



# COST-BENEFIT ANALYSES AND THE ENVIRONMENT

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# Introduction

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- OECD published *Cost-Benefit Analysis and the Environment: Recent Developments* in 2006.
- Much relevant work has been done since then.
- OECD's work includes:
  - [A meta-analysis](#) of VSL estimates (2012)
  - [The Cost of Air Pollution](#) (2014)
  - A discussion of monetary carbon values in policy assessments (2015)
  - An assessment of the economic costs of *morbidity* impacts of air pollution (2015).
  - Two reviews of recent work done by other authors (2015).
- An update of the 2006 book is being prepared.



# What is an externality?

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- When person A carries out a certain activity that causes **impacts on someone else which person A does not have an economic incentive to take into account** when deciding on his activity level, an **externality** exists.
- Externalities can be
  - **positive** (innovation spillovers); or
  - **negative** (pollution).



# Why should we value external costs?

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- An important economic rationale for public policies is to correct “**market failures**” – situations where “leaving everything to the market” will **not** lead to economically efficient outcomes.
- The existence of externalities is one of the most important examples of “market failures”.
  - Other examples include information asymmetries, non-competitive markets, principal–agent problems and public goods.
- To know what would be the best “dosage” of public policies, it is necessary to know the **magnitude** of the externalities, and to put an **economic value** on them.
- This will allow a comparison of **benefits** and **costs** of possible policy interventions.



# The role of cost-benefit analyses (CBA)

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- CBA can, and should, be carried out
  - **Ex ante**, when a new policy or project is being prepared
  - **Ex post**, after the policy or project has been implemented.
- **Obviously**, the outcome of a CBA should not alone “dictate” the policy choices to be made.
- Distributive impacts of the policy can e.g. also be important.
- Systematic use of CBA can provide a better basis for making well-informed and coherent policy choices.



# Benefits of *ex post* evaluation

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- There are still relatively few systematic *ex post* evaluations of environmental policies in general.
- More extensive evaluation evidence would have a number of benefits:
  - Help to **improve the administration of current policy**, and contribute to a process of policy reappraisal, modification and improvement.
  - **Improve the choice of instruments in future policy**, by demonstrating how different instruments perform in specific contexts.
  - Contribute to **better communication** with stakeholders and the public about the purpose, operation and effects of policy.



# Example: Carbon values in policy and project appraisal – potential applications

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- **Project cost-benefit analysis** (project appraisal).
  - E.g., valuing the changes in carbon emissions from a public transport investment that would reduce private car use.
- **Policy cost-benefit analyses** (“regulatory impact assessments”).
  - E.g., valuing the carbon emissions savings as a result of regulations imposing an obligation on power generators to generate a certain proportion of their electricity from renewable energy sources.
- **Determining the efficient rate at which economic instruments should be set.**
  - E.g., setting the rate of a carbon tax.
- **Making decisions about long-term policy goals**
  - E.g., setting carbon targets for national environmental policy, or national negotiating positions in international climate negotiations.



# Currents use of CBA in different contexts

## Results of a recent OECD survey

		Transport investments		Energy investments		Other investments		New policy assessments		Ex post assessments	
		#	%	#	%	#	%	#	%	#	%
Are there clear criteria for how to do CBAs?	Yes	18	90%	15	75%	10	77%	15	83%	11	65%
	No	2	10%	5	25%	3	23%	3	17%	6	35%
	Total	20	100%	20	100%	13	100%	18	100%	17	100%
What is the share of cases in the last 3-5 years that have been CB-analysed?	All	3	16%	3	19%	3	25%	4	25%	0	0%
	Most	14	74%	6	38%	5	42%	8	50%	4	27%
	Some	1	5%	3	19%	4	33%	3	19%	6	40%
	A few	1	5%	3	19%	0	0%	1	6%	2	13%
	None	0	0%	1	6%	0	0%	0	0%	3	20%
	Total	19	100%	16	100%	12	100%	16	100%	15	100%
	Total	19	100%	16	100%	12	100%	16	100%	15	100%
Are there clear criteria for how to include GHG emission changes?	Yes	12	63%	6	40%	3	27%	4	24%	2	13%
	No	7	37%	9	60%	8	73%	13	76%	13	87%
	Total	19	100%	15	100%	11	100%	17	100%	15	100%
What is the share of cases in the last 3-5 years where impacts on GHG emissions have been part of the CBAs?	All	1	6%	1	7%	1	10%	1	7%	0	0%
	Most	7	41%	3	21%	1	10%	2	14%	2	20%
	Some	2	12%	4	29%	1	10%	1	7%	0	0%
	A few	3	18%	1	7%	1	10%	3	21%	1	10%
	Not known	2	12%	2	14%	3	30%	5	36%	3	30%
	None	2	12%	3	21%	3	30%	2	14%	4	40%
	Total	17	100%	14	100%	10	100%	14	100%	10	100%





# General comments on CBAs

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- The data and information needed will vary widely.
- There could be major differences in the availability of data.
- For all projects or policies, there will be aspects of the costs and benefits that cannot be precisely quantified.
- In the CBA, and in interpretation of the findings, it is important that also the unquantified elements are clearly identified, and given appropriate consideration.



# The counterfactual

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- Not all of the change in producer or consumer behaviour following the implementation of a project or policy can be attributed to them.
- Some of the changes **might have occurred in any case**.
- In evaluating the effects of a project or policy we are not interested simply in describing changes, but in **ascribing cause**.
- Hence, we need to be clear about how we specify environmental policy in the hypothetical alternative:
  - What, if anything, is the alternative environmental policy against which the project or policy is being evaluated?
  - What are the pollution prevention benefits?
  - What could have happened if an existing practice continued?



# Disentangling problems

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- Policy instruments are frequently combined in a “package” of measures.
- E.g., the effects of new economic instruments can be reinforced by regulatory measures, or other measures, taken at the same time.
- It can be impossible to separate out the contribution of each measure implemented as part of a package, and the evaluation will have to focus on the joint effect of all the elements of the package.



# Timing of ex post CBAs

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- How soon after implementation should a policy or project be assessed?
- Is there any point in early evaluation, aiming to make early modifications and improvements to the programme?
- There are a number of factors which need to be taken into account:
  - Some of the behavioural responses may take time to appear.
  - However, evaluation too long after the implementation of a new project or policy is likely to mean that some of the relevant economic actors are no longer available to survey or interview.
  - Also, with the passage of time, the “counterfactual” may become increasingly imprecise.
  - Another consideration is the possibility that the behavioural response to a new policy instrument may partly anticipate its introduction.



# BIODIVERSITY AND ECOSYSTEM SERVICES IN CBA<sub>s</sub>



# Biodiversity and ecosystem services

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- *Biodiversity* is defined by the Convention on Biological Diversity (CBD) as “**the variability among living organisms from all sources** including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity **within** species, **between** species and of **ecosystems**”.
- CBD defines an *ecosystem* as “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit”,
- And CBD defines *ecosystem services* as **the benefits people obtain** from ecosystems.



# Types of ecosystem services

<b>Provisioning Services</b>	<b>Regulating services</b>
Food and fibre	Air quality maintenance
Fuel	Climate regulation (e.g. temperature and precipitation, carbon storage)
Biochemicals, natural medicines, and pharmaceuticals	Water regulation (e.g. flood prevention, timing and magnitude of runoff, aquifer recharge)
Ornamental resources	Erosion control
Fresh water	Water purification and waste management
<b>Cultural services</b>	Regulation of human diseases
Cultural diversity, spiritual, religious educational, inspirational, aesthetic values, social relations, sense of place and identity	Biological control (e.g. loss of natural predator of pests)
Cultural heritage values	Pollination
Recreation and ecotourism	Storm protection (damage by hurricanes or large waves)
<b>Supporting services</b>	Fire resistance (change of vegetation cover lead to increased fire susceptibility)
Primary production	Avalanche protection
Nutrient cycling	Other (loss of indicator species)
Soil formation	

Source: Millennium Ecosystem Assessment, 2005



# Range of values in studies of ecosystem services

International dollars per hectare per year, 2007 Price level

Ecosystem	Mean	Median	Minimum/Mean (%)	Maximum/Mean (%)
Marine	491	135	17%	339%
Coral Reefs	352,915	197,900	10%	603%
Coastal Systems	28,917	26,760	90%	145%
Coastal Wetlands	193,845	12,163	0.2%	458%
Inland Wetlands	25,682	16,534	12%	409%
Rivers and Lakes	4,267	3,938	34%	182%
Tropical Forests	5,264	2,355	30%	396%
Temperate Forests	3,013	1,127	9%	545%
Woodlands	1,588	1,522	86%	138%
Grasslands	2,871	2,698	4%	207%

Source: Adapted from De Groot et al., 2012, in an upcoming paper for OECD by Anil Markandya.





## Some findings |

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- A wide range of applications of cost-benefit assessments use biodiversity and ESS values to evaluate different policies and measures.
- There are now estimate ranges for the services from most habitats, by type of ESS, usually expressed in USD per hectare per year.
- Relatively few studies actually conduct a full-blown cost-benefit analysis.
- The most important reason is probably the need to estimate *changes in ESS* as a function of a policy change, rather than value the ESS in their current form.
- The additional data required to do that is not easily available and cannot always be collected.



## Some findings II

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- There are wide ranges of values for ecosystem services by habitat, indicating that **spatial variability** is of great importance.
- For policy assessment and cost-benefit analysis, **primary data collection** quite often seems to be required.
- There is still **some scepticism** on the use of e.g. **stated preferences** methods compared to methods that rely on market information.
- However, the evidence shows that non-market methods **can give reliable estimates** of values, ...
- ... and for some categories of value, such as **non-use**, they are the **only method available**.
- In situations comparing gains or losses from ESS against other costs and benefits, there are important distributional considerations that have to be taken into account.