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Marine Matters

Introduction to valuation

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sweep

Marine Ecosystems Research Programme

UK Research and Innovation

Natural Environment Research Council

VECTORS   DEVOTES   European MARINE BOARD   GCRF   Blue Communities
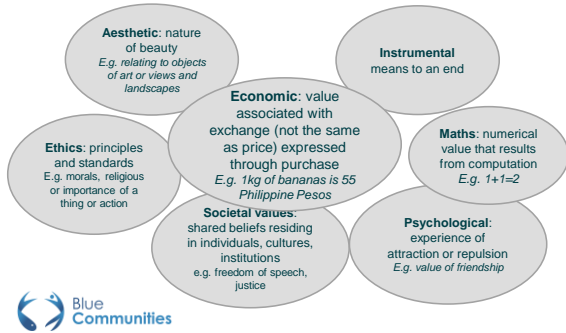

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What do we mean by "value"? And especially economic value.

Why do we want to value the environment?

Introduction to (some) valuation methods, their strengths and weaknesses.

How we can use valuation in decision making.

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Meaning of value

Aesthetic: nature of beauty *E.g. relating to objects of art or views and landscapes*

Instrumental means to an end

Economic: value associated with exchange (not the same as price) expressed through purchase *E.g. 1kg of bananas is 55 Philippine Pesos*

Maths: numerical value that results from computation *E.g. 1+1=2*

Ethics: principles and standards E.g. morals, religious or importance of a thing or action

Societal values: shared beliefs residing in individuals, cultures, institutions e.g. freedom of speech, justice

Psychological: experience of attraction or repulsion *E.g. value of friendship*

Blue Communities

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What does this mean?

- Different valuation methods needed to assess different values

- You get different valuation outcomes from different methods

Mostly focus on economic valuation that allows us to place a monetary value on goods and services.

Can also introduce some decision support tools that can use valuation evidence to support decision-making
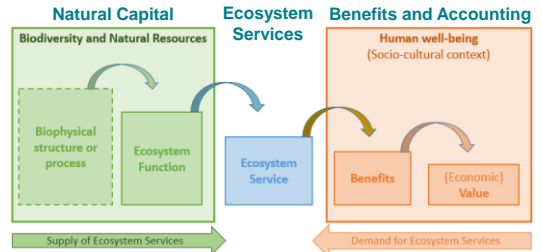

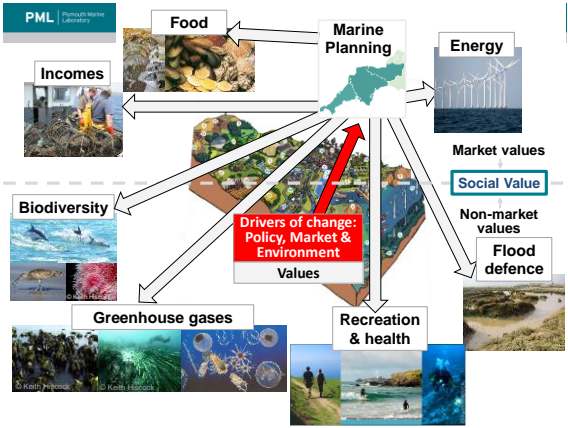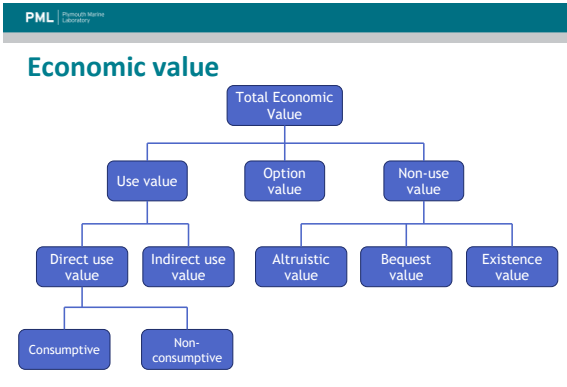**PML** | Plymouth Marine Laboratory

Economic value

Is economic value the same as price?

No

Price is determined by supply and demand and doesn't reflect:
- **Negative externalities** (e.g. environmental impacts of production)
- **Positive externalities** (e.g. benefits consumer receives from consumption of a good or service)

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Natural Capital
Biodiversity and Natural Resources

Biophysical structure or process   Ecosystem Function

Supply of Ecosystem Services

Ecosystem Services

Ecosystem Service

Benefits and Accounting
Human well-being (Socio-cultural context)

Benefits   (Economic) Value

Demand for Ecosystem Services

Economic value

Focus on economic valuation

Why do we want to place monetary values on environmental/ecosystem good and services?

Economic valuation

- There are no markets to buy or sell most environmental goods or services
- Externalities rarely captured in the price of a good

Consequence?

- We make choices that we may not have made if we knew the total value of the good/service
- We produce and consume goods that result in environmental degradation and damage to our welfare

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What can we do about it?

- Measure the externalities
- Introduce policy instruments (e.g. taxes, licences) to take account of them
- Introduce market-based instruments (e.g. using markets and prices) to incentivise behaviour change

But how big should these instruments be?

Why economic valuation?

- If we can place a financial value on ecosystem goods and services it helps places environmental goods/services on equal footing with economic and social interests
- Tool for supporting decision-making: resources are limited, choices are needed
- Helps us to understand preferences and how much something is worth to an individual, group of individuals or to society as a whole

- **What it is not:**
  - THE answer
  - The ABSOLUTE TOTAL value
  - A replacement for social and political debate

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Any questions?

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Value = importance?
Whose value?

- **Economic values**
  - assume individuals are rational, and have well-defined and stable preferences over alternative outcomes, which are revealed through actual or stated choices.
  - based on utilitarianism and assume substitutability
  - defined in terms of the trade-offs that individuals are willing to make, given the constraints they face.
- **Community-based values**
  - based on assumption that individuals make choices based on what they think is good for society as a whole rather than what is good for them as individuals.

US Environmental Protection Agency, 2009

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Valuation: Approaches and Methodologies

- Revealed preference
  - Market values, travel cost, hedonic pricing


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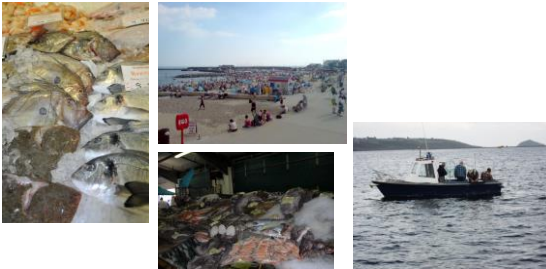
Direct market valuation: Production function

- Production function approaches
  - Estimates contribution of an ecosystem service to a final commodity
  - Improvement in resource base or environmental quality, i.e. enhanced ecosystem services, lowers costs and prices or increases quantity of goods
  - Requires knowledge of relationships between ecosystems services and valued end points
- Applicable to regulating and supporting services

Photo: Keith Hiscock
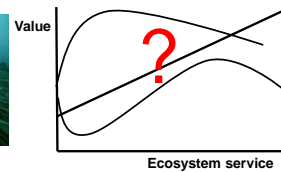
Value vs **Ecosystem service** ?

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Valuation: Approaches and Methodologies

- Revealed preference
  - Market values, travel cost, hedonic pricing
- Stated preference
  - Contingent valuation, contingent behaviour, choice experiments
- Benefit transfer
  - Adapt values derived from existing studies to some other context
- Measures of attitudes, preferences, and intentions
  - Surveys, narratives, focus groups, behavioural observation
- Civic valuation
  - Referenda, citizen jury

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Valuing Marine Ecosystems

European Marine Board Future Science Brief 5
Working Group on Valuing Marine Ecosystems
(WG VALMARE)

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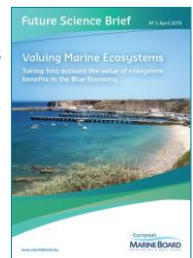**Series Editor**
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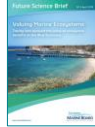**External Reviewers**
Nicolas Hanley, Sebastian Villasante, Linwood Pendleton

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Recommendations and Key Actions

Include ecosystem valuation in marine management decision models

- Use to support marine management and policy decision making
- Understand trade-offs
- Assess sustainability by including the loss of natural capital in all cost-benefit analyses, and match it against the growth of economic capital.

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Ethics

- When conducting research/collecting data from human participants (e.g. surveys, questionnaires) must follow guidelines from University Ethics Board/Committee
  – Informing interviewee how/where the data will be used
  – Anonymising information where required
  – Not putting interviewee under stress; can opt of answering questions

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Ethical Approval

from University Ethics Board/Committee/Panel

- Necessary for almost any data collection involving human participants.
  – A review of the ethics of the process of data collection
- Funding requirement (usually).
- Approval should also be sought in the country where data collection takes place.
  – For workshops, interviews, surveys etc.

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Any questions?

Some more detail?

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Introduction to valuation methods

- Different ways to measure economic value
- For a positive change:
  – Willingness to pay for a change
  – Willingness to accept as compensation to forego a change
- For a negative change:
  – Willingness to pay to avoid a change
  – Willingness to accept compensation to tolerate change

> **Change can be to:**
> Quantity or quality of an environmental good or service or access to it
> **Change must be:**
> Linked to the benefit received by the individual (e.g. to health)
> **or**
> be discernible to the individual (e.g. to landscape)

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A three step process

1. Understand how decision/intervention will influence the environment
2. Measure/estimate the change in the environment and related benefits
3. Valuation in monetary terms

> Important take home message:
> **Economic valuation is about valuing change**

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Main valuation methods

Four main approaches to monetary valuation:
1. Market prices
2. Revealed preference (observed consumer behaviour)
    i. Travel cost method
    ii. Hedonic pricing
    iii. Averted costs
    iv. Replacement costs
    v. Production function
3. Stated preference (individual's stated values)
    i. Contingent valuation
    ii. Choice modelling
    iii. Contingent behaviour
4. Benefit transfer

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4. **Benefit transfer**

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Market prices

- Use data about markets for goods e.g. food, water, timber, fuel etc. to identify the price and quantity consumed.
    - For direct consumption or as input to other products
- Observe how this changes following intervention to change quantity/quality/access to good.

> **Example**: (Primavera 2000)
> Mangrove-dependent prawns valued at US$1.4 billion in the ASEAN region

- If there were no market, the **PRICE** would be zero
- BUT remember this is not its **ECONOMIC VALUE**

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Market prices

Strengths	Weaknesses
Data often available through government statistics	Data may not be available at scale relevant to case study
Can be a useful approximation	Price does not reflect all aspects of value
Can support cost benefit analysis	Only captures direct use

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Travel cost method

- Trip expenditure to location of interest as proxy for value
    - Fuel, accommodation, food, entry fees, time etc.
- Expenditure is at least as much as they value the benefits of the trip

> **Example: Blackwell (2007) Value of beach visits**
> Interviewed 250 visitors to Mooloolaba Beach, Sunshine Coast, Queensland
> Calculate travel cost and consumer surplus
>
> **Resulting values:**
> Total sample: AUS$862 million/year
> Resiendents:AUS$152 million/year
> Visitors: AUS$205 million/year

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Travel cost method

Strengths	Weaknesses
Great for recreation/tourism valuation	Typically only used in context of recreation
Standardised questions that are easy to complete	Difficult to capture international tourist visitors due to substitution complexities
Can support cost benefit analysis	Only captures use values

Contingent valuation

- Survey based method asking respondents to state their willingness to pay (WTP) for a hypothetical change in environmental quality.

Example 1: Shellock, Borger, White and Hattam (unpublished)
Asked 314 survey respondents their WTP for renovation of an urban coastal area. Mean individual WTP £8
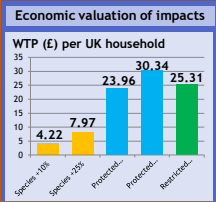
Example 2: Bann (1999)
Asked 243 respondents their WTP for implementation of management plan for mangrove protection in Benut, Johor. Aggregated mean WTP US$40,000 per year

Contingent valuation

Strengths	Weaknesses
Captures use and non-use values	Can be cognitively demanding – requires individuals to know their preferences
Can be used for all ecosystem goods and services	Requires extensive preparation
Best practice well established	Hypothetical WTP often not the same as actual WTP
Can support cost benefit analysis	Subject to a number of biases as result of survey method and design

Choice experiments

- Similar to the CVM, a surv[ey] individuals their WTP for [a] management.
- Respondents shown choice[s] to indicate their preferre[d]

Economic valuation of impacts

WTP (£) per UK household

Species -10%	4.22
Species -25%	7.97
Protected...	23.96
Protected...	30.34
Restricted...	25.31

Choice Experiments

Strengths	Weaknesses
Can assess values for more than one ecosystem good/service	Even more cognitively demanding than the CVM - requires individuals to know their preferences for multiple aspects of the environment
Can capture use and non-use values	Requires extensive preparation
Can be used to assess trade-offs between ecosystem services	Subject to a number of biases as result of survey method and design
Can support cost benefit analysis	

Benefit transfer

- Also known as "Value transfer"
- Transfer of valuations from one site to another
- Characteristics of sites should be similar
- Values should be adjusted appropriately
- Two broad methods:
  - Unit value transfer (mean values, adjusted/unadjusted)
  - Value function transfer (coefficients of explanatory variables used to adjust value or meta-analysis undertaken)
- Method used depends on resources, similarity between sites, availability of evidence, expectation of level of error

Example: Rao et al (2015)
Use meta-analysis to undertake spatially explicit benefit transfer to derive global values for shoreline protection. Example applied to the Caribbean.

Benefit transfer

Strengths	Weaknesses
Can assess values for more than one ecosystem good/service	Values for other sites may not be appropriate for the site of interest
Can capture use and non-use values	Value adjustment may be challenging
Can support cost benefit analysis	Uncertainties may be exaggerated
Relatively quick and cheap	

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Any questions?

What can we do with valuation outputs?

Decision support tools
Cost benefit analysis
Multi-criteria analysis
Bayesian belief networks

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Cost Benefit Analysis

- Systematic approach for comparing costs against benefits of interventions to support decision over which option to chose
- Money is the common metric
  - expressed for the same period of time
  - discounted into the future
- Option taken forward should have benefits > costs
- Can also be done retrospectively
- Traditionally environmental costs/benefits excluded

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Nature Reserves Balance Sheet

	2016/17 (PV £m)	Private value
Assets		
benefits — The discounted sum of benefits provided by the asset in perpetuity	Baseline value (00/01) ❶	(73)
	Cumulative gains/losses ❷	–
	Additions/disposals ❸	21
	Revaluations and adjustments ❹	93
	Gross asset value	41
Liabilities		
costs — The discounted sum of costs of maintaining the Natural Capital asset to the specified minimum condition in perpetuity	Legal maintenance obligations	–
	Other maintenance provisions	(448)
	Total net maintenance provisions	(448)
	Total net Natural Capital Assets	**(407)**

Note: Following accounting convention, negative values are reported in parentheses

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Multi-criteria analysis

- A group of social appraisal/evaluatory methods
- A set of methods that complement techniques dependent upon monetary valuation
- Criteria of importance are identified and weighted against each other.
- Used to determine relative importance and capture range of preferences and values
- Typically workshop setting

Example: Beaumont et al (unpublished)
MCA workshops used to assess trawling regimes and their economic, social and environmental impacts

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London: Weights when allocating 20 points between the ecosystem services

Weights applied to different criteria to identify preferred management measures

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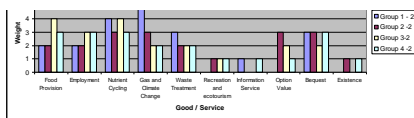
Bayesian Belief Networks

- System conceptualised as a network of nodes and linkages
- Quantitative description of linkages described by probabilistic relationships
- Can integrate multiple sources of information (including valuation outputs)
- New information incorporated as it becomes available
- Can be used to examine:
  - potential impacts on ecosystem services resulting from different management measures
  - trade-offs between ecosystem services under different management regimes

Slide 1

Bayesian belief networks (BBNs)

Parent node → Dependent node

Habitat type → Vulnerability ← Pressure

6 broad habitat types

3 levels of pressure

4 classes of vulnerability

Conditional probability table – describes relationship between parents and dependent nodes

Parents		Dependent - Vulnerability			
Habitat type	Pressure	Absent	Low	Medium	High
1. Coarse sands with infauna	Absent	100	0	0	0
2. Sand	Absent	100	0	0	0
3. Fine & muddy sand	Absent	100	0	0	0
4. Mud & sandy mud	Absent	100	0	0	0
5. Dynamic shallow water fine sand	Absent	100	0	0	0
6. Unstable cobbles	Absent	100	0	0	0
:	:	:	:	:	:
1. Coarse sand with infauna	High	0	5	20	75
2. Sand	High	0	0	0	100

Slide 2

Key Take Home Messages

- Economic value is not the same as price.
- Total economic value framework describes the economists view of values held for the environment.
- Valuation is important for defining the size of instruments that can help reduce the size of negative externalities and encourage positive externalities.
- Valuation is a tool that can support decision-making.
  - Can be integrated into formal decision-support tools.
- Multiple valuation methods exist, each with strengths and weaknesses.
- Method selection will depend on ecosystem service to be valued and project objectives.

Slide 3

Any questions?