

# Chapter 1: Ecosystem Services in the Twenty-First Century<sup>1</sup>

Marion Potschin<sup>1</sup> \*, Roy Haines-Young<sup>1</sup>, Robert Fish<sup>2</sup> and Kerry Turner<sup>3</sup>

<sup>1</sup> Centre for Environmental Management, School of Geography, University of Nottingham, Nottingham, UK

<sup>2</sup> School of Anthropology and Conservation at the University of Kent, UK

<sup>3</sup> School of Environmental Sciences, University of East Anglia, Norwich, UK

\*Email: Marion.Potschin@Nottingham.ac.uk

*Your true modern is separate from the land by many middlemen, and by innumerable physical gadgets. He [sic.] has no vital relation to it; to him it is the space between cities on which crops grow. Turn him loose for a day on the land, and if the spot does not happen to be a golf links or a 'scenic' area, he is bored stiff. If crops could be raised by hydroponics instead of farming, it would suit him very well. Synthetic substitutes for wood, leather, wool, and other natural land products suit him better than the originals. In short, land is something he has 'outgrown.'*

***The Land Ethic from 'A Sand County Almanac', Aldo Leopold, 1948***

## [a] Introduction

Around 2008, the human population passed something of a milestone. For the first time there were more people living in cities and in rural areas. Looking forward, it is estimated that by 2050 roughly two-thirds of the 9 or so billion people that inhabit the Earth will be urban dwellers (UNFPA, 2007). It is also projected that the absolute numbers of people living in the countryside will decline, compared to the present.

That we are becoming a predominantly urban species, and that *all* future population growth will be in built-up areas, will have many consequences. The outlook for human well-being is likely to be positive in many important respects, because there is generally better employment prospects in cities, and better access to education and health services. The United Nations Population Fund argues that social mobility in cities is greater and the chances that women can take control of their lives are greater. As a result, they suggest, fertility rates in urban areas are likely to reduce and this will change trajectory of overall population growth<sup>2</sup>. But there will be other consequences too. The idea that societies depend fundamentally on natural systems may be readily masked and obscured by the experience of city living. Many critical traditions have argued in the vein of Leopold that, with urbanity, nature is often remade as a distant 'other'; as merely background scenery for cultural processes; and as a set of commodities that conceal, or at best stylise, their origins in natural processes. While we may say that this model of spatial organisation makes society less vulnerable to

---

<sup>1</sup> If you use this chapter please quote as: Potschin, M. and R. Haines-Young (2016): Ecosystem Services in the Twenty-First Century. In: Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) *Routledge Handbook of Ecosystem Services*. Routledge, London and New York, pp 1-9. (available from: <http://www.routledge.com/books/details/9781138025080/>

<sup>2</sup> <http://www.unfpa.org/urbanization> (Accessed May, 2015)

environmental hazards, an appreciation of the ties that bind people and nature together will arguably be more difficult to sustain. Our planet will become no less finite, just because most people will be living in cities.

The problem of the changing connection between people with nature is the one we want to address in this chapter. In thinking about this, and in particular what it means for the ecosystem services debate in the twenty-first century, we were reminded of Leopold's thoughts about the 'true modern'. Not only did we imagine that his future descendants would be less able to see the 'vital relation' that he or she has with ecosystem function, but since the 'golf-links' and 'scenic area' are now likely to be regarded as 'valuable cultural ecosystem services' the prospect of changing his or her mind may be even more remote.

Of course, it is not inevitable that Leopold's description of the 'true modern' will apply in the future. The prospect is very much dependent on the kinds of narrative that people develop to describe their lives and the societies that they inhabit – which is why the idea of ecosystem services and the importance of natural capital may have particular significance for *Homo urbanus*. In this Chapter we will examine the history of the idea of ecosystem services, and argue that while it is an idea shaped by thinking at the end of the last century, it can continue to be relevant providing we can connect it into wider debates about what people care about.

#### **[a] Histories**

In their 'fragmentary history' of ecosystem services Mooney and Ehrlich (1997) attribute the first use of the term 'ecosystem services' to *Extinction: The Causes and Consequences of the Disappearance of Species* (Ehrlich and Ehrlich, 1981). However, they also recognise the idea that ecosystems can be thought of as providing 'services' to people can be found in the literature long before the particular phrase was used. They note for example the account of 'environmental services' a decade earlier in the *Study of Critical Environmental Problems* (SCEP, 1970), and ideas the 'public-services' that can be provided by the global environment described in Holdren and Ehrlich (1974) and other papers published around that time (e.g. Ehrlich, 1973; Ehrlich et al. 1973) – not to mention the account of 'nature's services' provided by Westman (1977).

In their history of the concept and its link with economic valuation of the environment Gómez-Baggethun et al. (2010) agree with Mooney and Ehrlich (1997) that while the impact of human actions on the way nature can benefit people were discussed by writers even in ancient civilizations, it was probably the publication of *Man and Nature* in 1864 by George Perkins Marsh that stimulated interest in modern times. It is from Marsh's work that we can see some of the central themes of contemporary debates about ecosystem services being rehearsed, namely the finite capacity of the earth, its limitations in providing benefits to people, and its vulnerability to human action.

As Lowenthal (2000, p3) argues, a noteworthy feature of *Man and Nature*, 'was Marsh's stress on the unforeseen and unintended consequences, as well as the heedless greed, of technological enterprise'. Marsh contended that to sustain global resources society needed to become aware how it affected them (Lowenthal, 2000). While the term 'ecosystem services' did not enter scientific discourse until 1981, the ideas that people directly benefit from nature, and that nature's capacity to support these benefits was limited, were thus already common currency. Indeed, the ideas were not only shaping conservation debates but also institutional responses.

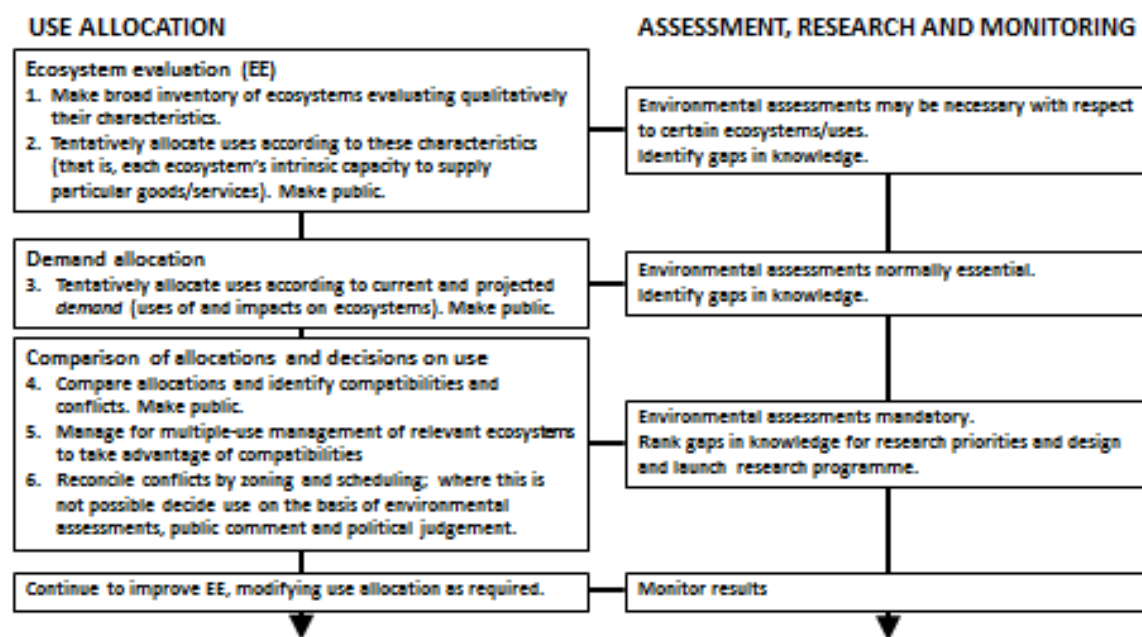


Figure 1: Framework for ecosystem assessment developed in the 1980 *World Conservation Strategy* (after, IUCN 1980). Original title: 'The relationship between the allocation of land and water uses and assessment, research and monitoring'.

For example, in a 'Worldwatch' paper of 1978, we find Eckholm discussing the significance of loss of species 'whose ecological functions are especially important to society'. He cautions: 'at the broadest level, extinctions serve as markers of the general reduction in the capacity of the earth's biological systems to provide goods and crucial, if subtle, *ecological services*' (Eckholm, 1978, p18, authors emphasis). In 1981 the IUCN *World Conservation Strategy* explicitly uses the notion of goods and services provided by ecosystems in the section on 'policy making and the integration of conservation and development', where it is used in connection with sustainable forest management, and in the section on 'environmental planning and rational use of resources', where it is discussed more generally in the context of how to use ecosystem assessments to help allocate resource use (IUCN, 1981). Despite the passage of nearly four decades, the assessment framework that they proposed (Figure 1) remains highly applicable and consistent with current thinking.

What is perhaps surprising when we look back is that despite this early interest the idea of ecosystem services was given little attention in the 'Brundtland Report' of 1987. Reference is made to the idea only once, when the Report deals with species and ecosystems in the context of resources for development, and where it is noted that 'species and natural ecosystems make many important contributions to human welfare' (World Commission for Environment and Development, 1987, p.125). The report observes that these resources are often not used in ways that will be able to meet the demands for the 'goods and services that depend upon these natural resources'.

Background reports to the Commission did however emphasise the importance of natural resources and natural processes which affect human wellbeing (Turner 1989). Nevertheless, the point was taken up more fully in *Agenda 21*. This was a key and influential output from the Earth Summit in 1992 and which set out the United Nation's action plan for delivering on sustainable development. In the discussion on 'combatting deforestation', the document echoes the points made in the *World Conservation Strategy* on the role of wood and non-wood goods and services as a component of sustainable forest management. Perhaps more importantly, when addressing with the conservation of biodiversity, *Agenda 21* charges us to 'take measures to encourage a greater understanding and appreciation of the value of biological diversity, as manifested both in its component parts and in the ecosystem services provided' (United Nations, 1992, sect. 15.5.m). The development of integrated environmental and economic accounting methods was seen as one necessary step. The aim was to expand national accounting systems so that they better measured the '... crucial role of the environment as a source of natural capital ...' (United Nations, 1992, sect. 8.41). Another key action identified in *Agenda 21* was the development of a 'science for sustainable development', in which scientific knowledge is applied 'through scientific assessments of current conditions and future prospects for the Earth system' (United Nations, 1992, sect. 35.3).

Mooney and Ehrlich (1997) describe how biodiversity assessment approaches were developed in the 1990s, eventually as part of wider related initiatives, for example the Global Biodiversity Assessment of UNEP which integrated economic and ethical issues with biodiversity science (UNEP 1995; Perrings et al. 1995). However, despite such advances, there was a wider recognition that the new findings that were emerging from ecology and related fields were poorly reflected in policy discussions. A key part of the debate was the publication of *Protecting our Planet, Securing our Future: Linkages Among Global Environmental Issues and Human Needs*, in 1998. This was the output of an international study sponsored by UNEP, NASA, and the World Bank.

Importantly, *Protecting our Planet* called for more integrative assessments 'that can highlight the linkages between questions relevant to climate, biodiversity, desertification, and forest issues' (UNEP, NASA and World Bank, 1998, p56). It provided some of the impetus<sup>3</sup> to the 2005 Millennium Ecosystem Assessment (MA), an examination of the consequences of ecosystem change for human well-being, and a key influence on the early mainstreaming of the ecosystem services agenda (Daily et al 2011: 3). Significant institutional factors were, however, perhaps more decisive: the work associated with a number of international agreements such as the Convention on Biological Diversity (CBD), the Convention to Combat Desertification, the Convention on Migratory Species, and the Ramsar Convention, had shown that the needs for scientific assessments within the conventions were not being met. And so the foundations of the MA were laid. It became one of the key initiatives to help achieve the United Nations Millennium Development Goals and to carry out the Plan of Implementation for the 2002 World Summit on Sustainable Development.

As the result of the stimulus of the MA national assessments have been made in a number of countries, including New Zealand, France, Spain Portugal and Israel<sup>4</sup>. The UK Government has also funded two national ecosystem assessments and set up a formal Natural Capital Committee<sup>5</sup> to audit society's use of ecosystem services (UK NEA 2011; UKNEA FO 2014). Most significantly, the

---

<sup>3</sup> <http://www.millenniumassessment.org/en/History.html>

<sup>4</sup> See IPBES database at: <http://catalog.ipbes.net/>

<sup>5</sup> See: <http://www.naturalcapitalcommittee.org/>

Inter-Governmental Platform on Biodiversity and Ecosystem Services has now been established<sup>6</sup> to continue to review, assess and evaluate the growing knowledge base that has developed around the topic, and crucially to improve the capacity for using that knowledge effectively in decision making. With its formal endorsement by the science and policy communities, the aim is to give as strong and credible a voice to issues surrounding biodiversity and ecosystem services as has been done for climate change.

#### **[a] Reflections on the Future: People and nature?**

*A system of conservation based solely on economic self-interest is hopelessly lopsided. It tends to ignore, and thus eventually to eliminate, many elements in the land community that lack commercial value, but that are (as far as we know) essential to its healthy functioning. It assumes falsely, that the economic parts of the biological clock will function without the uneconomic parts.*

***The Land Ethic from 'A Sand County Almanac', Aldo Leopold, 1948***

What our short history shows is that despite the attention that the idea of ecosystem services is currently receiving, it is very much a *twentieth century* concept. Looked at in one way, the terminology could be seen as to merely representing another way of describing a set of problems that have preoccupied people for at least 50 years – if not more, namely: the failure of ‘developed’ societies to take account of their dependency on nature; the prospect that the capacity of nature to support future prosperity appears to be limited – not least through the impacts of human activities. In this guise, the idea of ecosystem services is therefore no more than a ‘refresh’ – as in the case of the updating of the CBD Biodiversity Targets from those set in 2010 to those for 2020.

Looked at in another way there is, nevertheless, something that is fundamentally novel about the current discussions around the idea of ecosystem services. It is, we suggest, the context in which those ‘old problems’ must now be viewed. Part of the changed context is the prospect of what in this volume Costanza (2016) describes as a ‘full world’ in which, as a result of the growth of population and resource use, we are approaching some key planetary boundaries. Another aspect is, as we have described in this chapter, the prospect that we will become a predominantly urban species, with the increasing detachment from the natural world that this may involve. While the environmental problems of living on a finite planet and halting biodiversity loss may not have changed since ideas about ecosystem services were first articulated, the ‘solution space’ that we now have to explore has fundamentally been transformed. This new context will force us to look at the idea of ecosystem services in a new way. What kinds of change are required?

Some aspects of the development of the science of ecosystem services fits with the description of science offered by Kuhn (1962). It could be claimed, for example, that there has been a revolution in our thinking about nature with the appearance of the concept, and we are now, in small steps, working our way through the implications of the new paradigm, in a period of ‘puzzle solving’. However, there is, we suggest, an important characteristic of a ‘post-normal’ science like ecosystem services that makes it different from more traditional ones. Although there is indeed further basic natural and social science to be done, if the science of ecosystem service is truly ‘transdisciplinary’,

---

<sup>6</sup> <http://www.ipbes.net/>

then any puzzle solving has to take place in parallel with a process of embedding the knowledge gained in wider societal discourses. The history of ecosystem services, and much of the contemporary work that now surrounds the concept, is largely presented from the perspective of 'nature for people' (Mace 2016). This theme underpinned the MA, with its emphasis on the importance of ecosystem services *for* human well-being. It also characterised *The Economics of Ecosystems and Biodiversity* (TEEB), with its arguments about the value of nature *to* society. These are fundamentally twentieth century perspectives and can only take us so far. If we are to embed the idea of ecosystem services and natural capital in wider decision making then the future, we suggest, lies with what Mace (2016) has identified as an alternative view – namely that based on the theme of 'people and nature'.

With the development of the ecosystem service concept we have got better at making the case about nature *for* people. Many of the contributions to this *Handbook* demonstrate the richness of the basic research that has been done to underpin these kinds of argument. We have even made 'progress' with this kind of thinking in that the sentiment expressed by Leopold at the start of this section does not seem so much at odds with contemporary views as it would have done a few years ago, when the valuation debate first took hold. The proposition that monetary values can be assigned to some components but not all of nature, has captured the attention of many outside the core disciplines represented here (Turner 2016 p xx). Many now accept that while monetary valuation of ecosystem services can be an important tool for decision making it is not the only one; as Gómez-Baggethun (2016, p.XX) argues 'there are various ways in which people ascribe meaning to nature', including 'ecological values'. To see what can be added by taking up the alternative 'people and nature' theme, it is useful to return to the passage by Leopold.

What is interesting about Leopold's proposition about the limits of economic valuation is not so much its prescience but rather what he writes next. For while at first glance the quotation seems to imply that ecological values count too, the passage continues by suggesting that an approach to conservation based on 'self-interest':

*... tends to relegate to government many functions eventually too large, too complex, or too widely dispersed to be performed by government. An ethical obligation on the part of the private owner is the only visible remedy for these situations.*

While we do not entirely endorse Leopold's prescription, the challenge he throws down in this proposition elegantly opens up the 'people and nature' debate, with its focus on issues of governance and ethics rather than just ecology. These, we suggest, are themes that need to figure more strongly in future debates about our relationships to nature, and are key to realising what many commentators mean when they write of 'operationalising' and 'mainstreaming' ecosystem services. We conclude by exploring how a focus on people *and* nature could change how the ideas of ecosystem services and natural capital are seen and used.

#### **[a] Mainstreaming and Operationalisation**

Daily (2016) argues that the 'urgent challenge today is to move from ideas to action on a broad scale'. The need for action has, in fact, long been recognised and strongly argued for as part of the 'nature for people' debate, with the development of such frameworks as the Ecosystem Approach<sup>7</sup>, and the call to engage with 'all relevant actors' as part of the participatory process that we now see

---

<sup>7</sup> <https://www.cbd.int/ecosystem/>

as essential to the successful delivery of environmental policy and management. But, following Daily, it seems that more needs to be done; she argues that ‘mainstreaming natural capital into decisions is a long-term game plan, requiring co-evolving advances in knowledge, social institutions, and culture’ (Daily, 2016, pXX).

One way of looking at the differences between the ‘nature for people’ vs the ‘nature and people’ perspectives is in terms of whether we are aiming ultimately to achieve for action *for* nature or *through* nature. Similar kinds of debate about the focus of action have, in fact, been had in the landscape community as part of their search for ways of making a more socially relevant case for what they seek to do (Matthews and Selman, 2006). In the context of ecosystem services, the important point to note here is that rather than environment or biodiversity being seen as the target of our action, the argument to be made is that ‘nature-based solutions’ to a wide range of social and economic problems can be found by thinking about them in different ways. This, we suggest, is key to understanding what is being implied by the people and nature perspective. It is also key to understanding what mainstreaming, or what others have called ‘operationalisation’ represents. O’Riordan (2016, pxx) sets out the task succinctly: ‘to shift the default position to sustainability will require global recognition of the essentialness of ecosystem services for viable continuation of wealth creation’. Similarly, if biodiversity is indeed the most fundamental element of green economic development (Watson, 2016) then we need to *demonstrate* that it is so, and act accordingly.

To mainstream or to operationalise the ideas about ecosystem services around the theme of people and nature will mean finding ways of embedding these perspectives in other debates - perhaps far removed from the core concerns of the current research and environmental policy communities. Only then will a more balanced view of the relationship between people and nature be achieved. Where we disagree with Leopold is that it seems unlikely that it can be done by focussing actions only at the individual, and specifically private, level. Despite the complexity of the problems we face, we would argue that governments and institutions have an enabling role to play too. Institutional change can alter rights and responsibilities (cf. Primer 2016); it can also influence and modify behaviour through practices of regulation and reward. Further still, we need to be careful of viewing individuals as economic agents alone. The socialisation of ecosystem services is by implication a wider question of environmental citizenship; how we mobilise individuals to work, think and connect to environmental concern as members of communities as much as property owners and consumers of resources.

The short-comings of the ‘nature for people’ perspective can be seen in debates surrounding the IPBES conceptual framework (Díaz et al., 2015; Potschin and Haines-Young, 2016), where different cultural perspectives emerged on how people and nature were connected. Differences were not so much to do with recognition of the dependency of people on nature, but rather how the idea of ecosystem services could be interpreted as a one-way, utilitarian type of the relationship. This is clearly one of the dangers of the ‘nature for people’ viewpoint, in that it could lead us to underestimate the complexity of the environment and its many facets. It could also obscure an appreciation of the deeper and more reciprocal relationships and duties of care that people have in relation to the non-human world. To shift the default position, Leopold’s ‘true modern’ will need some kind of narrative to explain how contemporary society is as much connected to nature as more traditional ones and that this implies certain obligations. The ideas of ecosystem services and natural capital, told through the lens of ‘people and nature’ could be an important part of that story.

As we look to the future there is an urgent need to build more elaborate narratives of ecosystem services and natural capital to emphasise people's rights and responsibilities in relation to nature, as well as the benefits that people derive from it. A test of whether a more balanced 'people and nature' has been achieved will be in the kinds of institutions that we construct to help us cope with a rapidly urbanising, full world. One of the ways in which we have moved away from Leopold's argument that solutions lie with private owners is that we now accept that ecosystem services can have quite different characteristics in terms of rivalry and excludability because the systems generating them can be multi-functional. Thus, we have to manage and regulate different kinds of interactions between providers and beneficiaries and hence think of different kinds of governance arrangement for these *socio-ecological systems* (Barnaud and Antona, 2014). Moreover, since private ownership can now involve multi-national organisations of the kind not envisaged in the early part of the last century, the task of managing the mix of public and private benefits that most ecosystems can provide in 'sustainable ways' has become much more complex.

If the 'people and nature' argument is to be made effectively then it needs to start from the position that many problems previously thought to be independent of the environment are intimately connected to it. In the policy arena these include, for example, debates around human health, the economy, social justice and national security (cf. Lubchenco, 2009). In the scientific realm the ideas of ecosystem services and natural capital have to be seen as essential ways of exploring key 'problem nexuses' linking such things as climate, energy food and water (cf. Liu et al., 2015). These kinds of debate in the policy and science communities will be fundamental, because they will shape the kinds of governance approaches that will be needed in the twenty first century. Green economies will be as much about the institutions we design as the technologies we use. In a full, connected world, problems of 'spill overs' from one problem area to another, and the unexpected interaction activities and impacts at global scales, in the form of 'telecoupling', will require ever more careful design of incentive and regulatory frameworks to cope with unwelcome effects. They will also require critical scrutiny of existing institutional and legal structures to ensure that they are fit for purpose, or can be made so.

In a world where city living becomes the norm, it will be more difficult make the argument for the importance of nature. In such a world, there are also dangers in presenting our dependency on nature in narrow utilitarian terms. The countryside and wilder landscapes could be seen simply as a means to an end, where only the parts that are useful to people are retained or conserved. The challenges are therefore considerable. If we are to address them, then the twenty-first century the story of ecosystem services perhaps has to be retold as a partnership between people *and* nature. As our history has shown the development such ideas can take a long time. Getting them into the mainstream will also not be easy. This *Handbook* has been written in the belief that it can be done. The descendent of Leopold's 'true modern' is already living in a city near you.

#### **[a] References**

- Barnaud, C., & Antona, M. (2014). Deconstructing ecosystem services: Uncertainties and controversies around a socially constructed concept. *Geoforum*, vol 56, pp. 113-123
- Costanza, R. (2016). Ecosystem Services in Theory and Practice. In: Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) *Routledge Handbook of Ecosystem Services*. Routledge, London and New York. – this volume



- Daily, G.C. (2016). Securing Nature and People: Can We Replicate and Scale Success? In: Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [– this volume](#)
- Díaz, S., Demissew, S., Carabias, J., et al. (29 authors) (2015). The IPBES Conceptual Framework—connecting nature and people. *Current Opinion in Environmental Sustainability*, vol 14, pp. 1-16
- Gomez-Baggethun, E., Barton, D.N., Dunford, R. and P. Harrison (2016). Concepts and methods in ecosystem services valuation. In: Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [– this volume](#)
- Gómez-Baggethun, E., De Groot, R., Lomas, P. L., & Montes, C. (2010). The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecological Economics*, vol 69, no 6, pp. 1209-1218
- Liu, J., Mooney, H.; Hull, V.; et al. (11 authors) (2015). "Systems integration for global sustainability." *Science* 347, no. 6225 (2015): 1258832
- Lowenthal, D. (2000). Nature and morality from George Perkins Marsh to the millennium. *Journal of Historical Geography*, vol 26, no 1, pp. 3-23
- Lubchenco, J. (1998). Entering the century of the environment: a new social contract for science. *Science*, vol 279, no 5350, pp. 491-497
- Mace, G. (2016). Ecosystem services: where is the discipline heading? In: Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [This volume](#)
- Matthews, R. and Selman, P. (2006). Landscape as a Focus for Integrating Human and Environmental Processes. *Journal of Agricultural Economics*, Vol. 57, no 2, pp. 199–212
- Mooney, H. A., & Ehrlich, P. R. (1997). Ecosystem services: a fragmentary history. In Daily, D.C. (Ed) *Nature's Services: societal dependence on natural ecosystems*, 11-19.
- O’Riordan, T. (2016). On the changing relationship between ecosystem services continuance and sustainability. In Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [This volume](#)
- Perrings, C., Barbier, E.B., Brown, S et al. (12 authors) (1995) *The economic value of biodiversity*. In UNEP, *Global Biodiversity Assessment*, Cambridge University Press, Cambridge.
- Potschin, M. and R. Haines-Young (2016). Frameworks for ecosystem assessments. In Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [This volume,](#)
- Primer, E. (2016). An institutional perspective. In Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. [This volume](#)
- Turner R.K. (1989) Economics and environmentally sensitive aid, *International Journal of Environmental Studies* , Vol 35, pp 39-50.

- Turner, R.K. (2016) Ecosystem services: economic perspectives. In Potschin, M., Haines-Young, R., Fish, R. and Turner R.K. (eds) Routledge Handbook of Ecosystem Services, Routledge, London and New York. This volume.
- UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment Technical Report, UNEP-WCMC, Cambridge.
- UK National Ecosystem Assessment Follow On (2014) The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, Cambridge.
- UNEP (1995) Global Biodiversity Assessment, Cambridge University Press, Cambridge.
- UNFPA (2008) *State of world population 2007 Unleashing the Potential of Urban Growth*. United Nations Population Fund. ISBN 978-0-89714-807-8
- United Nations (1992). Results of the World Conference on Environment and Development: Agenda 21. UNCED United Nations Conference on Environment and Development, Rio de Janeiro, United Nations, New York
- Watson, R. (2016). Preface for the Routledge Handbook of Ecosystem Service. In Potschin, M., Haines-Young, R., Fish, R. and Turner, R.K. (eds) Routledge Handbook of Ecosystem Services. Routledge, London and New York. **This volume**
- World Commission on Environment and Development (1987). *Our common future*. Oxford: Oxford University Press.