



A Gateway to Payments for Ecosystem Services

Using Payments for Ecosystem Services for Livelihoods and Landscapes

D. Huberman



MARKETS AND INCENTIVES FOR LIVELIHOODS AND LANDSCAPES SERIES NO. 2

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List of Abbreviations

BBOP	Business and Biodiversity Offsets Programme
CDM	Clean Development Mechanism
CES	Compensation for Ecosystem Services
CGD	Computable General Equilibrium
CIAT	International Center for Tropical Agriculture
CIFOR	Center for International Forestry Research
CRES	Compensation and Reward mechanisms for Ecosystem Services
EEPSEA	Economy and Environment Programme for Southeast Asia
ES	Ecosystem Services
ESI	Ecosystem Services Index
HANPP	Human Appropriation of Net Primary Production
ICRAF	World Agroforestry Centre
IIED	International Institute for Environment and Development
IISD	International Institute for Sustainable Development
IPES	International Payments for Ecosystem Services
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
LLS	Livelihoods and Landscapes Strategy
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
PEP	Poverty Environment Partnership
PES	Payments for Ecosystem Services
REDD	Reducing Emissions from Deforestation and forest Degradation
RISEMP	Regional Integrated Silvopastoral Ecosystem Management Project
RUPES	Rewarding Upland Poor for the Provision of Ecosystem Services
SFM	Sustainable Forest Management
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention for Climate Change
WWF	World Wildlife Fund for Nature

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Introduction: The Gateway to Payments for Ecosystem Services (PES)

The main objective of this work is to provide an introduction and sense of direction (i.e. a “Gateway”) into the complicated world of Payments for Ecosystem Services (PES). It by no means intends to serve as a comprehensive overview of this vast field. It provides one entry point for engaging in PES, and was designed to fit into the broader Livelihoods and Landscapes (LLS) strategy, as developed by IUCN’s Forest Conservation Programme.

This toolkit has been created to serve as the basis for the development of an internet-based resource guide. Thus, the Gateway to PES will evolve from its current form into a more interactive and user-friendly website. It is anticipated that many additional resources will be added in the meantime. The author warmly welcomes any comments or suggestions for improvement. All of the references mentioned in this document will be made available on this internet facility. In the mean time, electronic copies may be requested from the LLS programme.

The main feature is the ‘Gateway to PES’ (Sections 2-5), which draws upon a variety of resources to provide guidance to LLS practitioners and decision makers. Section 6, which provides some useful internet links, is not yet fully organized, and will be integrated into the other sections in the web-based version of the Gateway. Finally, Section 7 is the more subjective portion of the document, and serves the purpose of communicating the authors’ vision for moving ahead with PES through LLS.

Understanding Ecosystem Services

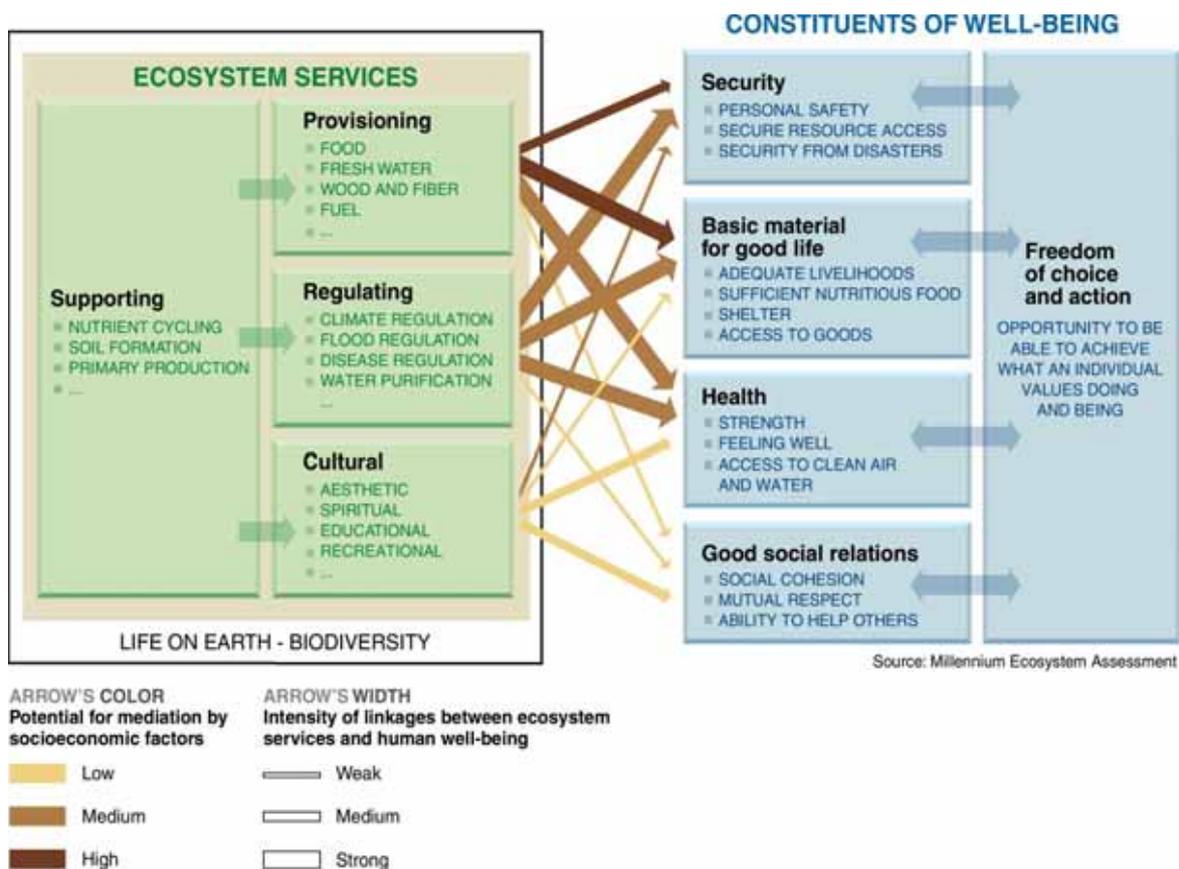
Talk of 'ecosystem services' has recently risen to the forefront of environmental discussions. Studied extensively in the recently completed Millennium Ecosystem Assessment (MA), this increasingly popular topic offers an enhanced perspective on the many ways in which the natural environment sustains and fulfils human life. Some typical examples of ecosystem services are the provision of genetic resources for medicine and biotechnology, plant pollination, carbon sequestration, and soil formation. Biodiversity, which is an integral component of ecosystem functioning, plays a fundamental role in determining the delivery of these services.

Defining ecosystem services:

A commonly accepted definition of ecosystem services is to consider them as natural processes by which ecosystems, and the species that make them up, sustain and fulfil human life (Daily et al 1997). Another commonly accepted definition is the one used in the Millennium Ecosystem Assessment (MA) - <http://www.millenniumassessment.org/>, which defines them simply as being the benefits that people obtain from ecosystems. The MA further classifies them into either provisioning, regulating, supporting, or cultural services (see Figure 1).

The MA reported that 60 to 70% of our world's ecosystem services are deteriorating, with dramatic consequences for those who are most dependent on their steady provision, such as subsistence farmers. Throughout the MA, the 'ecosystem services' concept is used to highlight the relationship between human welfare and natural wealth. Figure 1 offers an illustration of the conceptual linkages between ecosystem services and human well-being.

Figure 1: The Millennium Assessment Conceptual Framework



The attractiveness of the 'ecosystem services' concept is also largely due to its capacity to provide a unifying language between the economic, business and environmental communities; as beneficiaries of valuable services are identified, previously uninvolved actors are recognizing that they have a stake in conserving the environment. This offers a strategic opportunity to further engage economic policy makers and the private sector in conservation efforts.

Recommended reading

- Daily, G. et al. 1997. Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems, *Issues in Ecology*, 2: 1-18.

<http://md1.csa.com/partners/viewrecord.php?requester=gs&collection=ENV&recid=5290950&q=Ecosystem+Services%3A+Benefits+Supplied+to+Human+Societies+by+Natural+Ecosystems&uid=&setcookie=yes>

This article marks the beginning of the rise of the ecosystem services concept within the environmental community. It provides an overview of the main types of ecosystem services, of the main threats to their maintenance, and some thoughts on their valuation. For a more complete vision of this pioneer piece of work, the author edited a book dedicated to the subject of ES:

<http://www.amazon.com/Natures-Services-Societal-Dependence-Ecosystems/dp/1559634766>

- Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-Being. Synthesis Report. <http://www.millenniumassessment.org/en/index.aspx>

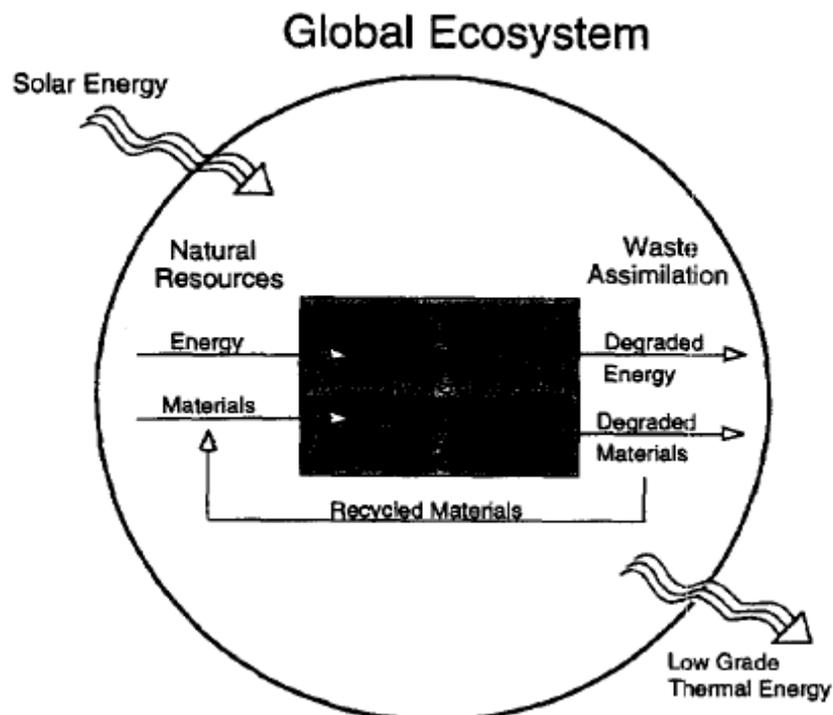
The MA is a landmark publication which provides a comprehensive overview of the state of ecosystems and of how this relates to human well-being. This document is a summary report (100 pages!). It offers a brief 20-page summary for decision makers on ecosystem change and degradation, followed by a 75-page overview of the key issues raised in the MA, such as recent changes to the provision of ecosystem services.

Background theory: ecological economics vs. environmental economics

Our definition of ecosystem services is immersed in the burgeoning of a new field of thought at the crossroads of economics and ecology – ecological economics. This trans-disciplinary field of study is specifically tailored to guide explorations into the complex relationship between natural and human systems. The conceptual 'grandfather' and main source of inspiration of the discipline is the economist Nicholas Georgescu-Roegen, who introduced the fundamental concept of entropy into economic thinking.

One of the defining premises of ecological economics is to consider the economy as a sub-system of the larger finite ecological system (see Figure 2).

Figure 2: The human economy as an open subsystem of the larger global ecosystem



Source: Cleveland and Ruth, 1997

The closely related discipline of environmental and resource economics, on the other hand, takes a different approach by addressing environmental issues within the more established neo-classical economics model. Thus, the focus in environmental economics is more on carrying out cost-benefit analyses of environmental policies and on the economic internalization of externalities and market failures.

Another way of approaching this epistemological dichotomy as it relates to PES is to consider ecological economics as being relevant for the ES valuation exercise, and environmental economics as being more useful in terms of designing specific market-based schemes.

Recommended reading

- Cleveland, C. and Ruth, M. 1997. When, where and by how much do biophysical limits constrain the economic process? – A survey of Nicholas Georgescu-Roegen's contribution to ecological economics. *Ecological Economics*, Vol 22, Issue 2: 203-223.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-3T7F34K-4&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8c29312c935a054fde2f692cdf8eea09.
Part of an *Ecological Economics* issue devoted to Georgescu-Roegen. This article presents G-R's contribution to the field of ecological economics, acknowledging how he was a pioneer in addressing "*substitution between human and natural capital*".
- Daly, H. 2005. Economics in a Full World, *Scientific American*, vol 295, n. 3: 100-107.
<http://www.ncbi.nlm.nih.gov/pubmed/16121860>
This paper offers a solid, brief and general introduction into the field of Ecological Economics – within which most of PES theory is inscribed. It discusses the limited supply of natural capital and how our economy can adapt to our finite global biosphere. For a more complete reading on the topic of ecological economics, Daly co-authored a book entitled: *Ecological Economics: Principles and Applications*:
<http://www.islandpress.org/books/detail.html?cart=%5Bcart%5D&SKU=1-55963-312-3>
- Gowdy, J., and Mesner, S. 1998. The evolution of Georgescu-Roegen's bioeconomics. *Review of Social Economy*, Vol 56, Issue 2: 136-156.
<http://www.rpi.edu/~gowdyj/mypapers/RSE1998.pdf>
This article offers an overview of Georgescu-Roegen's epistemological evolution and on the "*valuation and the environmental and social policy recommendations which arise out of his bioeconomic framework*".
- Harris, M. 1996. Environmental Economics. *The Australian Economic Review*.
<http://www3.interscience.wiley.com/journal/119832035/abstract?CRETRY=1&SRETRY=0>
In this paper, a solid overview of the main issues that are the focus of environmental economics is offered. A lot of ground is covered in a relatively short paper (15 pages). It describes market failures, pollution control, and environmental valuation. It concludes by stating that "incentives matter", and that environmental economics can help decision makers make informed choices on the costs and benefits of a given policy.
- Van Den Bergh, J. 2000. Ecological Economics: Themes, Approaches, and Differences with Environmental Economics. *Regional Environmental Change*, Vol. 2 (1).
<http://www.springerlink.com/content/3h05k4gtjnt30ab/>
This article describes the main themes of ecological economics, and then compares it to the field of environmental and resource economics. Specific themes which are dealt with in more detail include: sustainable development, the growth debate, international trade, dynamic processes, behaviour, and policy.

Natural capital

This debate about which between man and environment should come first does not hold much importance for the purpose of understanding the concept of ecosystem services, which is ultimately about highlighting environmental benefits. In economic terms, these benefits can be considered as being assets, or in other words: natural capital. Here, we touch at the heart of the ecosystem services potential, which is its capacity

to serve as a unifying language between 'exploitationist' and 'conservationist' interests in the natural environment.

Natural capital is a critical component of almost every sector of economic activity. The specific processes through which natural capital contributes positively to our economies (or well-being) are what we refer to as ecosystem services. Resource users, extractors, and protectors are all beneficiaries of these services, and all have a common stake in ensuring their maintenance. Despite the combined objective of preserving ecosystem services, not all beneficiaries associate similar values to natural capital. Indeed, there are many ways in which nature can be valued in economic terms. An equitable and effective management of the environment will inevitably involve trade-offs among the different land-use types, each of which provides a different mix of ecosystem services.

Recommended reading

- Hawken, P. Lovins A. & Lovins H. 1999. Natural Capital – see chapter 8: Capital Gains. Rocky Mountain Institute.

<http://www.natcap.org/sitepages/pid20.php>

In the excellent book Natural Capital, a chapter is devoted to the ecosystem services concept. It offers a very insightful view into the qualitative dimension of the environment, and explains why businesses will inevitably need to care about preserving this quality. Natural capital is presented as a limiting factor to economic growth and the chapter concludes with some thoughts on reforming economic policies (mainly through taxation) to better reflect its real value.

Valuing ecosystem services – a commoditization of biodiversity?

In the search for a lasting balance, the common language between 'exploitationists' and 'conservationists' will need to develop a way of comparing conflicting values. Yet, the challenges of quantifying nature stand out as an imposing barrier. Is it right to put a dollar price on biodiversity? Is it desirable? Is it even possible? These are just some of the key questions that have yet to deliver clear answers.

In 1997, a landmark publication was published in which the total value of the world's ecosystems was estimated at \$30 trillion (Costanza et al., 1997). The attention that such a figure drew helped to spark the ensuing wave of enthusiasm and controversy surrounding the economic valuation of ecosystem services. While it might seem absurd to allocate a quantifiable measurement to the infinite value of our unique biosphere, this 'ecosystem services' concept provided some new vocabulary to feed into the discussions on environmental valuation.

A major conceptual hurdle currently hindering the development of environmental valuation efforts is in addressing biodiversity. Although biodiversity is a widely used concept, it does not lend itself well to any type of economic quantification. Moreover, its linkages to ecosystem processes and services are still an ongoing source of debate.

Heal (1999) breaks down the values of biodiversity into those related to ecosystem productivity (e.g. plant pollination), the insurance value (e.g. storm buffering, erosion control), and to the contribution to human knowledge (e.g. medical research). With regards to the knowledge value of biodiversity, this is where valuation becomes particularly tricky, and the cultural services of ecosystems are often left to the side in valuation efforts. Here, it is essential to bear in mind that local livelihoods, are also integral to the maintenance of functioning ecosystems.

Recommended reading

- Appleton, A. 2002. How New York City Used an Ecosystem Services Strategy Carried out Through an Urban-Rural Partnership to Preserve the Pristine Quality of Its Drinking Water and Save Billions of Dollars and What Lessons It Teaches about Using Ecosystem Services. Paper presented at 2002 Katoomba Group Meeting.

<http://assets.panda.org/downloads/pesnewyorkappetlon.pdf>

A paper from an architect of one of the most famous PES deals, which took place in the catchment area of New York City's water supply (the Catskills). The PES deal resulted in an estimated savings of up to \$6 billion by conserving the upper catchment area instead of investing in upgrading treatment plants. Although it relates to a 'developed' context, it provides some interesting insights into for developing PES in various landscapes. One of the key findings of the scheme was that

“properly harnessed, locally based and locally designed programs work best”. The importance of reconciling urban and rural interests is strongly reinforced.

- Ash, N., and Jenkins, M.. 2007. Biodiversity and Poverty Reduction; the importance of biodiversity for ecosystem services. UNEP-WCMC.

<http://www.unep-wcmc.org/latenews/Biodiversity%20and%20Poverty%20Reduction%20UNEP-WCMC.pdf>

The paper presents a very comprehensive overview of ecosystem services and how they relate to biodiversity conservation. It covers a wide variety of different ES and then presents the impacts that their supply has on the poor. The policy recommendations (which apply to environmental and development fields) formulated tend to support the creation of landscape-level PES systems that would maintain a naturally diverse resource base. There is a particularly well-developed section on cultural services, which are often overlooked in ES publications.

- Costanza, R., et al. 1997. The value of the world's ecosystem services and natural capital. Ecological Economics, Volume 25, Issue 1: 3-15.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-45RFNGW-2&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=2195efd3cbf8fd4c2ffa111e07504646

This is the landmark publication that sparked the ecosystem services valuation wave (and much ensuing controversy). In this paper, the authors estimate the total value of the world's ecosystems at some \$30-odd trillion. It provides a methodology for the valuation process and a comprehensive list of the ecosystem services included.

- DEFRA. 2007. An introductory guide to valuing ecosystem services.

http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/valuing_ecosystems.pdf

“The aim of this guide is to provide an introduction to the valuation of ecosystem services. It builds on previous approaches to valuing the environment but takes a more systematic approach to the assessment of impacts on the natural environment. The central theme of this work is to ensure that the value of ecosystems and the services provided are taken into account in policy decision-making.” Introduces the dual ‘economic’ benefits of ecosystems – contributions to income generation and prevention of damages, and provides a sound methodology for valuing ecosystem services in a policy appraisal context.”

- European Commission. 2008. The Economics of Ecosystems and Biodiversity (TEEB). Interim Report.

http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm

This comprehensive research effort is designed to follow on the Stern Review on the costs of Climate Change by focusing more specifically on the values of biodiversity and ecosystems. In the first phase of the project, a team of researchers (led by Pavan Sukhdev) establish an analytical framework for evaluating the costs and benefits of biodiversity and ecosystem services. The second phase of this study is ongoing, with final results scheduled to be presented in 2010.

- Heal, G. 1999. Biodiversity as a commodity. Columbia University.

<http://www2.gsb.columbia.edu/faculty/gheal/General%20Interest%20Papers/pw-99-07.pdf>

The first part of the paper is particularly insightful, and offers an excellent breakdown of the various values that biodiversity can take on – productivity, insurance, and knowledge. After expanding on these 3 categories, Heal goes on to explore the linkages between biodiversity and ecosystem services. The latter part of the paper explores how biodiversity can eventually become integrated into markets as a commodity.

- Heal, G. 1999. Valuing ecosystem services. Paine Webber Working Paper No. 98-12. Columbia University.

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=279191

This is an excellent complementary reading to the above-mentioned work. The inherent difficulties in valuing ecosystem services are presented and analyzed, and the author concludes that the design of adequate incentives is more important than the valuation exercise.

- Pagiola, S., von Ritter, K., and Bishop, J. 2004. How much is an Ecosystem Worth? Assessing the Economic Value of Conservation. IUCN, TNC, The World Bank.
<http://www.cbd.int/doc/case-studies/inc/cs-inc-iucn-nc-wb-en.pdf>
This is a very comprehensive and illustrated study of ecosystem valuation, with many helpful tables and figures. The paper explores the strengths and weaknesses of valuation and concludes by comparing the three main approaches to ecosystem valuation. It also provides a good list of references for some follow-up reading.
- Perrings, C. et al. 2007. DRAFT. The Economics of Biodiversity and Ecosystem Services. DIVERSITAS international Paris background.doc
This was the background paper to a recent expert workshop on the economics of ecosystem services. It discusses the complex linkages between biodiversity, ecosystem functioning, and ecosystem services. The consideration of trade-offs is central to the valuation of ES. It also provides models for measuring biodiversity externalities and considers the implications for management at both the local and international scales.
- Perrings, C. et al 2007. DRAFT. The Valuation of Ecosystem Services. DIVERSITAS international. Paris valuation draft.doc
This is another background paper for the economics of Diversitas workshop. It follow the MA breakdown of ES, excluding supporting services and separating regulating ones from provision and cultural services. Various valuation techniques that estimate social opportunity costs of ES are discussed. Challenges are highlighted, such as the lack of understanding on the links between the provision of ES and their value to humans.

Ecological resilience

Some of the most recent efforts at clearing up the linkages between biodiversity, ecosystem processes, ecosystem services, and human well-being, relate to the concept of resilience. The resilience of a system is its capacity to absorb external shocks without suffering a change in state. It is therefore central to the overall productivity of ecosystems.

Recommended reading

- Baumgärtner, S. 2006. The Insurance Value of Biodiversity in the Provision of Ecosystem Services. Available at SSRN: <http://ssrn.com/abstract=892105>
This paper builds on the notion of resilience and on the findings of Hooper et al (2005) to analyze the role of biodiversity as a natural form of insurance, whose value is directly comparable to the value of financial insurance. The paper concludes that biodiversity does indeed “*act as a form of natural insurance for risk-averse ecosystem managers against the over- or under-provision with ecosystem services*”.
- Bengtsson, J., et al. 2003. Reserves, Resilience and Dynamic Landscapes. AMBIO A Journal of the Human Environment, Volume 32, Issue 6: 389-396.
[http://ambio.allenpress.com/perlserv/?request=get-abstract&doi=10.1639%2F0044-7447\(2003\)032%5B0389%3ARRADL%5D2.0.CO%3B2&ct=1](http://ambio.allenpress.com/perlserv/?request=get-abstract&doi=10.1639%2F0044-7447(2003)032%5B0389%3ARRADL%5D2.0.CO%3B2&ct=1)
This paper specifically addresses the insurance value of biodiversity. It argues that “*for ecosystems to reorganize after large-scale natural and human-induced disturbances, spatial resilience in the form of ecological memory is a prerequisite*”. It describes an innovative approach to ecosystem management which aims towards building resilience by considering dynamic as opposed to static nature reserves.
- Hooper, D., et al. 2005. Effects of Biodiversity on Ecosystem Functioning: A Consensus of Current Knowledge, Ecological Monographs, Volume 75, Issue 1.
<http://www.esajournals.org/doi/abs/10.1890/04-0922>
This is a scientific overview of the biodiversity-ES linkages. Most of the findings in the study lead to the general conclusion that biodiversity contributes positively to the overall resilience of an ecosystem, and that it is often crucial to the overall productivity of ecosystems.

- Mäler, K.G. et al. 2007. Pricing Resilience in a Dynamic Economy-environment System: A Capital-theoretical Approach. Resilience.pdf
Here is a recent paper on resilience and potential ways of pricing it within a given socio-ecological system. It offers an interesting theoretical application of the resilience concept.
- WRI. 2008. The Roots of Resilience – Growing the Wealth of the Poor. World Resources.
<http://www.wri.org/publication/world-resources-2008-roots-of-resilience>
This excellent and comprehensive report offers an overview of the various means of enhancing socio-ecological resilience in poor landscape. The paper highlights the importance of building ownership, capacity, and connections as the pillars for sustainable development. Case studies are offered to illustrate various means of enhancing resilience. The report notably argues that sustainable enterprise development offers an opportunity to address the challenges of climate change while enhancing local livelihoods.

Managing Ecosystem Services

We have seen that the ecosystem services concept serves as a convenient link between human well-being (economics) and natural processes (ecology). It is perhaps most useful in the simple way that it provides for a unifying language between resource users and resource conservationists. Developing this common language will involve a balancing act between the various interests of these ecosystem 'beneficiaries'. In short, the particular balancing act that we're talking about is ecosystem management. This section attempts to highlight how the recently developed 'ecosystem services' concept applies to the broader task of ecosystem management.

The landscape approach

The issue of scale is paramount in ecosystem management. Inevitably, there will be a geographical mismatch between social institutions and natural processes. The challenge is in finding an approach that can best complement both scales. The 'landscape scale' or 'landscape approach', which defines IUCN's Livelihoods and Landscape Strategy (LLS), is particularly appropriate for the implementation of ecosystem services policies.

The integration of natural capital into economic production processes is best implemented at a scale which is not only most relevant to the context-specific ecological processes according to which the ecosystem services are being valued, but which also maximizes the sustainable economic development of communities through broad and balanced participation. Inevitably, this task will involve a combination of top-down provision of capital investments with the bottom-up cultural acceptance of policy implementation.

Recommended reading

- Arrow, K., et al. 1999. Managing Ecosystem Resources. Environmental Science and Technology
<http://www.colby.edu/personal/t/thtieten/Mneco.pdf>
This is a paper written by some leading economists and ecologists on environmental management as it relates to ecosystem services. The authors notably state that "*the greatest challenge perhaps is in the valuation of the manifold services ecosystems provide to humanity, and in maintaining the resiliency that sustains them. To this end, we recommend precautionary and adaptive approaches, coupled with mechanisms to tighten cost and benefit loops and internalize externalities, including local empowerment and common property resource management*".
- Fisher, B., and Christopher, T. 2007. Poverty and biodiversity: Measuring the overlap of human poverty and the biodiversity hotspots.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-4KNKBYF-3&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=a028ce9285dd9ace39ad31398c9d4fe1
The paper analyzes the biodiversity hotspots using five key socioeconomic poverty indicators (access to water, undernourishment, potential population pressure, number living below poverty line and debt service) and integrate them with an ecologically based hotspots analysis in order to illustrate magnitude of the overlap between biological conservation and poverty. The analysis challenges how PES could address the conservation-poverty alleviation issue.
- Goldman, R.L., Thompson, D.H., and Daily, G.C. 2007. Institutional incentives for managing the landscape: inducing cooperation for the production of ecosystem services. Ecological Economics, Vol. 64, Issue 2: 333-343.
<http://ideas.repec.org/a/eee/ecolec/v64y2007i2p333-343.html>
This paper focuses on three services: pollination (local), hydrological (regional), and carbon sequestration (global). The paper explains why the landscape approach is adequate for ES and PES. The main focus of the paper is to compare different kinds of institutional incentives that would encourage farm management to realize optimal landscape mosaics.
- Irwin, F., and Ranganathan, J (with others). 2007. Restoring Nature's Capital – An Action Agenda to Sustain Ecosystem Services. WRI Report.
http://www.wri.org/biodiv/pubs_description.cfm?pid=4309#pdf_files

This is an excellent and comprehensive report on taking action towards managing ecosystem services. Five concrete action plans are proposed, including one to “*align economic and financial incentives with ecosystem stewardship*”. Then, either through existing institutions, or through the creation of new ones (such as ecosystem services districts, for example) the paper explores ways of achieving the desired actions.

- Janzen, D. 1998 Gardenification of tropical conserved wildlands: Multitasking, mutlicropping, and multiusers Proc. Natl. Acad. Sci.

<http://www.pnas.org/content/96/11/5987.abstract>

This is a well-written and inspiring piece on our capacity to tap into the goods and services provided by the ‘wildland garden’ (not to be confused with ‘agroscape’). The author highlights the need for establishing a “yellow pages” for ecosystem goods and services and establishing “*environmental services contracts*” between the wildlands and society. A key insight in the paper is the ‘decentralized’ nature of PES systems, which risk facing strong resistance from the centralized governments of many developing countries of the tropics. The author also strengthened the importance of local context in managing ecosystem services.

- Kremen, C. 2005. Managing ecosystem services: what do we need to know about their ecology?

<http://www.blackwell-synergy.com/links/doi/10.1111/j.1461-0248.2005.00751.x/abs/>

This paper offers an excellent introduction into the fundamental ecological consideration that should be taken into account when dealing with ecosystem services. The author provides a research agenda for moving ahead with ecological research that will be necessary to support the development of management efforts related to ecosystem services.

- Pearce, D. 2005. Managing Environmental Wealth for Poverty Reduction. Poverty Environment Partnership

<http://www.povertyenvironment.net/pep/node/959/print>

This is a very comprehensive report (160 pages) on the environment and its role within the achievement of the Millennium Development Goals (MDG). “*The report attempts to identify what environmental interventions contribute most efficiently to poverty reduction... It develops a framework for analyzing the contribution of natural resources to human well-being and sets out an ambitious agenda for public investment and policy reform*”.

Conservation in productive landscapes

At a localized level, the landscape approach to ecosystem management needs to address the multiple uses of a given area. Within LLS, this relates to the sustainable management of forests and forest resources in areas that are inhabited. In this context, ecosystem management will need to address deforestation and the degradation of forest landscapes without compromising local livelihoods. The challenge is thus to integrate conservation into managed landscapes, where agriculture is often a major land use. Ecosystem services, however, can often highlight some win-win opportunities for integrating conservation into managed landscapes.

There could be a whole lot of different competing land uses that would compromise a sustainable supply of ecosystem services, such as grazing pastures, and crop and tree plantations. Several strategies for more sustainable land uses that would jointly optimize the delivery of ecosystem goods and services are agro-forestry, eco-agriculture, and silvo-pastoral systems.

Recommended reading

- Bennett, E., and Balvanera, P. 2007. The Future of Production Systems in a Globalized World, *Frontiers in Ecology and Environment*, Volume 5, Issue 4.

[http://www.esajournals.org/doi/abs/10.1890/1540-9295\(2007\)5%5B191:TFOPSI%5D2.0.CO%3B2](http://www.esajournals.org/doi/abs/10.1890/1540-9295(2007)5%5B191:TFOPSI%5D2.0.CO%3B2)

Building on the resilience concept, this paper focuses on production systems and explores ways in which to mitigate impacts of an increased demand for food on the provision of ES. The authors address a very interesting question: “*How do ecosystems provide bundles of services and what are the interactions among such services, including trade-offs and synergies?*”

- Chomitz, K. 2007. At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests. The World Bank.
<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPRRS/EXTTROPICALFOREST/0,,menuPK:2463898~pagePK:64168092~piPK:64168088~theSitePK:2463874,00.html>
 This is a very comprehensive report (over 300 pages) on the linkages between agriculture, livelihoods, and sustainability in tropical forests. The author stylizes three main forest types (managed, frontier, and untouched) and studies recent trends in forest change. After a detailed outline of the main issues currently defining deforestation and forest poverty, the author explores various institutional policy and institutional responses. There is an interesting section on tapping into the market for carbon sequestration through avoided deforestation (chapter 7).
- FAO, LEAD. 2006. Livestock's Long Shadow – Environmental Issues and Options
<ftp://ftp.fao.org/docrep/fao/010/A0701E/A0701E00.pdf>
 This report offers some interesting insights into the role that payments for ecosystem services (PES) might play as a framework for incentivizing sustainable livestock practices. Beyond the more focused section on PES, the report offers a very comprehensive overview (400 pages!) of the environmental aspects of the global livestock industry.
- Kleijn, D., and Sutherland, W. 2003. How Effective are European Agri-environmental Schemes in Conserving and Promoting Biodiversity? *Journal of Applied Ecology*, Volume 40, Issue 6: 947-969.
<http://www3.interscience.wiley.com/journal/118869721/abstract>
 This paper evaluates the effectiveness of the European financial compensation scheme for conservation – which is directed towards farmers in 26 countries. It summarizes a large collection of field studies without coming up with conclusive evidence on the overall effectiveness of the programme.
- McNeely, J., and Scherr, S. 2001. Common Ground, Common Future – How Ecoagriculture Can Help Feed the World and Save Wild Biodiversity. Ecoagriculture Partners.
<http://www.ecoagriculturepartners.org/documents/reports/FinalPrintingReport2.pdf>
 This paper introduces the challenge that ecoagriculture is designed to address: the loss of biodiversity and the increase in demand for agriculture. Then, six different ecoagriculture strategies are presented. They all have in common that they strive for a better joint management of conservation and agricultural production in support of rural livelihoods.
- Perrings, C. 2001. The Economics of Biodiversity Loss and Agricultural Development in Low Income Countries. The World Bank
<http://siteresources.worldbank.org/WBI/Resources/213798-1104176940274/agriculture.pdf>
 While not specifically focused on ecosystem services, this paper explores biodiversity's role in productive landscapes. The author is concerned mainly with the "*local efficiency of biodiversity loss, and the scope for developing local incentives for biodiversity conservation*".
- Swift, M.J., Izac, A. M.N., and van Noordwijk, M.. 2004. Biodiversity and Ecosystem Services in Agricultural Landscapes: Are We Asking the Right Questions? *Agriculture, Ecosystems & Environment*, Volume 104, Issue 1: 113-134.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y-4D5JW0F-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=be1eeb706d3aeba5bdd999ca6e2eb51d
 Discusses the scientific aspects underpinning ecosystem services, and argues that utilitarian biodiversity benefits prime at the farm/plot scale, often at scales which are not large enough to ensure the maintenance of the ecosystem service. In managed landscapes, high levels of biodiversity will probably be maintained for more intrinsic values. "*The major opportunity for both maintaining and ecosystem services and biodiversity outside conservation areas lies in promoting diversity of land use at the landscape and farm rather than field scale*".
- Tscharntke, T., et al. 2005. Landscape Perspectives on Agricultural Intensification and Biodiversity – ecosystem service management. *Ecology Letters*, Volume 8, Issue 8: 857-874.
<http://www3.interscience.wiley.com/journal/118669370/abstract>

This scientific paper addresses the environmental problems associated with agricultural intensification both at the landscape and farm levels. The authors notably discuss the insurance hypothesis (e.g. Baumgartner), and conclude that “*conservation of biodiversity and ecosystem services in agricultural systems requires a landscape perspective*”. The authors then contrast the implications for simple (smaller species pool) landscapes and complex (larger species pool) landscapes. “*Financial support should consider the limited importance of local environmental changes, take a landscape perspective into account and better adapt schemes to landscape type.*”

Rewarding Ecosystem Services

As we have seen from the previous sections, ecosystem services are highly complex. They affect our lives in many different ways, and often come with trade-offs. However, they are often delivered as 'free gifts' to human well-being and are frequently undervalued. To the extent that they contribute to human welfare, it seems appropriate to reward, or incentivize, the provision of ecosystem services.

While the marketplace is particularly efficient at satisfying those most worthy of being rewarded, it is not the only means of creating the incentives necessary for the sustainable provision of ecosystem services. The use of economic incentives in public policy is no new endeavour. However, a main distinction between a payment for an ecosystem service and a government subsidy is that the beneficiary is not necessarily the general public. In some cases, it is; and that's when the public authorities need to secure the provision of the service. In other cases, the beneficiaries can be narrowed down to a specific user group, such as coffee growers or carbon brokers.

The innovative characteristic of the 'ecosystem services' language is that it goes beyond the public/private distinction and strives towards the identification of specific beneficiaries of ecosystem services in both spheres. These can be individuals, businesses, local communities, user groups such as associations of fishermen or hunters, or even national governments.

Incentive-based conservation tools

In practice, the 'ecosystem services' concept is most easily applied through sustainable financing. Indeed, a service rendered merits some kind of a commission. While payments for ecosystem services (PES) most often take the shape of financial transfers, they can also apply to a broader set of rewards, including technology transfer, capacity building, and debt relief.

By offering economic incentives for maintaining ecosystem services, PES operates on the basis that market forces can offer an efficient and effective means of supporting sustainable development objectives. However, PES remains a specific policy tool, not a one-size-fits-all model for sustainable development.

Recommended reading

- Daily, G., and Ellison, K. 2002. *The New Economy of Nature*. Island Press.
http://books.google.com/books?hl=en&lr=&id=To69sewhpHkC&oi=fnd&pg=PA1&dq=The+New+Economy+of+Nature&ots=0moLcHZAuU&sig=filQ1Y2nY2MOozpx_k5siuek4rg#PPP1,M1
This is a fundamental book on the integration of nature into the economy. It makes the case for a better recognition of the values of nature and provides insights into possible future development of markets for environmental services.
- Ferraro, P., and Kiss, A. 2002. Direct Payments to Conserve Biodiversity. *Science*, Volume 298, no. 5599: 1718-1719
<http://md1.csa.com/partners/viewrecord.php?requester=gs&collection=ENV&recid=5526230&q=Direct+Payments+to+Conserve+Biodiversity+ferraro&uid=&setcookie=yes>
This is a brief two-page article which makes the case for more direct conservation finance. It offers an interesting an interesting continuum of conservation investments, ranging from indirect to direct investments.
- Lovera, S. 2006. Environmental Markets Impoverish the Poor. *Cultural Values and Nature Initiative*
<http://www.fsd.nl/CVNI/72331>
This article presents views on the social impacts of markets for ES by a PES critic. It finds that PES are mainly beneficial to big industry and large landholders.
- Richards, M, and Moura-Costa, P. 1999. Can Tropical Forestry Be Made Profitable by 'Internalizing the Externalities'. Overseas Development Institute.
<http://www.odi.org.uk/NRP/46.html>

This is a brief but informative paper on innovative financial mechanisms for sustainable forest management. It offers a good classification of the various approaches to the application of economic incentives for sustainable forest management (SFM).

- Shilling, J., and Osha, J. 2002. Making Markets Pay for Stewardship. WWF

<http://www.newamerica.net/index.cfm?pg=article&DocID=1729>

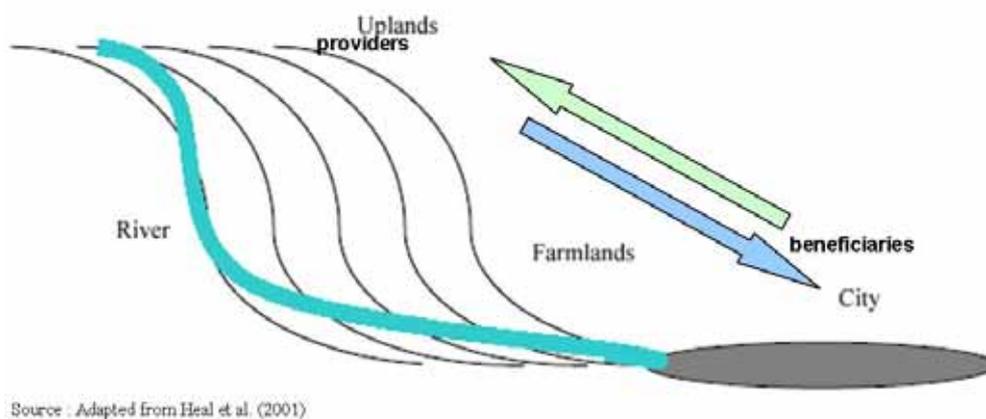
This is a technical paper on developing pro-(rural) poor markets and PES systems. Section 7 of the paper outlines various tools that can be used to link poverty reduction and sustainability, such as reforming property rights, improving the valuation of ES, compensating local people for resource use, and establishing funds to pay for stewardship.

Introducing PES

While PES is commonly believed to be an innovative new conservation tool, there still is no clear consensus on its exact definition. A commonly accepted one, however, is offered by Wunder (2005) who defines PES as a voluntary transaction whereby a well-defined ecosystem service, or a land-use likely to secure that service, is being 'bought' by at least one buyer from at least one provider – if, and only if, the provider secures the provision of the service.

One of the most widespread and easily understood forms of PES is a transaction between downstream water users and upstream landowners to secure the water-related benefits of a sustainably managed watershed (e.g. flow regulation, filtration, and erosion control).

Figure 3: Basic watershed-based PES model



The PES model, however, has a much broader application. Carbon sequestration projects through the Kyoto Protocol's Clean Development Mechanism (CDM), bioprospecting deals, and even entrance fees at national parks have all been tagged with a PES label. Perceived widely to be an innovative and somewhat ground-breaking policy tool, the success of PES is largely contingent on its capacity to engage previously uninvolved actors (beneficiaries of ecosystem services) into conservation activities. In that regard, the equitable and sustainable integration of private enterprise into ecosystem management efforts, at all scales, represents a major task for PES.

Recommended reading

- Duraiappah, A. 2007. Markets for Ecosystem Services – A Potential Tool for Multilateral Environmental Agreements. IISD

<http://www.iisd.org/publications/pub.aspx?id=844>

A well-written and comprehensive overview of the PES debate and highlights the importance of property rights is mentioned as an essential ingredient for success. There is a particularly useful table which highlights the different steps necessary for creating pro-poor PES schemes.

- Ferraro, P. 2008. Asymmetric information and contract design for payments for environmental services. *Ecological Economics*, Vol 65, Issue 4: 810-821
<http://ideas.repec.org/a/eee/ecolect/v65y2008i4p810-821.html>

The paper discusses the asymmetric information between landowners and conservation agents which limits the effectiveness of PES schemes. The author explains the importance of “information rents” in designing contracts for PES and how to reduce them in three approaches: (1) acquire information on observable landowner attributes that are correlated with compliance costs; (2) offer landowners a menu of screening contracts; and (3) allocate contracts through procurement auctions.
- Landell-Mills, N., and Porras, I. 2002. Silver Bullet or Fools Gold? A Global Review of Markets For Forest Environmental Services and Their Impact on the Poor. IIED.
<http://www.iied.org/pubs/display.php?o=9066IIED>

Perhaps the most often mentioned PES reference. It provides a truly global assessment of the various types of existing PES schemes, with a carbon, biodiversity, water, and scenic beauty breakdown. The lack of property rights and access to finance are highlighted as main factors limiting the participation of poor households in PES schemes.
- Lugo, E. 2008. Ecosystem Services, the Millennium Ecosystem Assessment, and the Conceptual Difference between Benefits Provided by Ecosystems and the Benefits Provided by People. *Florida State University College of Law Journal of Land Use*, Vol. 23, Number 2.
http://www.law.fsu.edu/journals/landuse/vol23_2/Lugo.pdf

This paper offers an excellent overview of the current state of the PES debate and highlights the inherent ambiguities associated with the concept. More specifically, the paper highlights the distinction between ‘ecosystem services’ (benefits provided by ecosystems) and ‘environmental services’ (benefits provided by people) and calls for a more coordinated effort to help further differentiate between the concepts by focusing on the term ‘ecosystem services’ and offering more clarity to the MA definition.
- Mayrand, K., and Paquin, M. 2004. Payments for Environmental Services: A Survey and Assessment of Current Schemes. *Unisfera*.
http://www.cec.org/files/PDF/ECONOMY/PES-Unisfera_en.pdf

This study covers a lot of different types of PES schemes, showing that a multiplicity of PES models coexist without a single standing out as a standard-setter. A key finding is that *“PES systems work best when services are visible and beneficiaries are well organized, and when land user communities are well structured, have clear and secure property rights, strong legal frameworks, and are relatively wealthy or have access to resources”*.
- Powell, I., White, A., and Landell-Mills, N. 2002. Developing Markets for the Ecosystem Services of Forests. *Forest Trends*.
http://www.earthscape.org/p1/ES16904/ecosys_market.pdf

This is a general paper on market-based instruments for ecosystem services. It provides a basic overview of existing types of schemes and then poses the key questions necessary for developing new markets. It concludes with some words of advice on making PES deals.
- Salzman, J. .2005. Creating Markets for Ecosystem Services: Notes from the Field. *New York University Law Review*, Volume 80, No. 6.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=796772

“This is a retelling of personal experiences with the benefits and challenges of implementing PES, explained as an ecosystem approach to environmental protection. The author established a market for a water quality payment scheme in Australia and gives personal reflection. The author reviews current payment scheme structures and delineates key variables. Policy changes fundamental to assist PES are proposed as the author argues PES should be favored over the traditional regulatory and tax-based approaches.”
- Scherr, S, White, A., and Khare, A. 2004. For Services Rendered: The Current Status and Future Potential of Markets for Ecosystem Services Provided by Tropical Forests. *Forest Trends*.

[http://www.forest-trends.org/documents/publications/For%20Services%20Rendered%20\(ITTO\).pdf](http://www.forest-trends.org/documents/publications/For%20Services%20Rendered%20(ITTO).pdf)

This is an excellent overview of the different types of existing PES schemes. The paper concludes by listing the main strategic issues that tropical countries should consider: international competitiveness, legal and regulatory framework, property rights and the politics of protecting ecosystem services, domestic equity, and reducing transaction costs and financial risks.

- Sierra, R., and Russman, E. 2007. On the efficiency of environmental service payments: A forest conservation assessment in the Osa Peninsula, Costa Rica. *Ecological Economics*, Vol. 59, Issue 1: 131-141.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-4HRMV3W-2&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=a413ff90c1466d41fa5c22079317c6f8
This study examines the efficiency of programs supporting the conservation of forest resources and services through direct payments to land owners; or payments for environmental services (PES) in Osa Peninsula, Costa Rica. The findings of the study suggest three conditions to determine the level efficiency of PES: 1) whether forest cover would be lower without the payments; 2) whether any additional gain in forest cover is temporary or permanent; and 3) whether the protection of some forest habitats in a farm creates pressure in other habitats, maybe biologically and economically more important, in the same farm or elsewhere. This study lends support to the growing expectation that project administrators improve their capacity to target payments where they are most needed and not simply where they are most wanted.
- Swallow, B. 2006. Pan-Tropical Scoping Study of Compensation for Ecosystem Services: Conceptual Foundations. ICRAF. DRAFT.
<http://www.worldagroforestry.org/es/ces/Downloads/ces%20conc%20framework%20third%20draft%20-%20may%206%202006.doc>
This paper is destined to be the first in a series of several papers prepared by an ad hoc group created to study Compensation for Ecosystem Services (CES). This one outlines the conceptual framework of this initiative, which is part of ICRAF's Rural Poverty and Environment programme. There is a particularly interesting section on the different perspectives on PES (environmental management, conservation, poverty, etc.). It also offers a good table with a typology of different kinds of ecosystem services.
- Wunder, S. 2005. Payments for environmental services: some nuts and bolts. CIFOR Occasional Paper No. 42.
http://www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf
This is a key conceptual paper, offering the generally accepted definition of PES, and providing insights into some of the key questions that arise when thinking about developing such schemes. It concludes by assessing when and where PES should be used as a conservation instrument.
- Wunder, S. 2007. The Efficiency of Payments for Environmental Services in Tropical Conservation. *Conservation Biology*, Volume 21, Number 1: 48-58.
<http://www.ingentaconnect.com/content/bsc/cbi/2007/00000021/00000001/art00014>
Written by one of the leading developers of PES theory, this essay attempts to 'demystify' PES and "clarify its scope for application as a tool for tropical conservation". The author finds that a PES scheme can "*benefit both buyers and sellers while improving the resource base, but it is unlikely to fully replace other conservation instruments*".
- WWF. 2006. Ecosystem Services and Payments for Ecosystem Services: Why should businesses care? WWF.
http://assets.panda.org/downloads/business_brochure_1.pdf
This is a short brochure highlighting the main findings of a recent forum on the private sector's involvement in PES (November 2006 in Vienna). The document is mainly focused on getting businesses more interested in PES, but also provides interesting information on the ways of tapping into this potential source of demand.

Implementing PES

Placing rural communities at the heart of PES schemes

Generally speaking, PES can be conceived as a specific ecosystem management tool used to correct market failures and their negative effects on ecosystems. Its broad objective consists in supporting sustainable development through a stronger appreciation of biodiversity and ecosystem values.

The development of PES efforts will need to be wary of eventual trade-offs; conservation projects that support the delivery of a given ecosystem service may conflict with the provision of other ecosystem services, or may hinder other development activities. Consequently, it is important to consider the use of PES not just as an incentive for conservation, but more generally as an incentive for more sustainable land-use in inhabited landscapes. PES should, above all, be used to support sustainable development in rural communities. In other words, communities living in areas considered 'sources' of ecosystem services should be better off with PES than without it.

The most important rationale behind the use of incentive-based instruments such as payments for ecosystem services within LLS is that it can help achieve conservation and livelihood objectives jointly. Payments should therefore be distributed in such a manner that incentivizes both conservation and rural development. Within a rural development perspective, it might be appropriate to consider PES systems as a means of rewarding those who maintain the natural systems upon which modern (or urban) lifestyles depend. This means using PES to tap into biodiversity values that are provided by rural landscapes and that are enjoyed by urban consumers.

Recommended reading

- Mayers, J. 2007. Trees, poverty, and targets – Forests and the Millennium Development Goals. IIED. http://dl.klima2008.net/ccsl/treespovertynadtargets_ied.pdf
Evidence is presented on how forest resources contribute to poverty mitigation, e.g. by acting as subsistence safety nets or low-income gap-fillers and helping to reduce poverty by increasing assets, services, civil and political rights, voice, and the rule of law structured around the MDGs. Some recommendations on how forestry specialists can do better are offered.
- Ravnborg, H. M., et al. 2007. Payments for Ecosystem Services – Issues and Pro-poor Opportunities for Development Assistance. DIIS Report. <http://www.diis.dk/sw37381.asp>
This paper served as a background paper for a recent workshop partially dedicated to PES and poverty. After providing background information on PES, including main risks and challenges of further development, it deals briefly with the issue of poverty and then explores four main options for the development assistance community to consider when supporting PES schemes.
- Scherr, S., Milder, J., and Bracer, C. 2007. How important will different types of Compensation and Reward Mechanisms be in shaping poverty and ecosystem services across Africa, Asia & Latin America over the next two decades? ICRAF Working paper series. <http://www.worldagroforestry.org/library/listdetails.asp?id=49860>
The purpose of this paper is to explore the relative importance of different types of Compensation and Reward mechanisms for Ecosystem Services (CRES) in shaping poverty and ecosystem services across the developing world, as they are likely to evolve over the next two decades. The document follows the often used biodiversity-carbon-scenic beauty-water breakdown.
- Sunderlin, W., Angelsen, A., Belcher, B., Burgers, P. Nasi., R. Santoso, L. and Wunder, S. 2005. Livelihoods, forests, and conservation in developing countries: an overview. World Development, Volume 33, Issue 9: 1383-1402. <http://ideas.repec.org/a/eee/wdevel/v33y2005i9p1383-1402.html>
In the growing literature at the interface of rural livelihood improvement and conservation of natural forests, two overarching issues stand out: (1) How and to what extent use of forest resources do and can contribute to poverty alleviation and (2) How and to what extent poverty alleviation and forest conservation are and can be made convergent rather than divergent goals. This article summarizes

and evaluates the state-of-the-art knowledge in these domains of thought and identifies priorities for future research.

- Wunder, S. 2008. Payments for Environmental Services and the Poor: Concepts and Preliminary Evidence. *Environment and Development Economics*, 13: 279-297.
<http://journals.cambridge.org/action/displayAbstract;jsessionid=50F0C6792DDB72548F4FA2D4A0ED6DCB.tomcat1?fromPage=online&aid=1880984>

This is a recent paper on the poverty dimension of existing PES schemes. The author evaluates the level of participation of the poor in PES using literature reviews and empirical data from fieldwork in Bolivia, Vietnam, and Ecuador. While Wunder finds that poor people participate widely in PES schemes, he questions the poverty benefits of the schemes and proposes to focus first on gaining on-ground experience and learning how to make this project work.

- Zilberman, D., Lipper, L., and McCarthy, N. 2006. When are Payments for Environmental Services Beneficial to the Poor? ESA Working Paper No. 06-04.
<ftp://ftp.fao.org/docrep/fao/009/aq074e/aq074e00.pdf>

This FAO report studies the impact of PES on poverty, and provides insights into ways that PES programs can be targeted to obtain poverty reduction benefits. The urban poor, the landless, and poor landholders are the three categories considered. The analysis pertains both to cases where land use is diverted from strict agricultural production to the generation of environmental amenities and where ES are being provided in working landscapes. Findings are then applied to countries showing various types of land distribution and agricultural population densities. The analyses suggest that PES programs might have negative effects on poverty in areas that are marginalized from the global economy while having more positive effects in areas that are well integrated into the global economy.

Local schemes

In most PES cases, the beneficiaries and providers of ecosystem services are found in the same area. Although it is always difficult to align ecological and institutional scales into coherent management structures, it has been argued that watersheds represent an appropriate unit for developing environmental projects such as PES. Thus, they are a good starting point for thinking about how to implement PES.

Recommended reading

- Eigenraam, M., L. Strappazon, N. Landsell, A. Ha, C. Beverly, and J. Todd. 2006. *EcoTender: Auction for Multiple Environmental Outcomes*.

<http://www.napswg.gov.au/publications/books/mbi/pubs/round1-project20.pdf>

This book (150 pages) reports on the EcoTender pilot experiment in Australia, which builds on the BushTender experience. It presents the Catchment Modelling Framework (CMF) which is a modeling tool used to estimate *multiple* ecosystem outcomes (which was not assessed in BushTender) including carbon, terrestrial biodiversity, aquatic function and saline land area. The CMF estimates the environmental impacts of the multiple environmental outcomes and spatially represents them to the potential bidders (landholders) and the purchaser (Victorian gvt.) of ecosystem services.

- FAO. 2004. Payments schemes for environmental services in watersheds.

ftp://ftp.fao.org/agl/aglw/docs/lwdp3_es.pdf

This is a bilingual (English-Spanish) report of the regional forum on watershed PES, which took place during the 3rd Latin American Congress on Watershed Management in Arequipa Peru, 2003. The report outlines the main lessons learned from previous experiences, their main advantages and limitations, and concludes with some recommendations.

- Gouyon, A. 2003. Rewarding the Upland Poor for Environmental Services: A Review of Initiatives from Developed Countries. ICRAF.

http://www.worldagroforestrycentre.org/SEA/Networks/RUPES/download/paper/AGouyon_RUPES.pdf

This lengthy (100 pages) work highlights the main lessons learned from PES schemes operating in developed countries. It was prepared for the Rewarding Upland Poor for Environmental Services (RUPES) inception meeting. The findings for the RUPES project are not necessarily very promising,

as it is found that private sector involvement is a key to a success and that there currently are many perverse incentives that limit pro-poor involvement and environmentally-friendly practices. The author also mentions the difficulty in separating market-based from non-market based mechanisms.

- Johnson, N., White, A., and Perrot-Maître, D. 2002. Developing Markets for Water Services from Services. Forest Trends.
http://www.forest-trends.org/documents/publications/Developing_Markets_for_Water_Services.pdf
This paper examines experiences with watershed-based PES schemes from around the world. It has a very useful table as an annex which compiles information from several case studies. A complementary publication which focuses more specifically on 9 case studies provides the necessary context (see tools section).
- Smith, M., De Groot, D., and Bergkamp, G. 2006. Pay – Establishing Payments for Watershed Services. IUCN.
<http://data.iucn.org/dbtw-wpd/edocs/2006-054.pdf>
This is a very comprehensive report on payments for watershed services (over 100 pages). It provides information on valuing and managing watershed services, designing a payment scheme, and negotiating successful arrangements.
- Stoneham, G., V. Chaudhri, A. Ha, and L. Strappazzon. 2003. Auctions for conservation contracts: an empirical examination of Victoria's BushTender trial. Australian Journal of Agricultural and Resource Economics 47(4): 477-500.
<http://www3.interscience.wiley.com/journal/118852208/abstract>
This paper describes the BushTender experience in Australia, where an auction was instituted to allocate PES. The scheme was specifically focused on preserving biodiversity on private lands. Biodiversity was assessed through the Biodiversity Significance Score (BSS), which reflects existing information about the scarcity of remnant vegetation types. By contrasting the auction with a fixed-price scheme, the paper shows how an auction could offer large cost savings to governments interested in nature conservation on private land.

International schemes

PES extends beyond watershed level schemes. The Clean Development Mechanism (CDM) under the Kyoto Protocol is an example of a truly international PES scheme, whereby carbon sequestration projects in developing countries are paid for by polluters in developed countries. While the CDM has attracted criticism, there is hope that the basic idea of channelling 'sustainable' investments from North to South can be reinforced through other international PES (IPES) systems.

IPES can be apprehended at two distinct levels, depending on whether we are considering (i) ecosystem services of global significance (e.g. provision of genetic information, climate regulation, etc.), or (ii) ecosystem services that have more regional effects (e.g. watershed protection, storm buffering, etc.). Fitting both into a common framework capable of integrating a variety of PES schemes will inevitably imply a multi-scale approach.

As climate change continues to rise to the forefront of global public consciousness, there is a real opportunity to give new impetus to both conservation and sustainable development efforts. Growing interest in carbon sequestration and the conservation of natural carbon stocks could serve as an important stepping stone for IPES. With an established market for carbon emissions, there is reason to believe that carbon sequestration could become an important source of finance for ecosystem conservation. Such a belief is contingent however on the ability of the international community to reach consensus on how to reduce greenhouse gas emission from deforestation and land degradation.

Recommended reading

- Griffiths, T. 2007. Seeing 'RED'? 'Avoided Deforestation' and the Rights of Indigenous Peoples and Local Communities. Forest Peoples Programme.
http://www.forestpeoples.org/documents/ifi_igo/avoided_deforestation_red_jun07_eng.pdf
This paper explores how local communities might be able to benefit from REDD. It analyzes the existing proposals on REDD and outlines the need for urgent debate on the social and rights issues

that risk being overlooked. It has an interesting annex section which analyzes a recent World Bank REDD proposal as well as Nicholas Stern's views on the issue. Also, it provides a brief historical of REDD's inclusion in international negotiations.

- IUCN-UNEP. 2007. Developing International Payments for Ecosystem Services – Greening the World Economy.

http://www.unep.ch/etb/areas/pdf/IPES_IUCNbrochure.pdf

This is a brief introduction into the development of International Payments for Ecosystem Services (IPES). It provides the main conceptual grounding for the recently launched IPES initiative, whose main objective is to “*support sustainable development through biodiversity conservation at the global scale*”. It provides insights into a multi-scale application of PES, and highlights reduce emission from deforestation and land degradation (REDD) as an immediate opportunity for bundling PES and tapping into the carbon market to achieve channel greater support for conservation efforts.

- Jenkins, M., Scherr, S., and Inbar, M. 2004. Markets for Biodiversity Services. Environment, Vol. 46, No. 6: 32-41.

http://www.forest-trends.org/documents/publications/Markets%20for%20Biodiversity%20Services_Environment.pdf

This article provides a basic but relatively complete overview of the market potential for biodiversity-related ecosystem services. Many different types of transactions are described and possible next steps for scaling-up are explored.

- Peskett, L., Brown, D., and Luttrell, C. 2006. Can Payments for Avoided Deforestation to Tackle Climate Change Also Benefit the Poor? Forestry Briefing 12. ODI.

<http://www.odi.org.uk/resources/specialist/forestry-briefings/12-payments-avoided-deforestation-climate-change-poor.pdf>

A brief but excellent overview of the poverty aspects of REDD, with clear advice on how to include poverty reduction goals into REDD schemes.

- Skutsch, M., et al. 2006. Clearing the Way for Reducing Emissions from Tropical Deforestation. CIFOR

<http://www.cifor.cgiar.org/Publications/Detail.htm?pid=2258>

This paper presents the context within which the REDD debate is currently set and then goes on to compare the main approaches that have been proposed for implementing it. It highlights the main challenges currently standing in the way of a wide scale implementation of REDD, notably mentioning that “*leakage will be of greater concern at the project level, whilst accuracy will be a larger problem at the regional or global scale*”.

- Smith, J., and Scherr, S. 2003. Capturing the Value of Forest Carbon for Local Livelihoods. World Development. Earthscape.

<http://www.earthscape.org/r1/ES16940/>

This paper focuses on the social issues related to the growing interest in carbon sequestration by forests. They offer a great overview of the livelihood impacts of forest carbon projects, by project type. They find that “*community-based projects, such as agroforestry, small-scale plantations, agroforests, secondary forest fallows, community forest rehabilitation and multiple-use forest management, have the highest potential for local livelihood benefits and pose the fewest risks to communities*”.

- ten Kate, K., Bishop, J., and Bayon, R. 2004. Biodiversity offsets: Views, experience and the business case. IUCN and Insight Investment.

http://conservationfinance.org/Documents/CF_related_papers/Biodiversity_offsets.pdf

This is a comprehensive overview of biodiversity offsets, contrasting the conservation, regulatory, and business cases for their use. It outlines major technical issues that define implementation and identifies the main stakeholders that need to be involved in the process.

- UNFCCC. 2006. Background Paper for the Workshop on Reducing Emissions from Deforestation in Developing Countries. UNFCCC
http://unfccc.int/methods_and_science/lulucf/items/3757.php

This paper begins by going over the main scientific, socio-economic, technical, and methodological issues pertaining to forests and their eventual inclusion into the UNFCCC through REDD. Then, six policy approaches and positive incentives for REDD are examined. Finally, the annex section (about half of the overall paper) provides input from country experiences in Bolivia, Costa Rica, Nicaragua, Central America as a whole, Papua New Guinea, Malaysia, and the USA.

Some Additional PES “Luggage”

It is hoped that the Gateway to PES will spark some interest and provide a greater appreciation of how PES might be used in support of sustainable and equitable ecosystem management. In an effort to limit the amount of ‘Recommended reading’, we have created this annex section which is organized more as a clearinghouse for digging a bit deeper into the various issues we have raised through the Gateway.

This collection of PES ‘Luggage’ comprises a wide set of resources: case studies, methodologies, tools, theoretical analyses, links to relevant websites and related activities, etc. As with the Gateway, it is far from comprehensive and will continue to be a working document as more information is collected.

We have not yet identified an optimal method for organizing these resources, and have chosen to arrange them according to the structure of the Gateway.

Resources

Understanding ecosystem services

Defining Ecosystem Services

The Millennium Assessment toolkit. 2007

Provides an overview of the MA, examples of how it is used, and resources to help tap into the lessons learned.

Millennium Ecosystem Assessment

Regularly updated with good reference. Good reference section.

<http://www.millenniumassessment.org/>

Ecosystem Services Fact Sheet

Provides basic information on ecosystem services, with links to basic info on pollution, water purification, forest carbon storage, and flood damage.

<http://www.esa.org/ecoservices/comm/body.comm.fact.ecos.html>

Background Theory

Feldman, I., and Blaustein, R.J. Ecosystem Services as a Framework for Law and Policy.

The authors examine the “potential intersections of ecosystem services and law and policy. They discuss how economic considerations like valuation, scale, and uncertainty might figure in the policy opportunities for ecosystem services. And they address how such considerations as taxation and payment arrangements, common-law rights, “constitutive” constitutional rights, and established international legal norms might work to protect ecosystem services”.

http://d.wanfangdata.com.cn/NSTLQK_NSTL_QK15424211.aspx

Malghan, D.V. 2005. On being the right size: a framework for the analytical study of scale, economy, and ecosystem. UM Thesis. Malghan 2005.pdf

Written under the supervision of Herman Daly, it offers some methodologies for measuring scale, such as the Human Appropriation of Net Primary Production (HANPP) and the ecological footprint. The author offers a framework for measuring benchmarks while explores axioms for consistent scale metrics. It has a chapter on optimal scale for environmental management. It is very long and complex, but well written and insightful.

Natural Capital

The Natural Capital Project

TNC, WWF, Stanford University. Recently launched initiative with selected study sites in Tanzania, China, California, and Hawaii.

<http://naturalcapitalproject.org>

Valuing Ecosystem Services

Boyd, J., and Banzhaf, S. 2006. What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units. Resources for the Future.

In this paper, the authors advance a definition of ecosystem services which lends itself to quantification. By establishing an accounting unit for ecosystem services, there is hope that they can help create a 'services inventory' within a given landscape and provide 'an architecture for performance accounting'.

<http://www.rff.org/Documents/RFF-DP-06-02.pdf>

Boyd, J., and Banzhaf, S. 2005. The Architecture and Measurement of an Ecosystem Services Index. Resources for the Future.

This paper describes the construction of an ecological services index (ESI), which is intended to track ecosystem benefits over time. The value is derived either by its "contribution to market outputs... or by its substitutability for market inputs", and thus ES are seen as assets. Willingness-to-pay indicators are used as weights to help measure values within the ESI.

<http://www.rff.org/rff/Documents/RFF-DP-05-22.pdf>

De Groot, R., et al. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. Ecological Economics, Vol. 31, Issue 3: 393-408.

"This article attempts to create a standardized framework for the comprehensive evaluation of ecosystem functions in a clear and consistent manner. Discussion of different ecosystem services, their functions, values and human impacts. It talks about the value of natural capital, its benefits, and degradation of certain ecosystems".

<http://ideas.repec.org/a/eee/ecolec/v41y2002i3p393-408.html>

Managing ecosystem services

The Landscape Approach

Chan, K.M. et al. 2006. Conservation Planning for Ecosystem Services. PLoS Biology 4(11)

This paper presents findings from a conservation planning exercise in California, where trade-offs between 6 ecosystem services (carbon storage, flood control, forage production, outdoor recreation, crop pollination, and water provision) were analyzed. The study found that planning for ES "would involve a major shift toward new geographies and a broadening of current conservation goals".

<http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0040379>

Farber et al, 2006 Linking Ecology and Economics for Ecosystem Management. BioScience Vol 56 No2.

This paper provides a good basic overview of how the ecosystem services approach is relevant to environmental management and how it can be used to evaluate trade-offs. A couple of USA-based case studies are explained. One key insight offered is *"that current management institutions may have to be reconfigured to allow the simultaneous consideration of the entire set of services"*.

<https://darchive.mblwhoilibrary.org/handle/1912/1366>

Hein, L., et al. 2005. Spatial scales, stakeholders and the valuation of ecosystem services.

This paper analyzes how stakeholders at different spatial scales attach different values to ecosystem services. The authors argue that scales of ecosystem services are central to the valuation process. The paper includes many important considerations for thinking about implementing PES, such as avoiding double-counting and reconciling ecological and institutional scales. A case study of a Dutch wetland is offered to illustrate the importance of integrating scale considerations into the design of PES.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-4GCX1J8-2&_user=10&_coverDate=05%2F01%2F2006&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=c3a4062727db3fe1c192277a72ffeb3d

Kremen, C and Ostfeld, R. 2005. A call to ecologists: measuring, analyzing, and managing ecosystem services. Front Ecol Environ 2005, 3(10): 510-548.

In this paper, 2 case studies (pollination and disease prevention) are used to highlight the value of biodiversity services. It offers a sound approach for assessing ecosystem services, notably through the 'functional inventory' methodology.

http://www.ecostudies.org/reprints/Kremen_Ostfeld_2005_Front_Ecol.pdf

Maass, J.M., et al. 2005. Ecosystem Services of Tropical Dry Forests: Insights from Long-term Ecological and Social Research on the Pacific Coast of Mexico. *Ecology and Society*, Vol. 10, No.1, article 17.

This paper describes the biophysical and socio-economic constraints and drivers determining the supply of ES in a specific coastal region. Main ES are identified and their spatial and temporal patterns are analyzed, including the trade-offs among them. Finally, 3 alternative future scenarios are constructed and compared. The paper offers an interesting conceptual model/map of ES within the landscape. Overall, it provides a sound methodology for evaluating the provision of multiple ES within a landscape.

<http://www.ecologyandsociety.org/vol10/iss1/art17/>

The Natural Capital Project INVEST tool

It has a very interesting 'toolbox' involving both an integrated valuation modeling of ecosystem services and tradeoffs (InVEST) tool (invest.doc) and a natural capital database.

<http://naturalcapitalproject.org>

Nelson, et al. 2007 (DRAFT). Payments for Ecosystem Services and Efficient Allocation: An Application to Biodiversity, Carbon Sequestration and Marketable Commodities in the Willamette Basin or Efficiency of Conservation Easements for Providing Ecosystem Services. AERE.

The purpose of this paper is to analyze the effects of multiple policy instruments on the provision of ecosystem services (biodiversity conservation and carbon sequestration) at the landscape level. An efficient frontier of ecosystem services is estimated and used as a benchmark for comparing different policy options.

http://www.aere.org/meetings/payments_workshop_2007.pdf

Pattanayak, S., et al. 2007. Climate Change, Contagion and Conservation: Valuing Services and Evaluating Policies in Brazil via Applied CGE.

In this paper, the authors develop a case study for Brazil to illustrate how econometric estimation can be combined with computable general equilibrium (CGE) modeling to estimate ecosystem values associated with climate change and forest conservation. An interesting introduction on health (disease regulation) considerations into the modeling of land uses for ecosystem services. The model used shows how a \$120 million prevented GDP decline represents an approximation of the ecosystem services from conservation via the pathway of regulating infectious diseases.

http://portal.conservation.org/portal/server.pt/gateway/PTARGS_0_2_143955_0_0_18/Pattanayak,%20Brasil%202007.pdf

Conservation in Productive Landscapes

Antle, J., et al. (2006). Predicting the Supply of Ecosystem Services from Agriculture. *American Journal of Agricultural Economics*, Vol. 55, issue 5: 1174-1180.

"This paper is designed to provide a conceptual framework for the supply of ES and to discuss some of the data and modeling issues that rise up in predicting participation in payments for ecosystem services (PES)."

http://econpapers.repec.org/article/blaajagec/v_3A88_3Ay_3A2006_3Ai_3A5_3Ap_3A1174-1180.htm

Naidoo, R., and Adamowicz, W. 2006. Modeling Opportunity Costs of Conservation in Transitional Landscapes. *Conservation Biology*, 20 (2): 490-500.

This paper presents methods for estimating opportunity costs of land preservation in landscapes or ecoregions that are a changing mix of agriculture and natural habitat. The method tested in this study was carried out in Paraguay, but could be *"applied to any region where alternative land uses are well defined and their net rents are calculable"*.

<http://lib.bioinfo.pl/pmid:16903110>

Naidoo, R. and Ricketts, T. 2006 Mapping the economic costs and benefits of conservation. *PLoS Biology*, 4(11).

This paper describes a spatial evaluation of costs and benefits of conservation by taking 5 ES into account (carbon sequestration, sustainable bushmeat harvest, sustainable timber harvest, bioprospecting for pharmaceutical products, and existence value). It found that carbon storage values dominated others and swamped opportunity costs ("payments for carbon storage could preserve a substantial amount of the region's forest"). The study also helped identify specific areas where conservation made more financial sense than other land uses.

<http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371%2Fjournal.pbio.0040360>

Naidoo, R. and Iwamura, T 2007. Global-Scale Mapping of Economic Benefits from Agricultural Lands: Implications for Conservation Priorities. *Biological Conservation*, Volume 149, Issues 1-2: 40-49.

In this paper, the authors integrate spatial information on crop productivity, livestock density, and prices to produce a global map of the gross economic rents from agricultural lands. The importance of including such opportunity costs in global planning for the conservation of endemic vertebrate species is illustrated. The paper highlights the need to better integrate cost-effectiveness concerns when setting conservation priorities.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V5X-4PMJB1F-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=34652e2015608265041e206a15582fa4

Pagiola, S., et al. 2004. Paying for Biodiversity Conservation Services in Agricultural Landscapes. FAO.

This paper describes the approach used in the Regional Integrated Silvopastoral Ecosystem Management Project (RISEMP). A particularly interesting component of the RISEMP approach is the use of a dual biodiversity-carbon land-use index to measure ecosystem services indices in varying land use scenarios.
<http://www.fao.org/WAIRDOCS/LEAD/x6154e/x6154e00.htm>

Polasky, S., et al. 2007. Where to Put Things? Spatial Land Management to Sustain Biodiversity and Economic Returns. *Biological Conservation*, Volume 141, No. 6: 1505-1524.

In this paper, a spatially explicit model for analyzing the biological and economic consequences of alternative land-use patterns is developed and applied to a watershed in Oregon, USA. The authors find that both biodiversity conservation and the value of commodities produced could be increased substantially. The economic model does not include values for ecosystem services, due to the difficulty “*of generating reliable estimates of value for non-marketed ecosystem services*”.
<http://cat.inist.fr/?aModele=afficheN&cpsidt=20472153>

Ricketts, T., et al. 2004. Economic Value of Tropical Forest to Coffee Production. *PNAS*, Vol. 101, no. 34.

This paper describes a case study of the economic value of the pollination service of tropical forests to coffee production in Costa Rica.
<http://www.pnas.org/content/101/34/12579.full.pdf>

Scherr, S., and McNeely, J. 2003. *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*. Island press.

Comprehensive book on eco-agriculture as described above.
<http://www.islandpress.com/books/detail.html?cart=1056126081268552&SKU=1-55963-644-0>

Scherr, S., and McNeely, J. 2006. DRAFT. Biodiversity Conservation and Agricultural Sustainability: Towards a New Paradigm of ‘Ecoagriculture’ Landscapes. *Philos Trans R Soc Lond B Biol Sci*. 363(1491).

This more recent paper synthesizes the results of a large number of sectoral review papers and case studies to assess the state of knowledge of ecoagriculture. It discusses where ecoagricultural approaches are needed, offering a list of priority areas (page 10). It also discusses new tools for landscape assessment (page 15). Offers a very useful guide for moving forward with ecoagriculture.
<http://www.ncbi.nlm.nih.gov/pubmed/17652072>

Schroth, G. et al. 2004. *Agroforestry and Biodiversity Conservation in Tropical Landscapes*. Island press.

This is a comprehensive book on agroforestry, with 20 chapters.
<http://www.cababstractsplus.org/google/abstract.asp?AcNo=20043143279>

Wilson, K., et al. 2007. Conserving Biodiversity Efficiently: What to Do, Where, and When. *PLOS Biology* 5(9).

The authors develop a geographical analytical framework for guiding the prioritization of conservation funding in accordance with threats. The findings are based on an analysis of conservation threats in 17 different Mediterranean ecoregions. Some of the identified actions that would address specific threats were invasive species control, land acquisition, and off-reserve management. The authors argue that the application of this framework will result in greater cost-effectiveness for biodiversity conservation.
<http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0050223>

Rewarding ecosystem services

Incentive-based Conservation Tools

El Lakany, et al. 2007. Background paper on means of implementation. PROFOR (FAO), for the UNFF discussions.

"This paper reviews current and emerging financial resources for sustainable forest management (SFM) and elaborates a range of innovative approaches to mobilize new and additional financial resources for SFM". The paper describes a new institution called the Forest Financing Mechanism, which uses a portfolio approach – *"a portfolio of products and services should be created for raising financial resources from a variety of actors aimed to meet diverse SFM objectives"*. PES is one option with a great presentation of the PES mechanism (page 23). Annex 2 (page 49) exposes alternative options for AD. Annex 4 (page 51) highlights the strengths and weaknesses of watershed PES schemes. Annex 7 (page 56) gives the findings from Ebeling, 2006 on the estimates of AD income for different countries.

<http://www.fao.org/forestry/media/14704/1/0/>

Kousky, C. 2005. Choosing from the Policy Toolbox.

The article is highlighting the benefits and challenges of implementing an ecosystem approach. The author offers 5 criteria for determining when government-run PES schemes should be chosen over other instruments.

http://ecosystemmarketplace.com/pages/article.opinion.php?component_id=4002&component_version_id=6447&language_id=12

Introducing Payments for Ecosystem Services (PES)

Inbar, M., S. Scherr, C. Bracer and S. Waage. Getting Started with PES – An Introductory Primer to Making Payments for Ecosystem Services Agreements. The Katoomba Group.

This paper provides a step-by-step methodology for engaging in PES deals. It also outlines various types of possible deals and provides examples.

<http://www.katoombagroup.org/documents/publications/GettingStarted.pdf>

Scherr, S., et al. 2006. Developing Future Ecosystem Service Payments in China: Lessons Learned from International Experience. Forest Trends.

This paper outlines the lessons learned from the four main types of PES schemes (biodiversity, carbon, water, and scenic beauty), and then study the implications and ensuing recommendations for implementation in China. Provides many insightful lessons from experience to date.

<http://www.forest-trends.org/documents/publications/ChinaPES%20from%20Caro.pdf>

TNC. 2006. Ecosystem Services: Status and Summaries.

A global review of PES projects, organized into short one-page sheets. It covers about 30 different projects operating at various scales and in various parts of the world. Also includes a contacts sheet for TNC staff working on these projects.

http://www.nature.org/partners/files/ecosystem_services_may_20061.pdf

Waage, S., et al. 2006. A Scoping Assessment of Current Work on Payments for Ecosystem Services in Asia, Latin America, and East & Southern Africa. Forest Trends.

This article discusses the current status of Payments for Ecosystem Services around the globe. 57 interviews were conducted, documents reviewed and internet searches were the grounds on which the paper identified barriers to PES, capacity building needs, and current capacity building initiatives. It also offers a clearing house of PES related power point presentations, online materials and workshop information.

<http://cec.wcln.org/index.php?module=pagesetter&func=viewpub&tid=15&pid=69>

Implementing Payments for Ecosystem Services

Placing Rural Communities at the Heart of PES Schemes

Bracer, C., et al. 2007. Organization and Governance for Fostering Pro-Poor Compensation for Environmental Services. ICRAF Working papers series.

This paper presents a PES model based on compensation and rewards schemes (CRES), not necessarily financial payments. These systems are designed to achieve pro-poor outcomes. The paper assesses the requirements, current state and key issues necessary for the development of these schemes, recognizing

that they are more about participatory natural resource management than about market development. The paper provides a four step methodology for implementing CRES (see annex A), and advance a 3 phase process of ES market development. The paper includes an interesting table on CRES potential according to Typology of Communities.

<http://www.worldagroforestrycentre.com/downloads/publications/PDFs/WP14961.PDF>

Pagiola, S., Rios, A., and Arcenas, A. 2008. Can the poor participate in Payments for Environmental Services? Lessons from the Silvopastoral Project in Nicaragua. *Environment and Development Economics* 13: 299-325.

It presents an interesting case study of an important social dimension of PES – the level of participation of poorer households. The findings offer some optimistic considerations on the participation of the rural poor. Transaction costs as opposed to ability are seen as the biggest threat to participation.

<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=1880972>

Rosa, H., et al. 2003. Compensation for Environmental Services and Rural Communities: Lessons from the Americas and Key Issues for Strengthening Community Strategies. PRISMA.

This large report (87 pages) provides key lessons learned from case studies in Costa Rica, Brazil, the US, El Salvador, and Mexico. Then, it provides an interesting methodology for successfully integrating community-level concerns into the design of PES. The final sections are particularly insightful in terms of thinking of integrating PES into a landscape perspective.

[http://orton.catie.ac.cr/cgi-](http://orton.catie.ac.cr/cgi-bin/wxis.exe/?IsisScript=OET.xis&method=post&formato=2&cantidad=1&expresion=mfn=030230)

[bin/wxis.exe/?IsisScript=OET.xis&method=post&formato=2&cantidad=1&expresion=mfn=030230](http://orton.catie.ac.cr/cgi-bin/wxis.exe/?IsisScript=OET.xis&method=post&formato=2&cantidad=1&expresion=mfn=030230)

Local Schemes

Kosoy, N., et al. 2006 Payments for environmental services in watersheds: Insights from a comparative study of three cases in Central America.

An interesting and highly relevant study on designing successful PES schemes within watersheds. Overall, the findings are not very positive. The authors find that the amounts paid are usually lower than the opportunity costs of the land and that they have small impacts on service buyers and providers. Also, they highlight the existence of trade-offs between different social and environmental goals, although it was acknowledged that PES could also work as a conflict-resolution instrument.

<http://www.sciencedirect.com/science/article/B6VDY-4JVTBVR-2/e095cb0206a6141fe9a2a303b605b33c>

Krchnak, K. 2007. Watershed Valuation as a Tool for Biodiversity Conservation – Lessons Learned from Conservancy Projects. TNC-USAID.

This report is a compilation of 8 case studies in developing countries on watershed valuation. It concludes with a lengthy section on overall lessons learned.

http://dec.usaid.gov/index.cfm?p=search.getCitation&CFID=7775&CFTOKEN=99688013&id=s_7EA57678-D566-FC5C-DCFB4DE48B0C5583&rec_no=145098

Pattanayak, S. 2004. Valuing Watershed Services: Concepts and Empirics from Southeast Asia. *Agriculture, Ecosystems & Environment*, Vol. 104, Issue 1: 171-184.

This paper evaluates the importance of watershed services to farming communities in Southeast Asia. A case study in Indonesia which integrates household level economic and environmental data shows a substantive and quantitative economic benefit of watershed services.

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y-4BYNR1Y-

[1&user=10&rdoc=1&fmt=&orig=search&sort=d&view=c&acct=C000050221&version=1&urlVersion=0&userid=10&md5=8feb5fccb699e6646263304ba7fe1426](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y-4BYNR1Y-1&user=10&rdoc=1&fmt=&orig=search&sort=d&view=c&acct=C000050221&version=1&urlVersion=0&userid=10&md5=8feb5fccb699e6646263304ba7fe1426)

Perrot-Maître, D., and Davis, P. 2001. Case Studies of Markets and Innovative Mechanisms for Water Services from Forests. *Forest Trends*.

Case studies from the US, Brazil, Colombia, France, Costa Rica, and Australia.

<http://www.earthscape.org/p1/ES16895/>

van Noordwijk, V. 2005. RUPES typology of environmental service worthy of reward. CGIAR.

“The development of transparent and sustainable reward mechanisms for environmental services provided by upland farmers to downstream communities requires clarity on the relationship between land-use and the

type of environmental services provided. In the context of the RUPES project ('rewarding upland poor for the environmental services they provide'), a typology of environmental services is discussed that leads to the distinction of twelve 'proto-types' of situations of where the upland-lowland relationship is focused on a specific environmental service function."

http://www.worldagroforestry.org/sea/Networks/RUPES/download/Working%20Paper/RUPES_Typology.pdf

International Schemes

Auckland, L., Moura Costa, P., and Brown, S. 2002. A Conceptual Framework and its Application for Addressing Leakage: The Case of Avoided Deforestation. Winrock International.

This is a paper specifically dedicated to the troubling issue of leakage in avoided deforestation projects. It offers a nice methodology for assessing, identifying, and quantifying leakage. It could help identify potential sources of leakage at the project level.

<http://www.winrock.org/ecosystems/files/Product%209%20Leakage%20paper.pdf>

http://unfccc.int/files/methods_science/redd/application/pdf/incentives_to_reduce_ghg_emissions_from_deforestation_lesson_learned_from_costa_rica_and_mexico.pdf

Karousakis, K. 2007. Incentives to Reduce GHG Emissions from Deforestation: Lessons Learned From Costa Rican and Mexico. OECD.

This paper offers a great perspective into the inclusion of REDD into PES schemes, using examples from Costa Rica and Mexico. Then, the author discusses the eventual implementation of both an international and a national REDD incentive system.

Murdiyarso, D., and H. Herawati. 2005. Carbon Forestry: Who will benefit? Proceedings of Workshop on Carbon Sequestration and Sustainable Livelihoods.

This is a large compilation of 14 papers which contributed towards the proceedings of an international workshop on CO2 sequestration and livelihoods. A lot of the cases are from Indonesia, but many different aspects are covered overall.

<http://library.wur.nl/WebQuery/catalog/lang/1830130>

Murdiyarso, D., and Skutsch, M. 2006. Community forest management as a carbon mitigation options: case studies. CIFOR.

This book presents 13 case studies from developing countries to show how smallholder farmers could participate in mitigating atmospheric carbon and opportunities for CDM.

http://www.cifor.cgiar.org/publications/pdf_files/Books/BMurdiyarso0602.pdf

Waage, S. 2007. Investing in the future: an assessment of private sector demand for engaging in markets and payments for ecosystem services. PESAL Paper Series No. 2.

A look at the demand and willingness-to-pay for ecosystem services. Focuses specifically on the business community.

http://www.fao.org/es/esa/pesal/attachments/PESAL2_Waage.pdf

Useful websites

Association of Environmental and Resource Economists

www.aere.org.

They had a recent meeting, with some of the most cutting edge efforts at modeling ecosystem services (many of which are still preliminary) <http://www.aere.org/meetings/aere2007workshopsPapers.html>

BBOP – Business and Biodiversity Offsets Programme

<http://www.forest-trends.org/biodiversityoffsetprogram/>

The Beijer Institute of Ecological Economics

<http://www.beijer.kva.se/>

Biodiversity Economics

www.biodiversityeconomics.org

IUCN-WWF information portal with up-to-date publications and events on biodiversity economics.

Biography of Georgeschu Roegen:

<http://cepa.newschool.edu/het/profiles/georgescu.htm>

CIFOR's PES Website

<http://www.cifor.cgiar.org/pes/ref/home/index.htm>

CARBOFOR

<http://www.cifor.cgiar.org/carbofor>

CIFOR site dedicated to the issue of avoided deforestation.

DEFRA

<http://www.defra.gov.uk/wildlife-countryside/natres/eco-actionp.htm>

Ecosystems approach action plan for DEFRA

DIVERSITAS International ecoSERVICES

http://www.diversitas-international.org/core_ecoserv.html

Diversitas International ecoSERVICES initiative on exploring the linkages between biodiversity and ecosystem functioning and services.

Ecoagriculture Partners

<http://www.ecoagriculturepartners.org>

Eco-agriculture Partners. Recently, the ecoagriculture partnership is developing a concept for launching a Community Knowledge Service to help link community representatives from around the world.

The Ecological Society of America

<http://esa.org/ecoservices/>

They have a great toolkit for ecosystem services, dealing with pollination, water purification, and flood damage.

Ecology and Society

<http://www.ecologyandsociety.org/>

A journal of integrative science for resilience and sustainability.

Economy and Environment Program for SE Asia

<http://www.idrc.ca/eepsea/>

The Ecosystem Marketplace

<http://ecosystemmarketplace.com>

Initiated by the Katoomba Group. An information portal on ES and PES, with articles, case studies, a program and organization directory and a whole lot of additional resources including a 'Marketwatch' feature which tracks transactions in carbon, water, and biodiversity markets.

Ecosystem Services Project

<http://www.ecosystemsproject.org/>

Initiated by CSIRO (Australia).

Ecosystem Valuation

<http://www.ecosystemvaluation.org/>

Provides a clear, non-technical explanation of ecosystem valuation concepts, methods, and applications. Has a very complete links list.

EPPSEA - Economy and Environment Programme for Southeast Asia

http://www.idrc.ca/eepsea/ev-115216-201-1-DO_TOPIC.html

The page includes more than seventy tools for researchers and teachers on environmental economics. Some of these items are links to other webpages but most are original documents not available elsewhere. Access to the site is free of charge and does not require registration.

Environmental economics blog

<http://www.env-econ.net/>

Environmental Valuation Reference Inventory

http://www.evri.ca/francais/Resources/S_Services.cfm?Section=%20passive%20uses#list

A HUGE collection of references to valuation documents

European Environmental Agency

http://eea.eionet.europa.eu/Public/irc/eionet-circle/leac/library?l=/international_classification&vm=detailed&sb=Title

A web-based resource providing important documents related to the classification of ecosystem services.

Flows

<http://www.flowsonline.net/>

IIED, World Bank, Bank Netherlands Partnership program. Good resource for information on watershed payments, with monthly news bulletin, available in English and in Spanish. There also is a possibility for receiving issues in Indonesian.

Forest Trends

<http://www.forest-trends.org/programs/services.htm>

True pioneers in the development of PES.

Gothenburg University Environmental Economics Unit on-line library

<http://www.handels.gu.se/econ/EEU/>

ICLEI

www.iclei.org

<http://www.iclei.org/index.php?id=805>

resilient communities and cities

<http://www.iclei.org/index.php?id=803>

viable local economies

<http://www.iclei.org/index.php?id=1651>

this is an online publication called Cities for Climate Protection, an international campaign to reduce urban emissions of greenhouse gases

The International Institute for Sustainable Development (IISD)

http://www.iisd.ca/publications_resources/

The International Society for Ecological Economics

<http://www.ecoeco.org>

The Katoomba Group

<http://www.katoombagroup.org/>

An outcrop of Forest Trends, dedicating to advancing markets for ecosystem services. They have recently finalized a great resource guide – the PES learning tool:

http://147.202.71.177/~katoomba/learning_tools.php

Model Forests

International network

http://www.idrc.ca/en/ev-22891-201-1-DO_TOPIC.html

Latin American network

<http://www.bosquesmodelo.net/>

The Natural Capital Project

<http://naturalcapitalproject.org>

TNC, WWF, Stanford University. Recently launched initiative with selected study sites in Tanzania, China, California, and Hawaii. They have a very interesting 'toolbox' involving both an integrated valuation modeling of ecosystem services and tradeoffs (InVEST) tool (invest.doc) and a natural capital database. They also have a great links section.

Natural Capitalism

<http://www.natcap.org/sitepages/pid20.php>

Nature valuation

<http://topshare.wur.nl/naturevaluation>

Wageningen University, has a database of case studies and publications. Has a section on cultural values;

New South Wales Environmental Protection Authority Envalue database

<http://www.epa.nsw.gov.au/envalue>

Payments for Environmental Services from Agricultural Landscapes – PESAL

<http://www.fao.org/es/esa/PESAL/index.html>

Poverty and Conservation info

http://www.povertyandconservation.info/en/biblio/theme_MA.php?page=5

Proyecto Forma

<http://www.proyectoforma.com/>
Strengthening CDM capacity in Latin America

The Rainforest Alliance

has a good list of publications:
<http://www.rainforest-alliance.org/news.cfm?id=publications>
and an index to more than 1000 conservation projects. Available in English and Spanish
<http://www.eco-index.org/>

RECOFTC

Recently hosted a conference on forests and livelihoods
<http://recoftc.org/site/index.php?id=445>

The Resilience Alliance

<http://www.resalliance.org/1.php>.
They have recently added resilience assessment workbooks for practitioners and scientists.

Rewarding Upland Poor for the provision of Ecosystem Services (RUPES)

<http://www.worldagroforestrycentre.org/Sea/Networks/RUPES/index.asp>
A PES-like project of the World Agroforestry Centre.

Restoring Natural Capital Alliance

<http://www.rncalliance.org/epages/rncalliance.sf/?ObjectPath=/Shops/rncalliance>

The Rights and Resources Initiative

<http://www.rightsandresources.org/>
Supporting forest tenure, policy, and market reforms.

RUAF Foundation

<http://www.ruaf.org/node/398>
Resource centers on urban agriculture and food security

Species Banking.com

www.speciesbanking.com
Clearinghouse for the growing market of 'species credits'. Created by Forest Trends.

UN Food and Agriculture Organization

They have a Collaborative Partnership on Forests
<http://www.fao.org/forestry/site/cpf/en/>

University of Vermont Gund Institute

<http://www.uvm.edu/giee/pes/en/about/>
Gund Institute Conference "Local to Global" March 2007, Heredia, Costa Rica. Link includes an 8 page annotated PES bibliography with 34 references.
They also have an interesting mapping tool for ecosystem services, the Ecovalue Project:
<http://ecovalue.uvm.edu/evp/default.asp>
and an ecosystem services database
<http://esd.uvm.edu/cgi-bin/esd.c?reset=1>.

US Forest Service - Valuing Ecosystem Services:

<http://www.fs.fed.us/ecosystemservices/links.shtml>
Has a lot of information and a very complete 'links' page

Watershed Markets

<http://www.watershedmarkets.org/IIED>
Site contains about 60 case studies from developing countries as well as other resources relevant to watershed services.

Wikipedia on ecological economics

http://en.wikipedia.org/wiki/Ecological_economics

Wikipedia on ecological resilience

<http://en.wikipedia.org/wiki/Resilience#Ecology>

Wikipedia on environmental and resource economics:

http://en.wikipedia.org/wiki/Environmental_economics

Winrock International and IIED

<http://www.environmental-incentives.org/>
on incentives for watershed protection in India

World Agroforestry Centre

<http://www.worldagroforestry.org>
A great amount of resources on agroforestry are available from CGIAR.

The World Bank Environmental Economics

www.worldbank.org/environmentaleconomics

The World Bank PROFOR initiative

<http://www.profor.info/>
http://www.profor.info/content/livelihood_poverty.html poverty-forests linkages toolkit

The World Resources Institute

<http://www.wri.org/biodiv/about.cfm#EcosystemServices>.
They do a lot of work on ecosystem services
WRI are currently developing a corporate ecosystem services review:
http://www.wri.org/biodiv/topic_content.cfm?cid=4228
They also have an interesting mapping project:
http://www.wri.org/biodiv/project_description2.cfm?pid=171

Worldwide Fund for Nature (WWF)

http://www.panda.org/about_wwf/what_we_do/policy/macro_economics/our_solutions/pes/index.cfm
They have a great newsletter.

A Vision for the Future

The 'Gateway to PES' is designed to serve as a launching pad. Armed with the collected 'PES Luggage', it is hoped that those who are interested in engaging in PES will be off to a safe and well-informed departure. Although uncertainty prevents us from predicting specific outcomes towards which PES might lead ecosystem management efforts, it is still important to have some kind of a destination. This section, which is even more subjective than the others, offers a vision for the path down which the Gateway to PES might lead.

Actually, we see two desirable outcomes for PES. The first one is for the enhancement of local livelihoods through a stronger appreciation of the value of natural capital. The second one is to encourage sustainable land use decisions that maximize the provision of ecosystem services. The vision of the future is to meet both objectives through a common approach. Stated generally, PES is thus best yielded as a catalyst for sustainable rural development.

A tremendous advantage of such a tool as that it can apply in a wide variety of socio-economic contexts. It can be used to combat environmental degradation in remote tropical forests and as a means of combating unsustainable urban sprawl around cities. The common thread is that it extends beyond a context-specific application by focusing on the relationship between urban/modern consumers and rural/traditional land stewards. With such a spatially malleable conceptualization, the urban-rural approach addresses the 'resource use vs. preservation' at all scales. The focus is thus on using the ecosystem services concept as a means of incentivizing rural development by highlighting how urban/modern lifestyles depend on their supporting landscapes.

Participation in support of rural sustainability should be seen as more than just a means of offsetting the environmental impacts of cities. It simply represents an investment in the natural infrastructure that supports urban life. All cities depend on a supporting rural/natural landscape capable of providing them with the food, construction materials, energy sources, recreation, and many other environmental goods and services.

A good step in the right direction towards using PES as a means of encouraging a more sustainable and equitable relationship between urban and rural systems is to institutionalize ecosystem services. At the smallest scale, this would mean the establishment of 'ecosystem service districts' that could be inspired from watershed-type PES schemes and that would aim towards the formal recognition of the upstream-downstream dependencies within a specific municipality.

Such developments would need to go hand-in-hand with a re-shifting of social, political, and economic activities down to regional watershed-scale ecosystems. Here, ecosystem management would prevail as an approach to policy implementation, and markets for ecosystem services would flourish through the strengthening of local communities.

Recommended reading

- Appleton, A. 2007 (DRAFT) Some Reflections on PES. A discussion paper prepared for the Bellagio Forum on PES
This paper offers a robust rural-urban framework to the application of PES, with a focus on supporting sustainable rural landscapes (as a reaction to the worldwide industrialization of rural landscapes). The potential for a multi-scale application of this urban-rural PES model make it a particularly interesting option. This paper provides both a vision and an inspiration for the future development of PES.
- Ditt, E.H. 2008. Integration of Ecosystem Services and Policy to Manage Forest and Water Resources around the Atzibainha Reservoir in Brazil. Doctoral Thesis presented to Center for Environmental Policy at Imperial College London.
This doctoral thesis offers a case study analysis of the integrated management of ecosystem services in a specific landscape in Brazil. The analysis focuses on mapping the economic values of different types of land uses, bearing in mind the values of forest and water-related ecosystem services. The paper also includes a discussion on the possibility of certifying ecosystem services. Finally, a structure for developing PES in the specific landscape is offered whereby bundles of ES would be the focus of trading.
- Glaeser, E., and Kahn, M. 2003. Sprawl and urban growth. Harvard Institute of Economic Research Discussion Paper No 2004. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=405962

This paper presents the problem of urban sprawl, and offers some general insights into the place of cities within their broader geographical context. Cities are defined as the absence of physical space between people and firms, dictated mainly by transportation technologies.

- Gutman, P. 2007. Ecosystem Services: Foundations for a new rural-urban compact. WWF.
<http://www.sciencedirect.com/science/article/B6VDY-4NF2HH2-6/2/6f4ece841ccaff17b81d1e317d237a3>
An excellent document for a complementary understanding of the urban-rural PES perspective (as it is developed by Al Appleton's work, referenced above). Gutman describes how rural populations have become marginalized and how a new urban-rural compact is necessary to keep on feeding the world while sustaining vital ecosystem services. The short paper concludes by outlining the main hurdles to the further development of this compact, notably the lack of demand, the lack of existing institutions, and the need for a more labour-intensive conservation model.
- Heal, G., et al. 2001. Protecting Natural Capital through Ecosystem Service Districts. Stanford Environmental Law Journal Vol. 20 (333).
http://www.stanford.edu/group/CCB/Pubs/Boggs_pdfs/2001_HealEtal_Protectingnaturalcapital.pdf
This is a landmark piece of work for thinking about PES in a landscape-based approach written by several leading PES authors. The authors call for the development of new institutions – Ecosystem Service Districts that would “ensure that natural capital is protected and maintained with the same care and concern as that given to built and human capital”. The paper provides some of the conceptual, legal, economic and ecological foundations upon which such institutions could be built. The authors suggest that ES mapping efforts should begin with water purification services.
- Hodge, I. 2007. The Governance of Rural Land in a Liberalized World. Journal of Agricultural Economics. 28 (3): 409-432.
<http://www3.interscience.wiley.com/journal/120700367/abstract>
This paper discusses the merits of adaptive co-management in the context of increased liberalization of the agricultural sector, which he expects will free-up land use decisions in rural communities. The author states that such an approach has the merit of “*challenging the conceptualization of the role of government in terms of the provision of public goods*”, and he advocates for “*less reliance on economic valuation methods and more emphasis on an institutional framework where values can be determined and policies implemented at a relatively local scale.*”
- Rights and Resources Group. 2007 Transitions in Forest Tenure and Governance: Drivers, Projected Patterns and Implications.
http://www.biodiversityeconomics.org/applications/library_documents/lib_document.rm?document_id=1121§ion_id=19
This forward-looking report offers an overview on the future trends that will shape forest policy in the years to come. The rise of BRIC countries (Brazil, Russia, India, and China) is highlighted as a major factor likely to influence the global economy at large. Further, increasing urbanization and a ‘return to the politics of city-states’ is likely to strengthen current trends of decentralization and devolution, with decision-making becoming increasingly biased by urban interests. The authors suggest that the more fundamental changes will come after 2020, when the BRIC countries establish themselves as full-fledged global leaders.
- Tacconi, L., Siagian, Y., and Syam, R. 2006. On the theory of decentralization, forests, and livelihoods. Australian National University. Asia Pacific School of Economics and Government, Canberra, Australia.
<http://www.cifor.cgiar.org/Publications/Detail?pid=2005>
The current theory and narrative states that democratic decentralization of forest management leads to sustainable forest management and improved livelihoods. Three assumptions underlie this theory and narrative: i) democratic decentralization is a means of institutionalizing and scaling up community-based natural resource management; ii) rural people benefit from the forest and will conserve it; iii) the success of decentralization can be measured by lack (or lower rates) of deforestation. The paper argues that the first two assumptions do not hold when tested with primary and secondary data and that the third assumption is incorrect and should be discarded. A revised theory of decentralized forest management needs to be developed and an initial sketch is discussed.



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