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VALUATION OF ECOSYSTEM SERVICES

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The Need for the Valuation of Ecosystem Services

Valuation of environmental functions is needed to help correct economic decisions that treat the environment as if it were a free input, in turn resulting in its misuse and to track their contribution to national income .

- Presentation covers:
 - Conceptual basis for valuation of ecosystem services.
 - Different ecosystems and the associated ecosystem services (ES), and methods of valuation applied to them
 - Applications of the methods to the range of ES as prepared by the ecosystem service group (WG3)

Valuation Issues and Methods

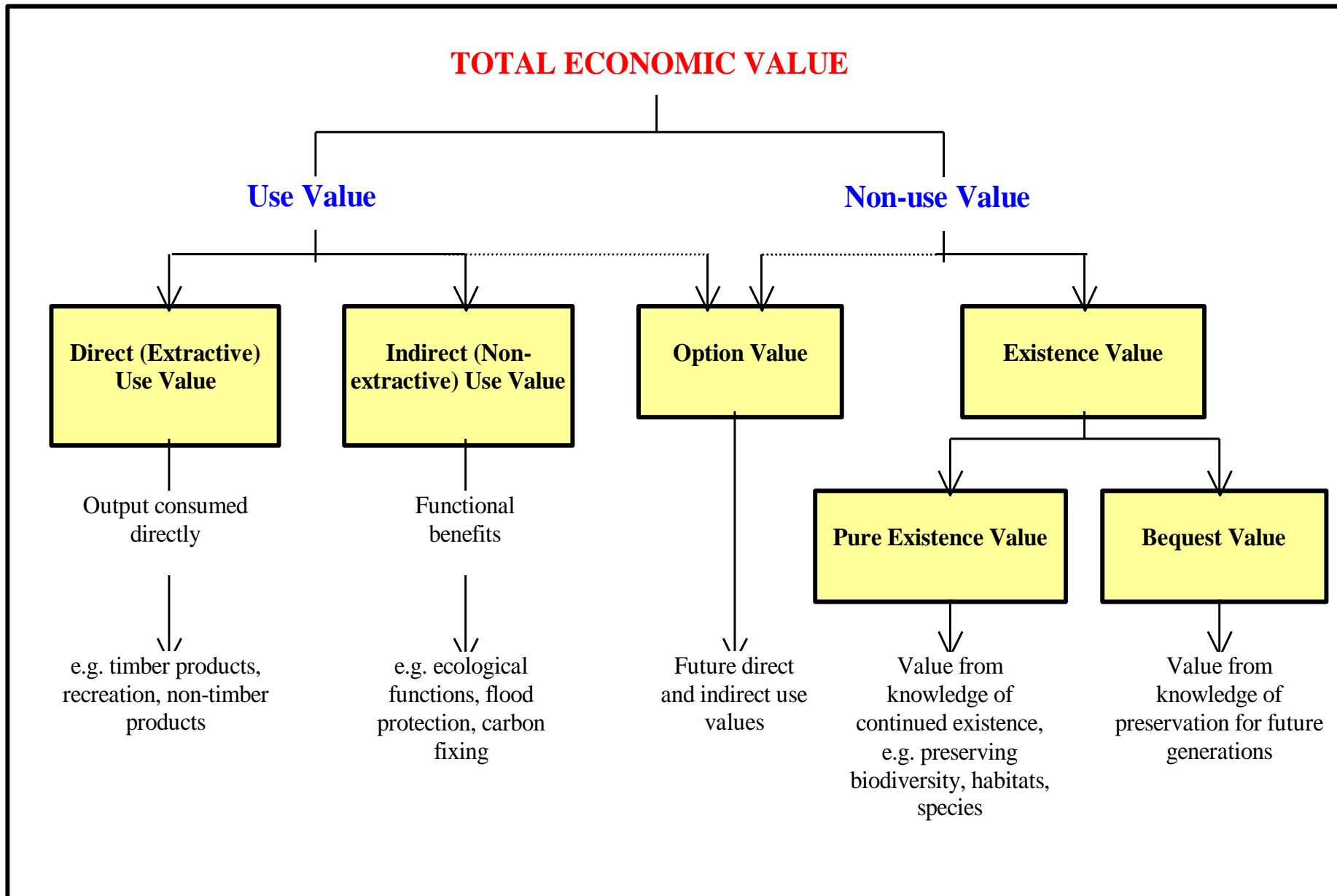
- ES are classified as: **Provisioning, Regulation and Maintenance, and Cultural.**
- **Provisioning services** relate to supply of food, energy and materials.
- **Regulation and Maintenance services** relate to control of wastes, toxics; flows of liquids, solids and gases; and maintenance of physical, chemical, biological conditions.
- **Cultural services** relate to physical & intellectual interactions with biota/ ecosystems; and to spiritual, symbolic interactions with biota/ ecosystems.

Biomes for which ES are Derived

Biome (marine/aquatic)	Biome (terrestrial)
Marine (Open Oceans)	Freshwater (Rivers/Lakes)
Coral Reefs	Tropical Forests
Coastal Systems	Temperate Forests
Coastal Wetlands	Woodlands
Inland Wetlands	Grasslands

Total Economic Value (TEV)

- TEV is made up of 'direct use,' 'indirect use' and 'non-use' values.
- Direct use can be 'consumptive' (e.g. direct harvest of forest products, fish or medicinal plants) or 'non-consumptive' (e.g. recreation).
- Indirect use values provide an input into another activity which has economic value, e.g. crop pollination, flood mitigation.
- Non-use values include option, bequest and existence values. Option values are the benefit placed on the potential future ability to use a resource (whether by current or future generations). Bequest value is the value attributed to maintaining something for the benefit of future generations. Existence value is the value obtained from knowing certain things exist for economic, moral, ethical or other reasons.
- TEV has been criticised because it can include double counting and does not separate stock and flow values. It can still provide a useful checklist.



TEV is concerned with the valuation of preferences **held by people**; it does not encompass any value which may intrinsically reside “in” environmental assets.

Estimates of Values of ES in the Literature

- Many ES services have been estimated for selected locations and across all the biomes.
- Estimates of values usually given in USD/ha vary a lot across studies.
- Estimates of different services for a biome cannot be added as regulating services are often the source of provisioning services.
- Also while many ES have been valued there are still gaps. The role of oceans in climate regulation is still being investigated. The same applies to the value of genetic resources and genetic diversity in different biomes and to a number of other categories of services.
- Studies for recreational and cultural services are disproportionately from developed countries

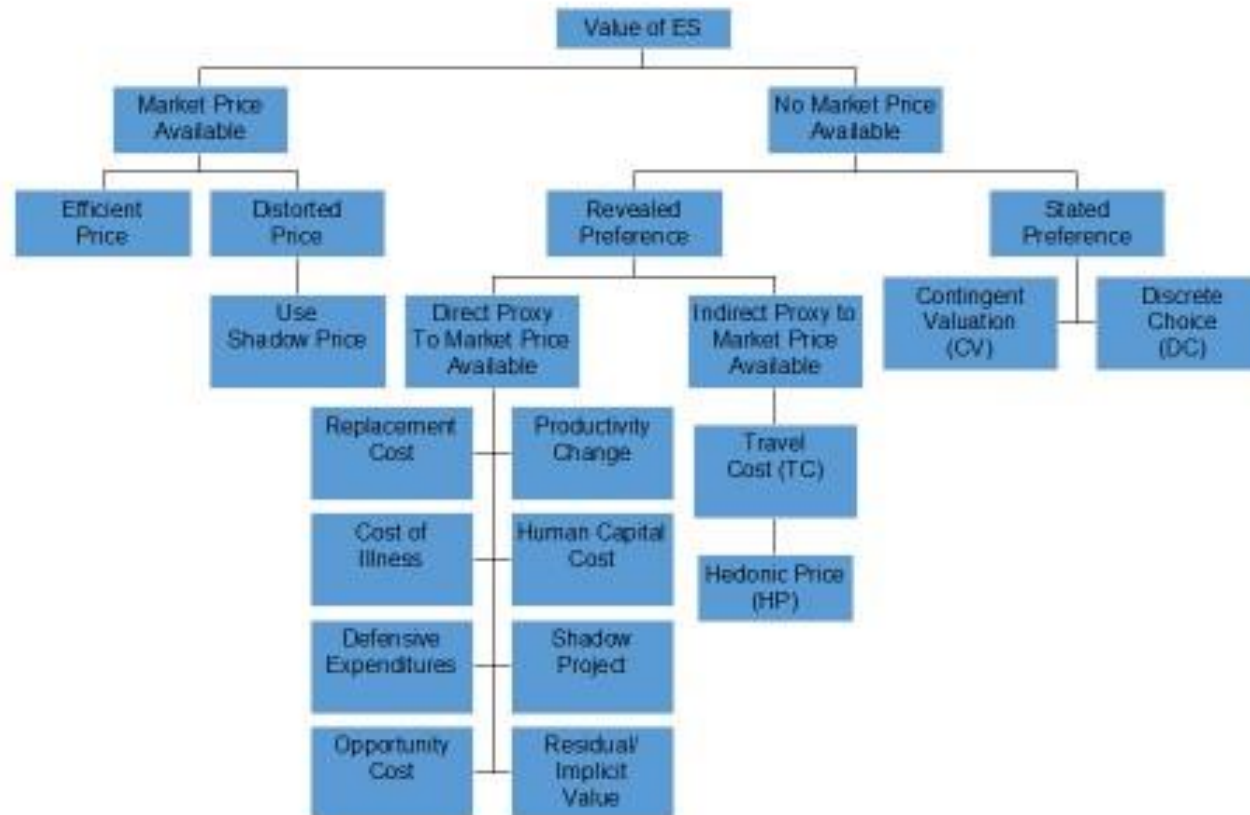
Range of Values for ES (USD/Ha. 2007 Values)

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%

Methods of Valuation

1. Based on physical linkages between environment and good, services, health.
2. Methods based on revealed preference
Investigating expenditures made to protect against a bad environment or take advantage of a good one
3. Methods based on stated preference.
Asking people affected by environmental change how much they value that change.

Taxonomy of Methods of Valuation



Benefit Transfer Methods

- Studies of the values of ES are location and time specific and do not cover all locations within a country. In these circumstances values that would feed into a set of national accounts would need to draw on data from the limited set to cover the whole country.
- This would involve value or benefit transfer, terms used to refer to using data from given sites and time periods to other sites and time periods.
- Value transfer is now the subject of a large literature dealing with the concerns that the procedures used in such transfer be valid and reliable.

Benefit Transfer Methods

- Studies show that possible ranges of error in using even sophisticated benefit transfer methods can be large. Controlling for extreme outliers, however, the average transfer error is about 40%.
- More sophisticated approaches (based on benefit function transfers) outperformed simpler approaches (based on largely unadjusted value transfers) in terms of reducing the likely error range
- Geographical proximity between policy and study sites reduces transfer error.
- Transfer errors are smaller for policies involving changes in environmental quantities than for those involving changes in environmental quality.

Summary of Valuation Methods and their Links to Exchange Values

Approach	Method	Exchange Values			Welfare Values
		Exchange Values Incorporated in GDP of SNA by Contribution to		Exchange Values not Incorporated in GDP of SNA	
		Production Activities	Consumption Activities		
Market Data Available	Productivity Change	√			
	Replacement Cost			√	
	Opportunity Cost			√	
	Defensive Expenditure	√	√		
	Cost of Illness			√	√
	Human Capital			√	
	Shadow Project	√			
	Residual Value	√			
Revealed Preference Methods	Travel Cost		√		√
	Hedonic Price	√			
Stated Preference	Contingent Valuation				√
	Discrete Choice				√

Valuation Methods Applied to Different ES

- SEEA has sought advice on valuing ES for a range of specific ES.
- In each case the question is which method to use and how estimate can be related to values that could be used in an SNA.
- ES covered are:
 - Cultivated biomass from agriculture, forestry and fisheries
 - Uncultivated biomass from agriculture, forestry and fisheries & marine environments
 - Carbon sequestration
 - Air filtration
 - Soil erosion prevention
 - Water purification
 - Water regulation
 - Water supply
 - Recreation enabling services
 - Habitat and biodiversity related services

Recreation Enabling Services

- Ecosystems provide a range of recreational and cultural services in urban and non-urban areas. Places where the activities take place are usually public areas with access that can be free or based on some payment.
- Where a charge is made for access to the location it usually covers some of the costs of maintenance but this is not a 'price' based on equating the demand for the service to the supply. Such an equilibrium price would lie somewhere between the full cost of provision of the service and the value to the users of the service.
- Supply costs can be estimated based on costs of maintenance plus costs of increasing the level of service to provide recreation for more people.
- Methods for estimating the demand were discussed earlier. The most common are revealed preference methods based on travel cost and hedonic pricing, and stated preference methods based on contingent valuation and discrete choice techniques.
- The "market price" for the service will lie somewhere between the demand marginal WTP and the marginal cost of supply. Methods to determine where are being researched.

Methods to Estimate ES and Inclusion in SNA

ESS	Included in SNA	Sectors	Methods/Comments
Cultivated biomass from agriculture	√	Agriculture	Market rental value of land if available. Residual value if not. Both used in some pilot accounts
Cultivated biomass from forests	√	Forestry	Market rental value of land. Implicit User Cost. Both used in some pilot accounts
Cultivated biomass from fisheries	√	Fishery	Production function. Residual value. Only residual value used in some pilot accounts
Uncultivated biomass from agriculture	√	Agriculture	Replacement cost. Crude production function possible.
Wild animals	Partial	Agriculture	Residual value from market transactions used in some pilot accounts
Uncultivated biomass from forests	Partial	Forestry	Stumpage value (2)

Methods to Estimate ES and Inclusion in SNA

ESS	Included in SNA	Sectors	Methods/Comments
Uncultivated biomass from fishery & marine environments	√	Fishery	Production function (Capture fishery). Residual value (Seagrasses)
Carbon sequestration	Partial	Several	Marginal cost of abatement. Carbon related instruments such as taxes are recorded in the national accounts in many countries Social cost of carbon.
Air filtration	Partial	Health	VSL or DALY plus Costs of Morbidity (3)
Soil erosion prevention	Partial	Agriculture	Production function. Replacement cost.
Water purification	Partial	Utility	Market Transactions (4). Avoided artificial purification costs and costs of artificial treatment (5)
Water regulation	Partial	Utility	Value of services based on damages avoided and costs of provision (5)
Water supply	Partial	Utility	Residual value. Production function.
Recreation enabling services	Partial	Public service	Value of services estimated from revealed preference or stated preference and costs of provision (5)
Habitat & biodiversity-related services	Yes Partial No No	Agriculture Rural public	Nursery: Residual value Habitat: Prospecting transaction data Cultural: Travel cost Non-Use: Stated Preference

Conclusions

- Valuing of ES is a well developed field of research.
- It is based on the theory of value where WTP and WTA are the foundations.
- Values have been obtained for a wide range of services and methods have improved a lot over the last 50 years but there are still gaps.
- In applying these values in an accounting context it will often be necessary to transfer values from studies of specific sites to others where there are studies. This gives rise to some errors but is unavoidable and should be done taking account of differences as much as possible.

Areas Where Further Discussion is Needed

- Where exchange values cannot be obtained directly from the methods described, alternative approaches may be possible but need further discussion.
- One is to use also estimate the costs of provision and combine the demand information of WTP to obtain a range for the exchange value.
- Another is to rely on the costs of provision of the ES as the value for the SNA, as is done for other public goods.
- A third is to consider voluntary contributions to different nature conservation groups as a measure of use and non-use values not included in the above.