

# A Gateway to PES

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## Foreword –

The main objective of this work is to provide an introduction and sense of direction (i.e. a “Gateway”) into the complicated world of PES. It is by no means intended 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.

At this stage, *this document is still a work in progress*. It was 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.

The main feature is the ‘Gateway to PES’ (Section 1), which draws upon a variety of resources to provide guidance to LLS practitioners and decision makers. Section 1 of this document provides some basic considerations from the author and provides references and abstracts for some recommended readings. Additional resources are provided in Section 2, which follows the Gateway outline. Section 3, 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 4 is the more subjective portion of the document, and serves the purpose of communicating the authors’ vision for moving ahead with PES through LLS.

**All resources that are highlighted in yellow will be made available when the Gateway goes online. In the meantime, please do not hesitate to contact David Huberman ([david.huberman@iucn.org](mailto:david.huberman@iucn.org)) if you want to have specific documents sent to you.**

# 1) A Gateway to PES

## ***a) 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 fulfills 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.

## **i) 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 fulfill human life (Daily et al 1997). Another common



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

how he was a pioneer in addressing “*substitution between human and natural capital*”.

- Š John Gowdy and Susan Mesner. 1998. ***The evolution of Georgescu-Roegen's bioeconomics***. Review of social economy. [Gowdy and mesner 1998.pdf](#)

Overview of G-R's epistemoligal evolution and on the “*valuation and the*

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.

#### **iv) Valuing ecosystem services – a commoditization of biodiversity?**

In the search for a lasting balance, the common language between ‘exploitationists’ and ‘preservationists’ 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 well-understood 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:**

- § Bob Costanza et al. 1997. *The value of the world’s ecosystem services and natural capital*. Nature, volume 387. [costanzanature1997.pdf](#)

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.

- § Geoffrey Heal. 1999. *Biodiversity as a commodity*. Columbia University. [Heal\\_bdcommodity\\_1999.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.

- § Geoffrey Heal. 1999. *Valuing ecosystem services*. Columbia University. [Heal valuing ES.pdf](#)

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.

- § Stefano Pagiola, Konrad von Ritter and Joshua Bishop. 2004. *How much is an Ecosystem Worth? Assessing the Economic Value of Conservation*. IUCN, TNC, The World Bank. [Pagiolaritterbishop2004.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.

- § Charles Perrings 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.

- § Charles Perrings. 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 follows 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.



- Š Neville Ash and Martin Jenkins. 2007. *Biodiversity and Poverty Reduction; the importance of biodiversity for ecosystem services*. UNEP-WCMC. [Ash and Jenkins 2007.pdf](#)

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)

*risk-averse ecosystem managers against the over- or under-provision with ecosystem services”.*

- Š Janne Bengtsson et al. 2003. ***Reserves, Resilience and Dynamic Landscapes.***  
**Bengtsson et al 2003.pdf**

This paper specifically addresses the insura

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.

- § Claire Kremen. 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.

- § Kenneth Arrow et al. 1999. *Managing Ecosystem Resources*. [Arrow et al 1999.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 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*”.

- § David Pearce. 2005. *Managing Environmental Wealth for Poverty Reduction*. UNDP. [Pearce 2005.pdf](#)

This is a very comprehensive report (160 pages) on the environment and its role within the achievement of the Millennium Development Goals. “*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*”.

- § Frances Irwin and Janet Ranganathan (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](http://www.wri.org/biodiv/pubs_description.cfm?pid=4309#pdf_files)

This is an excellent 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.

- § 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*. [Goldman et al pdf](#)

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.

## ii) 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:

- § Ken Chomitz. 2007. *At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests*. The World Bank. [WBloggerhead.pdf](#)

Very comprehensive report (over 300 pages) on the linkages between agriculture, livelihoods, and sustainability in tropical forests. The author stylizes 3 main forest types (mt was5ture, and nron4zn a m8cal foresanrondin7.2udo

This report offers some interesting insights into the role that payments for ecosystem services (PES) might play as a framework for incentivizing sustainable

*ecosystem services and biodiversity outside conservation areas lies in promoting diversity of land use at the landscape and farm rather than field scale”.*

- Š Jeff McNeely and Sara Scherr. 2001. Common Ground, Common Future – ***How Ecoagriculture Can Help Feed the World and Save Wild Biodiversity.*** [McNeely and Scherr 2001](#).

This paper introduces the challenge that ecoagriculture is designed to address: the loss of biodiversity and the increase in demand for agriculture. Then, 6 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.

- Š David Kleijn and William Sutherland. 2003. ***How Effective are European Agri-environmental Schemes in Conserving and Promoting Biodiversity?*** Ecology Letters. [Kleijn and Sutherland 2003.pdf](#)

This paper evaluates the effectiveness of the European financial compensation scheme for conservation – which is directed towards farmers in 26 countries. Summarizes a large collection of field studies without coming up with conclusive evidence on the overall effectiveness of the programme.

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:**

- § Gretchen Daily and K Ellison. 2002. *The New Economy of Nature*. Island Press.

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.

- § John Shilling and Jennifer Osha. 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.

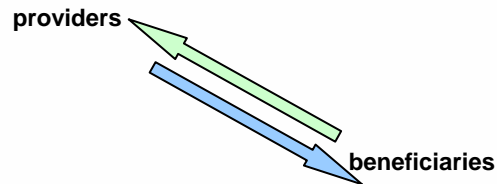
Views on the social impacts of markets for ES by a PES critic. Finds that PES are mainly beneficial to big industry and large landholders.

## ii) Introducing Payments for Ecosystem Services (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 Sven 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**



Source : Adapted from Heal et al. (2001)

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:

- § Ian Powell, Andy White and Natasha Landell-Mills. 2002. *Developing Markets for the Ecosystem Services of Forests*. Forest Trends. [Powellwhite.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.

- Š Natasha Landell-Mills and Ina Porras. 2002. *Silver Bullet or Fools Gold? A Global Review of Markets For Forest Environmental Services and Their Impact on the Poor*. IIED. [Landell-mills and porras 2002.pdf](#), full version available from

Topic: climate change, living conditions, legal and regulatory framework, property

Anantha Duraiappah. 2007.  
protecting ecosystem services, domestic equity, and

rights and the politics of financial risks.

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.

#### ***d) Implementing Payments for Ecosystem Services (PES)***

##### **i) 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 ach



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.

- Š Sara Scherr, Jeffrey Milder and Carina Bracer. 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. [Scherr milder bracer.pdf](#)

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.

## **ii) 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.

**Recommend** :



## Recommended Reading:

- § IUCN-UNEP. 2007. *Developing International Payments for Ecosystem Services – Greening the World Economy*. [IPES brochure 0607.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 REDD as an immediate opportunity for bundling PES and tapping into the carbon market to achieve channel greater support for conservation efforts.

- § UNFCCC. 2006. *Background Paper for the Workshop on Reducing Emissions from Deforestation in Developing Countries*. [UNFCCC.pdf](#)

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, PNG, Malaysia, and the USA.

- § Margaret Skutsch et al. 2006. *Clearing the Way for Reducing Emissions from Tropical Deforestation*. [Skutsch et al 2006.pdf](#)

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*”.

- § Joyothee Smith and Sara Scherr. 2003. *Capturing the Value of Forest Carbon for Local Livelihoods*. *World Development*. [Smith and Scherr 2003.pdf](#)

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*”.

- Š Tom Griffiths. 2007. *Seeing 'RED'? 'Avoided Deforestation' and the Rights of Indigenous Peoples and Local Communities*. Forest Peoples Programme. [Griffiths 2007.pdf](#)

This paper explores how local communities might be able to benefit from REDD. An analysis of 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.

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

## **a) Resources**

### **i) Understanding Ecosystem Services**

#### **Defining Ecosystem Services**

- § *The Millennium Assessment toolkit*. 2007 ([MAtoolkit.pdf](#)) – Provides an overview of the MA, examples of how it is used, and resources to help tap into the lessons learned.
- § *Millennium Ecosystem Assessment* - <http://www.millenniumassessment.org/>;; regularly updated with good reference. Good reference section.
- § *Ecosystem Services Fact Sheet* – <http://www.esa.org/ecoservices/comm/body.comm.fact.ecos.html>; provides basic information on ecosystem services, with links to basic info on pollution, water purification, forest carbon storage, and flood damage.

#### **Background Theory**

- § Deepak Vaman Malghan. 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. 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. Author explores axioms for consistent scale metrics. Has a chapter on optimal scale for environmental management. Very long and complex, but well written and insightful.

- § Ira R. Feldman and Richard J. Blaustein. *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*”.

- § *The International Society for Ecological Economics* - <http://www.ecoeco.org>,

- § *The Beijer Institute of Ecological Economics* - <http://www.beijer.kva.se/>

#### **Natural Capital**

- § *The Natural Capital Project* - <http://naturalcapitalproject.org> – TNC, WWF, Stanford University. Recently launched initiative with selected study sites in Tanzania, China, California, and Hawaii.

### **Valuing Ecosystem Services**

- § James Boyd and Spencer Banzhaf. 2006. *What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units*. Resources for the Future. [Boydandbanzhaf2006.pdf](#)

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’.

- § James Boyd and Spencer Banzhaf. 2005.



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.

## Conservation in Productive Landscapes

- § Robin Naidoo and Wiktor Adamowicz. 2006. *Modeling Opportunity Costs of Conservation in Transitional Landscapes*. <http://lib.bioinfo.pl/pmid:16903110>

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”.

- § Taylor Ricketts et al. 2004. *Economic Value of Tropical Forest to Coffee Production*. [Ricketts et al 2004.pdf](#)

This paper describes a case study of the economic value of the pollination service of tropical forests to coffee production in Costa Rica.

- § Naidoo, R. and Ricketts, T. 2006 *Mapping the economic costs and benefits of conservation*. Available online at:

<http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0040360> [naidoo and ricketts 2006.pdf](#)

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.

- § Robin Naidoo and Takuya Iwamura 2007. *Global-Scale Mapping of Economic Benefits from Agricultural Lands: Implications for Conservation Priorities*. [Naidoo and Iwamura 2007.pdf](#)

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.

- § Kerrie Wilson et al. 2007. *Conserving Biodiversity Efficiently: What to Do, Where, and When*. PLOS Biology [Wilson et al. 2007 pdf](#)

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.

- § Chan, K.M. et al. 2006. *Conservation Planning for Ecosystem Services*. Available online at: <http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0040379>, [chan et al 2006](#)

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”.

- § Stephen Polasky et al. 2007. *Where to Put Things? Spatial Land Management to Sustain Biodiversity and Economic Returns*. [Polasky et al 2007.pdf](#)

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”.

- § Stefano Pagiola et al. 2004. *Paying for Biodiversity Conservation Services in Agricultural Landscapes*. The World Bank. [Pagiola et al 2004](#).

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.

- § Sara Scherr and Jeff McNeely. 2003. *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*. Island press. <http://www.islandpress.com/books/detail.html?cart=1056126081268552&SKU=1-55963-644-0>

Comprehensive book on eco-agriculture as described above.

- § Sara Scherr and Jeff McNeely. 2006. DRAFT. *Biodiversity Conservation and Agricultural Sustainability: Towards a New Paradigm of ‘Ecoagriculture’ Landscapes*. [Scherr and McNeely 2006](#)

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.

- Š L. Jackson et al. 2005. *AgroBiodiversity: A New Science Agenda for Biodiversity in Support of Sustainable Agroecosystems*. DIVERSITAS Report No. 4
- Š Antle, John et al. (2006). *Predicting the Supply of Ecosystem Services from Agriculture*. [Antle and stoorvogel 2006.pdf](#)

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- § Sara Scherr et al. 2006. *Developing Future Ecosystem Service Payments in China: Lessons Learned from International Experience*. Forest Trends. [Scherr et al 2006.pdf](#)

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.

- § Sissel Waage et al. 2006. *A Scoping Assessment of Current Work on Payments for Ecosystem Services in Asia, Latin America, and East & Southern Africa*. Forest Trends. [Waage et al 2006.pdf](#)

*“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.”*

- § TNC. 2006. *Ecosystem Services: Status and Summaries*. [TNC\\_ecosystem\\_services.pdf](#)

A global review of PES projects, organized into short one-page sheets. 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.

- § Mira Inbar, Sara Scherr, Carina Bracer and Sissel Waage. *Getting Started with PES – An Introductory Primer to Making Payments for Ecosystem Services Agreements*. DRAFT. [Gettinstarted.doc](#)

Although still in a draft form, this paper provides a step-by-step methodology for engaging in PES deals. It also outlines various types of possible deals and





although it was acknowledged that PES could also work as a conflict-resolution instrument.

- § Danièle Perrot-Maître and Patsy Davis. 2001. *Case Studies of Markets and Innovative Mechanisms for Water Services from Forests*. Forest Trends. [Perrot-maitre and davis 2001. pdf](#)

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

- § Sughrendu Pattanayak. 2004. *Valuing Watershed Services: Concepts and Empirics from Southeast Asia*. [Pattanayak.2004.pdf](#)

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.

- § Meine van Noordwijk. 2005. *RUPES typology of environmental service worthy of reward*. CGIAR. [Van noordwijk 2005.pdf](#)

*“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 le*

Š Michael Dutschke and Reinhard Wolf. 2007. *Reducing Emissions from*



## **b) Useful Links**

- **Wikipedia on ecological economics:**  
[http://en.wikipedia.org/wiki/Ecological\\_economics](http://en.wikipedia.org/wiki/Ecological_economics)
- Biography of Georgeschu Roegen:  
<http://cepa.newschool.edu/het/profiles/georgescu.htm>
- **Wikipedia on environmental and resource economics:**  
[http://en.wikipedia.org/wiki/Environmental\\_economics](http://en.wikipedia.org/wiki/Environmental_economics)
- **Environmental economics blog:** <http://www.env-econ.net/>
- **Natural Capitalism** - <http://www.natcap.org/sitepages/pid20.php>
- **Wikipedia on ecological resilience** –  
<http://en.wikipedia.org/wiki/Resilience#Ecology>
- **The Resilience Alliance** - <http://www.resalliance.org/1.php>. They have recently added resilience assessment workbooks for practitioners and scientists.
- **Ecology and Society** – <http://www.ecologyandsociety.org/>. A journal of integrative science for resilience and sustainability:
- **Biodiversity Economics** - [www.biodiversityeconomics.org](http://www.biodiversityeconomics.org), IUCN-WWF information portal with up-to-date publications and events on biodiversity economics,
- **Nature valuation** - <http://topshare.wur.nl/naturevaluation>, Wageningen University, has a database of case studies and publications. Has a section on cultural values;
- **Association of Environmental and Resource Economists** – [www.aere.org](http://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>
- **EEPSEA - Economy and Environment Programme for Southeast Asia:** [http://www.idrc.ca/eeepsea/ev-115216-201-1-DO\\_TOPIC.html](http://www.idrc.ca/eeepsea/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.
- **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.
- **DIVERSITAS International ecoSERVICES** - [http://www.diversitas-international.org/core\\_ecoserv.html](http://www.diversitas-international.org/core_ecoserv.html) Diversitas Internation ecoSERVICES

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

- **Ecosystem Services Project -**



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supporting rural/natural landscap

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.

- § Pablo Gutman. 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 labor-intensive conservation model.

- § Edward Glaeser and Mathew Kahn. 2003. *Sprawl and urban growth*. [Glaeser and kahn 2003.pdf](#)

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.

- § Rights and Resources Group. 2007 *Transitions in Forest Tenure and Governance: Drivers, Projected Patterns and Implications*. [rri\\_forest\\_governance.pdf](#)

This forward-looking report offers an excellent overview on the future trends that will shape forest policy in the years to come. The rise of BRIC countries 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.

- § Ian Hodge. 2007. *The Governance of Rural Land in a Liberalized World*. *Journal of Agricultural Economics*. 28 (3): 409-432. [Hodge 2007.pdf](#)

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 “

*the provision of public goods*”, and he advocates for “



*where values can be determined and policies implemented at a relatively local scale.”*

- § Luca Tacconi, Y. Siagian, and R. Syam. 2006. *On the theory of decentralization, forests, and livelihoods*. [Tacconi et al 2006.pdf](#)

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.