



Economics of Ecosystem Goods and Services

Scope of this policy

1. This policy (2010) sets out the Scottish Wildlife Trust's (SWT's) position on the economics of ecosystem goods and services. It outlines how SWT will respond to developments in this increasingly important area to ensure maximum gain for biodiversity and wildlife conservation.

Policy Headlines

SWT believes that biodiversity should be conserved for both its intrinsic value, and for its role in maintaining healthily functioning ecosystems on which humans and other species depend.

SWT believes that the ecosystem services approach could become a valuable tool in reversing biodiversity loss and ecosystem degradation but much will depend on how valuations are used (or abused).

SWT supports efforts to incorporate the value of ecosystem goods and services in economic models subject to the selection of appropriate non-market values and consideration of the intrinsic value of biodiversity.

SWT advocates that the ecosystem services approach should always complement, rather than substitute for, traditional species, habitats and ecosystem conservation measures (such as legal protection, site designation and catchment planning).

SWT advises that relatively detailed and reliable biological data must be available prior to any ecosystem services assessment being carried out.

SWT urges Governments to develop alternative and / or parallel economic indicators to compensate for the shortcomings of Gross Domestic Product (GDP) which fundamentally fails to capture the value of biodiversity and the wider environment.

Definitions

2. "Biological diversity" means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems¹.
3. "Ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
4. "Sustainable use" means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.
5. Natural capital² is the stock of natural ecosystems that yields a flow of valuable ecosystem goods or services into the future and may be a useful concept for linking ecosystem services with ecosystem health and

¹ Definitions of biological diversity, ecosystem and sustainable use are those found in the Convention on Biological Diversity, Article 2.

functioning. Since the flow of services from ecosystems requires that they function as whole systems, the structure and diversity of the systems are important components of natural capital.

Context

6. Exclusion of environmental goods and services from consideration in economic decision-making systems is commonplace and is leading to global biodiversity loss on a pace and scale unprecedented in human history. To quote from a recent report from an influential international initiative entitled *The Economics of Ecosystems and Biodiversity* (TEEB)³ established by Government of Germany and the European Commission in response to a proposal by the G8+5:

"The steady loss of forests, soils, wetlands and coral reefs is closely tied to this economic invisibility. So too are the losses of species and of productive assets like fisheries, driven partly by ignoring values beyond the immediate and private. We are running down our natural capital stock without understanding the value of what we are losing".

7. An emerging approach to valuing the environment is the idea of valuing ecosystem services, which is widely interpreted to mean the benefits people obtain from ecosystems. These include provisioning, regulating and cultural services that directly affect people, including human health, and the supporting services needed to maintain other services.
8. The Millennium Ecosystem Assessment (MA) grouped ecosystem services into four broad categories:
 - **Supporting services** such as nutrient cycling, oxygen production and soil formation. These underpin the provision of the other "service" categories;
 - **Provisioning services** such as food, fibre, fuel and water;
 - **Regulating services** such as climate regulation, water purification and flood protection;
 - **Cultural services** such as education, recreation and aesthetic value.
9. It is important to stress that the concept of ecosystem services and their valuation and protection is one facet of the wider Ecosystem Approach.

Environmental economics and market failure

10. It has long been recognised that 'value' in economic systems is inadequately captured by price⁴. Measures based on price, such as Gross Domestic Product (GDP), measure economic activity, not national well-being. Responses to this problem have been historically slow in emerging, with the discipline of environmental economics coming to prominence in the wake of Garret Hardin's 1969 paper "The Tragedy of the Commons"⁵. Hardin's paper, although not without its critics, describes a market failure: that the market does not provide a panacea for all economic problems and situations and when unregulated it may actually destroy the resource₂.
11. Market failure can occur when private decisions based on prices, or lack of them, do not generate an efficient allocation of resources. There is a mis-match between what individuals want privately and what society wants as a collective.⁶ The environment, the goods and services we derive from it, and our dependence upon it are classic public goods, under-provided – or not provided at all – by the market which depends for its functioning on the concept of price and exchange.

² See Hawken, Paul; Amory Lovins, Hunter Lovins (1999). *Natural Capitalism: Creating the Next Industrial Revolution*

³ See <http://www.teebweb.org/LinkClick.aspx?fileticket=I4Y2nqqIICg%3d&tabid=1019&language=en-US>

⁴ In 1860 John Ruskin published a critique of the economic concept of value from a moral perspective. In *Unto This Last*, he wrote: "It is impossible to conclude, of any given mass of acquired wealth, merely by the fact of its existence, whether it signifies good or evil to the nation in the midst of which it exists. Its real value depends on the moral sign attached to it, just as strictly as that of a mathematical quantity depends on the algebraic sign attached to it. Any given accumulation of commercial wealth may be indicative, on the one hand, of faithful industries, progressive energies, and productive ingenuities: or, on the other, it may be indicative of mortal luxury, merciless tyranny, ruinous chicanery."

⁵ Hardin, G. 1968. The tragedy of the commons. *Science* 162 (3859): 1243-1248.

⁶ Hanley, N., J.F. Shogren and B. White. 1997. *Environmental Economics in Theory and Practice*. Basingstoke: Macmillan. p22

12. This market failure is characterised by economic externalities. An externality occurs where a cost (or benefit) from an activity does not accrue to the person or organization carrying out the activity⁷. An example might be a corporation which emits effluent into the wider environment causing pollution, the benefits of which (in the form of not paying to dispose of wastes properly) accrue to the corporation but costs of which are borne by society as a whole. External benefits are effects of activity which have a welcome effect on those who cannot be charged to receive them. Public enjoyment of views of private buildings or gardens, or the benefit of fruit crop pollination by bees are examples of external benefits which can be priced as a direct service, but cannot be charged.
13. Externalities can be corrected or internalised in a number of ways. Direct prohibition through legislation is perhaps the most obvious, as in the case of the United Kingdom's Clean Air Acts. Government provision, such as funding for environmental stewardship and the use of so-called Pigovian taxes which are imposed at a level equal to the perceived value of the negative externality. Landfill tax and carbon trading are examples of Pigovian mechanisms.
14. Public goods are available to anyone without charge. We might classify public goods into two further categories: provided public goods and natural public goods. Provided public goods include government services such as defence, municipal parks, roads, education and health services for which an indirect charge is levied through taxation. Less expensive public goods, such as monuments, smaller parks and nature reserves are often provided through private fundraising or altruism. Natural public goods are those which the environment provides such as air, water, pollination, etc. What they have in common is that their market price (where there is a market price) does not capture the social benefits of their provision.

Valuing the environment

15. Attempts have been made to bring environmental goods and services within the scope of economic decision-making by creating pricing tools to ascribe monetary values to them. For valuing services which can be marketised, this can be a relatively straightforward exercise: the economic value of pollination, for example, can be calculated from the value of crops produced, notwithstanding the wider importance of pollination in maintaining ecosystems. A 1997 study⁸ identified 17 ecosystem goods and services⁹ in its attempt to place a monetary value on the world's ecosystem goods and services. The study valued the entire biosphere at between US\$16-54 trillion (10^{12}) per year with an average of US\$ 33 trillion. Recent work¹⁰ estimates the value of ecosystem services to Scotland at £21 billion (2008 prices). It is important to note that of the 187 possible ecosystem services identified in the study, 88 could not be valued and were therefore assigned a zero value.
16. A number of methods are used to derive monetary values aspects of the environment. Market-based techniques (i.e. standard economic techniques) can be used to quantify the value, for example, of biodiversity-based ecotourism. Reintroduced white-tailed eagles are estimated to be worth around £1.7 million to the Mull economy annually¹¹. Revealed preference techniques can be used to elicit how much people spend to prevent biodiversity loss or how much people will spend to experience biodiversity (travel cost) etc. Stated preference techniques such as contingent valuation depend on what people say they are prepared to spend or to accept. In each case, biodiversity values are monetised in a fashion which forces non-market goods into market decision-making structures. These techniques can also elicit responses based on emotion which may reinforce preferences for so-called charismatic mega-fauna over equally important but less appealing or accessible organisms.

⁷ Black, J. 1997. *Oxford Dictionary of Economics*. Oxford: Oxford University Press.

⁸ Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. *Nature*. 387: 253 - 260

⁹ Gas regulation; climate regulation; disturbance regulation; water regulation; water supply; erosion control and sediment retention; soil formation; nutrient cycling; waste treatment; pollination; biological control; refugia; food production; raw materials; genetic resources; recreation; cultural.

¹⁰ RPA & Cambridge Econometrics. 2008. The economic impact of Scotland's natural environment. Scottish Natural Heritage Commissioned Report No 304 (ROAME No R07AA106)

¹¹ <http://www.scotland.gov.uk/News/Releases/2006/06/12104522>

17. Valuing ecosystem goods and services can underline their essential role in maintaining a healthy – indeed a functioning – economy. The Economics of Ecosystems and Biodiversity project (TEEB) estimates that the cost of global biodiversity decline under a business-as-usual scenario could be as much as €14 trillion by 2050¹² (around 7% of global gross domestic product or GDP). The *Stern Review of the Economics of Climate Change*, published in 2006, estimates that the cost of business-as-usual carbon emissions would cost 5-20% of GDP by 2050, while the costs of climate stabilisation could be around 1% of GDP. Valuing ecosystem goods and services brings those goods and services within economic decision-making systems. It is important to be clear about what is included and what is not.
18. The MA definition of ecosystem services is anthropocentric. Biodiversity (by which we mean “biological diversity” as defined by the Convention on Biological Diversity) is only considered insofar as it delivers specific services to humans, such as food provision, medicine or aspects of climate regulation. Many aspects of biodiversity do not currently appear to deliver any human benefit beyond their simple existence, whether that existence is yet known or not. This may be a function of insufficient understanding as research into the contribution of biodiversity to ecosystem function is in its infancy, with emphasis to date on understanding the contribution of biodiversity to selected ecosystem processes rather than to ecosystem services¹³. The contribution that an *ecosystem services* approach can make remains unknown and is therefore an urgent research priority.
19. There is a growing body of evidence that ecosystem services are more effectively protected when they are part of an ecological restoration strategy¹⁴. An ecosystem services approach should never be considered a replacement for a well-established biological conservation strategy¹⁵.
20. TEEB is currently conducting a global study on the economic consequences of biodiversity loss. TEEB aims to:
 - Rethink today's subsidies to reflect tomorrow's priorities;
 - Reward currently unrecognised ecosystem services and make sure that the costs of ecosystem damage are accounted for by creating new markets and promoting appropriate policy instruments;
 - Share the benefits of conservation;
 - Measure the costs and benefits of ecosystem services.
21. As TEEB is supported by the EU, major industrialised countries and the United Nations Environment Programme (UNEP), it can be expected to be influential in policy development.

Biodiversity Banking

22. Biodiversity has been commoditised in bio-banking schemes in New South Wales¹⁶ and wetland banking in the United States¹⁷. These schemes do not place a direct monetary value on biodiversity but do imply equivalence setting. Biodiversity offsets can provide the opportunity to create biologically diverse habitats where none would otherwise exist and may therefore represent a conservation gain.
23. Whilst biodiversity banking and offsetting schemes may appear to offer the possibility of limited biodiversity gain they depend on high-quality biological data, thorough assessment and a stringent approval process.

¹² Braat, L., P. ten Brink, J. Bakkes, A. Chiabai, H. Ding, M. Jeuken, M. Kettunen, U. Kirchholtes, C. Klok, A. Markandaya, M. Nunes, M. van Oorschot, M. Rayment, C. Traversi and M. Walpole. 2008. The cost of not meeting the 2010 biodiversity target. European Commission.

¹³ Luck, G.W., R. Harrington, P.A. Harrison, C. Kremen, P.M. Berry, R. Bugter, T.P. Dawson, F. de Bello, S. Diaz, C.K. Feld, J.R. Haslett, D. Hering, A. Konotogianni, S. Lavorel, M. Rounsevell, M.J. Samways, L. Sandin, J. Steele, M.T. Sykes, S. van den Hove, M. Vandewalle and M. Zobel. 2009. Qualifying the contribution of organisms to the provision of ecosystem services. *BioScience* 59: 223-235

¹⁴ Benayas, J. M., A.C. Newton, A. Diaz and J.M. VBullock. 2009. Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. *Science* 325: 1121-1124

¹⁵ The International Convention for the Regulation of Whaling of 1946 adopts an ecosystem services approach and aims not for the conservation of whales, but to “provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry”. The current (1986) moratorium is increasingly being breached and is under growing pressure from whaling nations and their client states with the likelihood of a return to commercial whaling a growing threat.

¹⁶ <http://www.environment.nsw.gov.au/biobanking/>

¹⁷ <http://cmsdata.iucn.org/downloads/bdoffsets.pdf>

24. Biodiversity offsetting is a supplementary means of minimising the environmental impacts of projects and should only be used when loss is otherwise unavoidable and all other alternatives have been considered.

Policy statement

25. Biodiversity has intrinsic value and SWT believes there is a clear moral justification for its conservation on these grounds alone, regardless of whether biodiversity also has benefits in terms of ecosystem services provision.
26. SWT also believes that valuing ecosystem goods and services can deliver conservation benefits (though this may not always be the case). The utilitarian concept of value can sometimes fail to capture all that is important or valuable, but such approaches can nevertheless offer insights which can benefit biodiversity. By showing the economic costs of damaging biodiversity, economic measures can be designed to eliminate, for example, perverse subsidies¹⁸ which can, and often do, reward environmentally damaging practices (e.g. headage payments for livestock leading to overgrazing). Similarly, by incorporating ecosystem services into Cost-Benefit Analysis alongside biodiversity, better environmental and economic outcomes might be expected of economic decisions. Economic analyses should never be used in isolation or as an alternative to traditional conservation strategies such as designating protected areas and environmental regulation.
27. Lack of a market value does not mean an environmental commodity lacks value; it merely lacks price. Over-reliance on market values for non-market goods can, in itself, create perverse incentives at government level and potentially lead to the loss of important species or habitats which are not perceived to be of great value by contributors to economic valuation techniques. As so many aspects of environmental and biodiversity value are beyond the reach of market values or prices, it is imperative that market measures should only be used as decision-support tools after non-market values have been considered.
28. SWT believes that Government and civil society in Scotland should work in partnership with the EU and other Governments worldwide to develop market-based mechanisms for valuing and trading ecosystem goods and services in a sustainable way. To this end, SWT supports efforts by Scottish Natural Heritage (SNH), Natural England and others to further understand and develop economic tools for valuing and protecting Natural Capital.
29. Although GDP and similar economic indicators may be useful to governments and economists, SWT believes they are an inadequate measure of real economic value and of the value inherent in environmental systems. Alternative and / or parallel measures should be developed and adopted which recognise that many of the most important life-support systems on which economies depend are “off balance-sheet” and cannot be captured by traditional economic measures.
30. Biodiversity banking and offsetting may be an acceptable backstop when adequate mitigation measures are not feasible. SWT believes there is a place for biodiversity banking and offsetting schemes in the toolbox of conservation measures, but they should be used only as a last resort. Irreplaceable habitat should never be considered for offsetting.
31. The concept of Natural Capital may act as a way of bringing biodiversity conservation further within the ambit of the economics of ecosystem goods and services. SWT supports further development in this field and believes that it should be a research priority.
32. SWT notes that the relationship between ecosystem services and biodiversity (both in terms of ecological quality and species diversity) is poorly understood and a precautionary approach should be taken. Where ecosystem services valuations help to explain environmentally-damaging actions they should be used to devise alternative drivers of behaviour and lever in new funding mechanisms.

¹⁸ The Common Agricultural Policy (CAP) of the European Union is a classic example of a system beset by perverse subsidies and incentives. The CAP has incentivised farmers to maximise yields at the expense of environmental services and biodiversity by removing hedgerows to the detriment of pollinators or by draining wetlands and increasing flood risk. The Scottish Rural Development Programme (SRDP) incentivises land managers to remove globally threatened Atlantic hazel woods by making it more profitable to remove them as scrub clearance than to manage them for their conservation value.

33. In addition to Natural Capital and the relationship between ecosystem services and biodiversity, research is urgently needed into:
- the potential for biodiversity to deliver economic gains in order to assess the opportunity cost of biodiversity and ecosystem service loss
 - the costs of loss of biodiversity and ecosystem services
 - the economics of whole ecosystem function rather than specific ecosystem processes
 - indicators of ecosystem health
 - public and decision-makers' understanding of the economic importance of biodiversity and conservation
34. SWT will continue to advocate the principles outlined in this policy statement to Government, the business sector, the wider public and other key stakeholders to promote less ecologically damaging and more sustainable choices.

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Appendix: Glossary

Cost-Benefit analysis. A technique for weighting the total expected costs of a development against the total expected benefits.

Externality. A cost or benefit, not transmitted through prices¹, incurred by a party who did not agree to the action causing the cost or benefit. A benefit in this case is called a positive externality or external benefit, while a cost is called a negative externality or external cost.

Gross Domestic Product (GDP)

A measure of a country's overall economic output. It is the market value of all final goods and services made within the borders of a country in a year.

Market failure The inefficient allocation of goods and services in a market.

Pigovian tax A tax levied on a market activity that generates negative externalities and is intended to correct the market outcome.

Precautionary approach

If an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is not harmful falls on those who advocate taking the action.

Public goods Goods which are available to anyone without charge

Revealed preference A technique to assess the preferences of consumers expressed through their purchasing decisions.

Stated preference A technique to assess the preferences of consumers based on their responses to hypothetical questions about a outcome options.