



Putting a price on nature

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Fictitious case 1

- 1 hectare of deciduous forest has been (illegally) destroyed
- How can we value this?
 - Identify the **ecosystem services** associated with this forest
 - provisioning, such as the production of food and timber
 - regulating, such as carbon sequestration, local climate control, erosion prevention
 - supporting, such as nutrient cycles and oxygen production
 - cultural, such as spiritual and recreational benefits.



Valuing nature

- Total Economic Value (TEV)
 - Anthropocentric concept: value assigned by humans
 - Context dependent: time, cultural context, religion, scientific knowledge matter...
 - Sum of several components
 - Different ecosystem services
 - Different economic values
 - Use value: benefits derived by individual ('me')
 - Option value: possible future benefits derived by individual ('me')
 - Non-use value: individual values benefits derived by others (now or in the future); nature is important as such (existence value)
 - ⇒ we are stewards, not owners, of nature
 - ⇒ sustainable development

Using the value of one particular ecosystem service to value the entire ecosystem is a serious underestimation of this value

The share of the non-use value is estimated to account for 40 to 90 percent of the total economic value

Monetary valuation

EASY



- Is there a price available?

- Timber
- Food
- CO₂

Corrections for taxes, subsidies and market failures may be needed

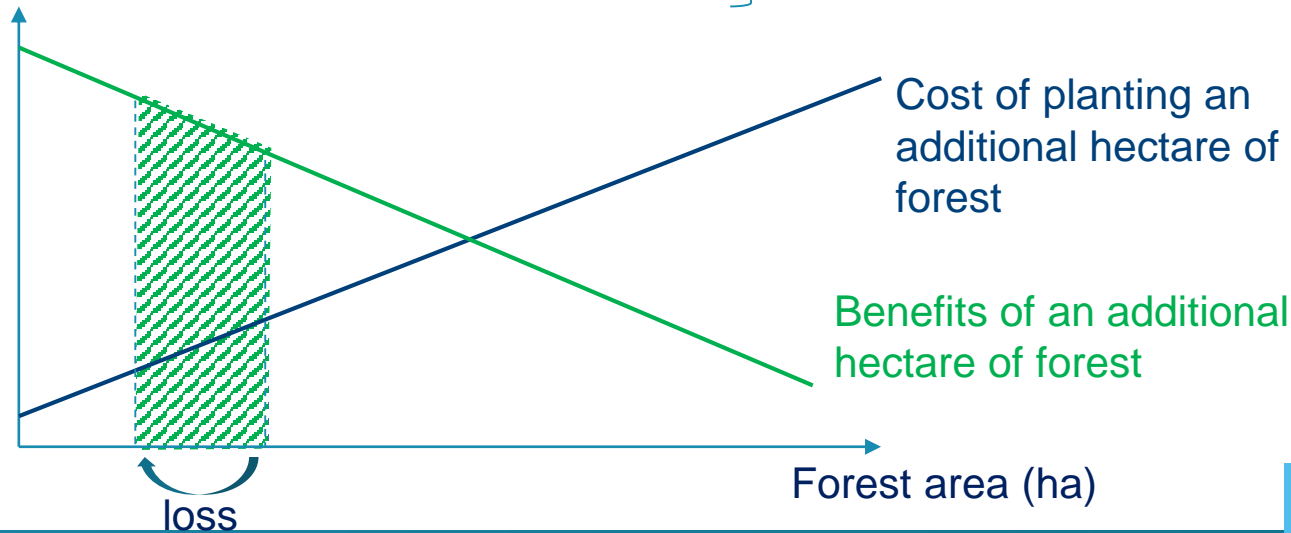
Price of carbon EU ETS is now approx. 20 euro per ton, while social cost of carbon is conventionally estimated between 40 and 100 euro per ton

- Is there a cost estimate available?

- Cost of planting a new forest (restoration)
- Cost of building noise mitigation screens

Focus on costs rather than benefits typically leads to underestimation of value

Euro per ha



CHALLENGING

Monetary valuation

- Is there a **related market/ activity**?
 - Housing market: homes near forests sell at a higher price
 - Tourism and trips: people are willing to travel (spend time, money) to visit a particular forest
 - ⇒ Based on real behavior
 - ⇒ Data availability can be problematic (privacy concerns, time consuming)
 - ⇒ Econometric techniques are more complex
 - ⇒ Context dependent


 - ⇒ **ONLY USE VALUES**



CHALLENGING

Monetary value

- How do we measure non-use values?
 - Surveys – ask individuals in an indirect way (CV = contingent valuation)
 - Hypothetical bias (stated preferences)
 - Use and acceptability in courts is subject of debate



“CV has been used officially and unofficially by Federal and State agencies in the USA for a number of decades, although its use accelerated in the early 1980s. The results of CV studies have guided resource regulation and environmental protection, and they have been accepted by Courts in legal cases.” (Loomis, 2001)



“US courts have occasionally found that CV studies may be presented in court if they meet standard tests for the admission of expert evidence. However, in no case has a court actually relied upon a CV or similar study in determining the value of damages in an NRD case. Furthermore, several courts have ruled that CV studies are so unreliable that they cannot even be admitted into evidence.” (Israel et al., 2017)

CHALLENGING

Fictitious case 2



- Suppose a prosecutor is confronted with the following case. A farmer has expanded his business without a permit and has built an additional shed with an access road. To this end, he destroyed a nearby meadow with several small landscape elements including an ancient oak tree. The area involved is 0.5 hectares.

How can the damage be valued?

- First step: remarkable vs ordinary natural entities?

Remarkable versus general biodiversity

- Remarkable biodiversity

- corresponds to entities (genes, species, habitats, landscapes) that society has identified as having an **intrinsic value** and based mainly on values other than economic
- the distinction of "remarkable" entities is not purely biological: it combines
 - **ecological** (rareness or determining functional role in the case of species),
 - **sociological** (the "heritage" aspect),
 - **economic** (the predominance of the non-use values over the use values)
 - and in some case **legal** (areas protected by statute, species on an official list) **criteria**.

- General (or ordinary) biodiversity

- **without intrinsic value** on its own but which, by the abundance of its entities and the multiple interactions between them, contributes in various degrees to the functioning of ecosystems and the production of the services that our societies find in them.

Case 1



A reference value is a predetermined value that is used by public administrations and corresponds to a minimum value on which a scientific consensus exists

- Ancient oak tree:
 - Remarkable entity
 - Do not use reference values
 - Indication of the seriousness of the offense
 - Aggravating factor in determining and motivating the sanction
- Meadow with small landscape entities
 - General biodiversity
 - Reference values can be used
 - Flanders - Belgium (Nature Value Explorer): 2332 to 3430 euro per hectare per year
 - France (Chevassus-au-Louis et al., 2009): 666 euro per hectare per year

	Monetary value (euro per hectare per year)	Flanders (nature value explorer)		France (reference value permanent grassland)	
		Low estimate	High estimate	High estimate	
Provisioning services	- Food production	-1121	-1636		
	- Wood	0	0		
	- Livestock			(market value)	
	- Subsidiary products			Undetermined	
Regulating services	- Air quality – PM capture	-1129	-2155	Undetermined	
	- Mitigation noise pollution	0	0		
	- Erosion prevention and sediment retention	Undetermined	Undetermined	Undetermined	
	- Climate change: carbon sequestration in soil	-168	-1291	-320	
	- Climate change: carbon sequestration in biomass	0	0	-47	
	- Water quality: Denitrification	-5.4	-80	-90	
	- Water quality: N leaching to water	117	1732		
	- Water quality: P leaching to water	125	1248		
	- Water (annual quantity)			0	
	- Water (flow regulation)			Undetermined	
	- Pollination			-80	
	- Biodiversity			Undetermined	
	Cultural services	- Total cultural services via stated preferences	0	0	
		- Recreational amenity value	-34	-101	-69
- Amenity value by residents		0	0		
- Health effects of contact with nature		-80	-80		
- Landscape value				-60	
Non-use value					
	Undetermined	Undetermined			
Total (euro per hectare per year)	-2332	-3430	-666		

Case 1

- The meadow (0.5 ha) provides a **continuous flow of benefits** and its destruction entails a loss in each of the subsequent years.
- **Discounting** of these annual losses (net present value) is needed (here over 20 years):

$$1166 + \frac{1166}{1,04} + \frac{1166}{(1,04)^2} + \dots + \frac{1166}{(1,04)^{20}} = 17012 \text{ euro}$$

- Social discount rate:
 - Typical 2% to 4%
 - The lower the discount rate, the more weight is given to the future

Fictitious case 3

- Suppose a public prosecutor is confronted with the following case. In a house search, 10 unregistered (non-ringed), illegally caught song thrushes (*turdus philomelos*) were found.
- The song thrush is **not threatened** and can therefore be treated as an **ordinary** natural entity.



Case 3

- Value of a song thrush
 - Option 1: commercial sales value
 - Online we can find song thrushes offered for 20 to 75 euro per specimen
 - This price reflects part of the use value

koppel zanglijsters
kurt
mooi koppel wildkleur zanglijsters 017 weg wegens
omstandigheden enkel telefonisch 0496 83 17 18 Geetbets

€ 100,00
2 bieding(en)

13 augustus 2018 - 16:35 | Berlaar



Cinnamon Song Thrush **£75**

Category: Passerines Gender: Mixed Gender
Advert Type: For Sale

I have for sale various Cinnamon Song Thrushes. Some 2018 and some a little older. Pairs and single cock birds. All closed rung and ...

1

Charsfield

Case 2

- Value of a song thrush

- Option 2:

- Finnish bird list
- 34 euro

- Option 3:

- [Spanish Hunting Law of 1978](#) (BOE-A-1978-6997): monetary values per illegally caught species of game
- Thrushes fall under 'non-threatened other birds' and were valued at [100 pesetas](#) each
- Correction for exchange rate and inflation (CPI = Consumer Price Index):

100 pesetas in 1978 = 0.6 euro in 1978

= 0.6 x CPI 2016 / CPI 1978

= 0.6 x 106.296 / 15.935 in 2016

= 4 euro in 2016

lapintiira (*Sterna paradisaea*) 84 €
lapinuunilintu (*Phylloscopus borealis*) 505 €
laulujoutsen (*Cygnus cygnus*) 2018 €
laulurastas (*Turdus philomelos*) 34 €
lehtokerttu (*Sylvia borin*) 34 €
lehtopöllö (*Strix aluco*) 673 €

Caza menor

Especie – Unidad	Valoración con independencia de sexo y edad
Urogallo	50.000
Avutarda	40.000
Gansos	5.000
Perdices o becada	600
Conejo	250
Liebre	300
Mamíferos predadores	1.000
Faisán	500
Ganga u ortega	400
Patos, sisón o alcaraván	350
Palomas, tórtola o codorniz	200
Focha o becacina	150
Garzas	1.000
Garcillas o somormujos	300
Aves marinas	500
Otras aves	100

Case 2

- Legislation of 2017 for the Spanish province of Andalusia includes a list of monetary values for protected game, including Latin generic names (Decreto 126/2017)
 - Explicit value for the song thrush, namely 8 euro per specimen
 - These values, which are based on species vulnerability, public investment in the species and a public consultation of experts and other interested parties, can be seen as a proxy of the existence value of the species (e.g. song thrush) and reflects part of the non-use value.

CAZA MENOR	VALOR EUROS
Conejo (<i>Oryctolagus cuniculus</i>)	38
Liebre (<i>Lepus capensis</i>)	76
Perdiz (<i>Alectoris rufa</i>)	57
Becada (<i>Scolopax rusticola</i>)	57
Codorniz (<i>Coturnix coturnix</i>)	19
Tórtola común (<i>Streptopelia turtur</i>)	19
Paloma torcaz (<i>Columba palumbus</i>)	19
Paloma zurita (<i>Columba oenas</i>)	19
Paloma bravía (<i>Columba livia</i>)	19
Estornino pinto (<i>Sturnus vulgaris</i>)	8
Zorzal real (<i>Turdus pilaris</i>)	8
Zorzal alirrojo (<i>Turdus iliacus</i>)	8
Zorzal charlo (<i>Turdus viscivorus</i>)	8
Zorzal común (<i>Turdus philomelos</i>)	8
Avefría (<i>Vanellus vanellus</i>)	8
Otras especies cinegéticas	8

Case 3

- We can add two estimates of value when they both appreciate a different aspect.
 - This gives an estimate of 28 to 109 euros per specimen
 - This gives an indication of the lower limit of the environmental damage in this case.
 - Thereafter, this estimate can be corrected to reflect other aspects of the case such as intent or to fully include the non-use value.



Some concluding remarks

- Valuing fauna, flora and biotopes is not easy
 - After all, value encompasses **different facets** based on a range of ecosystem services ranging from simple-to-understand services such as food production to less tangible services such as spiritual experience.
 - To accommodate this **heterogeneity** in ecosystem services, there are different approaches that each estimate certain parts of the total value.
 - It is important to realize that these valuation methods lead to **estimates of value** and therefore **not to exact amounts**.
 - In addition, the estimates are **sensitive to the context** in which the study is conducted and to the specific assumptions of the **method** used.
 - So there are **no simple universal rules** available to value nature and natural entities. The concrete valuation of environmental damage is and remains an important challenge.

Some concluding remarks

- The division between ordinary and remarkable natural entities is crucial.
 - Economic valuation of 'ordinary' natural entities can use reference values.
 - These reference values can best be regarded as a starting point and not as a definitive answer to the question of how high a fine or a compensation should be.
 - These reference values can therefore be adjusted by authorities or judges to reflect other elements that determine the seriousness of the facts such as repetition, intent or profit.
 - Indicators are therefore a relative element rather than an absolute element in the punishment of green crimes.
 - However, economic valuation of 'remarkable' entities cannot use such reference values.
 - A specifically designed valuation study is required
 - The destruction of extraordinary entities can be regarded as a serious offense which must be punished proportionally.



Any questions?
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Some useful sources

- Annex 1 van Decreto 126/2017, de 25 de julio, por el que se aprueba el Reglamento de Ordenación de la Caza en Andalucía. Boletín Oficial de la Junta de Andalucía - Histórico del BOJA Boletín número 149 de 04/08/2017 <http://www.juntadeandalucia.es/boja/2017/149/5>
- Chevassus-au-Louis, B., Salles, J.-M. and Puyol, J.-L. (2009). An economic approach to biodiversity and ecosystems services. Contribution to public decision-making. Centre d'analyse stratégique. http://www.strategie.gouv.fr/IMG/pdf/BIODIV_GB_19_02_2010pdf.pdf
- DG Regio (2015). *Guide to cost benefit analysis of investment projects*. ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf
- Nature Value Explorer Flanders (in Dutch and in English): www.natuurwaardeverkenner.be
- Rousseau, S. (2018). De waardering van schade aan fauna, flora en biotopen. In: Billiet, C.M. (ed.). *In Vlaamse savannes en Waalse regenwouden. Biodiversiteitsmisdrijven in eigen land*. Die Keure, p.183 – 205
- TEEB – The economics of ecosystems and biodiversity: www.teebweb.org