NON-MARKET VALUATION: METHODS AND DATA

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Outline

- Introduction
- What is "economic value"?
- Categories of value
- Common misconceptions regarding value
- Benefit-cost analysis
- Valuation methods & applications
- Benefits of conducting a valuation exercise
- Obstacles & budget considerations
- Gaps and unknowns
- The way forward?
- Conclusion

"Value" and "Valuation"

- "Economic Value" refers not only to what people *actually* pay, but also includes what people are *willing* to pay (or give up).

- Example: you pay $25 for a snorkel trip that is worth $100 to you.

    → The true economic value of this trip is $100.

- "Economic Valuation" means estimating what something is worth.

Economic Value

- *Value* is most meaningful and measurable in terms of what people are *willing and able to give up* for the good or service.

- Value is *anthropocentric* (human-centered), and the process of valuation is *utilitarian*: Its purpose is to understand (and hopefully improve) the well-being of <u>people</u>.

Economic Value and Willingness to Accept

- Oftentimes we *lose* something of value

- In these cases, we can look at value as willingness to pay to avoid loss, or *willingness to accept* compensation for loss.
  - Example: Coastal development may infringe upon society's "windows to the sea".   The economic value of this loss can be measured as society's willingness to pay to avoid that loss, or the amount of compensation they would be willing to accept to be just as well off with the loss.

Common Misconceptions

1. Economic Value vs. Economic Activity:

- Economic *activity* (sales, jobs) is often confused with economic *value*.

- The amount of money that changes hands may not reflect the benefits or worth to society.

- Measures of economic activity often do not account for alternatives that are foregone, and do not take into account goods and services that are not traded in markets.

Common Misconceptions

2. Economic *Value* vs. Economic *Cost*

- The cost of an item or "price paid" is not always a good reflection of value.
  - For example, it would *cost* a great deal to transfer 10 tons of sand from Colorado to the Sahara, but the *value* would be quite low.
  - Similarly, you may pay $20 for a pair of shoes that yields considerably more than $20 in value.

Common Misconceptions

3. Value is only revealed in markets.

- Goods that are not traded in the marketplace ("nonmarket goods" such as clean air, clean water, and healthy ecosystems) have real economic value.

- Non-market values are more difficult to measure than market values.

Common Misconceptions

4. The Broken Window Fallacy

- The idea that wars or natural disasters are "good" for an economy due to the ensuing upswing in economic activity fails to recognize *opportunity cost*.

- Money that is spent recovering from disaster (replacing the "broken window") could have been spent on something else.

  - E.g. Jobs that are created in the wake of something bad are not necessarily "new jobs", as that labor could have been used for something else.

Summary of Value

- Value is what something is worth to people.
- What something costs and the value or benefits it delivers are not necessarily equal.
- Value need not be revealed in markets.
- The value of foregone activities ("opportunity cost") must be considered.

Economic Value & Tradeoffs

- People derive real economic value from natural resources and the environment for many reasons.
  - Natural systems supply many goods and services that are critical for human well-being.
  - The entire market economy depends on the existence and proper functioning of natural systems.

Ecosystem Services

Supportive Services	Regulating Services
Nutrient Cycling	Climate Regulation
Net Primary Production	Hazard Protection
Pollination and Seed Dispersal	Disturbance Regulation
Habitat	Water Regulation
Hydrological Cycle	Soil Retention
	Waste Regulation
	Nutrient Regulation
Provisioning Services	**Cultural Services**
Water Supply	Recreation
Food	Aesthetics
Raw Materials	Science and Education
Genetic Resources	Spiritual and Historic
Medicinal Resources	
Ornamental Resources	

Ecosystem service values

- Despite their obvious importance policy makers often ignore the value of environmental goods and services and their economic and social benefits.
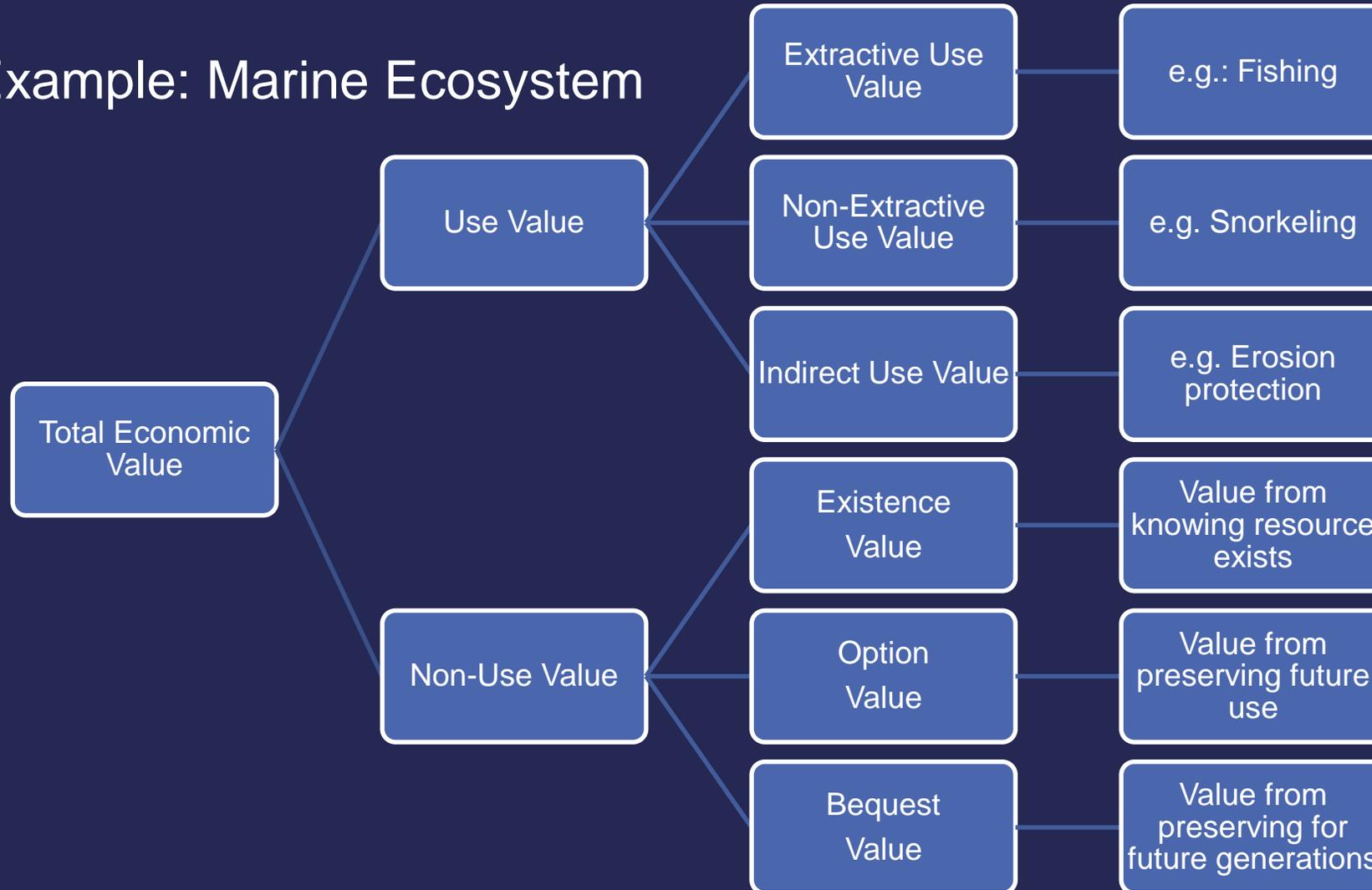 - Why?

Market Failure

- Markets do not capture the value of environmental and natural resources due to two common market failures:
  - The characteristics of public goods allow 'free riders'. Traditional market forces break down.
  - External costs created by the production or consumption of market goods are not reflected in the market prices of those goods.

Ecosystem values

- The *value* of environmental goods & services goes largely unmeasured because *markets* do not provide these goods and market prices do not reflect their full value to society.

- Understanding the full economic value of resources can help inform decisions regarding tradeoffs that society must make.

Components of Economic Value

Example: Marine Ecosystem

Total Economic Value

Use Value
- Extractive Use Value → e.g.: Fishing
- Non-Extractive Use Value → e.g. Snorkeling
- Indirect Use Value → e.g. Erosion protection

Non-Use Value
- Existence Value → Value from knowing resource exists
- Option Value → Value from preserving future use
- Bequest Value → Value from preserving for future generations

# Non-Use Value / Passive Use Values

- How do we know that these "non-use values" are real?

  - We observe that people give up time, money and energy to preserve natural resources that they never use in any tangible way.

Ecosystem valuation

- Understanding, measuring (and monetizing) environmental contributions to human well-being is the domain of *economic valuation*.

- Many situations call for non-market valuation.
  - Valuation does not establish absolute values for the environment.
  - Estimated values constitute lower bounds, and usually only capture the more obvious and readily calculated values.

What are the benefits of conducting a valuation exercise?

1. Having a common unit of measure

   - Uses of natural resources create a range of impacts, usually not in comparable units (generated revenues, changes in fish stocks, loss of tourists, water quality changes, reef degradation).

Market Goods

Non-Market Goods

Habitat

Jobs

Carbon sink

Revenues

Oxygen generation
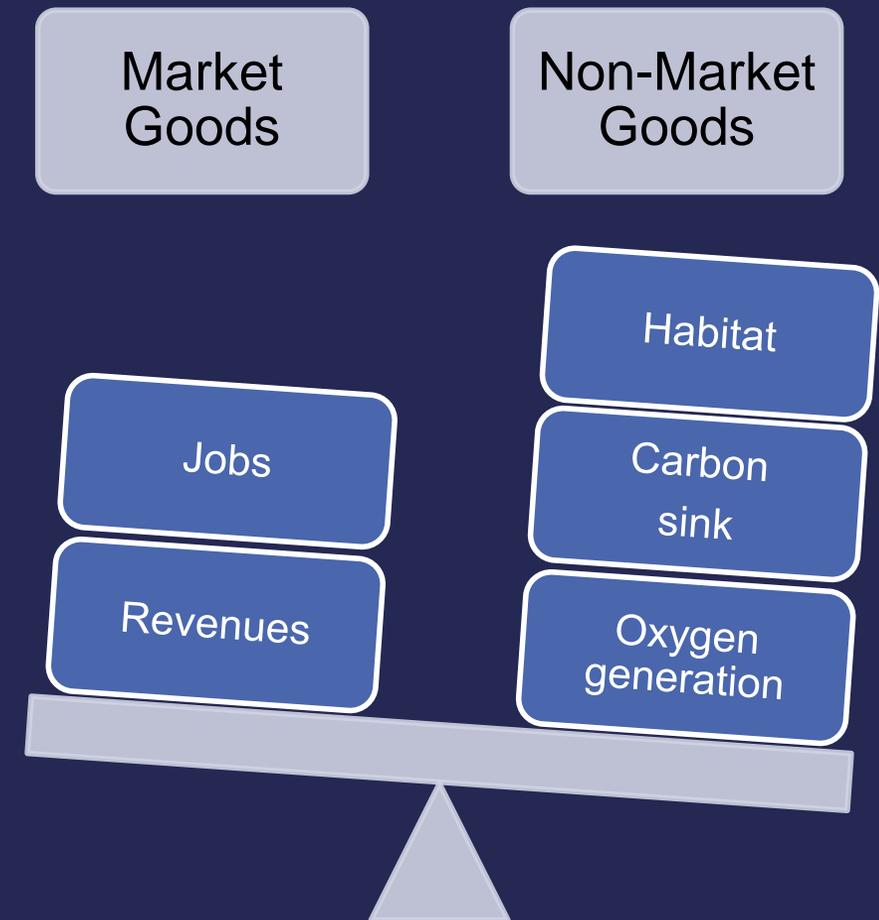
What are the benefits of conducting a valuation exercise?

- Objective decision-making is fostered when all these impacts expressed in the same units.
- Economic valuation facilitates this comparison by expressing all impacts in monetary units.

Coastal development project?

Jobs

Revenues

+$

vs.

-$

Resource damage

Lost tourist visits

What are the benefits of conducting a valuation exercise?

2. Valuation can be used in conjunction with benefit-cost analysis and provide information that can be used to inform complex management decisions.

Policy Decision

- Political Feasibility
- Valuation & CBA
- Budget
- Cultural Concerns
- Time
- Equity/Fairness

Benefit-Cost Analysis

- Benefit-Cost Analysis (BCA) is a systematic enumeration of the gains (benefits) and losses (costs) of particular decisions, in common units, for comparison purposes.

- Helps inform us of the relative trade-offs of alternative resource management strategies and outcomes.

- Non-market valuation can be an important component of BCA as it informs decision makers about what something is worth (in dollars) or what something will cost (in dollars).

What are the benefits of conducting a valuation exercise?

3. The services provided by the natural environment directly affect human welfare in myriad ways, but <u>are often overlooked</u> by some people and policy makers who only focus on jobs and revenues.

Valuation reminds everyone that although that the environment is "free", this in no way implies that it is not valuable.

What are the benefits of conducting a valuation exercise?

4. Understanding the incidence of costs and benefits.

- Who gains?
- Who loses?
- When are the gains to be realized?
- When are the costs to be borne?

Non-Market Valuation: How does it work?

- Non-market valuation methods require that a link be established between changes in the quantity or quality of the resource and changes in the stated or observed behavior of people.
  - For instance, changes in air quality may result in people moving to another area.
  - "Free" disposal of rubbish along the coast actually has an impact on beach quality and people's enjoyment and probability of return.

Valuation Methods

- Over the past 5 decades economists have developed techniques to assess the value of environmental goods.

- These techniques, which can estimate value for both users as non-users, are being employed intensively throughout the world and are being constantly refined and improved.

Valuation Methods
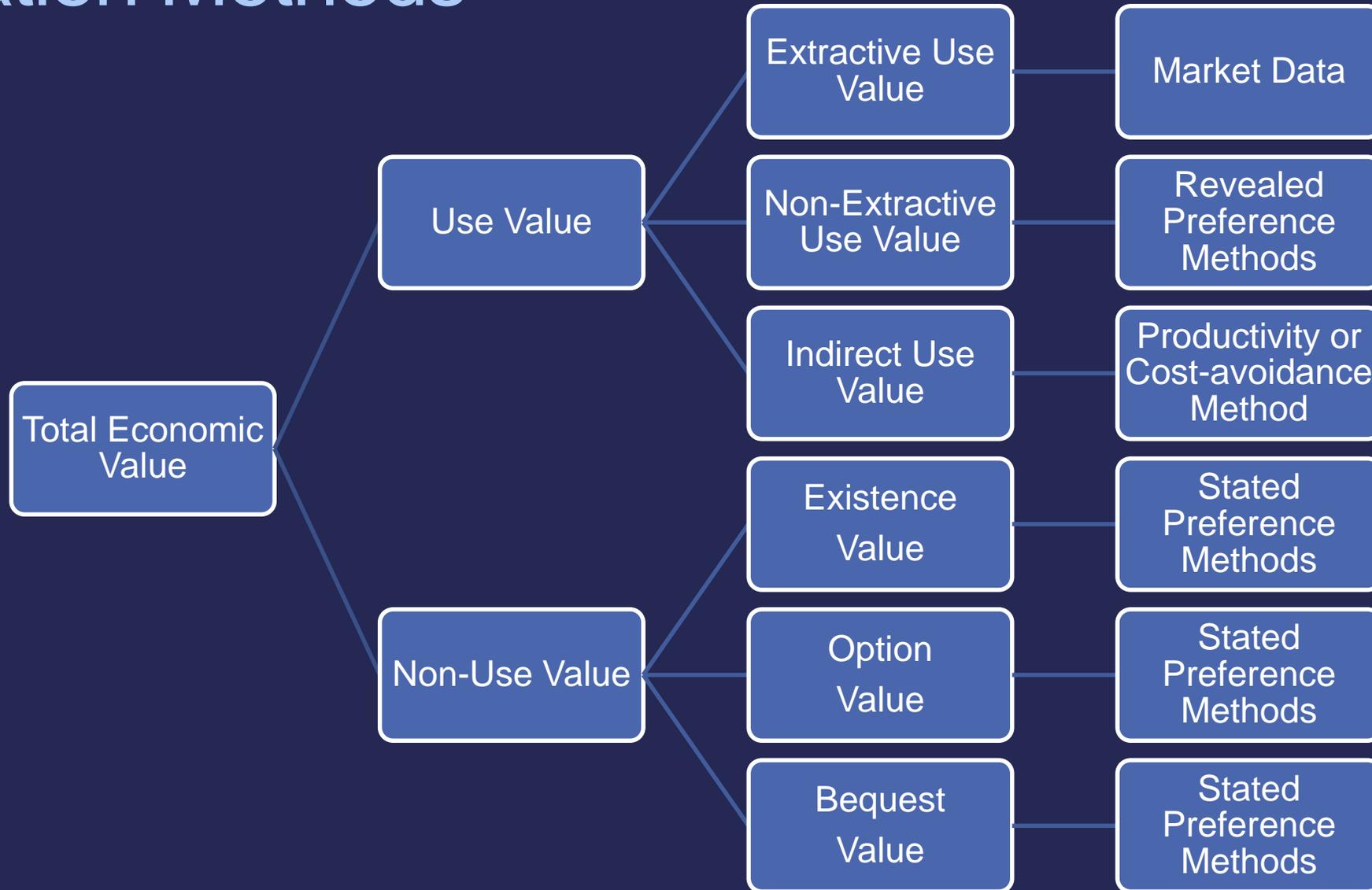
Valuation Methods

- Because of the complex nature of many environmental goods and natural resources, more than one type of method may be necessary to gain an understanding of all the components of value.

Valuation Scenarios & Examples

Scenario	Example
Assess the potential for user fees	Will tourists pay more for "environmentally friendly" recreation experiences?
Measure monetary damages from natural resource degradation	What is the economic loss realized as beach width diminishes?
Complete a benefit-cost analysis of a conservation project	Determine the net economic benefit of increasing use of reef balls or mooring buoys.

Market-Based Valuation

- The basic idea: Market transactions reveal the value that people assign to goods and services.

- Empirical approach: Use market prices and quantities to estimated the extractive direct use components of value.
  - E.g. economic contribution of commercial fishery harvests

- Pros: Relative ease of calculation, defensible value estimates

- Cons: Difficult to derive estimates of net gains (producer and consumer surpluses), seasonal or geographic variations in value may be obscured through the use of aggregate market measures

Market-Based Methods: The Replacement Cost Approach

The basic idea: Some goods and services provided by the natural environment can be replaced by manmade goods and services.

Empirical approach: Use market-based estimates of the costs of providing a replacement services as proxies for the value of the associated naturally provided services.

Pros: Relative ease of calculation (construction and engineering costs), easily understood.

Cons: Not a true means of measuring the value of ecosystem goods and services in the sense of gross or net benefits to people, man-made alternatives are unlikely to fully replace naturally provided goods and services.

Market-Based Methods: The Damage Avoidance method

The basic idea: The benefits of maintaining natural resources includes not having to spend money on things that will occur when natural resources are degraded

Empirical approach: Use estimates of the (market) expenditures that would have to be incurred to prevent, diminish, avoid, cure or repair harmful effects to human and physical capital as estimates of the natural resources that help us avoid those costs.

Pros: Relative ease of calculation, easily understood

Cons: Not a true means of measuring the value of ecosystem goods and services in the sense of gross or net benefits to people

Non-Market Valuation: Revealed Preference Techniques

- The basic idea: People's behavior in markets may help us understand the value of associated non-market goods.

- Empirical approach: Establish a link be between changes in ecosystem goods and services and changes in observable behaviors of people.

  - Travel Cost Methods
  - Hedonic Pricing

Revealed Preference Methods: The Travel Cost Method

- The basic idea: The costs incurred in travel represent a lower bound on willingness to pay for access to the natural resource.

- Empirical approach: Use information on travel expenses and trip frequency to estimate a trip demand function. Use trip demand function to estimate net gains from the resource.

- Typically applied to recreation

- Survey data should include:
  - Individual visitation frequency data
  - Travel costs & other expenditures
  - Environmental quality measures
  - Demographic information

Revealed Preference Methods: Random Utility Modeling

- A version of the travel cost method, RUM uses data on visitation at alternative recreation sites.
  - Uses information on travel to estimate a trip utility (satisfaction) function, based on the idea that individuals will choose the site that gives them the most enjoyment.
  - Survey data should include:
    - Individual visitation data from multiple alternative sites
    - Travel costs & other expenditures
    - Environmental quality measures at each site
    - Demographic information

Travel Cost Method and Random Utility Models

Values that can be derived from a TCM or RUM study include:

- The value of a visit to the visitor over and above the price he already pays (consumer surplus).

- The recreational value of a natural area (deducted by aggregating the consumer surplus per visit per visitor over all visitors). This is what would be lost when the natural area disappears or is closed for recreation.

- The value of changes in the quality or characteristics of the recreation site or area.

Revealed Preference Methods: Hedonic Pricing

- The basic idea: Demand for environmental attributes will be reflected in the prices people pay for associated goods such as housing.

- Empirical approach: Estimate a function describing how market prices are related to environmental amenities.

  - Real estate sales data should include:

    - House sales prices

    - House characteristics

   - Associated environmental attributes

Revealed Preference Methods

- Pros: Estimated values are grounded in actual behavior and are therefore empirically defensible.

- Cons: Data requirements, technical knowledge, limited to easily measured environmental amenities, not suitable for monetization of non-use values.

Stated Preference Techniques

- The basic idea: People can tell us what they value by answering questions.

- Empirical approach: Ask people what they are willing to pay or willing to accept or to make hypothetical choices between alternative goods or states of the world.

  - The Contingent Valuation Method
  - Choice Modeling
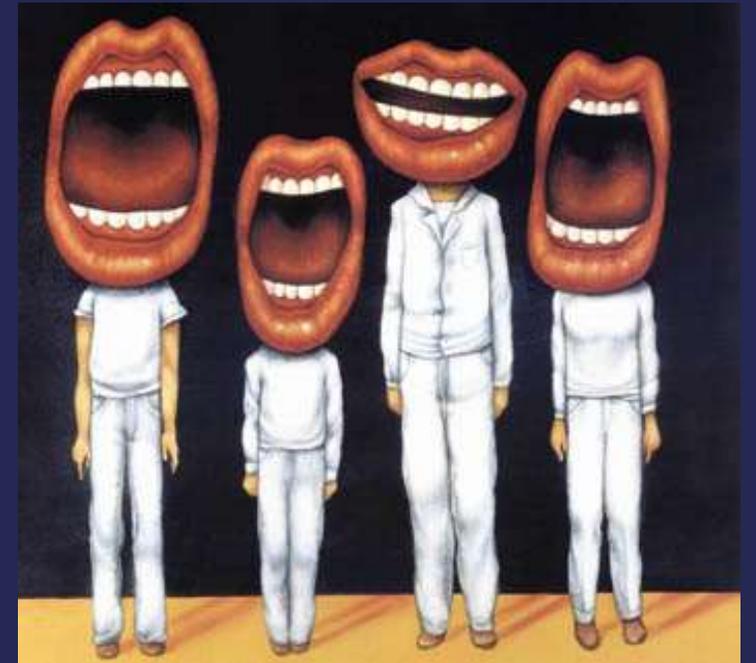
Stated Preference Methods: Contingent Valuation

- Survey method whereby people indicate willingness to pay (or accept) for changes described in a hypothetical market.
  - Survey data should include:
    - Detailed description of a program or change
    - Mechanism for eliciting value or choice
    - Payment vehicle
    - Information on respondent attitudes and characteristics

Stated Preference Methods: Choice Modeling

- Survey method whereby respondent preferences are elicited through a series of choices between alternatives.
- Alternative "goods" are described in terms of different levels of attributes.
  - Survey data should include:
    - Description of 2 or more options for a "good" specified with levels of attributes that make up the product.
    - Respondent attitudes and characteristics
  - Regression estimates for each attribute (and level) represent the part-worth utility (value) for the attribute level compared to a baseline level.

Stated Preference Methods: Choice Modeling

- ## Choice Modeling (CM)
  - Recognizes that most environmental goods are *composite* goods, made up of a variety of attributes that can take on various levels.
  - Allows estimation of the relative importance of multiple environmental attributes and their levels.
  - Generates large quantities of data in a single application.
  - Alternative model specifications can be used to explore preference heterogeneity.

Choice Model example

Attributes	Levels
Price ($US/night)	$75, $150, $225, $300
Lodging Type	SMALL HOTEL, LARGE HOTEL, APT HOTEL, VILLA
Beach Width (meters)	3-5 m, 8-10 m, 13-15 m, 18-20 m
Distance to Beach	BEACHFRONT, 2-3 Min Walk, 6-8 Min Walk, 18-20 Min Walk
Beach Litter (per 25 m)	0, 5, 10, 15

Choice Modeling example

Suppose that you could only choose from the lodging options below (Trip A, Trip B or neither trip).
If all other factors were equal, which would you prefer?

ATTRIBUTES	OPTION A	OPTION B	OPTION C
Price ($US)	$75	$225	I WOULD NOT CHOOSE EITHER OF THESE OPTIONS
Lodging Type	Small Hotel	Apartment/ Apt Hotel	
Beach Width	3-5 Meters Wide	13-15 Meters Wide	
Distance to Beach	12-15 Minute Walk	6-8 Minute Walk	
Beach Litter	0 Pieces Litter per 25 Meters	10 Pieces Litter per 25 Meters	
I prefer…(check **one** box)	☐ **OPTION A**	☐ **OPTION B**	☐ **NEITHER**

Stated Preference Methods

- Pros: Allow for the estimation of values associated with use as well as non-use values, flexible.
- Cons: Survey data are costly to acquire, high degree of technical knowledge needed for design and estimation, results may be subject to a variety of biases.

Which method is appropriate?

- Choice of valuation method depends on what is being valued and the intended purpose of value estimates.
  - Policy formation?
  - Building awareness?

- The benefits derived from a particular ecosystem service may be amenable to valuation using different procedures.

All of this sounds expensive. Is it worth it?

"The value of valuation lies in providing a more complete accounting of the benefits and costs to society." (Loomis, *Choices)*

- Well designed valuation studies allow for the costs and benefits of resource change to be estimated *ex ante*.

- Full appraisal of economic costs and benefits will not be the only metric for evaluating policy decisions, but expensive and potentially irreversible decisions should involve a careful consideration of the full range of benefits and costs.

Is valuation worth it?

- Valuation can also call attention to otherwise undervalued resources.
- Valuation studies can help policy makers understand the economic costs associated with loss of species and habitats, the benefits of conservation and restoration efforts, or economic dependence on natural systems.

Is valuation worth it?

- Valuation can help us understand the economic consequences of mismanagement.
- Resource value estimates can be used to guide policy in the direction of efficient and equitable use, and to create incentives that encourage sustainable use.

Is valuation worth it?

- Without an understanding of the economic value of natural resources, conservation efforts may be stymied because they are viewed as costly in terms of precluding activities that have large immediate and easily measurable financial rewards.

The role of valuation: Signals

- Market prices *should* incorporate economic costs that are external to the market.
- Public accounts *should* include stocks and flows of natural capital and their associated values.
- Public policy *should* reflect the values of the public.

Budget and Time Constraints

- Relatively low-cost approaches are available that may be applicable in some situations where time and/or money are limited.
  - Benefits (Value) transfer
  - Meta analysis

Obstacles

- Lack of technical capacity
- Lack of financial resources
- Legal impediments
- Politics
- Moral opposition

(Adapted from Moons, 2003)

Gaps & Unknowns

- Despite the breadth of environmental valuation research efforts across the globe, the *current approach is largely piecemeal,* uncoordinated and lacking a common unit of measure.

- As a result, resource value comparisons across or within nations may be cumbersome for policy makers.

An integrated, multidisciplinary approach to valuation

1. Identify of ecological processes that affect human well-being
2. Construct ecological and/or bio-physical models that transform natural or anthropogenic changes in ecosystem services into *measurable* indicators of benefits that are amenable to valuation
   - How does policy (or BAU) affect ecosystem structure and function?
   - How do these effects translate into changes in ecosystem services?
   - How do changes in ecosystem services affect measurable benefits to people?
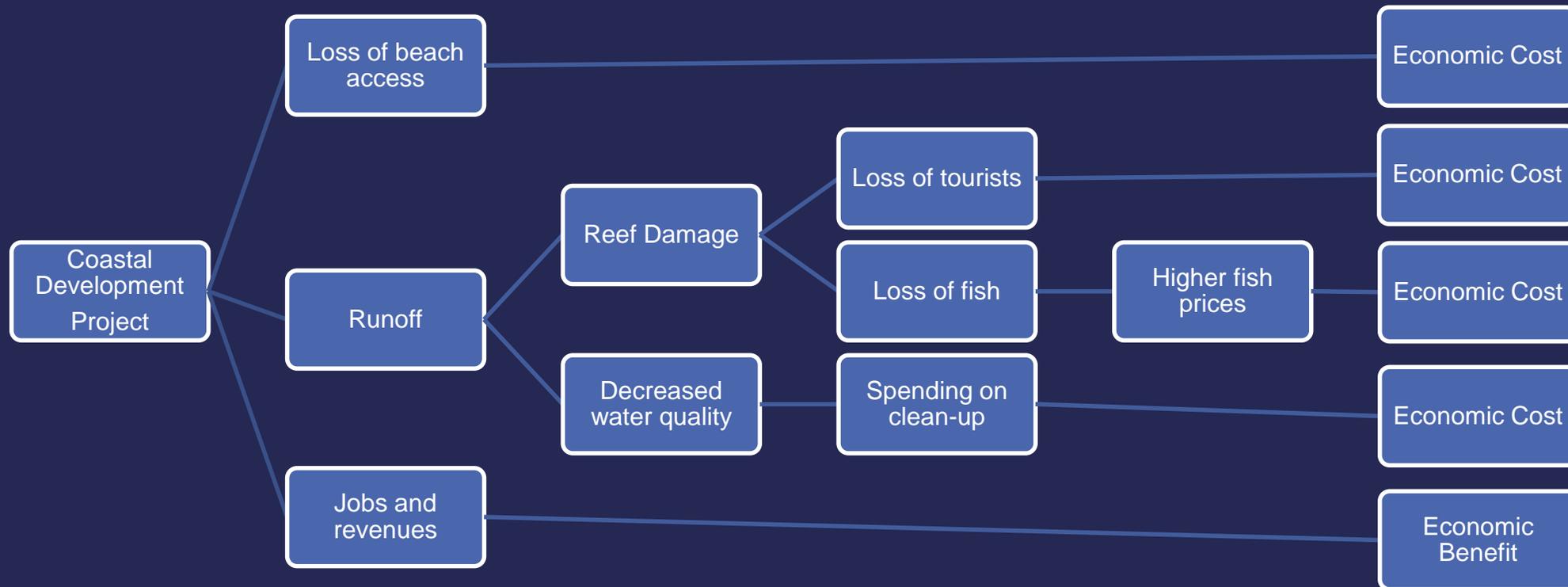
An integrated, multidisciplinary approach to valuation

Examples of measurable benefits indicators:

- Fisheries productivity and output
- Incidence of health effects
- Beach width
- Likelihood of storm damage
- Encounters with habitats and species
- Tourism visits
- Probability of pharmaceutical discovery

Prerequisites

- Consistent and accurate measurement of environmental conditions.
- A sound understanding of the biophysical relationships between resource use decisions and the ecological system. (Bennett, 2003)

An integrated, multidisciplinary approach to valuation

- Education of the general public regarding the costs and benefits of ecological change is a critical co-requisite to efforts aimed at expanding the scope of valuation of ecosystem services.

- In order to make appraisals of acceptable tradeoffs, the public must be accurately informed of the human, social and ecological consequences at hand (EPA, 2009).

Thank you for your time and attention