Valuation of ecosystem services: Panacea or Pandora's box for decision-makers?

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The Economics of Ecosystems and Biodiversity (TEEB, 2010) is an international initiative (i) to promote understanding of the value of ecosystem services (ES) and (ii) account for this value in decision-making. The report on the contribution of Forestry for People in Scotland (2008) highlights the importance of incorporating into forestry the provision of benefits in terms of health and well-being, learning, education, and the viability and vibrancy of communities.

OBJECTIVES: Taking inspiration from the ideas developed in Scotland, and in the MEA, UKNEA, Defra and other documents, we seek to contribute to:

- Conceptualising the value of ES (Table 1);
- Analysing the types of value estimates;
- Assessing social science valuation tools;
- Combining valuation tools;
- Applying ES valuation, and
- Answering the question: to value and how to value? Opportunities and challenges.

Table 1: Key components of total economic value (TEV)

Direct Use	Provisioning services	Timber, woody biomass for energy, non-timber products
	Social/cultural services	Recreation, health care
Indirect Use	Regulating services	Air quality regulation, flood and soil erosion management
	Support services	Soil formation & protection, carbon sequestration
Other	Option services	Future use, resilience
	Non-Use: Existence and Bequest services	Cultural, stewardship, intrinsic value of nature

Source: adapted from Glaves *et al* (2009)

Markets can provide tools in many cases, but they do not work everywhere. Wider social science approaches and their proper combination can then assist in valuation (Figure 1). Valuation should be incorporated wider in decision-making processes; but when public good and intrinsic values issues are concerned, ethical and political choices must be made carefully and deliberately agreed. Much then depends on government involvement and proper incentives (non-economic and economic, e.g. PES) towards the changing of behaviours for a more sustainable use of forests.

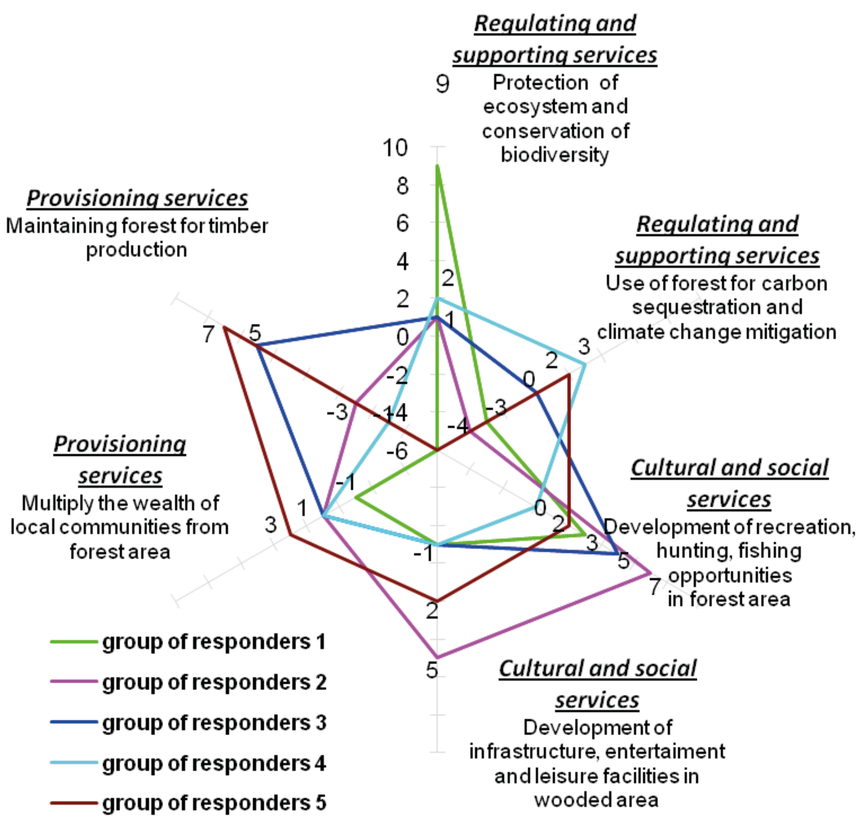

Figure 1: An example of stakeholder valuation of ES Source: Nijnik *et al*. (2013)

Valuation provides estimates of how an ES contributes to well-being. It helps informing decisions, prevention of damages and managing potential conflicts.

Valuation can be divided into ecological, socio-cultural and economic. **Ecological** value can be determined by the indicators of complexity, diversity or naturalness etc. **Socio-cultural** value is reflected in end-user perceptions of their non-material well-being or through equity. **Economic** indicators are those of employment, income etc.

Table 2: The connection between excludability/rivalness and categorization of ES

	Excludable	Non-excludable
Rival	***Market goods*, i.e. most elements of the provisioning ES (timber, fish, fungi, honey, berries etc.)**	***Open access resources ('tragedy of the commons'): elements of ecosystem structure that are not protected by property rights (e.g. timber from open access forests)***
Non-rival	**Inefficient market goods Information or '*club goods*'**	***Public good:* supporting and regulating ES (e.g. biodiversity, climate or water regulation, clean air)**

Source: adapted from Farnsworth *et al*. (1983) and Randall (1993)

Valuation also employs methods developed by economists. When markets are explicit, economic valuation (based on prices) is applicable. The user values can be 'marketed', e.g. using Contingent Valuation (CVM) or Travel Cost (TC) methods, even for some **public goods** (Table 2). However, economic valuation of biodiversity or landscapes is challenging due to their uniqueness and distinctiveness and because of the shortage of robust primary valuations.

Table 3: Selected examples of valuation methods

Examples of ES/goods	Valuation method	Value
Provisioning services		
Timber	Market valuation	Market prices
Non-timber products	Market valuation	Market prices
Woody biomass for energy	Market valuation	Market prices
Regulating services		
Carbon sequestration	Cost-effectiveness	MAC (costs per tCO_2)
Climate regulation	Market valuation	Market prices (if CO_2 is traded)
Erosion alleviation	Replacement, relocation and avoided cost methods	Avoided losses in yields or cost of increased yields
Shelter belts	Avoided cost methods	Avoided losses
Air quality	Benefit transfer (BT)	BT estimates
Flood regulation	Relocation and avoided cost methods	Avoided losses
Cultural services		
Recreation	CVM, Choice experiments (CE) or TC methods, Indirect market valuation	Willingness to pay (WTP) values or TC estimates, market pricing
Landscape beauty	Hedonic pricing (HP) or CE methods	HP values or WTP values
Health	Indirect market valuation	Changes-in-productivity, cost-of-illness
Supporting services		
Oxygen	Replacement cost methods	Cost of oxygen
Soil formation/protection	Avoided cost method	Cost of purchasing top-soil from elsewhere
Species diversity	Indirect market valuation	Donations for conservation

CONCLUSIONS:

- Valuation depends on the robustness of methods (Table 3), our understanding of ecological processes and the accuracy of quantifying human-environmental relationships.
- Valuation is case specific, context sensitive and contingent to scales.
- Values change temporally and spatially; they also vary across stakeholders.
- ES may contribute to other services leading to double counting.
- The complexity and spatial arrangements pose further challenges.
- ES are being judged on what they are rather than on their potential to become. Due to future uncertainties the potential use and non-use values are difficult to assess.
- Non-use values comprise intrinsic values, the economic valuation of which is unlikely to be possible.
- The concept of the safe minimum standard and 'cautionary principle' should be considered, where potentially irreversible impacts on ES can be predicted.

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