

Economic Valuation of Marine Ecosystem Services: Relevant Aspects

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Introduction

1. Concept, economic methodology and framework of valuation and accounting of marine ecosystem services

Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

Ecosystem services are the benefits people obtain from ecosystems (MEA, Synthesis Report, <http://www.unep.org/maweb/>)

Provisioning

Goods or products produced by ecosystems



Regulating

Natural processes regulated by ecosystems



Cultural

Non-material benefits obtained from ecosystems

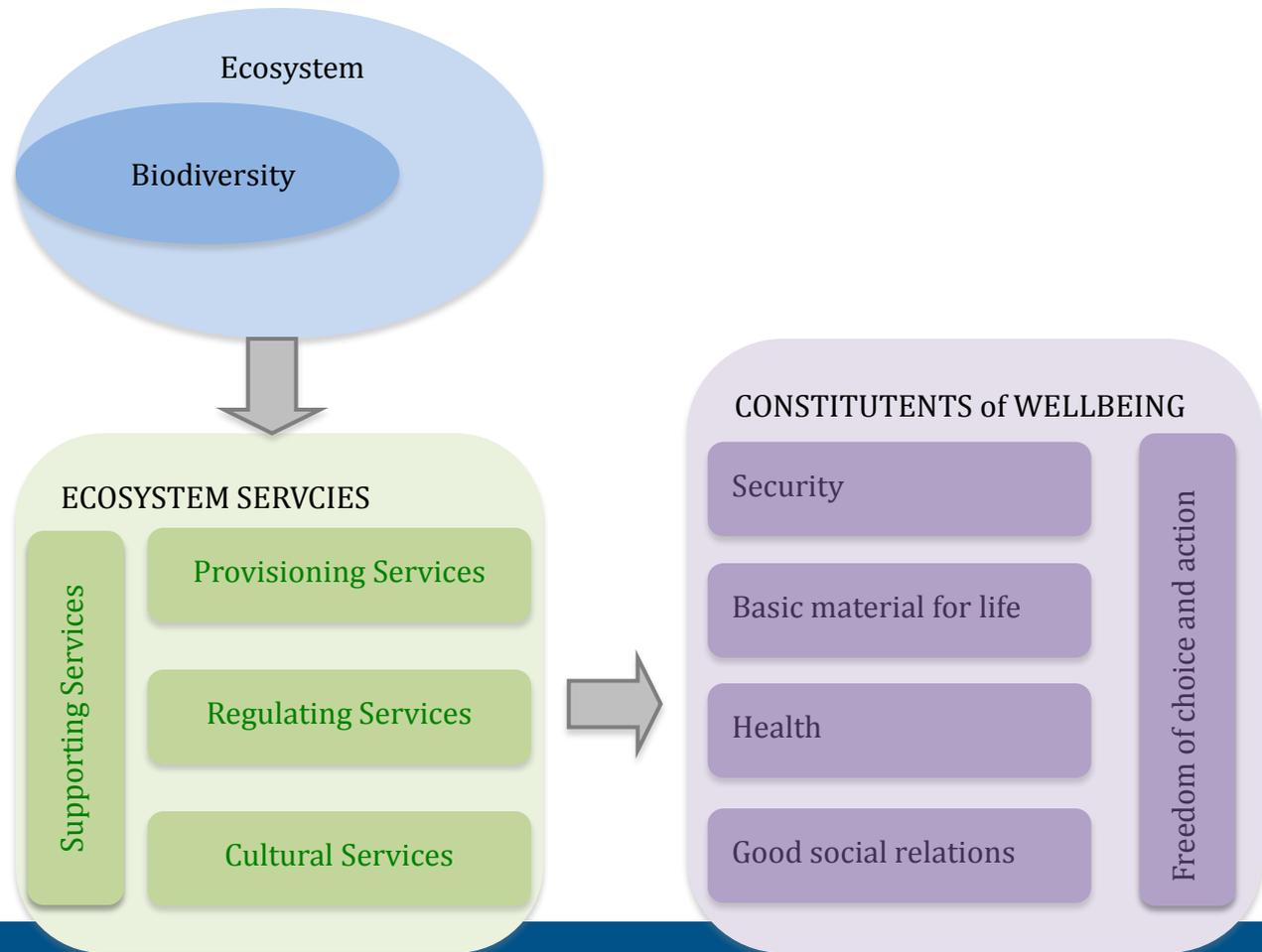


Supporting

Functions that maintain all other services



An analytical framework to link biodiversity, ecosystem and wellbeing

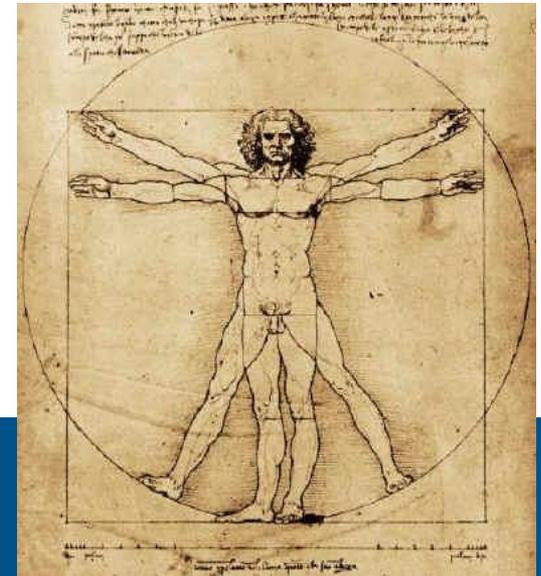


Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

Ecosystem services are the benefits people obtain from ecosystems (MEA, Synthesis Report, <http://www.unep.org/maweb/>)



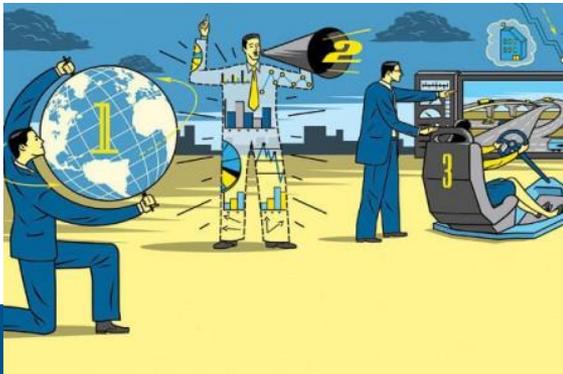
- **People:** anthropocentric perspective
- **Benefit:** (and its magnitude) is related to the impact on people
- **Valuation:** welfare based



Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

Ecosystem services are the benefits people obtain from ecosystems.

- From the economic perspective: **people are economic agents**
Producers/Firms, Consumers/Households, Government



u11397478 fotosearch.com



Economic Agents' s behavior is represented by:

- (1) an **objective function** (what the economic agent wants to achieve)
- (2) a **constraint** (what the economic agent can realistically achieve)



Solving for the problem determines, among the others, how markets work.

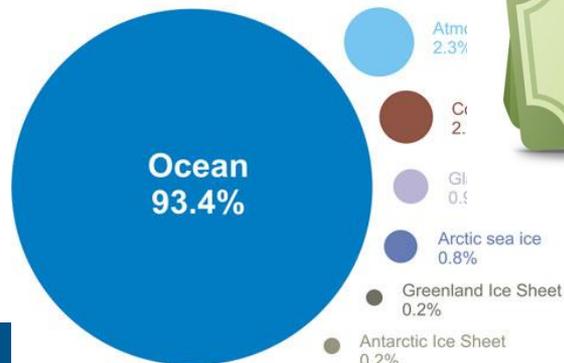
Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

Ecosystem services are the benefits people obtain from ecosystems.

- **Benefits** are measured in terms of the **ES contribution** to Producers/Firms, to Consumers/Households and to Government .



Where is global warming



Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

- **Producers/Firms**
 - Production function – (market) supply
- **Consumers/Households**
 - Utility function – (market) demand

Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

- **Producers/Firms**
 - Production function – (market) supply
- **Consumers/Households**
 - Utility function – (market) demand
- **Interaction Demand/Supply:**
market price equilibrium
(and quantity)

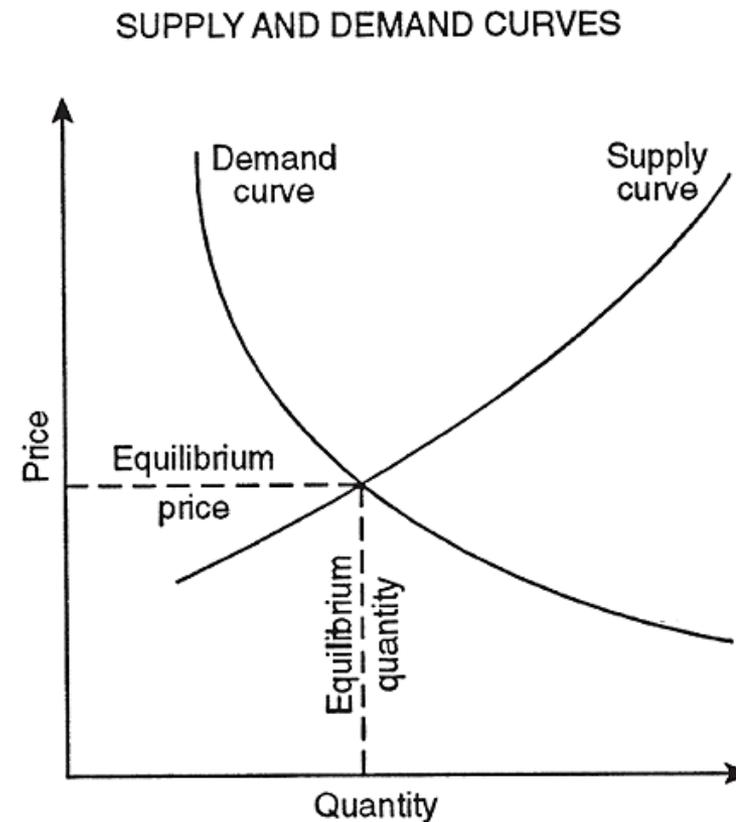
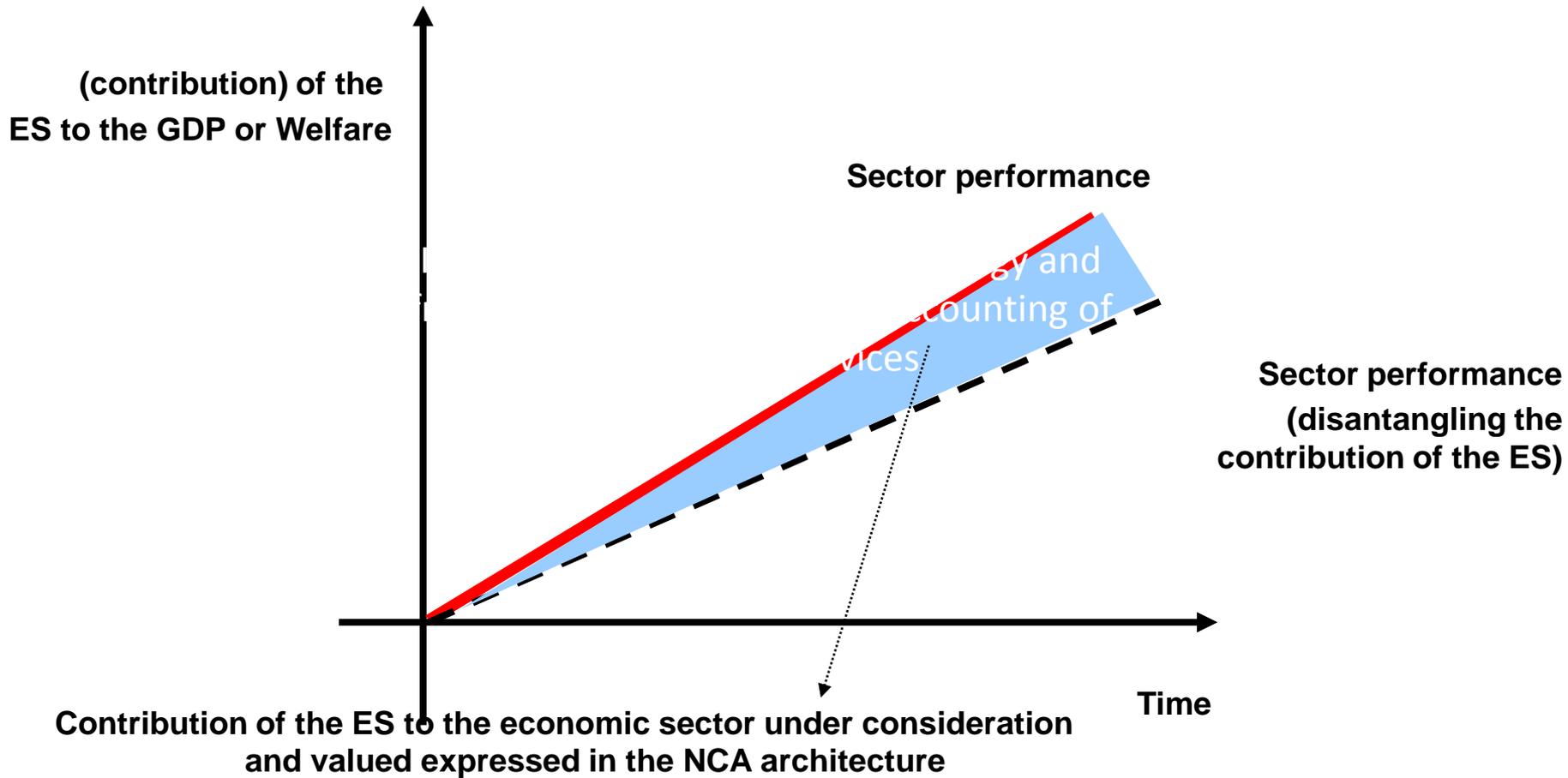


FIGURE 9

Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

- **Producers/Firms**
 - Production function – (market) supply
- **Consumers/Households**
 - Utility function – (market) demand
- **Interaction Demand/Supply:**
market price equilibrium (and quantity)
- **Value of the ES:** how, at the margin, will impact the behavior of the economic agent in question and therefore (market) supply and demand, and respective allocation of resources (new equilibrium)



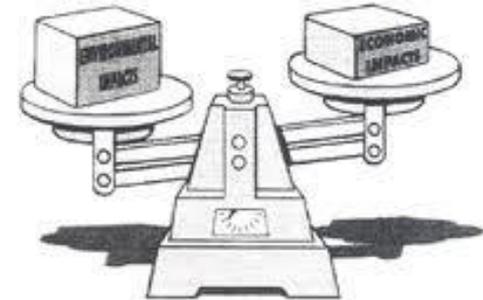
1. Techniques of valuation: various methodological tools

Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

- **Supply-based valuation methods (market values)**
 - Production function

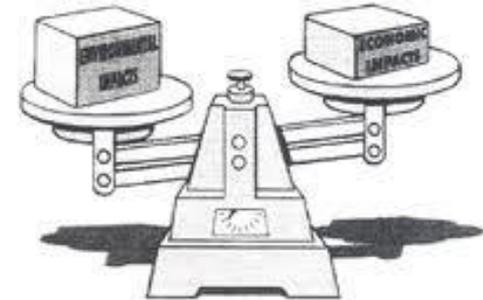
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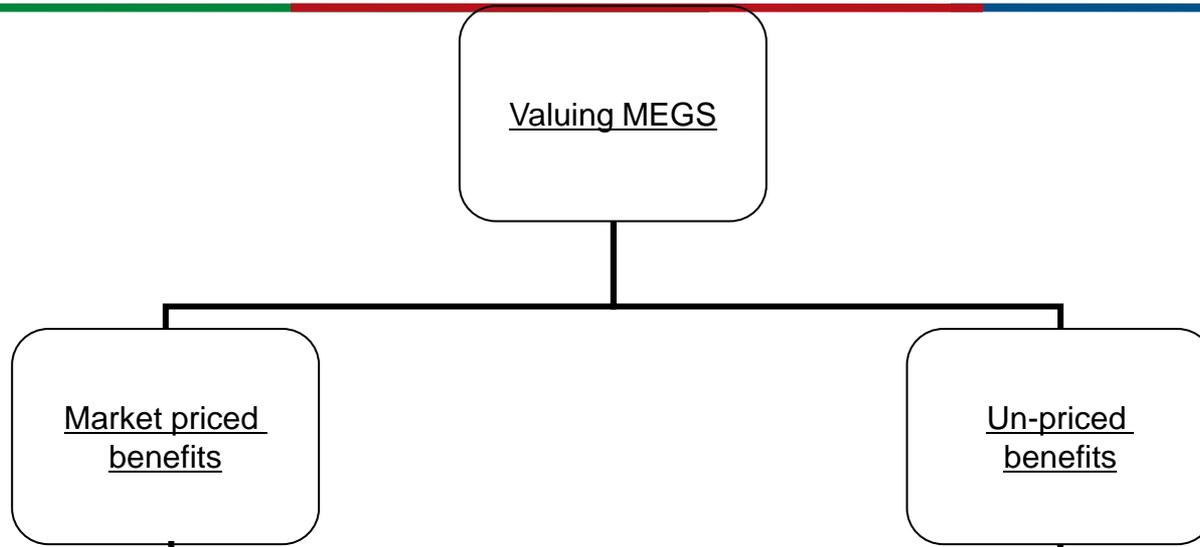
- **Supply-based valuation methods (market values)**
 - Production function
- **Demand-based methods (market values)**
 - Market prices
 - Travel cost
 - Hedonic pricing

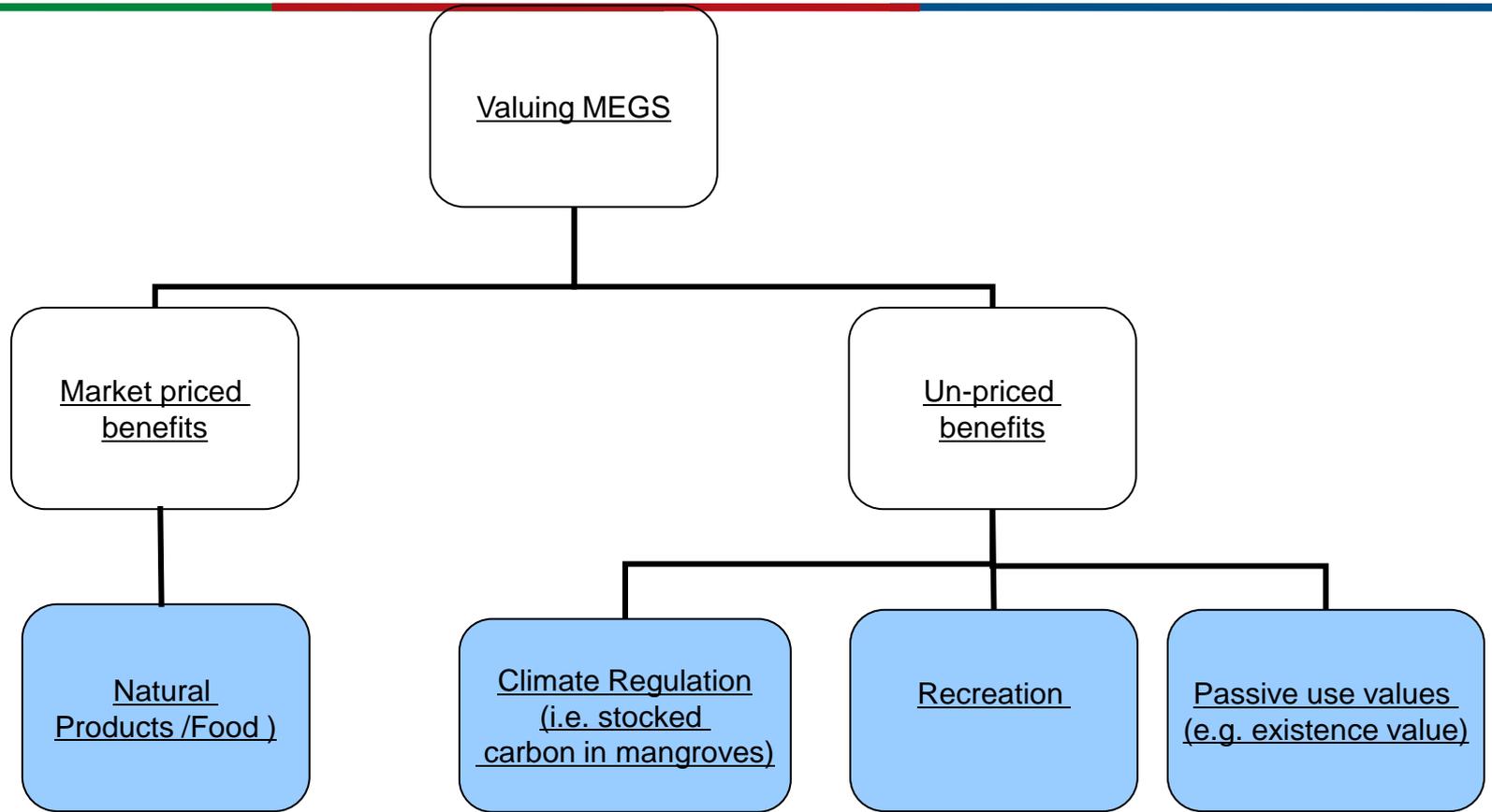


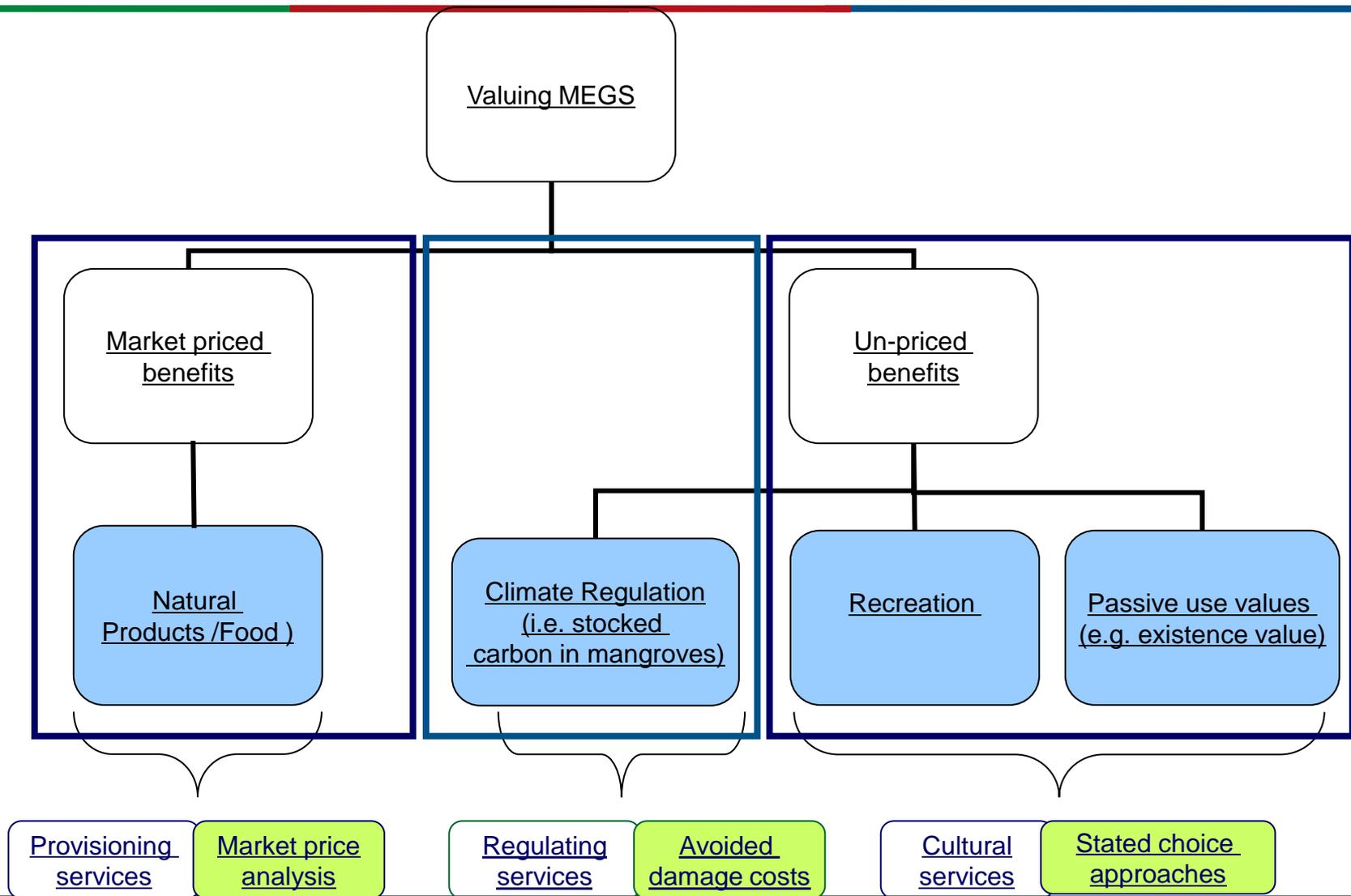
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- **Supply-based valuation methods (market values)**
 - Production function
- **Demand-based methods (market values)**
 - Market prices
 - Travel cost
 - Hedonic pricing
- **Cost-based method (market values)**
 - Replacement cost
 - Mitigative/avertive expenditures
 - Avoided damage cost









Valuing MEGS

Market priced benefits

Natural Products

Climate Regulation (i.e. stocked carbon in mangroves)

Unpriced benefits

Recreation

Passive use values (e.g. existence value)

Hybric Economic Valuation Approach

Provisioning services

Market price analysis

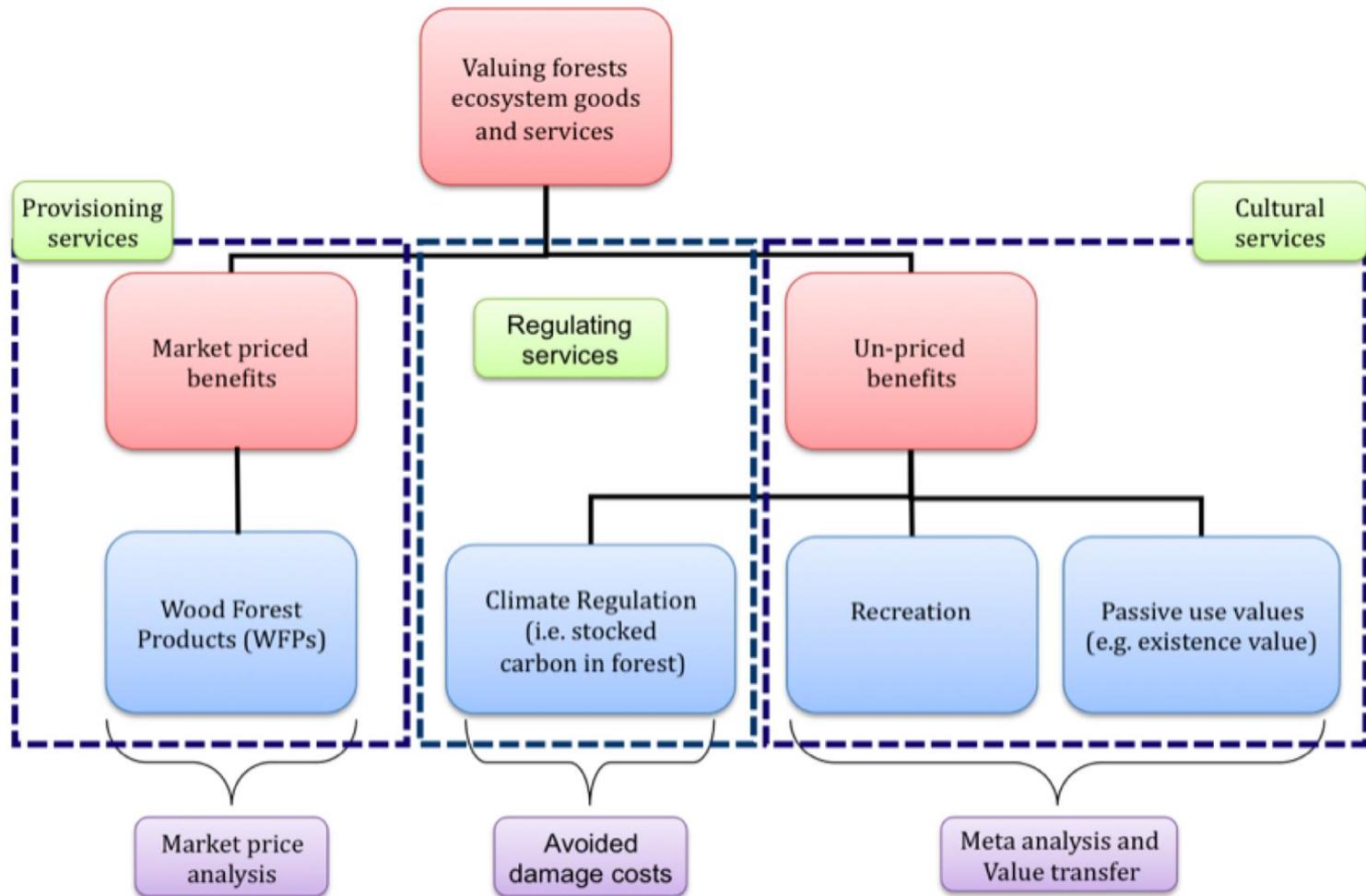
Regulating services

Avoided damage costs

Cultural services

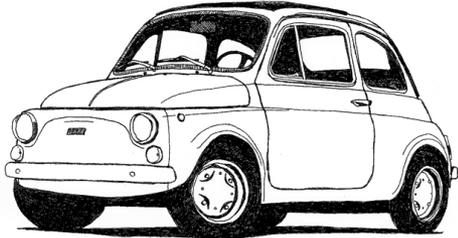
Stated choice approaches

The methodology is adapted from
Chiabai, A., Travisi, C., Ding, H., Markandya, A. and P.A.L.D. Nunes (2012)
“Economic Assessment of Forest Ecosystem Services Losses: Cost of Policy
Inaction”, *Journal of Environmental and Resource Economics*



Synthesis

Ecosystem Services	Market prices	Prod. Function	Travel costs	Hedonic pricing	Cost-based	Stated prefer.	Value transfer	Ecol. Prod. function
Provisioning	● / ●	● / ●			● / ●			● / ●
Regulating		● / ●		● / ○	● / ●	● / ○	● / ○	● / ●
Cultural	● / ●	● / ●	● / ○			● / ○	● / ○	● / ●



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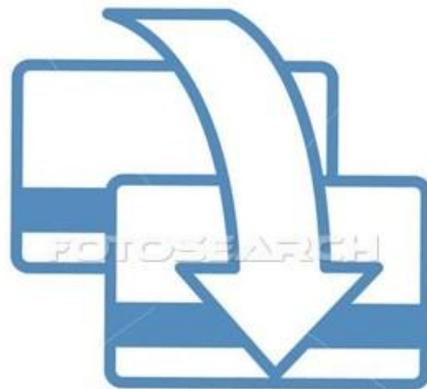
- **Demand-based methods (non-market values)**
 - Questionnaires / Interviews



Introduction: concept, methodology and framework of valuation and accounting of ecosystem services

- **Demand-based methods (non-market values)**
 - Questionnaires / Interviews – stated preferences

- **Value transfer (market and non-market values)**
 - Unit value
 - WTP function
 - Meta-analysis



Selecting “the proper” method/s

- There may be more than one method suitable for the valuation of certain MEGS:
- The choice depends on:
 - What is the objective of the assessment per se? (i.e. Estimates used for design of PES, estimates used for damage claims and litigation...)
 - What data do you have or can you have?
 - What period of time you have to provide estimations?

Market Prices, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service

(e.g. economic valuation of management program towards a gradual elimination of discards in tuna fishery management practices)

Step 2: Identify ES and beneficiaries impacted by policy

tasks to the analyst

- engage in meetings with the tuna and tuna fisherman communities

Step 3: Collect data on selected market price. Identify if price is distorted and if necessary correct distortions by finding comparable product or services in similar circumstances at undistorted prices

tasks to the analyst

- look for data on tuna prices in Palau as well as tuna prices in international markets

Step 4: Multiply price by the change in quantity to determine the value of the change

tasks to the analyst

- look for data on quantity of tuna landings today (business-as-usual) and calculated the projected quantity of tuna in the presence no discards fishery management practice and multiply this difference with the current price of tuna

Production function, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service (e.g. designation of a marine protected area)

Step 2: Identify ES and beneficiaries impacted by policy
tasks to the analyst

- engage in meetings with the tuna fisherman communities in Palau

Step 3: Identify the inputs that affect the output production and model production function using statistical analysis

tasks to the analyst

- look for data on number of fisherman, fishing area, effort, type of vessel, MPA

Step 4: Estimate the production function using statistical analysis

tasks to the analyst

- calculate the marginal impact of the no-take zone on output

Step 5: Calculate the change in revenues

tasks to the analyst

- calculate the monetary value marginal impact, measured before and after the introduction of the policy

Hedonic pricing, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service (e.g. designation of blue flag in a beach)

Step 2: Identify ES and beneficiaries impacted by policy

tasks to the analyst

– engage with meetings with the domestic and international residents in coastal areas mapped with different risks with respect to beach and coastal erosion

Step 3: Data collection on residential property in the coastal area, including the area being valued bearing in mind valued

tasks to the analyst

– look for real estate sale data such as market price per square foot, GIS maps with info on a beach and coastal erosion risk, population demographics, crime, and school quality and others as identified by the analyst

Step 4: Estimate a hedonic price function that where the prices of the house are explained by the set of selected characteristics, including inter alia risk of beach erosion of the area where the house is located

tasks to the analyst

– proceed with the estimation coefficient of the hedonic function relates the risk of beach erosion to market price of the house

Replacement cost, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service (e.g. introduction of ecosystem based program to protect wetland)

Step 2: Identify ES and beneficiaries impacted by policy

tasks to the analyst

– look at water supply and purification services and look for data on water use by domestic inhabitants of the SIDS country under consideration)

Step 3: Identify man-made goods, infrastructure/technology that can replace the ecosystem services at the scale at which they are being used

tasks to the analyst

– engage in consultation experts and together identify the most suitable man-built systems, including data on the initial investment and operation costs)

Step 4: Estimate the costs of the selected man-made replacement infrastructure/technology

tasks to the analyst

– calculate the annual costs of the selected alternative infrastructure/technology, for example a desalinization plant, obtained through expert consultation

Contingent/Choice experiments, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service

e.g. introduction of ecosystem based program to protect wetland

tasks to the analyst

- formulate and describe an ES management scenario (CV)
- identify and describe the number of characteristics, and respective attributes levels that characterizes each alternative set (CE)

Step 2: Identify ES and beneficiaries impacted by policy

tasks to the analyst

- define the beneficiaries-shed, i.e. which population is affected by the proposed scenario description

Step 3: Design the survey

tasks to the analyst

- choice of the type of survey that will be used (mail, telephone, face to face), describe the ES change (in CV) and architecting the choice set (i.e. what characteristics will respondents be required to choose between), the payment vehicle (the monetary characteristic). Analyst is also recommended to explore the use of focus-groups and pre-testing so as to calibrate the text in the questionnaire and test the overall understanding of the valuation exercise by the respondent.

Contingent/Choice experiments, step by step

Step 3: Survey implementation

tasks to the analyst

- sampling strategy since it will not be possible to interview all people (this is often based on a random sampling plan from a statistical significant and representative sample of the population)

Step 4: Analysing the results

tasks to the analyst

- both techniques involve the use of technical software so as to estimate willingness to pay (in CV) and the implicit price for the ES-related attribute (in CE). These estimates then scale-up for the relevant population in order to calculate a total value for the ES under different scenarios.

Value transfer, step by step

Step 1: Policy scenario: specify the change in the quantity of the good or service

e.g. introduction of ecosystem based program to protect wetland tasks to the analyst

- formulate and describe an ES management scenario
- identify existing, relevant studies by literature review to identify value data and respective determinants or valuation conditions, including the type of the valuation technique used in the 'study site'. Several comprehensive databases of valuation data are available. The most frequently used one is the Environmental Valuation Reference Inventory (EVRI). For SIDS and IES we have also only resources by MESP-Marine Ecosystem Services Partnership, the World Resource Institute, and the Dutch Caribbean dataset

Step 2: Identify ES and beneficiaries impacted by policy

tasks to the analyst

- look at water supply and purification services and look for data on water use by domestic inhabitants of the SIDS country under consideration

Step 3: Review and select available studies

tasks to the analyst

- review the quality of information of the primary valuation study and its applicability to the policy site
- adjust and convert all the primary value estimates to a common monetary metric that allows the comparison

Step 4: Transfer the benefit estimates

tasks to the analyst

- use statistical analysis to obtain the estimates for the policy site. The analyst may choose unit value, WTP

Step 5: Value aggregation

tasks to the analyst

- identify the market/constituency over which the welfare impacts are relevant to as this way obtain a measure

Examples of policy issues addressed through ES assessment

Issues

How can ES accounts help?

How to increase **the contribution of coastal ecosystems** to inclusive growth and increased resilience?



Ecosystem accounts can help determine how management of coastal ecosystems can be improved and who will benefit

How to provide **sustainable finance** for management of biodiversity-rich, protected areas?



Land accounts can help determine the value and potential contribution from tourism, climate regulating services, and water supply provision

How to **achieve economic diversification** and reducing reliance on finite mineral wealth?



Location-specific tourism accounts can help determine the contribution of nature to tourism and how this can be increased

Conclusions

Economic valuation can help with

- a. **Contribution to quantification of inventories**
- b. **Contribution to compensate the foregone benefits of built environment at the coast**
- c. **Policy Instruments: taxes, subsidies...**

Limitations/Caveats

- *Sensitivity of estimates*: outliers
- *Valuation of flows (not stocks)*: Flow values are those derived over a defined period of time (usually one year)
- *Valuation on marginal terms*: We should also acknowledge that the valuation exercises are based on how people make trade-offs between resources (UNEP, 2011).

- *Valuation of linear effects versus non-linear effects:* Valuation is also commonly conducted in terms of average values or average effects that is, in terms of mean linear effects. This implies that we assume that the estimated effect will be constant over the whole range of values that the particular variable may take.