# Economic valuation of Ecosystem Services : Applications and Uncertainties

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## Introduction

Ecosystems are under constant pressure from competing landscape uses such as agriculture, urban sprawling and industrial development. Much hoped has been placed in the ability of ecosystem service valuation (ESV) to provide economic rational to promote conservation. Furthermore, ESV values have been used to guide agricultural policies in allocating optimal landscape use.[1] However ESV values are complex and contain high degrees of uncertainties and should be used with caution. In this paper we seek to communicate key information necessary to adequately identify the context in which ESV value can be applied and the extent on which they can be relied upon. We consider three of the common economic values found in ESV studies: Benefit Values, Replacement Cost and Damage Avoided.

## Ecological Services(ES)

**Ecological services** (ES) are defined as the benefits that humans obtain from ecosystems.[2]

Examples of Ecological Services:

- Water purification and regulation
- Habitat for biodiversity
- Recreation activities (i.e. fishing, hiking)

**Essential and Non Essential Ecological Services**

Classifying ES in Essential and Non Essential will be helpful to identify the adequate economic valuation method. Essential ES are those that are necessary for survival, this includes drinkable water and clean air. However society may judge that other ES are essential such as the protection of an endangered species or the conservation of a specific type of habitat (i.e. wetlands).

| | Type de service écologique | | Types of application | | | |
|---|---|---|---|---|---|---|
| Estimation Method | Essential | Non Essential | Raise awareness | Compensation | Landscape tradeoffs | Paiement for ES (PES) |
| Replacement Cost | ✓ | | ✓ | ✓ | ✓ | |
| Damage Avoided cost | | ✓ | ✓ | ✓ | | ✓ |
| Marginal Benefit | | ✓ | ✓ | | ✓ | ✓ |
| Aggregated Values | ✓ | ✓ | ✓ | | | |

## Types of application

### Raise Awareness

Highly uncertain data can be valuable to help raise awareness and explicitly make the link between ecosystems and human welfare.

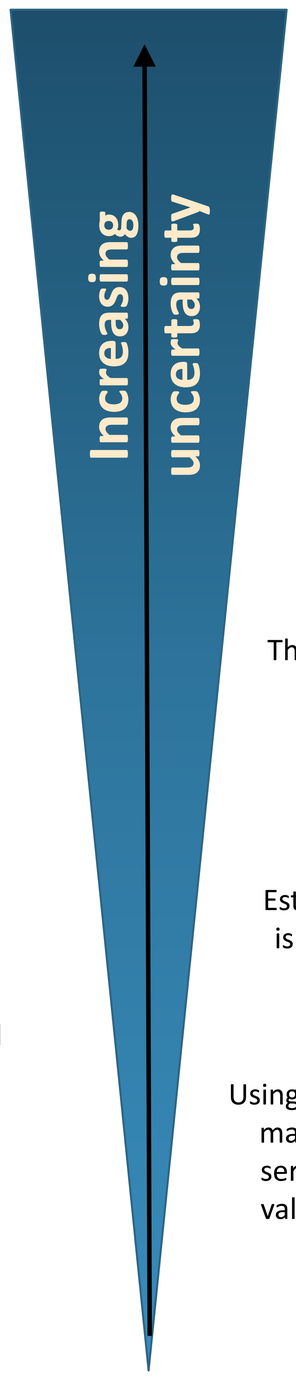
### Landscape Management

Using cost-benefit and cost-effectiveness analysis to determine optimal landscape allocation. Guide choices when trade-offs must be made between agricultural ecosystem services.

### Real Transaction

Highest degree of certainty is necessary to determine values for real transaction. This could be for a monetary compensation value or to determine a new tax.

## Degree of Uncertainty




## Economic valuation methods

### Social Cost of Carbon (SCC)

SCC is widely used in cost-benefit analysis however the many sources of extreme uncertainty may limit its usefulness.[3]

### Damage Avoided

Has been shown empirically to give very inaccurate estimation of true cost.[4]

### Replacement of Habitat for Biodiversity

The cost of acquiring or restoring a habitat is accurate. However the capacity of a replacement habitat to properly offset biodiversity loss is difficult to predict.

### Replacement by technologies

Estimating cost by the a replicating technology is accurate when the technology exist and its efficiency is know.

### Stated Preference Surveys

Using a stated preference survey to evaluate the marginal economic benefit of an ecosystem service has been shown to produce reliable values when internal and external validities have been verified.[5]

## Economic valuation methods

**Replacment Cost** : Replacing an ecosystem service is sometimes possible by either replicating an ecosystem to produce the same service or by finding a technological substitute.

**Damage Avoided Cost** : Some ecosystems provide protection from irregular weather and naturel disasters, preventing damage to public infrastructure, private property and livelihoods, this valuation method estimates the cost of such damage.

**Marginal Benefit** : Ecosystems services render benefits to members of society. The goal of stated preference methods is to estimate a *marginal benefit, or* willingness-to-pay for these benefits.

## Conclusions

The economic valuation of ecological services can provide valuable information to guide agricultural policies aimed at protecting ecosystems important for the welfare of society. However, care must be taken to adequately identify the context in which ESV value can be applied and the extent on which it they can be relied upon.

## Contact

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Fonds de recherche Société et culture Québec

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