cognitive development	2,154	6,461	4	
<b>Total</b>	<b>115,704</b>	<b>1,139,190</b>	<b>83</b>	
<b>Supporting Services</b>				
Maintenance of genetic diversity	13,541	57,133	7	

*Note: these estimates are based on ongoing analyses for TEEB (TEEB Ecological and Economic Foundations, Chapter 2). As the TEEB data base and value analysis are still under development, this table is for illustrative purposes only.*

*Note: ha = hectare, a metric unit of area defined as 10,000 square meters.*

*Source: TEEB, 2009, Climate Issues Updated (September) Table 1, p. 7.*

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## The Value of Coral Reefs in the U.S. Virgin Islands

The United States Virgin Islands (USVI) are located approximately 100 miles east of Puerto Rico by air. The four main islands are St. Croix, St. John, Water Island, and St. Thomas.

Recognizing the value of the local coral reefs and needing a baseline to provide a quantitative measure with which to compare possible alternative development/conservation plans, a study was commissioned to derive a total economic value (TEV) for these reefs. A TEV framework attempts to measure value from both use and nonuse values. This information was also felt to be useful in providing an economic basis for advocating for the preservation of these coral reefs, for establishing the basis for any damage compensation, and for determining potential user fees for residents and tourists.

This study focused on valuing the six main uses of coral reefs and adjacent habitats in selected sites on the USVI: (1) fishery value, (2) tourism value, (3) recreational and cultural value, (4) real estate value, (5) the value of shoreline protection, and (6) education/research values.

The study involved a wide range of valuation methodologies including (1) a revealed preference study of the commercial value of the fishery, (2) a local resident survey aimed at estimating the local cultural and recreation attachment to the marine environment, (3) a tourist survey using both travel cost and choice experiment methods to get a comprehensive insight into the importance of the marine environment for visitors to the USVI, (4) an analysis of the coastal protection function of reefs, (5) a hedonic pricing analysis to discern the positive impact of healthy reefs on house prices, (6) a GIS analysis aimed at preparing value maps of the coral reefs of the USVI, and (7) an aggregation of the separate components to produce the estimation of the TEV of these coral reefs.

This study found the TEV to be \$187 million per year with the values of the component parts found to be as follows:

- Reef related tourism—\$96 million
- Recreation—\$48 million
- Amenity—\$35 million
- Coastal protection—\$6 million
- Support to commercial fisheries—\$3 million

Note that tourism and recreation once again comprise the largest sources of value for this individual case as it did for the global total considered previously.

Source: van Beukering, P., Brander, L., van Zanten, B., Verbrugge, E., & Lems, K. (2011). The economic value of the coral reef ecosystems of the United States Virgin Islands. Final report. IVM Institute for Environmental Studies Report Number: 01-11-06. The Netherlands. Amsterdam (31 August).

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## Demonstrating the Value of Ecosystem Services

### • Damage Assessments: Loss of Ecosystem Services

- **Oil spills:** Through a process known as the Natural Resources Damage Assessment, trustees of the affected ecosystem must attempt to quantify the extent of damages caused by a spill in order to seek compensation from the responsible parties.



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# Chapter 13 Lecture - Ecosystem Goods and Services: Nature's Threatened Bounty

## Demonstrating the Value of Ecosystem Services

### Valuing Supporting Services: Pollination

- Pollination services supplied by bees is a valuable ecosystem service with multiple benefits
  - Aiding in genetic diversity
  - Ecosystem resilience and nutrient cycling
  - Increasing the productivity of agricultural crops
  - Many valuable agricultural crops rely on bees for pollination.



<https://royalsocietypublishing.org/doi/10.1098/rspb.2020.0922>

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## Demonstrating the Value of Ecosystem Services

### Valuing Supporting Services: Forests and Coastal Ecosystems

- Valuation methods have been used extensively to value forest ecosystem services, coastal and marine ecosystem services, and biodiversity.
- Quantifying the benefits of these services can provide an empirical foundation for decision-making and priority setting.

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## Demonstrating the Value of Ecosystem Services

### Challenges and Innovation in Ecosystem Valuation

- In order for valuations to be useful, their derivations must be based upon consistent methodologies.
- Achieving this kind of consistency requires precise definitions of the services, as well as agreement of how these services contribute to value.
- It also requires that the valuation procedures avoid double counting.

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## Ecotourism

Ecotourism is defined as: Environmentally responsible travel to natural areas, in order to enjoy and appreciate nature (and accompanying cultural features, both past and present) that promotes conservation, has a low visitor impact and provides for beneficially active socio-economic involvement of local peoples (Nature Conservancy and the World Conservation Union).



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## 8 Incredible Eco-Friendly Destinations In The World

1. Costa Rica - The country undoubtedly most associated with ecotourism, Costa Rica has made a name for itself as a travel destination because of its well-protected natural beauty.
2. Norway - Norway might not be a place that first comes to mind when thinking of ecotourism, but the country's culture of trying to live sustainably has influenced its travel industry extensively — especially in the Norwegian Fjords.
3. Kenya - Kenya is one of the prime destinations to take an African safari due to its grasslands full of animals such as giraffes, lions, and rhinos.
4. Palau - Palau, an island nation in the western Pacific that is part of Micronesia, is known more for its oceans than for its land.

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5. Galapagos Islands - In 1978, the Galapagos Islands were declared the first ever Natural World Heritage Site due to the amazing and unique fauna that call the archipelago home.
6. Antarctica - Antarctica remains one of the least-touched places on Earth for obvious reasons — you can only even reach the landmass during the summer.
7. Iceland - Iceland has recently become a top tourist destination as it lures visitors in with its remote beauty.
8. Amazon Rainforest - The Amazon has already suffered extremely from climate change and the encroachment of man, but some areas around the huge forest are aiming to change that by having native become guides to lead tourists around the forests in ways that are sustainable and even promote the health of the ecosystem

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## The Special Problem of Protecting Endangered Species

Economists have developed programs that attempt to reduce habitat fragmentation:

- Conservation Banking
  - The Agglomeration Bonus
  - Safe Harbor Agreements
- Conservation Banking
- A conservation bank is a parcel of land containing natural-resource values that are conserved and managed, in perpetuity, through a conservation easement held by an entity responsible for enforcing the terms of the easement.

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# Chapter 13 Lecture - Ecosystem Goods and Services: Nature's Threatened Bounty

## Conservation Banking: The Gopher Tortoise Conservation Bank

In rapidly growing Mobile County, Alabama, the gopher tortoise faced survival problems due to the disappearance of its habitat. Since the tortoise is federally listed as a threatened species under the Endangered Species Act (ESA), small landowners were forced to observe some rather severe restrictions on their use of the land. Because these restrictions were quite burdensome for the landowners and the resulting fragmented, patchy habitat proved ineffective in protecting the tortoise, these restrictions created quite a conflict in the community.

A conservation bank established by the Mobile Area Water and Sewer System (MAWSS) in 2001 reduced the conflict, allowing development to continue in other areas while restoring and permanently protecting a much more suitable large tract of the long-leaf pine habitat that the tortoise prefers.

MAWSS owns a 7000-acre forest that buffers and protects the county's water supply. Under the terms of its conservation bank, MAWSS has agreed to set aside 222 acres, forgo any development on that land, and manage it in perpetuity for the benefit of gopher tortoises. Landowners who want to build on tortoise habitat elsewhere in Mobile County can purchase "credits" from the bank, and thereby be relieved of their ESA responsibilities to set aside a small patch of their land. The tortoises benefit because the large tract of contiguous, suitable habitat is vastly superior to a network of small, unconnected patches of land, while the landowners can now develop their land by helping to fund (through the purchase of credits) this tortoise habitat.

Source: Environmental Defense's Center for Conservation Incentives. (February 24, 2003). Gopher tortoise conservation bank: Mobile area landowners and wildlife get help. Retrieved from <http://www.environmentaldefense.org>

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## The Special Problem of Protecting Endangered Species

### • The Agglomeration Bonus

• It is a voluntary incentive mechanism that is designed to protect endangered species and biodiversity by reuniting fragmented habitat across private land in a manner that minimizes landowner resistance.

### • Safe Harbor Agreements

• Any landowner who agrees to carry out activities expected to benefit an endangered species is guaranteed that no added Endangered Species Act restrictions will be imposed as a result.

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## Moving Forward

- In practice developing innovative mechanisms like payments for ecosystem services or carbon sequestration credits is challenging, especially in developing countries.
- Performing economic analysis on ecosystem is a new subfield, and it is experiencing some growing pains, but early successes and new innovations indicate that its future is promising.

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