

## Ecosystem service valuation and consistency with other valuation approaches

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### Key points

1. We highlight and illustrate differences between welfare and exchange values for non-provisioning services from ecosystem assets.
2. The exchange value concept can be interpreted either as a narrow “near market” value; or as a more substantial value based on an “imagined” or “posited” market. We recommend the latter as being more relevant for ecosystem accounting, but further work is needed to develop relevant conventions and guidance.
3. Welfare values are necessary for policy use; exchange values are necessary for consistency and integration with the national accounts. Both can be consistent with a single set of physical flow accounts.
4. This paper takes examples from three particular ecosystem services. There is a need to work systematically through other services, in order to identify relevant valuation solutions and options for each.

### Introduction

In recent years, the UK has been grappling with a number of valuation issues for ecosystem accounts.<sup>3</sup> The emphasis has been on making practical progress, whilst having due regard to the SEEA-EEA and the National Accounting framework to which the accounts are oriented. Based on UK experience, this short paper exposes some general challenges in valuing certain services, and offers suggestions on a way forward.

SEEA-EEA and the recently drafted Technical Recommendations (TRs)<sup>4</sup>, as well as other papers<sup>5</sup>, have reviewed valuation approaches in order to identify the extent to which they may be used or not to estimate “exchange values” that would be consistent with the National Accounts. The draft TRs define exchange values as values “that reflect the price at which ecosystem services would be exchanged between buyer and seller if a market existed” [emphasis added]. Underpinning exchange values is the “notion that there is a transaction or exchange between ecosystem assets and economic units, businesses, governments and households, that could be imagined to take place in a market setting” (6.13). It follows that exchange values could be hypothetical or imputed, and logically implies more than one method or estimate might be consistent with this concept. The rest

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<sup>3</sup> See ONS and Defra, [Principles of Natural Capital Accounting](#), (February 2017) for the latest statement of the UK approach.

<sup>4</sup> Final Draft v2.2 was issued on 15 August 2017.

<sup>5</sup> e.g. G. Atkinson and C. Obst, *Defining exchange values for non-market transactions in ecosystem accounting using environmental economics* (Draft paper for WAVES PTEC, April 2016)

of this paper demonstrates these differences, and the issues arising. To enable practical progress, further guidance and development of principles and conventions appear to be required.

### Different approaches to valuing services

As the draft TRs acknowledge, the existence of services which have a significant non-market element pose challenges. This is particularly clear for regulating services, such as air filtration, carbon sequestration, noise regulation or flood risk reduction. Cultural services such as outdoor recreation also have a strong non-market component. For these services, we can see two alternative valuation approaches: one tending to be based more on observed or revealed market exchanges, the other based squarely on an imagined or “posited” market setting. Both are considered distinct from a valuation approach based on economic welfare to beneficiaries. Table 1 summarises the position. In all cases, the aim would be to value the contribution of the ecosystem to the benefit i.e. excluding other (produced or economic) inputs, as set out in SEEA-EEA.

**Table 1 Summary of valuation concepts**

Concept	Description	Evaluation
<b>Welfare value</b>	Includes full consumer surplus	In principle not compatible with standard national accounts unless it is assumed that the ecosystem has monopoly power to extract all consumer surplus on every unit (Day, 2013) <sup>6</sup>
<b>Exchange value</b>	Posited market exchange	In principle compatible with standard national accounts.
	Observed market exchange	In principle compatible with standard national accounts. Likely to generate low unit values and would represent only a fraction of the physical service.

### Illustrating different valuation concepts

Table 2 illustrates the range of potential values these three concepts can generate, based on work done in the UK to date for three selected services: carbon sequestration, air filtration and outdoor recreation. Whilst the strength of the distinction between posited and observed exchange values may be contested, it is clear that a spectrum of possibilities is present. The first row shows that welfare-based values are relatively high, as might be expected. The bottom row shows that near-market exchange values can be very low. The middle row indicates that a posited or imagined market will provide a value somewhere between these two “extremes”. Intuitively, this approach would seem to offer a more appropriate way of valuing those services which have significant non-market benefits.

At present, the UK accounts are yet to make these distinctions explicit. Welfare values have provisionally been used in published accounts for carbon sequestration and air filtration, but not outdoor recreation, where a posited market approach has been taken. Observed exchange values for recreation have been published, but no such estimates for carbon sequestration or air filtration

<sup>6</sup> Note that adoption of a welfare approach need not mean that a downward sloping demand curve is essential to measure. In many cases, an ecosystem that supplies regulating services can be seen as a “price taker”. This is because the service (such as abated carbon, or reduced air pollution) is making a small reduction in a wider negative externality. In this case, the use of standard marginal unit valuations such as the UK Government’s non-traded price of carbon or air quality damage costs, can be applied to the whole volume of the service i.e. the demand curve is horizontal. For this reason also, it would be misleading to posit an ecosystem as having monopoly power.

have been published. For air filtration and carbon sequestration, estimates of posited market values are seen as a subset of the welfare estimate.

**Table 2 Illustrating different values for selected non-market services**

	<b>Carbon sequestration</b>	<b>Air filtration</b>	<b>Enabling outdoor recreation</b>
<b>Welfare value (relatively high)</b>	<p>UK Government provides “cost to society” values for use in policy appraisal. Based on meeting Government targets for carbon mitigation. Intuitively, social carbon value is given by the intersection of a “supply curve” of society-wide carbon abatement with the “demand curve” of UK policy target.</p> <p>In 2015, the published UK carbon price is £62/tonne CO2 eq. Future prices (rising) to 2100 are also published.</p> <p><b>2015 value = £1.05 billion* (woodland only)</b></p>	<p>Based on full social damage as set out in UK Government guidance, based on costs and avoided loss of health.</p> <p><b>2015 value = £1.01 billion (all ecosystems)*</b></p> <p>The vast majority of this value is based on savings in “life years lost”.</p>	<p>In theory this would reflect travel cost approaches or random utility modelling in which a willingness to pay value is estimated, for individual sites, groups of sites, or more generally. The value of time would be included in this concept, ideally as part of the willingness to pay function.</p> <p>In previous publications we have identified a comprehensive valuation based on:</p> <p>Observed travel costs</p> <p>+ Observed admission and parking fees</p> <p>+ Opportunity cost of travel time (standard values)</p> <p><b>2014 value = £21 billion (all ecosystems)</b></p> <p>Non-ecosystem inputs to the recreational service (e.g. facilities and maintenance) would need to be deducted.</p>
<b>Posited exchange values (inter-mediate)</b>	<p>Above cannot be interpreted as an exchange value because the Government looks for cost-effective interventions, and so would not pay £62/t for <u>every</u> tonne of carbon sequestered.</p> <p>Estimation requires further research, but would fall between welfare value and observed value (below)</p> <p><b>Value = somewhere between £0.1 billion and £1.05 billion.</b></p> <p>Needs further research.</p>	<p>Without the ecosystem, there would be an increase in health damages which would have costs to the public health service (or insurance premiums where healthcare is privately provided)</p> <p>Much of the £1.01 billion welfare value could be interpreted as an exchange value, since Government is willing to spend to improve public health, reduce hospital costs and improve productivity. But it seeks to procure health benefits cost-effectively, which would imply valuation at less than full social damage costs.</p>	<p>Valuing travel time is ruled out of exchange value by TR (Table 6.1) as outside the production boundary.</p> <p>Many UK sites, especially in urban areas, have free entry. Here, travel costs to sites are interpreted as the price of access; it is recognised that such transactions are with third parties (e.g. fuel providers, bus companies). Valuation based on:</p> <p>+ Observed travel costs</p> <p>+ Observed admission and parking fees</p> <p><b>2014 value = £6. 52 billion*</b></p> <p>An exchange value for free trips that involve walking could be imputed through hedonic analysis of property price data, or through the estimated expenditure had the visitor drove by car to that site. Needs research.</p>
<b>Observed exchange values (low)</b>	<p>Woodland carbon is currently traded in a fledgling market under the UK Woodland Carbon Code (WCC). Global prices average around £6/t, one tenth of the social carbon price. However, this only accounts for a fraction of the service supplied and does not reflect a fully functioning market in which prices reflect policy targets. Applying this price to <u>all</u> sequestered carbon = <b>£0.1 billion.</b> But a pure observed value would cover only UK WCC transactions i.e.</p>	<p>Market expenditure to reduce air pollution is seen as a substitute for the ecosystem service and can be valued in this way. References to air filtration services in the TRs suggest that the exchange value could be low (e.g. 6.21, 6.51).</p> <p>Market expenditure on produced air filtration services (e.g. spending on cycling masks) would be a narrow approach, and face serious challenges e.g. identifying and calculating a single replacement</p>	<p>Only values observed admission and parking fees to sites. This excludes recreational visits, whether accessed via transport or walking, which do not require entrance or parking fees. It implies that the majority of the physical service has zero value.</p> <p><b>2014 value = £2.99 billion</b></p> <p>This is gross of producer costs As these could be quite substantial, the net figure could be considerably lower.</p>

	16,000 hectares or 0.5% of total woodland area.	cost, or converting averted behaviour into unit values.	
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Note – \* indicate that the estimate has been used in the UK accounts

### **The need for further guidance on posited exchange values**

For progress to be made, further principles or conventions need to be developed to inform how such posited markets and their institutional settings may or may not be conceived. Examples of such considerations might include:

- The need for a clear description of the users and beneficiaries. The role of Government also needs to be clear: is it a buyer or simply the market maker? A related accounting issue is whether an imagined buyer (e.g. Government) can be a different institutional sector to the beneficiaries e.g. households (for air quality), rest of world (for carbon), on whose behalf government is buying.
- A recognition that for regulating services, the loss of the ecosystem service would increase costs elsewhere in the economy, for government, businesses or households, either because of damage or mitigation (whichever are the lower). There is a need to articulate better the nature of the exchange where replacement or damage cost approaches are used.
- A recognition that ecosystems may only be one supplier of a regulating service, implying that an ecosystem would lack monopoly power.<sup>7</sup> Conversely, if government is posited as a buyer, this would imply having monopsony power and a strong incentive to procure ecosystem services cost-effectively, suggesting lower exchange values.
- Whether a proxy market (e.g. such as fuel costs for travel to recreational sites in Table 2) can be interpreted as equivalent to a posited market.

Development of these and other issues would facilitate consistency of approaches, and enhance the credibility and understanding of estimates that are published.

### **The need for both exchange and welfare values**

The draft TRs confirm that economic welfare estimates of value are in principle not compatible with the exchange value accounting concept, even if they are important in other regards. However, it notes that welfare and exchange values can share the same underlying accounting framework, for example based on the same production boundary, and the same physical measure of the service (6.22, 6.24). This would be our working assumption.

The UK experience to date is that ecosystem accounts are more likely to have policy influence and buy-in where accounting values are seen to be comprehensive, intuitive and credible. For example, monetary accounts are seen as a readily available evidence source for appraisal purposes. Policy users are less conscious of the need to be fully aligned with SNA concepts of exchange value. For policy audiences, we may need to distinguish between “soft” and “hard” natural capital accounting estimates, the former making full use of welfare estimates, the latter being SNA compatible based on (posited) exchange values. Comparison of exchange and welfare values provides a potentially

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<sup>7</sup> See footnote 6 above.

interesting and relevant set of indicators, for example, how much of the “total” value is actually realised or potentially could be realised by markets.

## **Conclusion**

Generating transparent, intuitive, consistent and credible valuations within ecosystem accounts is vital to their wider acceptance but is challenging. Whilst some flexibility will be necessary, there is a need for more guidance and principles, in particular with regards to the definition of exchange values. The UK has done some groundwork as this paper shows, but significantly more work, discussion and testing is needed to clarify concepts and identify robust solutions for valuation and analytical purposes. More generally, there is a need to work systematically through each service and evolve guidance, principles and conventions for the most appropriate methods and approaches.