Growth and sustainability: integrating ecosystem services into economics

Economic development largely ignores ecosystem services. When problems ensue, they are met by responsive policy fixes that are largely cosmetic. Integrating the value of ecosystem services into economic processes would push development from an exploitative to an adaptive mode, making it inherently sustainable and avoiding the need for clumsy down-stream policy fixes. This paradigm shift will need a new social perspective and a number of enabling policy reforms.

Colin Hindmarch, Jim Harris and Joe Morris

Cranfield University, UK

It is increasingly understood that there may be limits to certain kinds of human economic development (Millennium Ecosystem Assessment, 2005). There are also worries that our environmental impacts may be exceeding critical thresholds, producing effects that portend rapid, unpredictable, and from a human standpoint, adverse change. Growing interest in applying the principles of sustainable development reflects this position.

Although there are numerous definitions of sustainable development, it is generally taken to mean development that "*meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987). Like many broad definitions, this needs further clarification (*sensu* Spedding, 2005).

In the context of this paper, sustainable development refers to the kind of human activity that maintains, or even augments, renewable resources rather than undermining their long-term productivity. Many traditional extensive farming systems conform to this model: although these continually adapt to change, they embrace a range of economic and environmental controls that limit adverse effects. Given these well-tried examples of sustainable management, it might seem reckless for large scale economic programmes to ignore the value of underpinning resources: just as it would be for farm management plans to neglect soil condition. Nonetheless, this is precisely what has been happening.

Ecosystem services (Table 1) are fundamental to human life, but despite the growing enthusiasm for sustainable development they are rarely factored into development plans – indicating that these are flawed and incapable of meeting current environmental objectives or delivering sustainable outcomes.

Run down the stock: the factory breaks down

Ecosystem services flow from the Earth's Natural Capital (Box 1) by way of four 'renewable' functions (Table 1). They provide such things as clean air and water, soil, timber and biodiversity and are fundamental to sustainable economic development and human well-being (Figure 1; Box 2). They are seldom on the political agenda until there is a delivery problem and when this happens there is surprise, institutional panic followed by a rash of cosmetic and often contradictory remedies.

In focusing on economic growth, it seems that humanity has problems coming to terms with its dependence on healthy natural assets and an uninterrupted flow of ecosystem services. Evidence for this is clear: for decades economic growth, maintained by the use of non-renewable fossil fuels, has exceeded the renewable ecosystem service capacity (Figure 2). This has

Box 1. Natural capital

An extension of the economic notion of capital (manufactured means of production) to environmental 'goods and services'. It refers to a stock (e.g. a forest) which produces a flow of goods (e.g. new trees) and services (e.g. carbon sequestration, erosion control, habitat).

European Environment Agency, Kongens Nytorv 6, DK-1050 Copenhagen K, Denmark. Available at: http://glossary.eea.eu.int/EEAGlossary/N/natural_capital

destroyed natural capital and reduced the resilience of much more by over-exploitation and pollution. Collateral effects include the loss of soil organic matter (Bellamy *et al*, 2005), an increase in atmospheric carbon dioxide and the loss of sustainable, locally adapted land management systems and their related patterns of biodiversity (Hindmarch and Pienkowski, 2000).

Box 2. Human well-being

A state dependent on a 'decent, healthy and secure life' and conditioned by geography, economic context, and a range of social factors

Underlying these difficulties is the likelihood that current economic systems are structurally unable to integrate the intrinsic worth of such things as ecosystem services into their accounting processes, or value their long-term role in sustaining human populations and underpinning growth.

Although theories linking ecosystems and economic welfare (ecological economics) have advanced considerably in the last 10 years (Costanza *et al*, 1997; de Groot, 2000; Turner *et al*, 2001), there has been reluctance, indeed a resistance in some cases, to push these advances to the forefront of economic planning. Ecosystem services are commonly ignored in national accounting, major areas of economic policy and in the detail of individual project appraisal. With a few notable exceptions such as Unilever, for example, they are also missing from the accounts of major corporations. Yet the principles of asset management as they affect service flows are well established, even in the accounting profession. It is an established canon of industry, for instance, that if the stock of machinery is run down, maintenance costs rise and eventually the factory breaks down. The analogy is simple and obvious, but the messages are not being picked up and applied to higher scales of economic practice.

Ecological and economic limits: the importance of perspective

A fundamental problem with economic planning is that it tends to have a narrow, short-term focus and a limited perspective. Even though student economists are taught otherwise (Begg *et al*, 2005), it also assumes a limitless supply of raw material, or one that can be eked-out by unspecified technical fixes or balanced by responsive economic or legislative measures.

Economic planning has a wilderness mentality (Box 3) that is blind to ecosystem services or perceives them as 'free goods' (Box 4). It has no real acceptance that there are limits to growth (*sensu* Nordhaus and Tobin, 1972; Meadows *et al*, 1972) and

Box 3. Wilderness mentality

An assumption that: human activity has no appreciable long-term impact on the stability of natural systems; that these have an unlimited capacity to provide a flow of goods and services regardless of the level of economic growth activity; and that if there is a problem it is always possible to pack-up-camp and move on.

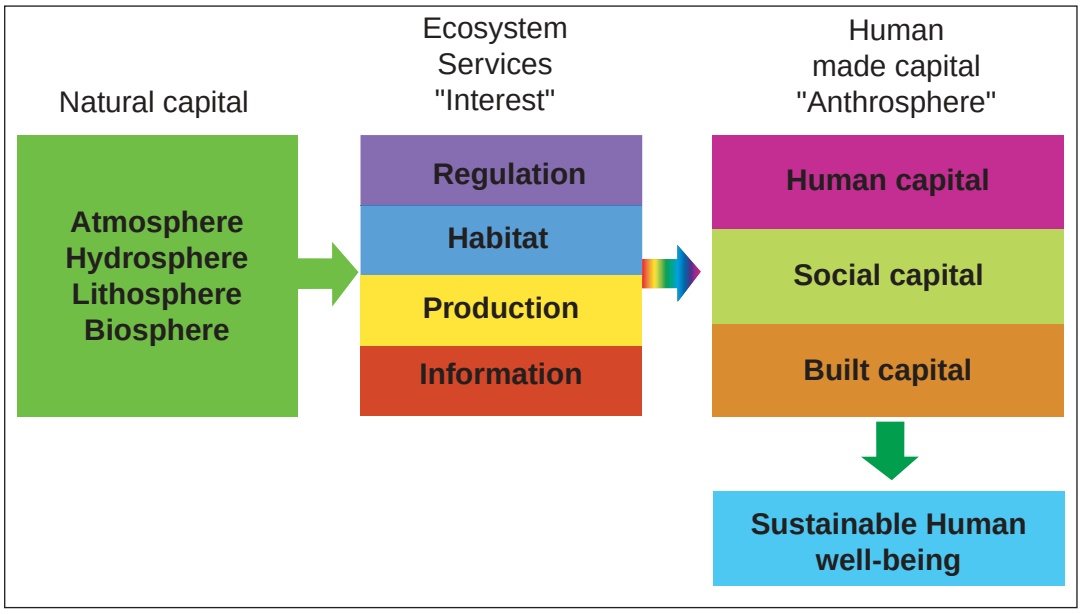


Figure 1. The Relationship between natural capital, ecosystem services, human capital, and sustainable human well-being.

Box 4. Free Goods

"We have habitually counted natural capital as a free good. This might have been justified in yesterday's empty world, but in today's full world it is anti-economic. The error of implicitly counting natural capital consumption as income is customary in three areas: (1) the System of National Accounts; (2) evaluation of projects that deplete natural capital; and (3) international balance of payments accounting."

Daly H E (1999)

has not developed the concepts, methods and supporting legislative mechanisms needed to internalise the value of ecosystem services into real world accounting processes. The problem with this approach to resource planning is that we no longer have a small economy and a large wilderness; our nomadic freedom has gone, and increasingly we have to contend with sedentary systems that are saturated.

It is true that 'extended' cost-benefit-analysis has moved a long way towards recognising the external costs associated with environmental change (Hanley and Splash, 1993), but this accounting procedure is for the most part reactionary and remedial. Project appraisals are adjusted to capture externalities, having based their initial prices and values on levels and distribution of income, production and consumption that are often skewed and potentially unstable. It is not that economists are unaware of this problem, but at the moment the theory is better than most practice.

Economic perspectives are also clouded by the fact that they tend to dwell on sites and situations rather than systems and processes, and on short-term needs and rewards rather than long-term consequences (Box 5). This obscures the value of ecosystem services, leaving them uncatalogued, undervalued, unprotected, and largely beyond the scope of creative manipulation by the planning process. It also perpetuates a form of exploitative development that is only checked when adverse environmental consequences become serious, and even then only by responsive measures such as site-based protection, subsidies and management grants.

Box 5. Short-term benefits – long-term consequences

"Historically, most responses to addressing ecosystem services have concentrated on the short term benefits from increasing the productivity of provisioning services. Far less emphasis has been placed on the long term consequences of ecosystem change and consequent effects for the provision of services. As a result the current management regime falls short of the potential for meeting human needs and conserving ecosystems."

Millennium Ecosystem Assessment (2005) Ecosystems and Human Well-being: synthesis, (p, 100). Island Press, Washington, DC. Available at: www.millenniumassessment.org/en/Products.aspx

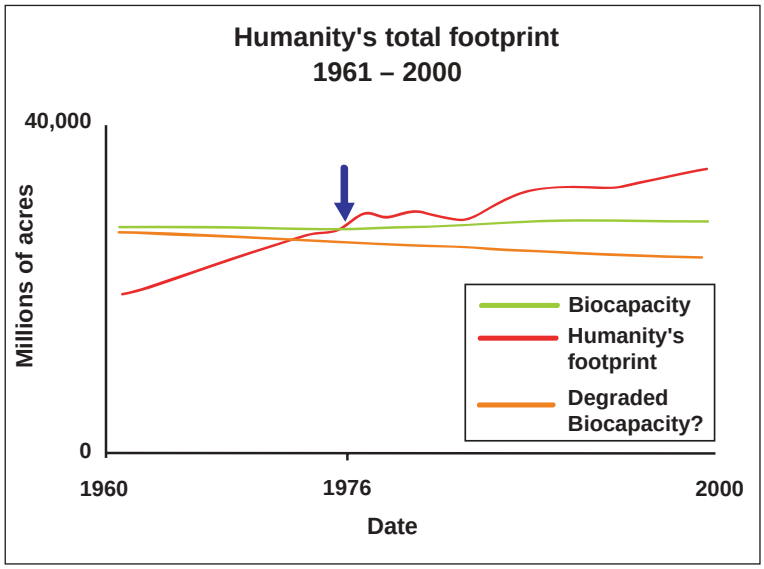


Figure 2. Global ecological footprint (redrawn from the Global Footprint Foundation).

This approach to the regulation of resource exploitation has a long history of failure because it does not address causal issues. If the problem continues, particularly in relation to the ecosystem's regulatory and habitat functions, it will be difficult to comply with current environmental legislation (Box 6), and the continuing erosion of our natural capital will progressively impoverish life and ultimately undermine the basis of economic development.

It is difficult to know how this situation has arisen, but it is likely that inappropriate social constructs will have played a part in clouding our judgement. Jacobs (1997) for example, argues that although there may be underlying absolute limits to development, 'acceptable' change is in practice determined socially. Essentially this means that while charismatic species such as the Great Crested Newt may have a local 'social constituency' and thus able to influence policy, the more diffuse and arguably important measures of environmental health such as the carbon cycle, or ecosystem services, are easy to ignore because they have no such local constituency.

This bias is problematic for a number of reasons. Firstly, it heightens the possibility

Box 6. Examples of European environmental legislation that will depend on the successful economic integration of ecosystem services.

- Water Framework Directive (2000) Directive 2000/60/EC.
- Habitats Directive (1992) Council directive 92/43/EEC.
- Birds Directive (1979) Council directive 79/409/EEC.
- Rural Development Regulations (2005) Council regulation (EC) No 1698/2005.
- European Community Biodiversity Strategy (1998).

that in ignorance we may cross a seemingly minor environmental threshold that may precipitate a cascade of unpredictable, deleterious and potentially irreversible effects. Secondly, it provides a 'get out of jail free' card for developers and the planning system who use scientific uncertainty and the lack of a strong social constituency so as to deny *biophysical* limits to growth. This suggests that the scientific community needs to engage with the democratic process in order to both develop a robust and widespread social constituency for ecosystem services and to integrate their value into economic processes. How might we achieve this?

Resource husbandry: lessons from a discredited model

The inability to integrate the value of ecosystem services into economic plans and policies mean that commitments to sustainable development are muddled, vague and largely unenforceable. They also perpetuate the environmentally destructive imbalance between easily accountable short-term economic goals and the more difficult to value long-term sustainability objectives. This has encouraged progressively more complex and difficult-to-manage systems of remedies. These give an illusion of security, but they blur discernment over core issues.

The complexity of responsive strategies should not be surprising, because simple inequalities in ecological systems often have random and sometimes unwanted outcomes. The Common Agricultural Policy, arguably the largest and 'best-supported' ecological experiment since *Genesis*, provides a good example of the phenomenon. In this case (Figure 3), funds were used to perturb inherently stable patterns of locally adapted land management in order to increase productivity. What followed was a complex cascade of adverse environmental outcomes and a tangle of contradictory policy fixes (Hindmarch and Peinkowski, 2000). While the social, economic and ecological consequences of this 'experiment' are still being evaluated (Pretty *et al* 2000; Hartridge and Pearce, 2001; Atkinson et *al*, 2004), it is possible to discern encouraging moves that will incorporate the hidden costs of land management practices and thus help to restore the flow of ecosystem services.

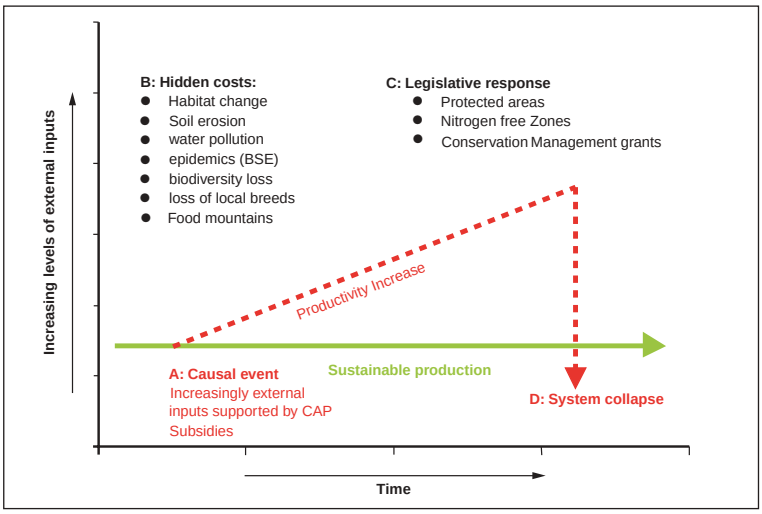
The fact that environmental policy is reactive is apparent in the widespread use of the *drivers-pressures-state-impact-response* logic that is used to frame the policy challenge (European Environment Agency, 1999; Environment Agency, 2005). Even a cursory review of existing policies, including most EU Directives, confirms that environmental policy responses to date have largely been reactionary and remedial, focusing on 'alleviating' pressures, protecting environmental 'states' and 'mitigating' impacts. A more effective and efficient approach would be to build ecosystems thinking into high-level policy drivers, rendering many 'downstream' regulatory interventions redundant. Rules of inertia suggest that this might be problematic: asking policy makers who operate in full 'responsive' mode to make the necessary changes might be seen as a rebuttal of established routines of governance (Carpenter and Folke, 2006).

As long as legislation deals with outcomes, it is likely to be complex and chaotic, uncoordinated, difficult to manage, often too late with its response and not very effective. The antidote to this frenetic muddle is to respond to ultimate causes

Table 1. Ecosystem functions and the services they provide.

Ecosystem functions	Ecosystem services
Regulation functions	Providing maintenance of ecological processes and life support systems
Habitat functions	Providing suitable living space for 'wild' plant and animal species
Production functions	Providing natural resources from which to make goods (consumable and structural)
Information functions	Providing opportunities for cognitive development

Figure 3: Simple causes, complex effects: environmental impacts of Europe's Common Agriculture Policy (CAP) and some legislative responses.
Notes: Simple causal events 'A' can have complex and sometimes unfavourable outcomes 'B'. In the case of European agriculture, not accounting for the 'hidden costs' of environmental services in early policy initiatives gave an illusion of efficiency, but it degraded the wider environment spawning a complex set of remedial measures 'C', pushing the system in many areas to the point of collapse 'D'. The simple, sustainable response would have been to tackle cause of the problem and remove subsidies for production 'A'. This is now being addressed by a number of European policy measures.



rather than just proximal phenomena (symptoms). In the case of economic planning, this would mean putting the value of ecosystem processes at the heart of the development process. Indeed, environmental policy needs to be fully integrated with policies for major economic sectors such as transport, energy and housing, to the extent that the very thought of building on a floodplain would provoke gasps of disbelief. Making the necessary changes, however, is unlikely to be easy, because current modes of economic planning seem stubbornly resistant to change.

In Europe for example, plans for economic growth, as represented by the Lisbon Strategy (LS, 2000) and the Sustainable Development Strategy (SSD, 2001) attempted to pull economic, social and environmental factors into one decision-making process – a policy conduit for ecosystem services. Unfortunately, the relaunched Lisbon Strategy (LS, 2005) is suspected of retreating from this position to take a more robust economic focus (Cohn-Bendit and Jonckheer, 2005). As long as this approach to conservation persists, human affairs will continue to be driven by growth-orientated models that will be unable to protect the environment or sustain long-term economic development.

Reasons for optimism: a new paradigm

Trends in policy development seem to give some cause for cautious optimism. For example, Figure 4 hints at a progression from response A, through correction B to the manipulation of causal processes C; but progress is slow, and much of our efforts still go into reacting to symptoms and devising proximal solutions rather than dealing with ultimate causes.

Although the 'responsive' and 'corrective' approach to the management of ecosystem services is both ineffective and complex, it is probably a comfortable place to be. It justifies an incremental approach to resolving immediate, easy to handle problems, rather than pressing for measures that might involve restricting markets, disrupting social conventions, or disengaging powerful lobbies (Janick, 1997; Gouldson and Murphy, 1998). It also puts off having to invest in the kind of scientific and legislative infrastructure needed to underpin a causal approach. Unfortunately, it also perpetuates a system of resource management that props up ecological 'overshoot' (Global Footprint Network, 2004) along with the attendant risks of system collapse. There comes a time

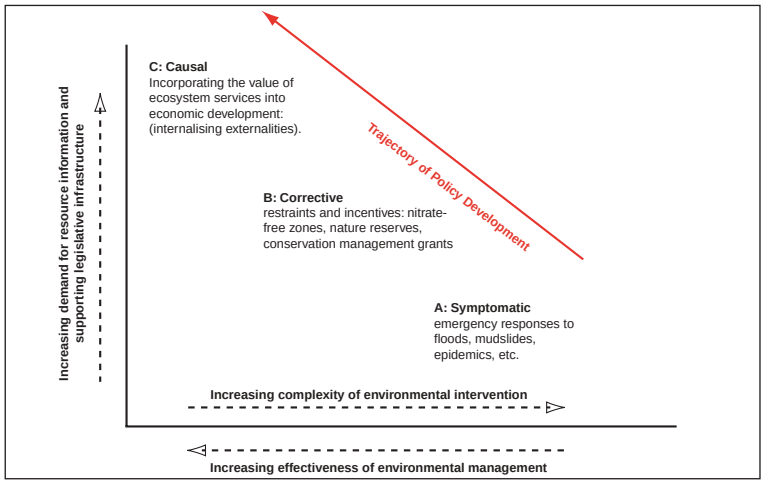


Figure 4. Evolution of European environmental policy: a schematic showing key stages. Notes: policy measures are moving from a 'responsive mode' (dealing with collapse) (A) through 'correction' (attempting to prevent collapse) (B), to a mode of operation that will avoid collapse (by influencing causal processes) (C). This trend increases the effectiveness of environmental management (x axis), but makes increasing demands on environmental information and the appropriate support infrastructure (y axis) – an area of that suffers from under-investment and is in decline.

when, in spite of resistance from misguided interests, only a major paradigm shift in economic practice will provide a sustainable solution.

This will only happen if biology raises itself above narrow philosophical uncertainties (*sensu* Daly, 2002a) and begins to promote bold high-level policy reforms based on simple logic and common sense.

This should not be too difficult. After all, integrating human economic activity and ecosystem functions into one process is essentially a simple idea (simple that is, in the sense that natural selection is simple) that opens up an approach to economic growth that is self-regulating and sustainable. Importantly, it one that is capable of moving development from an exploitative to an adaptive mode (Table 2), effecting an important shift in human affairs. In a situation where exploitatitive development is compromising human health and welfare and undermining the very basis of economic stability, exploring the potential of a largely benign, adaptive alternative is a social imperative that needs practical action rather than effete, dithering academic debate. This is increasingly being recognised by world economic institutions (Daly, 2002b; United Nations, 2003) and the business community at large (Simon and Proops, 2000; Vigar, 2006).

Securing sustainable change: policy options

Environmental policy needs to be bumped from a 'corrective' to a 'causal' mode (Figure 4). It is difficult to be prescriptive about the form that this might take, but it is likely to need a few simple high-level policy conditions (selective mechanisms) that will

Table 2. Economic development: exploitative and adaptive options.

Exploitative development	Adaptive development
General characteristics	
Ignores the value of ecosystem services or considers them 'free goods'.	Integrates the value of ecosystem services
Limits to growth not recognised	Environmental limits are a constraint to development.
Checks and balances short term economic and political cycles.	Checks and balances long term large-scale social and environmental considerations.
Pushes growth beyond carrying capacity.	Works within carrying capacity.
Symptomatic, 'first aid' approach to solving environmental problems. Promotes culture of post-hoc technical fixes, add-on remedies and emergency responses.	Environmental problems internalised and dealt with systemically at the appropriate ecological, economic and social scale.
Main environmental and economic impacts	
Erosion of natural capital, simplification of the ecosystem.	Sustainable production maintains and augments natural capital, increases complexity and biodiversity.
Increases environmental fragility.	Supports and often increases environmental stability.
Lacks a rational basis for mutual beneficial trading within a wider temporal and spatial economic environment	Promotes a rational basis for trading natural and economic resources within a unified economic model.
Undermines economic base	Maintains economic base

encourage the locally appropriate solutions (adaptive responses). This initiative is likely to need four main elements (Figure 5):

- *Awareness:* the importance of ecosystem services to human well-being has to become a matter of common social acceptance: ecosystem services need a strong 'social constituency' (*sensu* Jacobs, 1997) (Figure 5e).
- *Inclusion:* mandatory valuation of ecosystem services throughout the policy landscape supported by measures for the impact assessment of projects (EC, 1985) and policies (EC, 2001), environmental liability (EL, 2000) and certification (EC, 2000) (Figure 5f).
- *Intelligence:* a system-based, spatially explicit, information resource that would support the evaluation and valuation of natural capital, ecosystem services and environmental limits and capacities (Figure 5g). Central to this spatial data will be information on soils, geology, hydrology and vegetation.
- *Trade*: an agreed system of valuation and a common currency for ecosystem services, together with a unified trading framework and a system of resource bargaining that would allow for compensatory trading (Figure 5h), perhaps an elaborated form of the international free trade agreement.

Some of these changes are in hand, in that policymakers are investigating the hidden cost of externalities (EC, 2003) and debating ways of maintaining ecosystem services (EC, 2005). There has also been progress in accepting the value of ecosystem

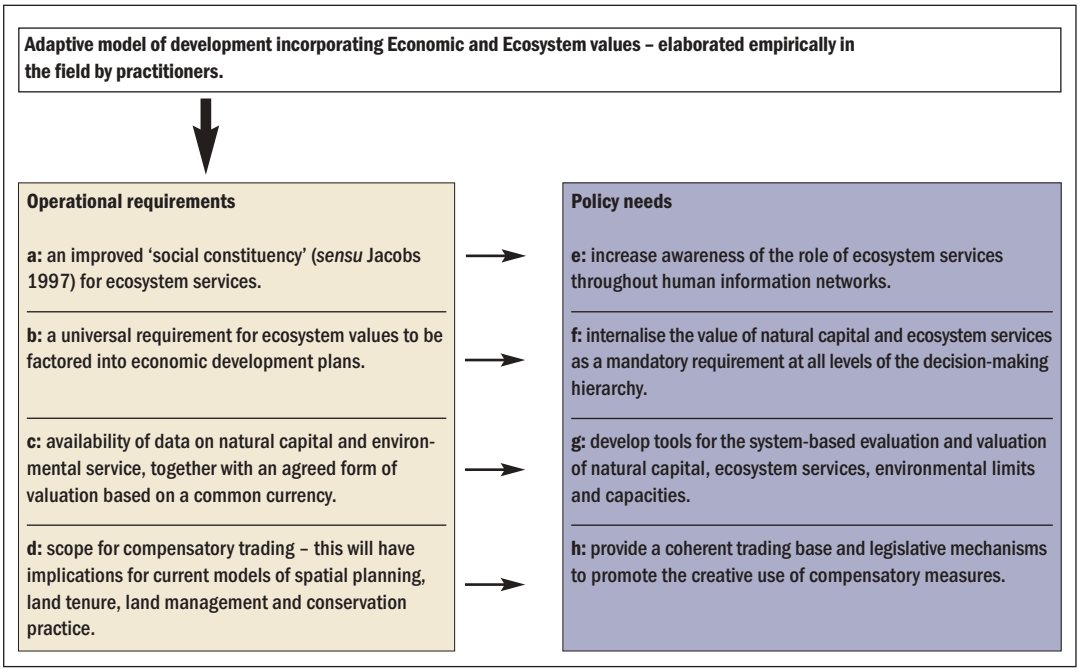


Figure 5. Integrating the value of ecosystem services into economic development: operational and policy needs. Although there is an increasing awareness of the value of ecosystem services among policymakers (e) there has been very little progress translating this into policy (f) or providing the necessary legal framework (h) or environmental information base (g).

services in agriculture, at least in terms of integrating the 'hidden costs' of production and removing perverse incentives. In the water sector, economic valuation of ecosystem services has recently informed investment decisions for improving environmental water quality (Environmental Agency, 2006), and the Water Framework Directive has confirmed the need for practical tools to assess the economic value of water quality (Morris, 2004).

In other areas, however, policy makers have been less prescient. For example, the need to value ecosystem services throughout policy (Figure 5f) and the need to develop a suitable trading system (Figure 5h) has had very little thought. Similarly, there has been little progress developing the necessary environmental information base (Figure 5g). On the contrary: evidence from the UK and elsewhere suggests that the strategic base for such an initiative may be under threat from a 'myriad small-scale, near market "business" adjustments' (Hindmarch, 2006).

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Colin Hindmarch is a consultant ecologist.
Email: colin@hindmarch1.wanadoo.co.uk.
Jim Harris and **Joe Morris** are both members of the Institute of Water and Environment, Cranfield University, Silsoe, MK45 4DT (UK).