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Payment for and Management of Ecosystem Services

Issues and Options in the Nordic Context

Marianne Zandersen, Kirsten Grønvik Bråten and Henrik Lindhjem

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Nordic Council of Ministers
Store Strandstræde 18
DK-1255 Copenhagen K
Phone (+45) 3396 0200
Fax (+45) 3396 0202

Nordic Council
Store Strandstræde 18
DK-1255 Copenhagen K
Phone (+45) 3396 0400
Fax (+45) 3311 1870

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List of abbreviations

ALR	Auction for Landscape Recovery
BIOSA	Biosphere Austria
BRIC	Brazil, Russia, India and China
CAP	Common Agricultural Policy
CDM	Clean Development Mechanism
CRP	Conservation Reserve Program
DECC	New South Wales Department of Environment and Climate Change
EBI	Environmental Benefit Index
ELS	Entry Level Stewardship
ES	Ecosystem Services
ESA	Environmentally Sensitive Area
EU ETS	EU Emission Trading Schemes
FEP	Farm Environmental Plan
GDP	Gross Domestic Product
GFP	Good Farming Practices
HLS	Higher Level Stewardship
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
MBI	Market Based Instrument
METSO	Forest Biodiversity Programme for Southern Finland
NERI	National Environmental Research Institute
NGO	Non Governmental Organisations
PES	Payment for Ecosystem Services
SFGS	Scottish Forestry Grant Scheme
TC	Transaction Cost
TDR	Tradable Development Rights
TEV	Total Economic Value
UNFCCC	United Nation Framework Convention on Climate Change
VMP III	Water Environmental Plan III (Vandmiljøplan III)
WFD	Water Framework Directive
WGS	Woodland Grant Scheme
WTA	Willingness to Accept
WTP	Willingness to Pay

Preface

Payment for ecosystem services (PES) is a type of environmental policy instrument that gives the owner of a natural resource direct incentives to manage it in society's best interest. For the resource owner this usually means giving up some private income (for example from timber sale) in exchange for a compensation for the ecosystem services (for example climate regulation, water purification, biodiversity protection, reduced nutrient runoff etc.). This report provides an overview of current theory and experiences from the use of PES in OECD countries, and discusses options to expand and improve PES schemes in the Nordic countries. The report was commissioned by the Working Group on Environment and Economics under the Nordic Council of Ministers. The project has been guided by a steering group consisting of Ulrika Lindstedt (Swedish Environmental Protection Agency), Øyvind Lone (Norwegian Ministry of Environment) and Jørgen Schou (Danish Ministry of Environment). The project has been carried out by Econ Pöyry in Norway and Pöyry in Denmark. Henrik Lindhjem, Econ Pöyry, has been project leader. The report has been written by Marianne Zandersen (main author), Kirsten Grønvik Bråten and Henrik Lindhjem. Haakon Vennemo of Econ Pöyry acted as the internal quality assurer of the report.

September 2009,

Ulrika Lindstedt
Chairwoman, the MEG working group
(for environmental economics)
of the Nordic Council of Ministers

Stig Johansson
Chairman, the TEG working group
(for terrestrial ecosystems)
of the Nordic Council of Ministers

Executive summary

Abstract

This report analyses and describes the theoretical basis for and practical implementation of payment for ecosystem services (PES) with a focus on conditions of particular relevance to the Nordic countries. It is shown that PES is firmly embedded in the tool box of classical incentive-based policy instruments and yet offers a novel way to managing ecosystem services (ES) by providing a direct conditional way of buying conservation and integrating the demand and supply sides of ES. PES is found either in the form of nature conservation contracts or in the form of creation of new market products such as offset credits or eco-labelling. The report proposes to use a distinction between intermediate and final goods of nature in helping to set up efficient PES schemes. It identifies at an overall level the beneficiaries of ES; the distribution of rights between buyers and sellers of ES; the public-private good aspects of ES; and proposes a framework for integrating ecosystems and economic values. A number of examples of PES from OECD countries are presented to show the variety in PES contract designs and two in-depth case studies from Denmark and Finland illustrate different experiences in the Nordic countries with PES. The report concludes by arguing there is scope both to improve and expand the current use of PES in the Nordic countries.

Background and objectives

The Economy and Environment Group of the Nordic Council of Ministers has initiated the study “Payment for and Management of Ecosystem Services: Issues and options in the Nordic context” with the aim to provide an overview status of methods and measures in the valuation of and payment for ecosystem services (PES) and to give examples of such payment systems or other similar management mechanisms. The study further aims to provide discussion and advice on how PES and PES-like schemes can be applied in different areas and for different types of ecosystem services (ES).

Conclusions and Options for the Nordic Countries

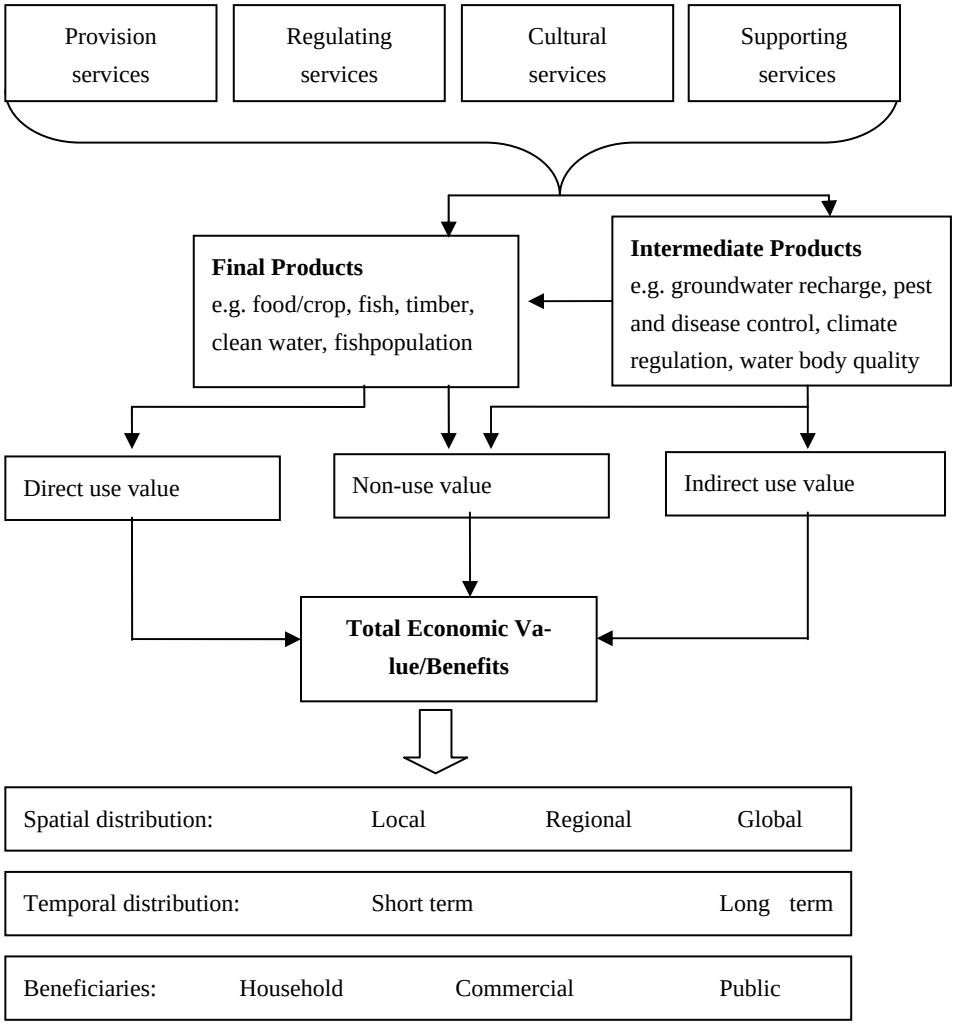
PES firmly embedded in the tool box of classical incentive-based policy instruments

PES is firmly embedded in the tool box of classical incentive-based environmental regulation. PES is a market-based voluntary approach that is, in its strictest sense, based on conditional performance contracting. It functions similarly to targeted subsidies but with PES, at least one of the parties (buyer or seller) can decline and there is ideally firm conditionality based on efficient monitoring and credible sanctioning in case of non-compliance. PES works by having at least one buyer of ES pay at least one provider of ES for securing a positive externality such as clean water, scenic beauty or carbon sequestration. The maximum payment that should be made is the willingness to pay of beneficiaries for the ES and the minimum payment is the cost that just compensates the land manager for foregoing his legal rights to manage his land in a specific way plus the transaction costs of setting up and running the PES scheme. The price can be subject to negotiation directly between buyers and sellers or it can be set as a fixed payment, which is often found where intermediaries such as governments or NGOs act as the buyer of ES.

Useful to separate intermediate and final ecosystem services

ES have become an important concept for linking the functioning of ecosystems to human welfare. ES "acquire" economic value when they impact on utility either directly (e.g. recreation) or indirectly when they are used as an input in the production of goods consumed (e.g. food products) or affects utility (e.g. avoids flood damage). ES can be perceived as "final products" of nature. These final products of nature are the result of biophysical structures, processes and functions of ecosystems, which can be perceived as "intermediate products". The distinction between final and intermediate products of nature is useful as an analytical tool for decision making in natural resource management as it helps avoiding double-counting the value of ES, it helps simplify the valuation of complex natural processes and in particular the distinction can help clarifying which processes and components of nature provide value as an ES to different beneficiaries.

Figure 1 Linking Ecosystem Services and the Economy



Necessary and desirable/useful criteria in the implementation of PES

Based on lessons learnt from full-scale and trial implementation of PES schemes and theory, a number of necessary and desirable/useful conditions can be formulated. These are presented in Table 1.

Table 1 Overview of necessary and useful criteria for PES

Necessary conditions of PES	Reason	Examples of ES excluded from PES	Examples of ES included in PES
i) Resolve public/private goods issues *OR* ii) Resolve to defining proxies of ES	i) PES is best suitable where it is possible to overcome the hurdles of non-rivalry and non-excludability. ii) Typically, however, land use practices are used as a proxy for delivering a specific ES -> challenge to ensure link between action and level of ES provision	i) ES that constitute mobile resources are typically more difficult to include in PES schemes, e.g. marine biodiversity, conservation of fish populations.	i) Carbon sequestration ii) Establishment of wetlands; conversion of arable land to grassland; set-aside of forest or farm land.
Positive externality	PES should ideally be applied where a positive externality is undersupplied as a correction to market failure.	ES that benefit only the landowner should not be included in a PES scheme, e.g. enhancement of on-farm soil fertility.	Watershed services, carbon sequestration, landscape amenity values, biodiversity.
Credibly threatened ES /size of externality	PES should only target ES for which there is a genuine interest to pay for the service *and* where the ES would not be provided in the absence of the payment.	The size of externality depends on landscape ecological assessments	Clean drinking water; biodiversity; climate stability; soil erosion
Appropriate economic trade-off	PES can only function where Willingness to pay (WTP) > Willingness to accept compensation (WTA) + transaction costs (TC). This implies that where TC is prohibitively high, PES is not workable and where the gap between WTP and WTA is narrow, TC cannot be high for PES to function.	Depends on local conditions. Where there are many buyers and sellers, TC is usually prohibitively high.	Depends on local conditions, contract design, and social set up.
Trust between buyer(s) and seller(s)	Sellers: important to know that the buyer is not trying through the back door to take away rights. Buyers: important to have confidence, that the sellers have a genuine interest in providing the service.	Independent of type of ES	
Appropriate design of PES	Design of PES has direct implications on the efficiency and the environmental performance of the scheme.	Independent of type of ES	
No strong intrinsic values placed on ES	Monetary payments may undermine conservation efforts in case of strong intrinsic values	Depends on local cultural conditions and traditions.	

Desirable/useful conditions	Reason	Examples of ES	
Financial Efficiency/strong additionality	Contract design can help avoid paying for actions that would have happened anyway	Independent of type of ES.	
Social Efficiency	Contract design can help avoid problems of paying too low (no or too low take-up) or too high (inefficient use of resources) levels of compensation	Independent of type of ES. Many nature conservation contracts appear to have a low level of social efficiency	
Spatial coordination	Targeting of land owners or agglomeration bonuses can help ensure continuous areas under PES across private borders	Most PES schemes in place today have weak or no efficient spatial coordination in place.	Landscape linkages for wildlife; riparian land for water quality;
Permanence	Long-term contracts and assurance or monitoring of no leakage of externalities outside the PES area	Independent of type of ES	
Competition between landowners with heterogeneous cost structures	Enables a cost-efficient delivery of ES, e.g. through the use of auctions and competitive bidding	Independent of type of ES	
Active role of Government	Starting up new PES necessitates awareness rising along with defining sellers/buyers, ES, negotiating contracts and monitoring delivery.	Independent of type of ES	

PES schemes tend to focus on four types of ES

PES schemes tend to focus on four areas, notably landscape beauty, watersheds, biodiversity and carbon sequestration. Examples of PES schemes in place for each of these areas are listed below:

- protection of landscape beauty for recreation and amenity purposes. This is an important area in OECD countries (e.g. agri-environment schemes targeting restoration of stone walls, repair of traditional farm buildings, or management and restoration of traditional farmland habitats such as hedge rows) and growing in BRIC countries.
- protection and regeneration of watersheds. This is found e.g. in Mexico (PSAH Program) and New York City's watershed protection programme;

- protection and regeneration of biodiversity. Examples are found in Australia (e.g. the BushTender and ALR); in the US (US Conservation Reserve Program) and in the EU (agri-environmental schemes, the BIOSA network in Austria and METSO in Finland); and
- protection and sequestration of carbon in forests and land-based systems. Examples can be found e.g. in China (Sloping Land Conservation Programme) in the UK (Challenge Funds in Scotland) and under the UNFCCC CDM mechanism (afforestation and reforestation projects).

The focus on these four areas does not, however, indicate that PES cannot or should not target other ES, such as marine based ES.

PES is already in use in the Nordic Countries

Conditional, voluntary payment mechanisms to preserve and enhance ES are already in use in the Nordic countries. Agri-environmental schemes aiming at increasing biodiversity or reducing nutrient leakage exist in all Nordic countries; biodiversity preservation and groundwater protection schemes exist in forestry in Denmark, Norway, Sweden and Finland; an innovative payment scheme using blue mussels to remove nutrient from coastal waters exists in Sweden and buyout schemes of fishing vessels exist in Denmark and Norway in order to reduce pressure on fishing stocks.

Experience from Denmark on paying land owners for creating and maintaining wetlands show a generally positive outcome with 1,704 hectares wetland created in four years and estimated 282 tonnes of nitrogen leakage avoided (2005 to 2009). However, compared to the target under VMP III of reducing nitrogen leakage by 400 tonnes by the end of 2009, the scheme missed the target by more than one fourth. A contributing reason was an insufficient number of participating landowners, which may be linked to the fact that the scheme was based on a fixed-payment that was not spatially targeted and with compensation at a level not attractive enough for landowners with high nitrogen leakage reduction potential.

In Finland a programme paying forest owners for conserving or managing forest in favour of biodiversity were tested from 2003 to 2007. Experiences from this programme have mainly been positive, and the project has been now been developed and extended until 2016. Forest owners are generally positive to this kind of voluntary conservation, and the number of sites offered for the project exceeded the amount of funding available. By late 2006, 268 contracts were agreed on, from which 241 are fixed-term contracts and 27 are permanent contracts, and a total of almost 2000 hectares of forest were protected as a result of the project.

There is scope to improve the current use of PES in the Nordic countries

Traditionally, PES-like schemes in the Nordic countries are based on fixed-rate payments with no or little spatial targeting or on individually negotiated levels of payments based on e.g. the amount of timber on the plot of land and a fixed level compensation. This may indicate that there is room for improving social and ecological efficiency of such schemes.

There is, however, very little experience with using competitive bidding in PES in the Nordic countries, the METSO programme in Finland is an exception to this, and to our knowledge no experience in using economic incentives to obtaining spatially connected areas.

In this respect, there is scope to experiment with PES contract designs. Where opportunity costs are likely to be heterogeneous among landowners, competitive bidding and auctioning may prove more efficient than fixed-rate payments. In addition, finding the right level of compensation in fixed-rate contracts may also profit from auctions, where landowners "reveal" their prices. Several of the PES schemes currently in use internationally may be considered for trial in the Nordic countries.

There is scope to expand the use of PES in the Nordic Countries

PES can be combined with existing natural resources regulation as a "top-up', where landholders can obtain compensation for undertaking more environmentally friendly action than the minimum regulation requires. The EU CAP agri-environmental schemes are already such an example, but in other areas, this can be expanded.

There is also scope for expanding the application of PES into areas, where regulation by landholders is traditionally perceived as very negative, and where property rights are very strong. PES could be an option, where PES substitutes partly or fully regulation on the grounds that regulation in any case is inefficient. This is the case in forestry.

Current legislation hold possibilities for integrating PES schemes in the policy mix. An example is the Water Framework Directive, where water users could pay for the groundwater protective services of forests via their water bill either for the investments in establishment of forests and/or the appropriate maintenance and management of existing forest ecosystems. Public agencies have between 2009 and 2012 to put programmes of measure into place.

Finally, there is significant scope for private sector engagement in biodiversity conservation with opportunities for positive financial returns as well as real biodiversity benefits. One avenue is the un-bundling and marketing of biodiversity benefits at landscape-level activities (e.g. organic farming, aquaculture, conservation credits or offsets of sustainable forestry or carbon sequestration). Another avenue is the creation of biodiversity "banks" in both terrestrial and marine/aquatic ecosystems to offset degradation due to land development. Businesses in the Nordic countries

may very well benefit from international experiences in this field. The role of Nordic governments in this area would be to create the enabling conditions for such trades to take place and to make sure that they are supplementary and not contradictory or overlapping with other natural resource management regulation.

1. Introduction

1.1 Objectives and methods

The Economy and Environment Group of the Nordic Council of Ministers has initiated this study with the aim to provide an overview status of methods and measures in the valuation of and payment for ecosystem[1] services (PES) and to give examples of such payment systems or other similar management mechanisms.

On this basis, the study further seeks to provide policy makers as well as the wider public advice and recommendations on how such methods and systems can be applied in different areas and for different types of ecosystem services (ES). Our focus is on the most important, broad ecosystem types in the Nordic countries: forests, wetlands (including freshwater systems) and agro-ecosystems. Other ecosystems, such as marine and mountain ecosystems, are covered to a lesser extent, as there are fewer working examples of PES in these areas. The report, however, does refer to one case of PES in marine ecosystems, namely the use of mussels in Sweden to clean the Baltic Sea.

As there is already a sizeable literature on PES, especially focused on developing country experiences (and several papers and reports reviewing this literature)[2] the aim is not to provide a new or supplementary review of PES mechanisms world wide. Further, we also do not aim to provide a review of the even more extensive literature on economic valuation of ES[3].

Our modest aim is rather to draw lessons from Western and Nordic experiences of particular relevance to the further refinement and use of such schemes in a Nordic context. The role of economic valuation of ES in PES schemes will be clarified and drawn into the analysis when relevant. Compared to other contributions in this area our Nordic focus represents one unique feature. Another is our attempt to discuss different approaches to classification of ES in relation to the degree of public good of

[1] In the literature "E" sometimes represents "environmental services", though a clear distinction in meaning is usually not intended. We stick to the term "ecosystem services" in this report.

[2] Examples include Wunder et al., 2008 and Engel et al., 2008 from the special issue Ecological Economics 65 (2008); Bulte et al., 2008 from the special issue Environment and Development Economics 13 (2008); Jack et al., 2008 from the special issue Proceedings of the National Academy of Sciences (2008), Mayrand and Paquin, 2004, Landell-Mills and Porras (2002).

[3] There are several such studies, reviews, manuals and guidebooks already published (for some recent ones see e.g. USEPA (2009), CBD (2007), Brander et al. (2008), OECD (2002), EFIMED (2008), Farber et al. (2006), and Martin-Lopez et al. (2008)). The Swedish Government also recently commissioned a study on this topic (see Sjöström (2007)). See also Lindhjem (2007) and Lindhjem and Navrud (2008) for a meta-analysis of valuation of non-timber benefits in the Nordic countries.

the ES and distribution of standing (i.e. who has the rights to what), and how this influences PES schemes.

Further, we also try to link PES more closely with existing environmental and natural resource policy, especially how different policies best deal with classic externality and public goods aspects of ES. It is clear from the outset that PES instruments do not represent something completely new, but is a group of instruments firmly placed in the toolbox of environmental market- or incentive-based regulation, and can be analysed and understood in that context.

Documented evaluations of experiences with PES schemes are generally limited in the academic literature, but have recently started to emerge (as e.g. mentioned in footnote 2). Much of the information on PES experiences (especially from developing countries) is more commonly reported in the grey literature (project documents, feasibility studies etc). The review has mostly focused on OECD country experiences in general and Europe in particular.

The literature review has been complemented with consultations with a few key experts on PES: Professor Nicholas Hanley at the University of Sterling, Joshua Bishop of the International Union for the Conservation of Nature. In addition, a one week PES course organised in June 2009 at the University of Copenhagen has provided valuable on-the-ground intelligence and knowledge on the practical issues of PES based on the lectures of Sven Wunder of the Center for International Forestry Research, Paul. J. Ferraro of Georgia State University, and Peter Bogetoft and Niels Strange of the University of Copenhagen. In addition, Øyvind Lone of the Norwegian Ministry of Environment and Kristian Eg Gadegaard of Danish Ministry of Food, Agriculture and Fisheries, Errki Mantymaa University of Oulu and Paula Horne of Pellervo Economic Research Institute have provided ideas and input to specific literature and case studies. Finally, the report draft has been reviewed (whole or in parts) by Nicholas Hanley, Joshua Bishop and David Huberman (also IUCN)[4].

The report has been written by Marianne Zandersen (main author, Pöyry, Denmark), Kirsten Grønvik Bråten and Henrik Lindhjem (both Econ Pöyry, Norway). Henrik Lindhjem was the project leader. Haakon Vennemo of Econ Pöyry acted as the internal quality assurer of the report.

1.2 Outline

The outline of the report is a follows. The next chapter first attempts to define and clarify the concept of ES. There are many ways such services can be classified, and many exist in the literature. There is also considerable confusion in this area. The chapter does not attempt to put all such

[4] All these inputs are greatly acknowledged. Neither reviewers nor other people consulted are of course responsible for any of the contents of this report.

issues to rest, but discusses and advocates that there are types of classifications which are more conducive to the setting up of PES schemes than others. Chapter 3 then explains what PES is and puts this class of instruments into context with other environmental and natural resource policies. The purpose of this chapter is to explain the basic rationale and components of PES schemes – based on the most recent work in the area – and explain how such mechanisms relate to more "classic" environmental regulation.

Chapter 4 brings the ES and economics together. The issues discussed include how economic values relate to ES, how ES can be classified as varying degrees of public goods, some key challenges in the regulation of the provision of such goods, building on the initial discussion of Chapter 3, who the beneficiaries of ES are and how the rights to such ES typically are distributed. These issues have important bearings on the design and use of PES schemes.

Chapter 5 then presents a few main types of PES schemes currently in use and discusses brief examples from Western countries, including two PES-like schemes from Norway and Swden. The aim is to exemplify and illustrate some of the core issues discussed more conceptually in Chapters 2–4. Chapter 6 also builds on previous discussions – practical and theoretical – and relates these to the specific Nordic context. Two case studies of PES-like schemes are presented more in depth; the METSO forest biodiversity conservation programme in Finland and an agri-environmental scheme to establish wetlands in Denmark. These cases serve to illustrate further the key issues and options in PES schemes applied in the Nordic context.

Finally, Chapter 7 draws out the most important lessons and provides a discussion of the main issues and options in using PES schemes more in the Nordic context. The report ends with outlining the most important knowledge gaps related to practical aspects of future developments of PES schemes.

2. Definition and classification of Ecosystem services

This section introduces the concept of ES and gives an overview of the different approaches for thinking about ES and possible ways of classifying ES according to the use of the ES concept.

2.1 What are Ecosystem Services?

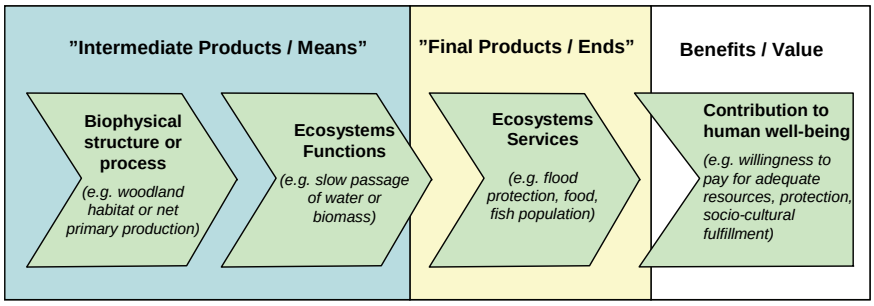
ES are increasingly promoted as a means for documenting the values humans place on ecosystems and for evaluating benefits derived from natural resources (e.g. Costanza et al., 1997; De Groot et al., 2002; Millenium Ecosystem Assessment (MA), 2005; Daily, 1997; Farber et al., 2006).

The Millenium Ecosystem Assessment (2005, p.1) defines ES as the "benefits people obtain from ecosystems". Other researchers use similar definitions, e.g. Daily (1997) "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life" and Costanza (1997) "The benefits human populations derive, directly or indirectly from ecosystem functions". Despite a general agreement on the idea of ES, there are significant differences between the definitions of ES. In Daily (1997), ES are the "conditions and processes" as well as the actual life-support functions. In Costanza (1997), ES represent the goods and services derived from the functions and used by human society and in the MA (2005), services are benefits in the largest sense.

As the references above illustrate, ES have become an important concept for linking the functioning of ecosystems to human welfare. ES are the beneficial outcomes, for the natural environment or people resulting from ecosystem functions. Ecosystem functions are the physical, chemical and biological processes or attributes that occur within ecosystems such as wetlands, forests or estuaries. These contribute to the self-maintenance of an ecosystem. In order words, ecosystem functions are the activities within an ecosystem. Some examples of ecosystem functions are the provision of wildlife habitats and the cycling of nutrients, carbon and water. These ecosystem functions are value-neutral whereas ES have value to society, because we interact with or have at least some appreciation of these services. ES "acquire" economic value when it impacts on utility, either directly (eg amenity, recreation) or indirectly by being an input to the production of something that is consumed or effects

utility (e.g. avoiding flood damages; food products).Figure 2–1 illustrates when ES becomes economically valuable.

Figure 2-1 When does an ES become economically valuable?



By intermediate products (means) we understand ecosystem processes such as climate, air and water regulation, soil formation and photosynthesis. These processes can be characterised as intermediate products in that they feed into "ends" (final products) such as fresh water, food, fibre, etc. Final products of nature are in other words components, assets or characteristics of ecosystems that human society benefits from directly. Processes and components of nature are both ES, but can be considered as intermediate or as final products depending on the benefit of interest.

The main reason for listing and classifying ES is to provide the basis for an effective framework for natural resource management decisions in particular when undertaking tradeoffs between ES. In the following sections we will look at different approaches in classifying ES and how these allow comparisons and trade-offs between the relevant set of potential benefits.

There are to date no standardised environmental accounting units for ES, despite several attempts to come up with a classification scheme. ES are categorised in different ways by governments, conservancies and environmental markets, reflecting different decision contexts and motivations.

There is a good reason for classifying ES according to the purpose of the classification, decision context and motivation. A fit-all classification of ES is most probably unlikely to satisfy all usages (Fischer et al., 2009). Also, when looking at ecosystems at the local or regional level, and the type and level of interaction with human society, services are likely to differ significantly, especially when taking into account the beneficiaries of the services, as different users demand different services

Organisations and scientists have attempted to classify ES in two main ways: *Group I* mixes means ('intermediate products') and ends ('final products') of ecosystems within the same category and *Group II* makes or attempts to make a distinct separation between means and ends in the classification of ES. The two groupings are described in more detail below.

2.2 Group I – no or little distinction between intermediate and final products of nature

The Millennium Ecosystem Assessment (MA, 2005) divided services into a few easily understandable categories of *supporting*, *regulating*, *provisioning*, and *cultural services*. This type of classification is one of the most widely used in the literature and offers a broad understanding and use of ES, such as educating the larger public. The classification used the "*complexity characteristic of ecosystems and the public-private good dynamic* [i.e. differences between marketable and non-marketable ES] *to draw distinct boundaries between different ES*" (Fisher et al, 2009). It also placed supporting services as an underpinning to the other service categories. Figure 2–2 illustrates the MA classification of some 30 ES into four broad categories. However, not only supporting but also regulating services are with one or two exceptions means to achieving services listed under provisioning or cultural services. For example, water and erosion regulation are not in their own right services sought by human society but they are rather processes to obtain potable water or to protect food and fibre resources.

Figure 2–2 MA Classification of Ecosystem Services

PROVISIONING	REGULATING	CULTURAL
Food	Air quality regulation	Cultural diversity
Fibre	Climate Regulation	Spiritual & religious values
Genetic Resources	Water Regulation	Knowledge systems
Biochemical, natural medicines, pharmaceuticals	Erosion regulation	Educational values
	Water purification & waste treatment	Inspiration
Freshwater	Disease regulation	Aesthetic values
	Pest regulation	Social relations
	Pollination	Sense of place
	Natural hazard regulation	Cultural heritage values
		Recreation and ecotourism
SUPPORTING		
Soil formation, Photosynthesis, Primary production, Nutrient cycling, Water cycling		

Source: MA, 2005

A number of leading practitioners such as Farber et al. (2006), de Groot (2002), Daily (1997) and Costanza et al. (1997) follow a similar approach of placing processes and end-products of nature in the same category[5].

Examples of how ES have been classified by conservancies, researchers and consultancies in this way are listed in Annex 1.

[5] The study by Costanza et al to estimate the total economic value of the world's ecosystems generated a large methodological controversy about valuation of ES (e.g. as documented in a special issue of Ecological Economics in April 1998 and in other outlets, e.g. Bockstael et al. (2000)). The main criticism was about the potential double counting of benefits and the impossibility of valuing total and not marginal changes in ES (since valuing the total violates the assumption that everything else in the economy is unchanged). We will not go into this debate, except to note that most of the issues discussed are of limited relevance to the analysis of PES schemes in this report.

2.3 Group II – attempts to separate between final and intermediate products of nature

Attempts to separate between final and intermediate products of nature are based on the understanding that we draw benefits from ES that we demand or depend upon directly (final products). These "final products" of nature are supported by and depend upon a set of "intermediate products" of nature, e.g. underlying structures, processes and composition of the full ecosystem. ES are in other words perceived as end-products of nature such as clean water, food or fibre and they contribute to human well-being such as providing adequate resources, health, recreation or flood control. Underlying structures and ecosystem processes (intermediate products) feed into the production of end-products. These include for instance groundwater recharge, pest and disease control or pollination.

This distinction between final and intermediate products of nature serves a number of purposes, for instance for use in green GDP accounting and measurement (Boyd and Banzhaf, 2007), in the practical management of landscapes (e.g. Binning et al., 2001) and in setting up frameworks for decisions in natural resource management (Wallace, 2007). Main motivations for distinguishing between final and intermediate products in the classification of ES include:

Double-counting - if intermediate and final products of ecosystems are not distinguished, the value of intermediate goods is double-counted because the value of intermediate goods is embodied in the value of final goods (Fischer et al., 2009; Boyd and Banzhaf, 2007; Wallace, 2007).

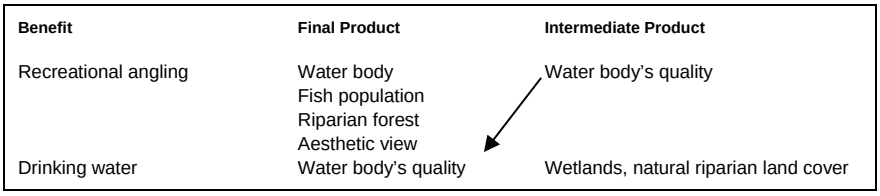
Complexity – the interaction and inter-dependence of different processes and components of ecosystems are complex. Rather than understanding the complexity, decision makers just have to be clear about some final services and benefits with which human society is concerned.

Limited knowledge & understanding – we have generally a poor understanding of the full range of ecosystem processes and their interaction with ecosystem components (Brooks et al., 2004). While it is also difficult to measure and value final products of ecosystems it is far more difficult to measure intermediate products, because we have far more information about components than about processes (Wallace, 2007).

ES are benefit specific – ES are dependent on their degree of connection to human welfare (Boyd and Banzhaf, 2007; Fischer et al., 2009). Figure 2–3 below illustrates a case where a service from an ecosystem can be perceived as an intermediate or final product depending on the beneficiary. For a recreational angler, the water body, fish population and surroundings impact his utility directly. These are final products of nature which have an economic value to the recreational angler. The water body's quality is an intermediate product of the underlying ecosystem, which enables the fish population to thrive. For a consumer benefitting from clean drinking water, the water body's quality directly impacts her

utility and it "acquires" economic value and becomes an ES. The functions of wetlands and natural riparian land cover, for instance are processes that help ensure the water body's quality.

Figure 2–3 Case of Benefit Dependency of ES



Source: Boyd and Banzhaf, 2006.

Following this approach, one way of thinking about the linkages between benefits and ES in terms of final and intermediate products is illustrated in Table 2–1. This macro-level approach is integrated into the framework for thinking about the links between ES and economic value in Figure 4–1 in Section 4.

Table 2–1 Macro-level approach to Benefits, Final and Intermediate Products

Benefits	Final Products	Intermediate Products
Adequate resources	Provisioning	Regulating & supporting
Protection	Natural hazard regulation (Regulating)	Regulating & supporting
Benign physical & chemical environment	Temperature, moisture, rainfall etc	Regulating & supporting
Socio-cultural fulfilment	Cultural services	Provisioning, regulating & supporting

Source: Based on Wallace, 2007; MA, 2005.

2.4 Summary

ES have become an important concept for linking the functioning of ecosystems to human welfare. ES "acquire" economic value when their impacts on utility either directly (e.g. recreation) or indirectly when they are used as an input in the production of goods consumed (e.g. food products) or affects utility (e.g. avoids flood damage). ES can be perceived as "final products" or "ends". These final products of nature are the result of biophysical structures, processes and functions of ecosystems, which can be perceived as "intermediate products" or "means". The distinction between ends and means of nature is useful as an analytical tool for decision making in natural resource management as it helps avoiding double-counting the value of ES, it helps simplify the valuation of complex natural processes and in particular the distinction can help clarifying which processes and components of nature provide value as an ES to different beneficiaries.

There are to date no standardised classification of ES. This brings to bear the need to classify ES according to the purpose of the classification, the decision context and motivation. A fit-all classification of ES is therefore most probably likely to fail satisfying all usages. The classification of ES in the Millennium Assessment Report builds on a general consensus in the academic literature. The division into a few easily understandable categories of supporting, regulating, provisioning and cultural services has in addition helped expand the understanding and use of ES to a large audience. However, the categories applied in the MA confound means and ends within the same classes, which in the case of analysing which ES are relevant for payment under PES may not prove very useful. Recent work has therefore attempted to separate between ecosystem processes and services.

3. What is Payment for Ecosystem services?

This section first gives a brief introduction to the different approaches in managing natural resources, from command and control (direct regulation) to marked-based and other instruments. It is shown that PES is firmly placed in the tool box of classical incentive-based environmental regulation and can be understood in that context.

PES is then introduced and defined including the theoretical approach to understanding the logic of PES and which aspects need to be considered when building up a PES scheme. The section ends with an overview of the main types of PES schemes implemented today.

3.1 PES in the context of environmental policy instruments

Ecosystems provide a great number of different products and services that human society enjoys and depends upon either directly or indirectly. There are varying degrees of de facto or presumed ownership and use of land in developed and emerging economies. Common for the different ownership structures is that certain land use activities can lead to adverse effects outside the area under management such as increased siltation in hydropower dams due to high rates of deforestation further upstream or eutrophication of inland waterways or the sea due to e.g. excessive phosphorous and nitrogen leakage from farming activities. These adverse effects are known in economic terms as externalities[6]. The problem of externalities arises when the individual resource manager provides too little of the demanded ES. This problem is closely linked with the underprovision of public goods.

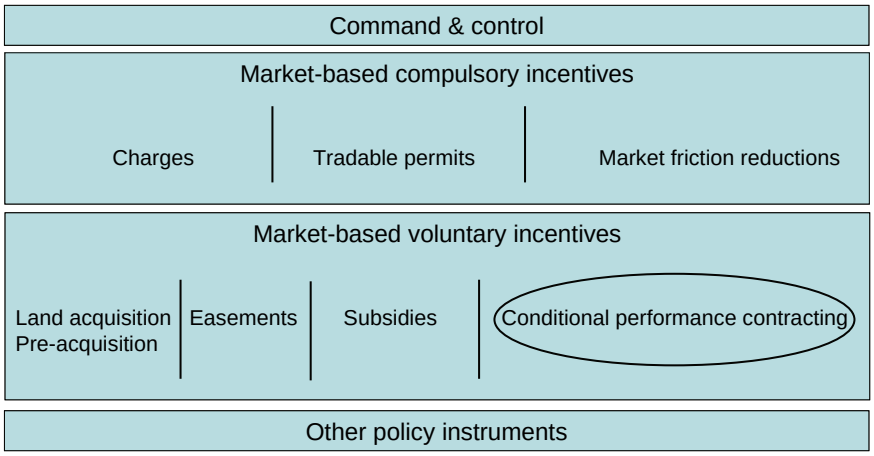
Different environmental policy instruments are used to deal with the problem of externalities. As illustrated in Figure 3–1, environmental policy instruments can be categorised in the following four main groups: command and control (direct regulation), market-based instruments (compulsory or voluntary), and other policy instruments (e.g. educational, voluntary emission reduction agreements etc). The former three groups are described in turn below.

[6] An “externality” is a positive or negative effect of an economic activity on others, which in an unregulated market is not taken into account by the economic agent responsible for the activity, e.g. pollution or degradation of ecosystems. The classic recommendation by economists to deal with this problem is to tax negative externalities and subsidise positive externalities, so that production and consumption activities generating such effects are adjusted to the full social costs and benefits they cause.

Command & control

Traditionally in the Nordic countries, direct "command-and-control" regulations have been used by governments to deal with environmental externalities such as controlling air and water pollution. These regulations, e.g. emission standards or technology mandates, force actors to act in a specific way and sanction those who do not comply. Restrictions on access and land use are for example used to achieve conservation objectives in National Parks and Nature Reserves or on non-conserved land to preserve a certain level of biodiversity. These kinds of regulations require all ecosystems covered by the regulation to be conserved according to specific requirements regardless of the level of benefits they provide or the cost of conserving the ecosystems (Engel et al. 2008). In situations with heterogeneity in costs associated with conserving a piece of land (e.g. due to different opportunity costs), these kind of regulations are not likely to be cost effective, i.e. reach conservation objectives at least cost. However, there may also be other reasons than cost-effectiveness why direct regulations may be sensible in conservation of ecosystems.

Figure 3–1 Overview of environmental policy instruments



Sources: adapted from Jack et al. (2008) and Ferraro (2009a)

Market-based compulsory approaches

Economic incentive-based schemes allow for a more cost-efficient implementation of environmental protection. Policy measures such as charges and tradable permits are compulsory and generally allow for the market to work out the most cost-efficient level of protection or conservation. Environmental taxes and charges set the price level and let the owners of land or large sources of emissions determine for instance the economically optimal level of pesticide application, use of mineral phosphorous in feed or the level of CO_2 emissions. The challenge for charges and taxes to be cost effective is the need to know the individual abatement

costs of companies or land owners in order to set a price level that achieves the original objectives of the regulation.

Tradable permits have the advantage over taxes and charges that the market determines the optimal price given a fixed cap on e.g. greenhouse gas emissions in the EU Emission Trading Schemes (EU ETS). Government does not need information on the cost structures of individual firms, but can set a specific target. The challenge is to set a target that is not too restrictive causing excessive leakage or economic failure of the agents or targets that are too lenient causing prices to collapse and the market to stop functioning. The use of tradable permits in land-based ecosystems is not frequent in Europe, but can be found on a pilot stage such as the Ecotrade project (See Box 3–1).

Box 3–1 Example of a land-based tradable permit system

The EcoTRADE project studies the applicability of tradable development rights (TDRs) as a cost-efficient way to biodiversity conservation. The idea of a TDR market is based on the requirement that whenever land is developed for infrastructure or industrial areas, a development right to compensate for ecological impacts is required. Such development rights can be supplied by landowners who restore or upgrade the ecological value of their land. A regulatory authority determines the exchange rules taking into account ecological targets and spatio-temporal contexts such as mutual dependency of habitats and temporal aspects like turnover rate. A case study is being carried out in the Randstad area in the Netherlands. The EcoTRADE project is carried out by Heimholz Centre for Environmental Research (UFZ), Wageningen University and Research Centre, The University of Queensland, Australia, Centre for Environmental Management, and European Science Foundation.

Source: www.ecotrade.ufz.de

Market friction reductions aim to reduce market barriers of for instance more environmentally friendly produce through labelling of products, information disclosure, extension and education programmes or research programmes designed to facilitate market exchanges. Examples of product labelling which indirectly benefit the provision of ES include Forest Stewardship Council (FSC) certification of wood products and various eco-labels such as for shade-grown coffee or Marine Stewardship Council's eco-label for sustainable fishing.

Market-based voluntary approaches

One fundamental aspect of market-based voluntary approaches in managing natural resources is that there is no regulation and no enforcement forced upon landowners. These can choose whether or not to participate and hence whether or not to change land management practices accordingly.

Subsidies are one such market-based voluntary approach. They are next to direct command and control and taxes one of the most widely

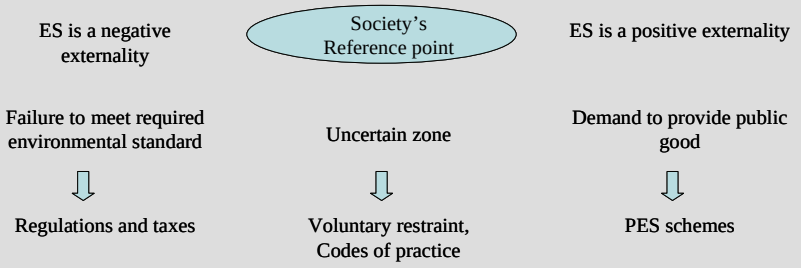
used approaches in the Nordic countries in ensuring a more socially optimal provision of environmental goods. Subsidies are generally schemes administered by governments reaching broadly across economic actors and sectors to which generators of externalities can choose to participate.

Ideally, subsidies should be introduced in situations where the land owner or agent provides a *positive* externality where the subsidy is a compensation of a legal right to forego income of an alternative use or management of the land. In reality, subsidies are often provided to land owners to reduce *negative* externalities based on their historically claimed right to do what they want with their land (e.g. Bromley and Hodge, 1990). Box 3–2 describes two ways of determining whether an ES is a positive or negative externality.

Box 3–2 When is an ES a Positive Externality?

One way of looking at determining whether a service is a positive or a negative externality is to use a culturally/politically determined reference point of quality or availability of a specific service. Below this level, the service is perceived as a negative externality and the land managers should be taxed or otherwise regulated. Above this reference point, the service is a positive externality where land managers should be compensated for undertaking a certain activity (Hodge, 1989; Hodge, 2000; Bromley and Hodge, 1990).

Figure 3-2 Determining Approaches to Environmental Management



Source: based on Hodge (2000).

Another way of looking at deciding between negative or positive externality is the actual property rights or in other words the level of political clout (legal or cultural rights). A well-known example are farmers in the European Union who traditionally have been allowed to do as they please and no politician to date have dared propose they should act under a polluter pays principle as is the case in industrial installations.

Payment for Ecosystem Services (PES) is similar to a targeted subsidy with a strong component of *conditional performance contracting* (approach circled in Figure 3–1). The theory behind PES approaches is based on the Coase theorem which states that the problem of externalities can,

under certain conditions[7], be overcome through private negotiations between affected parties (Coase, 1960). Examples of PES/targeted subsidy in the provision of ES comprise the support to agri-environmental measures under the EU Common Agricultural Policy, which is government financed. PES can also be negotiated directly between providers and beneficiaries of ES (user-financed PES). Common for the different set-ups of PES schemes is that the provider of the ES should only be paid under the condition that the specific service is delivered or a specific land-use likely to secure that ES is in place. If the land-owner does not deliver the service, payment should stop. A widely recognised definition for PES has been proposed by Sven Wunder from Center for International Forestry Research:

Box 3–3 A Definition of Payment for Ecosystem Services

Payment for Ecosystem Services is:

1. a *voluntary* transaction where
2. a *well-defined* environmental service (ES) or a land-use likely to secure that ES
3. is being "bought" by minimum one ES *buyer*
4. from minimum one ES *provider*
5. if, and only if, the ES provider continuously secures ES provision (*conditionality*)

Source: Wunder (2005)

PES is an incentive-based approach to conservation and ecosystem management that has attracted increasing interest from environmental policy makers in recent years. The ES approach is different from other approaches to natural resource management because of the focus on managing natural assets for the values they provide, rather than focusing on the problems that arise from inappropriate natural resource management (Binning et al., 2001). PES is not one single mechanism, but a series of mechanisms that are all based on the underlying theory that resource managers that are in a position to provide ES should be compensated for their costs of doing so, and that the beneficiaries of these services should pay for it. In fact, one of the most important defining features of PES is that one or more beneficiaries pay for the ES, either directly or through an intermediary (e.g. an organisation). This is in contrast with the common "polluter-pays-principle" in environmental policy, and is in effect a "bribe" to stop or reduce an environmentally harmful activity. In economic terms, PES is identical to a targeted subsidy[8].

[7] The main condition is that costs of negotiating and enforcing a deal (the so-called transaction costs) are low (i.e. not higher than the overall gain that can be achieved and shared between the parties if a deal is made). In this interpretation of the Coase theorem, government may be one of the actors, not just private agents.

[8] Though when a PES agreement is reached between economic agents without government involvement, the payment is of course not a "subsidy" in a strict sense. Further, if such deals material-

There are two ways of thinking about how e.g. a government might set the payment rates for PES: one based on the willingness to pay (WTP) of society for the benefits, the other on the supply price (minimum willingness to accept (WTA)) compensation of the seller, i.e. the reserve price). In private PES markets, these act jointly to determine the equilibrium price. PES schemes are mainly found commercialised today in the areas of sequestration of carbon, in the protection and regeneration of watersheds and biodiversity and in the protection of landscape beauty[9]. Equivalently to other externalities, the socially optimal provision level of an ES is the point at which the marginal cost to a land owner (or several cooperating owners) of providing that service (or the management activities giving rise to that service) equals the beneficiaries" WTP for that marginal change.

Other direct market-based voluntary approaches comprise *land acquisition*, where for instance public agencies or conservation funds purchase land for conservation purposes or afforestation. Examples include Danish afforestation initiatives, where the Danish Forest and Nature Agency together with local municipalities purchase farmland for afforestation purposes on a voluntary basis (Zandersen et al., 2007), or the voluntary land consolidation programme, where support from the Rural Development Programme can be provided to establish wetlands, forests, or protect drinking in Denmark (Danish Food Industry Agency, 2009). The voluntary forest conservation scheme in Norway is another example. Under this scheme forest owners report interest to the Ministry of Environment through their forest association to have their forest assessed for the establishment of reserve protection. If the forests qualify regarding biological criteria (i.e. contributes to missing elements of the overall biodiversity strategy), the government will enter into negotiations. The forest owner will get payment for foregone timber revenue according to a standard compensation formula and the land ownership will be transferred to the government[10].

Conservation *easements* and *pre-acquisition* are other ways of preventing that certain types of land uses or developments take place on private land. A landowner voluntarily agrees to have certain legal rights forfeited or removed in perpetuity provided a certain payment or tax relief, while keeping the property rights. Easements selectively target only

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ise, e.g. between conservation organisations and private land owners, there may be no need for government to regulate specifically. Hence, our main concern here are those schemes that are set up directly or indirectly by government to deal with an externality problem which may not be solved in private markets for various reasons (i.e. where the so-called Coase Theorem predicting that all externalities will be solved through negotiation between actors in markets, does not apply).

[9] There is another category of compensatory payments that may not fall under a strict definition of PES such as compensation payments for loss of livestock to predatory animals in Sweden, Finland and Norway, where farmers and reindeer herders get compensation for loss of animals to wolves, bears etc. In Denmark examples include compensation to farmers for loss of seeds on fields where trekking geese stop on the west coast of Jutland.

[10] See e.g. http://www.regjeringen.no/nb/dep/md/pressesenter/pressemeldinger/2008/store-skogarealer-vernet-i-dag-. html?id=541132

those rights necessary to protect specific conservation values, such as water quality or migration routes. In pre-acquisition, the State, for instance, purchases the land, implements an easement and sells off the land again, which is the equivalent to the State being a conservation buyer.

Although land acquisition and easements are considered as one of the most direct and hence efficient ways of ensuring preservation and restoration of certain ES, there is a non-negligible risk of spending conservation money on land that may not provide the highest level of ES with subsequent difficulties of reversing the measure afterwards. This risk is related to the problem of asymmetric information, where buyers of land or easements do not know landowners" supply price, neither can they easily distinguish between high- and low-cost suppliers. As a response to this problem of asymmetry, there is an emerging use, trial and study of different mechanisms to "reveal" the private supply price of landowners such as through different types of auctions and contract designs etc.

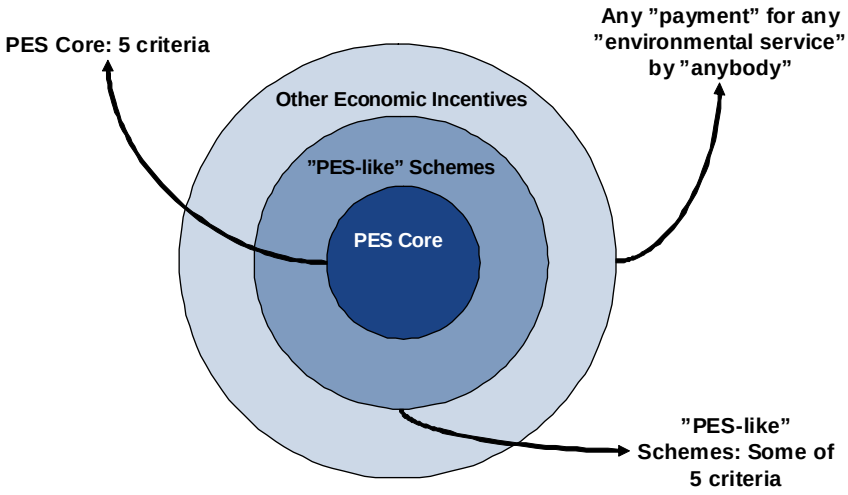
Distinguishing PES and PES-like schemes

The definition of PES in Box 3–3 proposes a strict set up for PES by requiring the PES to be a *voluntary* transaction between a minimum one *buyer* and minimum one *seller* of a *well-defined* ES and with a strong *conditionality* attached. This strict definition of PES places the instrument under conditional performance contracting in Figure 3–1.

However, many of the instruments in Figure 3–1 are sometimes referred to as PES in the literature (e.g. in Jack et al. 2008). In reality, many initiatives comply with only some of the five requirements and can be characterised as "PES-like" programmes. For instance some programmes may not have buyers paying voluntarily for the service or other programmes may only have a low conditionality implemented or have a weak additionality. Figure 3–3 illustrates the gradient between core PES schemes complying with the five criteria to the PES-like schemes that meet some of the five criteria and in periphery other economic incentives such as salaries for nature reserve guardians, reforestation subsidies etc.

For the purpose of this report, we do not limit ourselves to the theoretical, strict definition of PES which would narrow the scope of interesting incentive instruments unnecessarily. Instead we consider a range of economic incentives as PES where payments are made to achieve higher levels of ES streams in different contexts.

Figure 3–3 PES schemes, PES-like schemes and Other Economic Incentives



Source: Wunder, 2009

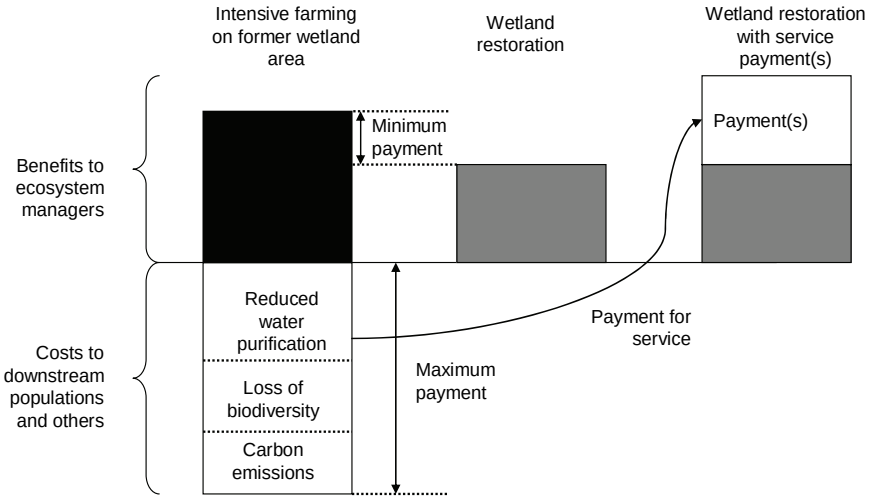
3.2 Understanding how PES works

3.2.1 Logic of PES

The logic behind PES approaches is illustrated in Figure 3–4 using an example of wetland restoration on intensively managed farmland, adapted from Engel et al. (2008). The figure shows that the minimum payment to the ecosystem manager has to equal the benefits given up (i.e. the opportunity cost) by converting from the privately most optimal land use to the socially desired land use, plus any private marginal costs of producing the ES (not shown in the figure, e.g. blocking drains to recover wetlands, fencing to exclude grazing livestock etc.). The maximum payment equals total costs to the public from reduced provision of ES such as reduced water purification leading to eutrophication and loss of biodiversity, and increased carbon emissions, if the privately most optimal land use is adopted. The actual payment from service users does not necessarily have to fully cover all benefits they enjoy from the preferred land use[11], but must be sufficient to make the socially desired action the more attractive option for the ecosystem manager.

[11] In many cases the exact total benefits are not known or do not need to be known, for a PES scheme to be set up. As long as the benefits are likely to be larger than the opportunity costs of the land owner, a PES scheme may be beneficial.

Figure 3–4 The logic of payments for environmental services



Source: Adapted from Engel et al. (2008).

In Figure 3–4, the supply price (payments) is less than the value of avoided damages (reduced water purification, loss of biodiversity and carbon emissions), but this may not always be the case.

3.2.2 Building up PES programmes

A number of aspects need to be considered when deciding to establish a PES scheme. These include i) understanding the link between land uses and provision of ES as well as the magnitude of value of the ES to beneficiaries; ii) identifying buyers and sellers; iii) designing the payment set-up; and finally iv) clarifying ownership structure and trust. These are briefly described below.

Understanding and valuing ecosystem services

ES are complex and they need to be defined, measured or linked to a specific land use, if the payment cannot be attributed to the ES itself. In order to establish a PES programme, scientific analyses need to be undertaken on assessing how ES are generated and what their relationship is to different land uses in order to get a clear understanding of the ES in question. The collection of scientific information is costly, and there will always be a trade-off between the amount of information gathered and analyses undertaken to design an effective PES scheme on the one hand and the costs associated with doing so on the other hand (Mayrand and Paquin, 2004).

When measuring and valuing ES, it is important to note the difference between establishing the value of an ES and the price that buyers and sellers of ES can agree on. Knowing the value of an ES at specific locations is important but not essential in setting up a PES scheme. It is im-

portant to know the approximate value of an ES in order to i) select the plots of land providing the maximum benefits of a specific ES; ii) trade off between different types of ES given limited funding; and iii) know the maximum payment that a land steward should receive for providing the ES. The latter refers to the Total Economic Value (TEV) (See Section 4–1). TEV corresponds to the maximum payment to ecosystem managers as illustrated in Figure 4–1. Since the actual payment in PES does not need to cover TEV, but rather compensate the land owner for foregone profit, it is not always necessary to estimate the total value of a benefit.

From a demand side perspective, two main approaches to valuing ES exist. Firstly an estimation of economic *benefits* associated with ES and secondly an estimation of *costs* associated with the implementation of the project and where benefits are assessed in non-monetary terms. A number of market and non-market valuation techniques[12] are available to measure benefits of ES, depending on the context, type of ES and identified beneficiaries. Cost-only approaches aim to reduce the complexity and time consumed in measuring benefits of ES by using the costs of implementation of the activity at different plots of land combined with biophysical scoring methods to spatially target where to contract PES in order to obtain maximum effect for the payment (Ferraro, 2003).

From a supply side perspective, finding the acceptable price of providing ES involves revealing (through auctions) or estimating the costs of maintaining ES such as opportunity costs of land use, costs of land use, farm budgets, proxy variables such as distance to road or trying different contracts with different providers and competitive auctioning.

The efficient price to be paid for the provision of a specific ES lies somewhere between the willingness to pay by beneficiaries (demand side approach) and the minimum payment that would compensate the land owner for the foregone profit and costs of implementation (supply side approach)[13]. A number of practical issues arise relating to heterogeneity that PES schemes should ideally accommodate for in order to ensure efficiency. These issues relate to:

i. how the level of actual service provision differs across the landscape;
ii. how the level of threat of resource degradation differs across the landscape;
iii. how the cost of implementation differs by the land steward and location;

[12] Examples include market price methods, productivity method, hedonic pricing method, travel cost method, damage cost avoided, replacement cost and substitute cost methods, contingent valuation method, contingent choice method and benefit transfer methods. Annex 2 contains an overview of valuation methods for different ecosystem services. References of relevant literature on valuation of ES and biodiversity were given in footnote 3 in Chapter 1.

[13] Assuming that the willingness to pay is higher than the willingness to accept and the transaction costs involved.

iv. how the level of opportunity costs differs across land managers depending on the spatial location to for instance population centres;
v. how the willingness to pay for ES varies geographically among populations
vi. whether the PES scheme can be set up to offer a variety of contracts to choose from.

Identifying buyers and sellers

A prerequisite for using PES is that there is an existing demand larger than cost for an ES or that such demand can emerge given appropriate conditions. Identifying who are beneficiaries and who are willing to pay for the ES is therefore crucial. PES schemes can be divided into two categories: user-financed schemes where buyers of ES are actual users of ES, and government financed schemes, where a government or an institution acts on behalf of the service beneficiaries. Potential sellers of ES are actors in a position to provide the services in question through management decisions they make. This means that potential sellers for example can be forest owners, farmers, or land holders in general.

Designing a payment scheme

A well designed payment scheme will make the desired action beneficial to all actors involved in the PES programme. To achieve this, there needs to be recognition of the goods and services provided by the ecosystem and that these ES can be traded at a price agreed upon by all parties involved (Smith et al. 2006). PES is flexible when it comes to the design of the actual payment to the ES provider.

One issue to consider when designing a payment scheme is whether the payment should be based on environmental outputs rather than management actions. In the former case, the risk of non-delivery of the ES is put on the landowner, since not all of the production process for ES is in her control (e.g. weather pattern, bird migration). This would be equivalent to landowners supplying the market with agricultural products and buyers paying for the output and not for the activity producing the output. Here, the risk of a poor harvest is put on the land owner. If a payment scheme for ES is based on the environmental output, it may be necessary to think about how to compensate for this additional risk or how to insure against it.

If the payment scheme is based on management actions, the risk of non-delivery is put on the buyer of the ES. This is frequently done if the ES is difficult to define and monitor, such as watershed services. Payments are then made for the delivery of ES proxies, such as payment based on the number of hectares that are put under a more extensive management practice or an area that is taken out of production.

Another issue to consider when designing a payment scheme for ES is the desirability of spatial coordination. Most ES benefit from landowners

enhancing the supply of ES in larger rather than in smaller, scattered and isolated areas and other ES profit from landscape corridors. Landscape ecologists seem to agree that habitat requirements tend to be species specific, and species that are more land sensitive need larger habitats for survival (Willis, 1984; Gilpin and Diamond, 1980; Whitcomb et al., 1976; Higgs and Usher, 1980). The provision of ES is therefore best ensured when payment schemes manage to coordinate efforts spatially such that areas under PES are united into one continuous area over private borders. As PES per definition is voluntary, contract designs can help create spatially linked patches of protected land through e.g. agglomeration bonuses, where landowners receive a bonus if neighbouring landowners participate in the scheme, preferably with patches of land bordering to each order (Parkhurst et al., 2002). This may maximise habitat protection and minimise landowner resentment.

PES programmes can also provide non-monetary benefits like training, infrastructure or support for revenue diversification (Mayrand and Paquin 2004). In addition to the compensation paid to the service provider, start up costs, costs associated with training, research, administration, monitoring etc. need to be included in the payment scheme. Final design of the payment scheme that is able to meet established goals of the programme will be subject to a negotiation process. It is crucial for the outcome that identified buyers, sellers and other intermediary partners get involved in the negotiation process at an early stage.

Legal and policy context

Clear and strong property rights, but also trust between the buyer and seller is a prerequisite for the creation of a successful PES scheme. Mayrand and Paquin (2004) split property rights into five categories according to the authority they grant:

- *Access*: The right to enter a defined physical property and enjoy non-extractive benefits, primarily recreational activities.
- *Withdrawal*: The right to extract the resources or products of a system (e.g., catch fish, gather fuel wood and water for irrigation or human consumption).
- *Management*: The right to regulate internal use patterns and transform the resource.
- *Exclusion*: The right to determine who will have an access or withdrawal right, and how those rights may be transferred.
- *Alienation*: The right to transfer the rights of management and exclusion.

In the Nordic context, compared to developing countries where land tenure and rights are major issues, in most cases these rights are relatively clearly defined.

Existing regulatory and fiscal environments also need to be assessed to avoid distorting market signals by creating counter-incentives or otherwise reducing effectiveness and efficiency of the programme. Sometimes it might be useful to modify the regulatory framework and/or fiscal policies to get it more in line with the PES programme. This is important for example to avoid different systems pulling in opposite directions or paying land owners for doing something they are obliged to by law.

A PES scheme needs to include measures for assessing compliance with rules agreed upon by the stakeholders. Response mechanisms to non-compliance can range from remedial action to sanctions, and are used to enforce compliance with the set rules.

3.2.3 Issues when designing PES programmes

As funding for conservation measures and restoration of ES is limited, it is important to ensure *efficiency* in natural resources management. Market based instruments (MBIs) are often referred to as being more cost-efficient than direct regulation as agents are given the freedom to choose the best and least costly response to the regulation. Whether a MBI is more efficient than direct regulation depends on the cultural, economic and institutional circumstances in which the instruments are applied rather than on their general nature. For PES to be efficient, it needs to focus on those situations where privately unprofitable, but socially desirable practices become profitable to land stewards (Engel et al, 2008). There are three main categories of inefficient usage of PES, namely, when:

1. the level of compensation for land stewards is too low for them to take on socially-desirable land uses; or
2. the level of compensation is higher than the minimum payment that the land steward would have accepted to adopt the desir-able land use;
3. the compensation is made for activities that would have been adopted also without the compensation (i.e. non-additionality)

The size and type of payment in a PES system have influence on the likelihood of encountering problems of *social* inefficiency. Payments that are either low, undifferentiated or un-targeted may very well provoke situations as those described under points 1) and 2). *Financial* inefficiency may occur where funds are allocated without having a real and tangible effect as under point 3). The term often related to financial inefficiency is *additionality*, i.e. the change in land use is not additional to what would otherwise have happened without the payment.

Additionality also covers the issue of *leakage* effects. If a PES payment scheme alters a specific land use in an environmentally friendly way in one location only for the specific land use to shift to another location,

the funds have not been used efficiently and ultimately the level or quality of ES provision has not improved overall.

Permanence refers to a continued provision of the ES that beneficiaries have a demand for. If the PES scheme is limited in time, it is important to ensure that some mechanism is in place to ensure benefits beyond the scheme. Numerous examples exist of agri-environmental schemes providing a subsidy for e.g. set-aside for a number of years, and where the original land use returns when the payment stops.

A novel aspect in PES compared to other more traditional regulatory measures is, as mentioned above, the use of *conditionality* (quid pro quo) in the payment. Compliance should be clearly defined; often this is in terms of changes in land use practices or land- and resource-use caps. Monitoring and sanctioning mechanisms for non-compliance should be credible and efficiently monitored for the scheme to be truly conditional.

Government financed PES schemes generally attempt to widen the scope of the PES scheme by including a number of *side-effects* such as rural regeneration and job creation[14]. The inclusion of side-effects is prominent in donor programme initiated PES schemes, where poverty reduction, gender issues and other social objectives are sought included in the scheme. There is evidence that where PES schemes are designed to *also* meet a number of side-effects, efficiency in meeting the core PES objectives is reduced (Wunder, 2009).

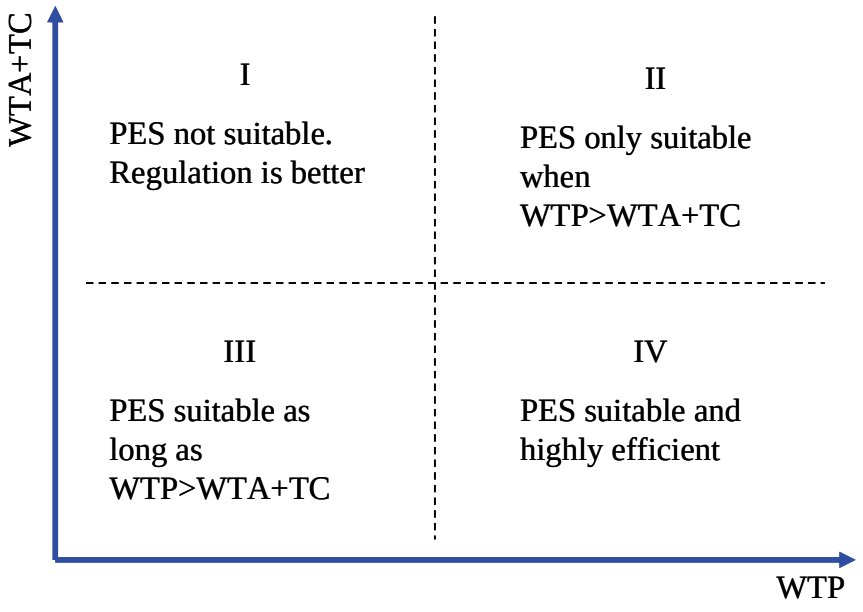
When designing PES programmes, care should be taken not to build in *perverse incentives* for land owners to boost environmental threats in order to get more out of the programme. If payments for example are offered for reforestation, this could increase deforestation if eligibility requirements are not carefully thought through. Careful contract design can limit or avoid this problem.

Finally, *transactions costs* in terms of conducting ecological studies, identifying buyers and sellers, negotiation and design of the payment scheme, monitor of supply of ES and management of the recurring payments need to be paid for. If buyers' Willingness to Pay (WTP) is higher than the service providers' Willingness to Accept (WTA) compensation for trading off the first-best private land use, plus the transaction costs, then the PES can function and have an effect. This means, that where the gap between WTP and WTA is narrow, transaction costs need to be low in order for the PES scheme to function. Figure 3–5 below illustrates the cases, where PES, from an economic perspective, is suitable. We assume here that the ES in question is credibly threatened and/or constitutes a large externality. In quadrant I, the opportunity costs of the landholders and the transaction costs involved in setting up and running the PES are

[14] In some cases, such additional benefits may make it easier for both parties to accept the deal. In the case of voluntary protection of Norwegian forests for biodiversity, a part of one scheme (Trillemarka) has been to set up a community/regional fund for supporting investment in other economic activities in the area to counteract (perceived or real) reduced opportunities for economic activities (e.g. tourism, cabin construction) in the protected areas.

larger than society's willingness to pay for the provision of the ES. The landholders would therefore not voluntarily opt for the PES scheme. As the ES is considered important to society (given the high level WTP), regulation offers the better solution in actually achieving the provision of the ES. In quadrant II, both the willingness to accept compensation in combination with the transaction costs and the willingness to pay for a provision of the ES are high. PES will only work from an economic view if society is willing to at least cover the need for compensation and the transaction costs. This could be a situation where there are multiple ES involved, many sellers or a complex contract design. In quadrant III, both the willingness to pay for the externality by society and the landholders' need for compensation and level of transaction costs are low. Again, as in quadrant II, the PES scheme will only function if society or buyers are willing to at least cover these costs. This could be in a situation, where the ES is fairly simple and the actions to improve or restore the ES straight forward, e.g. ES from extensive grassland. In quadrant IV, society's value of the ES clearly exceeds the costs to compensate the landowner and the transaction costs, and PES would function well under such a condition. This does not mean that society should actually pay the value it attributes to the ES, but the contract design and negotiation will determine the level of payment somewhere between WTP and WTA+TC.

Figure 3–5 Economic Trade-Off in PES



Source: Pöyry

3.3 What types of PES are implemented today?

ES benefits range from what we define as private goods often traded in a market to pure public goods for which markets usually do not exist (See coming Section 4–2). ES in the latter category are often produced as positive externalities arising from different land use or management practices, and it is generally assumed that the social optimal level of many of these services are higher than what is actually supplied, due to market failures. In Section 3–1, PES was placed within a broader group of incentive-based mechanisms that work by altering the economic incentives faced by land managers, thus encouraging an increased production of socially desired ES. Below we explain and discuss the main PES schemes under contractual nature conservation and market creation.

3.3.1 Contractual Nature Conservation

Voluntary contractual nature conservation is a type of PES typically used for nature conservation measures on private land. A contract between a land owner and e.g. a public entity can be applied to compensate the landowner for income losses or opportunity costs experienced. These kinds of contracts are most often used to conserve private land, but public forest companies may also receive compensation from other government budgets. Contractual nature conservation has been a typical way to increase for example forest conservation in Norway, Sweden and Finland, though the level of conflict has been high among private forest owners reluctant to give up ownership to their forest land[15]. The conflicts have resulted in a search for more voluntary mechanisms in these countries which may increase participation. There are also examples on contractual nature conservation programmes on a supranational level, aimed at nature and biodiversity conservation in the EU.

Contractual nature conservation can be either *government-financed*, which is the most typical case in the OECD, or it can be *user-financed* where e.g. local beneficiaries pay the landowners directly for providing the demanded ES.

Voluntary contracts between a public entity and private land managers are a common form of PES, where contracts are agreed voluntarily between the parties for a certain time period. When entering into contracts like this, the government does not act as an authority but as a private entity. The contracts can for example specify a certain kind of land use, conservation or specific land management practices linked to various ES.

Fixed-rate payment in contractual nature conservation is currently the most common payment set-up. Landowners apply for funding and com-

[15] This has been the effect of voluntary conservation combined with expropriation in some case (meaning that the government implicitly have had the use of force as an underlying sanction). Currently, the government of Norway has stated that forests only will be conserved through (real) voluntary participation in the future

pensation for changes in land management activities and the public entity selects the applications which best fit their selection criteria. The fixed-rate payments are not subject to negotiation between the landowner and the buyer of the ES, but they can for instance be differentiated depending on the previous land use, which reflects the level of opportunity cost. Where opportunity costs, threat of resource degradation and/or cost of implementation differ significantly between locations and applicants, fixed rate payments may not offer the best social efficiency. Competitive tendering and auctioning may help address such heterogeneity issues.

Competitive tendering such as BushTender in Australia (See Section 5–2) is an innovative approach used to allocate public funds to various projects in order to secure provision of certain ES. The tendering (or auction) component is implemented so that the body responsible for the tendering may choose to contract the offers that provide most of the ES demanded at the lowest price. This kind of scheme lets land owners establish protected areas based on their willingness to undertake conservation measures on a voluntary basis. The government may call for tenders and chooses the offers that best meet their needs, while landowners are compensated for their economic losses. This is a popular new mechanism considered in many countries, including forest biodiversity conservation in Sweden and Finland (see e.g. Romstad et al., 2009).

Contractual nature conservation is applicable to ES that are strongly connected to a specific piece of land including biodiversity conservation, protection against natural hazards, improving landscape amenities and recreational services. Because the contracts are voluntary for both sides it is a measure that stakeholders usually accept. The land managers know their costs of fulfilling the contract, and will therefore only accept if the compensation received covers all their costs, included foregone profit (and transaction costs involved in making the deal).

3.3.2 Market creation

Creation of markets that trade products, which in turn enhance provision of demanded ES, is another approach to obtaining socially optimal supply of these services. Some of these markets are voluntary for both buyers and sellers (e.g. eco labelling) whereas other markets pose an emission cap on actors in the market (e.g. emission trading) or minimum standards on buyers of ES (e.g. biodiversity or wetland banking). Common for these markets is that they can reduce overall costs of obtaining ES. We classify market creation under PES-like schemes, as they do not function as a targeted subsidy and at times involve compulsory measures on the side of buyers and/or sellers.

Tradable permits can be introduced in order to create a market for environmental externalities. Under a tradable permit scheme there is a maximum limit for the use of a certain resource or the release of pollut-

ants for all actors participating. This total is then divided between the participants in the form of tradable permits or credits. These permits can then be traded between the participants so actors can sell permits they do not need to other participants who need more than their allocation. A trading scheme increases efficiency by allowing companies, developers or landowners to buy permits from actors that are able to comply with a given standard in a cheaper way. The Kyoto Protocol has for example led to creation of markets for carbon credits or offsets, including using the sequestration potential of forests as a carbon credit. Other examples related to ES is the EcoTRADE research project on tradable development rights (See Box 3–1) and Tim Cason's work on non-point source pollution trading from nutrient runoff to waterways from agricultural production (Cason et al., 2003).

Conservation banks can be used to compensate for undesired impacts on biodiversity or landscape caused by development projects. The idea is that projects with negative impacts on ecosystems pay into a bank for compensation. The bank then holds or purchases land where projects are carried out to make up for the negative effects on ecosystems in other places. The concept of conservation banks is commonly used in the US, and increasingly worldwide. Examples include the Mitigation Bank, compensating for impacts to wetlands and streams in the US, Biodiversity Conservation Bank in France and Biobanking in Australia.

Mechanisms that work by creating a market for environmental externalities have the advantage of market mechanisms' efficiency, but transaction costs associated with creating the market and ensuring compliance can be high. Market creating mechanisms are applicable in securing a range of ES including carbon sequestration, biodiversity or habitat conservation, soil protection and extraction of natural resources such as water.

3.4 Summary

Payment for Ecosystem Services (PES) is, despite its relatively novel entry into natural resource management, firmly embedded in the tool box of classical incentive-based environmental regulation. PES is a market-based voluntary approach that is, in its strictest sense, based on conditional performance contracting. It functions similarly to targeted subsidies but with PES, at least one of the parties (buyer or seller) can decline and there is ideally firm conditionality based on efficient monitoring and credible sanctioning in case of non-compliance.

In the literature, several types of economic incentives for ES provision have been termed PES, besides the strict definition. In this report both PES and PES-like schemes are considered. PES works by having at least one buyer of ES pay at least one provider of ES for securing a positive externality such as clean water, scenic beauty or carbon sequestration.

The maximum payment that should be paid is the willingness to pay of beneficiaries for the ES and the minimum payment is the cost that just compensates the land manager for foregoing his legal rights to manage his land in a specific way plus the transaction costs. The price can be subject to negotiation directly between buyers and sellers or it can be set as a fixed payment, which is often found where intermediaries such as governments or NGOs act as the buyer of ES.

There are a range of issues that need to be considered in the design of PES schemes. These include, for instance, whether the activities would have happened also without payments (non-additionality), whether to compensate for specific ES outputs or certain management actions (proxies of ES outputs), spatial coordination of several adjacent land owners, the permanence of the ES over time (both in terms of time-limited contracts and leakage of externalities to other areas) and the level of transaction costs to set up and manage a PES scheme.

PES schemes can be found implemented either as contractual nature conservation schemes, where the landowner enters into a performance contract with a government body or directly with beneficiaries, or it can be the result of attempts to create markets for ES that are not otherwise traded on the markets, such as through tradable permits, conservation banks or eco-labels.

4. Linking Ecosystem services and Economic value

This section links the notion of ES to economic value. It describes the different types of economic value that human society derives from ES and sets forth a framework for thinking about how and which ES become economically valuable, their role in providing human society with benefits and how we value these services. Public-private good aspects are introduced to discuss the different regulatory approaches to dealing with (mainly) negative and positive externalities. This section ends by identifying and discussing different types of beneficiaries and the distribution of rights.

4.1 Integrating Ecosystems and Economic Values

Section 2.1 and Section 2.3 described how ES acquire economic value when they have an impact on our utility and contributes to human well-being. A useful concept for analysing utility that human society gains from different ES is Total Economic Value (TEV). TEV is a welfare concept which is the sum of both the use and non-use values that individuals and society gain or lose from marginal changes in ES. Use values involve an interaction with the ES, either directly or indirectly whereas non-use values are associated with benefits derived from the knowledge that the ES is maintained or restored (see Box 4-1 below). It should be noted that TEV only takes into account marginal changes in ES (such as the value of changes in an ES as a result of a PES scheme).

Box 4–1 Economic values of ES

Direct use values: involve an interaction with the final products of nature such as extraction of fish and minerals, consumption of drinking water or recreational fishing. These activities can be traded on a market (e.g. timber) or can be non-marketable i.e. there is no formal market on which they are traded (e.g. recreation or the inspiration people find in directly experiencing nature).

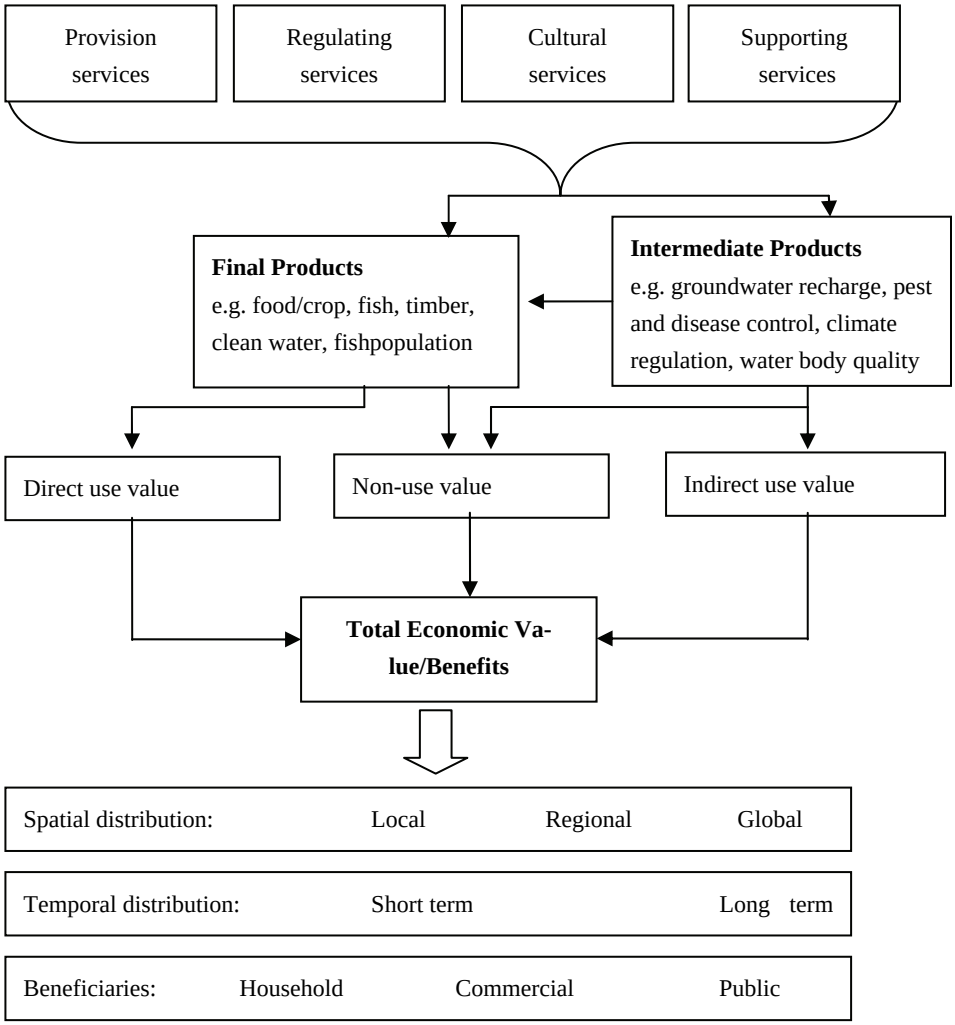
Indirect use values: are derived from intermediate services of the ecosystem such as groundwater recharge, pest and disease control, prevention of downstream flooding and removal of nutrients. These ES are often not noticed by people until they are damaged or lost, yet they are very important. Measuring indirect use values is often significantly more challenging than measuring direct use values. Changes in the quality or quantity of a service being provided are often difficult to measure or are poorly understood.

Non-use values: can be derived both from nature's end products and intermediate products based on the satisfaction of knowing the ES continue to exist (existence value), or associated with the knowledge that ES and ecosystems will be passed on to future generations (bequest value), or derived from knowing that people elsewhere can enjoy ES (altruistic value).

Figure 4–1 presents a framework for thinking about the link between ES, their role in providing human society with benefits and how we value these services. TEV in this framework is a useful tool for exploring what types of values for each ES we are trying to elicit and it helps determine the valuation methods required to capture these values in economic terms. Annex 2 describes the choice of valuation method for different ES and type of economic values.

The framework also makes the conceptual link between the value that we attribute to services and the distribution of benefits in terms of who are the beneficiaries, at what spatial scale do beneficiaries perceive the benefits and at which time-scale (now, in the future or for future generations).

Figure 4–1 Integrated Ecosystem/Economy Framework



Source: Based on Pearce and Warford (1993) and eftec (2005).

Temporal and spatial scales are crucial in the management of ES and have different impacts on benefits and beneficiaries. Spatial and temporal issues are also important when identifying beneficiaries for specific ES in specific areas and assessing the value of the ES to the different groups of beneficiaries. Below, the spatial and temporal considerations are discussed in more detail.

Spatial considerations

ES tend to be spatially explicit, i.e. the production of food and fibre or flood protection and alleviation remain located within one area whereas ecosystem processes (in this report referred to as intermediate products) link distant areas, such as ground, surface and precipitated water.

The spatial issues for ES that link distant areas can be exemplified through a farmer's excess use of fertilisers with resulting nutrient leakage to waterways, causing eutrophication and reduced angling and other rec-

reation opportunities in the catchment area, or the excess use of pesticides in sensitive areas, which may cause pollution of drinking water for local people in the catchment area. Another example is the destruction of old farmland hedgerows supplying aesthetic values, wildlife habitats and protection against soil erosion in order to increase the size of farming plots for larger machinery.

The spatial distribution of ES and of beneficiaries is an essential ingredient when defining the ES and the potential buyers of the ES. An ES is often best evaluated across its full extent and the ecological analysis will need to carefully consider the spatial scale. Moreover, the spatial scale will also need to take account of who the beneficiaries are, whose values may be affected through changes in ES. To evaluate the welfare value of a particular ES, there is a need to understand whether it impacts at a local, regional, national or global level. The population affected by the service will be influenced by the uniqueness of the service provided. For example, a rare species in Finland may have significant non-use values attached to it across a wide population, whereas for a less unique species, values may be held only by a local population.

Temporal considerations

Temporal issues involve short term versus long term effects of land- and waterscape management, where for instance exploitation of ES in the short term leads to a decline in ES in the long term. An example is logging of forests and subsequent conversion to pasture or crop agriculture in the short term, which may lead to a decline or loss of watershed, increasing siltation of waterways, reduced storm protection and other services of forests. These temporal effects may be of such an irreversible nature, that future generations may experience a significant loss in utility from a permanently degraded ES level.

The time-scale at which beneficiaries can reap the benefits of the ES is also important for the design of the payment scheme and for defining who the beneficiaries are. Some ES can take considerable time to develop. For instance, the afforestation of a forest for recreation purposes may only reach a maximum utility for beneficiaries after 30–40 years when the forest is mature, whereas other ES can develop over a short period such as the ecological quality in converting crop-land to low-intensity grassland. Ecological studies of the ES and the link between e.g. changes in management practices and the quality of the ES need to demonstrate how changes will develop over time. Where an ES takes a considerable time to develop and/or where benefits accrue a long time into the future, PES schemes are most often initiated by public agencies, which may be more inclined to represent the interests of future generations.

Example of linking ES from Wetlands to the Economy

Table 4–1 combines the MA framework for classifying ES from wetlands[16] (as an example) with the typology of ES (ends or means), the type of economic value (TEV) and the spatial distribution of beneficiaries of ES at a local, regional and global level.

Picking out a few ES from the wetland ecosystems, Table 4–1 shows that fresh water, fibre and food extracted from wetlands are final products that provide a direct impact on utility and are therefore used directly and valued accordingly under a TEV framework. Beneficiaries for these ES tend to be local and to some extent regional. Climate regulation, water and erosion regulation are processes of the wetland ecosystem that provide an indirect utility to society (hence indirect use value). They can be considered intermediate products of wetlands feeding into final products of direct benefits to human society. Climate regulation is the only ES that has an equal impact on beneficiaries locally as well as regionally and globally. The exact spatial and temporal definition of beneficiaries depends on the specific context, spatial conditions and socio-cultural set up in a given location.

Table 4–1 Linking ES from Wetlands to the Economy

MA Classification	ES	Element of TEV Captured	Beneficiaries		
			local	regional	global
Provisioning					
Food (fish, wild game, fruits and grains)	Final Products	Direct Use	X	X	
Freshwater				X	
Fibre and fuel				X	
Regulation					
Climate regulation	Intermediate Products	Indirect Use	X	X	X
Water regulation			X	X	
Erosion regulation			X	X	
Pollination (habitat)			X		
Natural hazard regulation	Final Products	Direct Use	X	X	
Water purification and waste treatment	Intermediate Services/Final Products	Indirect/Direct Use	X	X	

[16] The range of wetlands as defined by the RAMSAR Convention on Wetlands include inland wetlands (such as swamps, marshes, lakes, rivers, peatlands, and underground water habitats); coastal and near-shore marine wetlands (such as coral reefs, mangroves, seagrass beds, and estuaries); and human-made wetlands (such as rice fields (paddies), dams, reservoirs, and fish ponds).

MA Classification	ES	Element of TEV Captured	Beneficiaries		
			local	regional	global
Cultural					
Spiritual and inspirational Recreational Aesthetic Educational	Final Products	Direct Use	X	X	X
Supporting					
Soil formation Nutrient cycling	Intermediate Products	Indirect Use	X X	X	

Source: based on MA (2005) and eftec (2005)

4.2 Public-Private Good Aspects of ES

Ecosystems produce intermediate and final products that range from goods traded on the market such as timber, fish and medicines to services that are delivered free of charge such as regulation of the climate system, soil formation or erosion control.

Goods that are traded on the market are in economic terms known as *rival* and *excludable*. To be rival means there is less of it to use if someone else consumes it. To be excludable means that one person can keep another person from using the service or good. Services that can be considered both rival and excludable are known as *private goods* such as grain, timber and apples. Services that are rival but non-excludable are known as *open access* or common pool resources. An example is game hunting and deep-sea fisheries that is used at a high level of extraction, where the extraction by one user leaves less to fish or game to another user, but the first cannot prevent the second from fishing. Open access to these resources often results in their over-exploitation, because every user has an incentive to capture the benefits for themselves as quickly as possible before someone else gets them. At the other end of the scale are services that can be seen as *non-rival*, i.e. one person's use of an ES does not preclude another person from enjoying the same level of the ES. Non-rival and excludable services are known as *club goods* below level of congestion such as recreation areas and hunting reserves, where the group of users can be restricted according to property rights. Non-rival and non-excludable goods are considered *pure public goods*, for example the ability of the atmosphere to cleanse itself of pollutants or the water regulation of runoff, flooding and aquifer recharge.

The reason why the distinction between rival/non-rival and excludable/non-excludable ES is useful here is that externalities, i.e. unintended negative or positive effects of an economic activity on others, most often occur for ES that are non-rival and/or non-excludable. PES can help internalise such externalities, i.e. give them a positive price or value that economic agents take into account in their decisions.

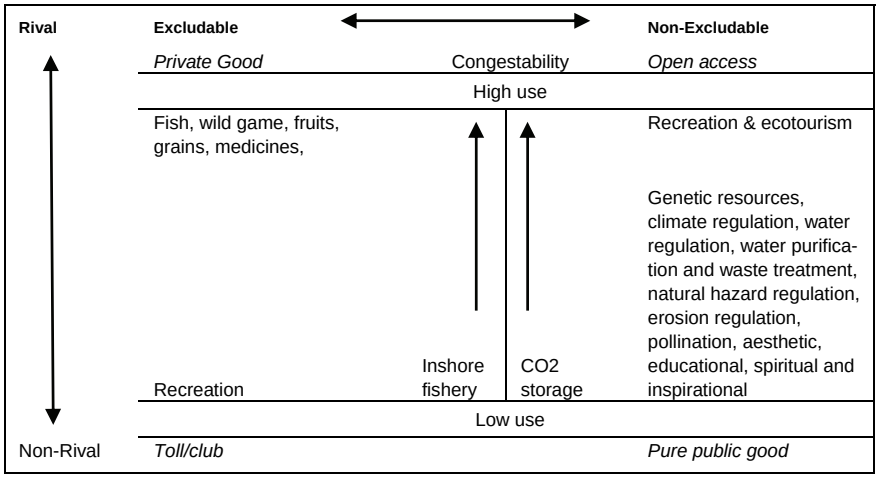
Public-Private Good aspects of Wetland Services – an Example

The MA utilised i.a. the public-private good dynamic to draw distinct boundaries between different ES. Taking wetlands as an example, Figure 4–2 shows that most regulating and supporting services are pure public goods while most provisioning services are private goods. The category of pure public goods coincides largely with the classification made previously of intermediate products whereas private goods largely correspond to final product in the ES classification.

There are inevitably different levels of rivalry and excludability for some of the ES that depend on the different social solutions for each type. The complexity of understanding how ES fit into the public-private goods space is not just a function of ecosystem dynamics, but also dependent upon the social systems, technological possibilities and use of service.

An example of how the use of a service can move between rival and non-rival is inshore fishery derived from wetlands. As the level of fish extraction reaches unsustainable levels, the service moves from being a non-rival good (there is sufficient fish to catch for the beneficiaries) to a rival good (extraction reduces the possibilities for other beneficiaries to benefit from the service). The same analogy can be applied for recreation in low or high levels of congestion. An example of how social solutions can determine whether ES are excludable or non-excludable is recreation with entrance fees, for instance to a wetland reserve, and open access to marsh lands, based on the free public access for forests in Sweden and Finland. Among pure public goods, a gray scale can be observed for instance with genetic resources, that are non-exclusive until a patent prevents the information or resource to be used, such as the patenting of genetic resources for medicine.

Figure 4–2 Public-private good aspects of ES from Wetlands



Source: Based on Fisher et al., 2009

From a regulatory perspective, problems in ensuring a socially optimal provision level of a specific ES arise for club goods, pure public goods and common pool resources. In the following section, we will identify and discuss different types of stakeholders and how these stand with regard to the public-private good aspects of ES and the distribution of rights.

4.3 Regulatory approaches to dealing with Public Goods and Externalities

The ultimate goal of environmental policy is to provide the right levels of public goods and to control negative and positive externalities to a level which reflects the preferences of the population in terms of their willingness to pay for such goods (i.e. their willingness to give up other goods for environmental benefits). This is the idea of socially efficient environmental policy. Pure public goods, which are located in the bottom right corner of Figure 4–2 above, are usually underprovided because no single entity can capture or collect peoples' WTP for the benefits and individuals can free ride on the contributions of others.

When it is difficult to measure economic values of negative and positive environmental changes, policy targets are typically set instead based on different considerations (usually including an idea of the magnitude of economic value). For policy instruments to be cost effective (rather than to be socially efficient[17]), they need to contribute to reaching the policy targets at least cost. A third criterion used to assess policy instruments is the effectiveness or certainty in reaching a policy target.

In textbook economics, many of the instruments discussed in Section 3, both command and control and market-based incentives can be used to reach efficient levels of environmental goods. However, the high level of information required and the costs of administration (among other reasons) make command and control (direct regulation) less attractive for certain environmental externalities or goods. There is an increasing trend in environmental regulation to use economic incentives, e.g. taxes and tradable emission permit schemes to regulate pollution problems. The main advantages of market-based instruments are that they equalise abatement costs across sources and leave the individual source flexibility to reduce emissions in the best way. The advantage of direct regulation (e.g. non-tradable emission permits) is that the exact level of emissions from say a large point source is (more) certain.

The efficiency of market-based instruments rests on a number of assumptions, including full information about abatement costs (to the

[17] The "socially optimal" or efficient level of environmental pollution/impact is where the WTP for the last unit of pollution emitted equals the marginal cost of reducing that unit. To reach this level, not just abatement cost curves need to be known, but the marginal damage curve. "Cost effectiveness" means reaching a target at least cost (whether the target is the optimal level or not is another matter).

agents, not necessarily to the regulator), that the marginal environmental damage curve is known and that there are competitive markets. If any of these assumptions are violated (which to varying degrees is the case in practice), combination of different instruments may be required. This is the so-called second best world of regulation, which may be incredibly complex when multiple externalities and market-failures are considered at the same time. In such situations it is very difficult to assess which instrument is the most suitable. It is often the case that market-based instruments may be more efficient if combined with other types of instruments (for example both direct regulation and information measures) (see Econ Pöyry (2009) for a discussion).

ES are to varying degrees pure public goods. They do not lend themselves readily for standard taxes and subsidies (or tradable permit schemes), levied on the source of the environmental problem across many sources. ES are, as discussed, typically very site specific – and so are the costs of providing them and the ES benefits of certain actions on the land. Equivalently to other externalities, the socially optimal provision level of an ES is the point at which the marginal cost to a land owner (or several cooperating owners) of providing that service (or the management activities giving rise to that service) equals the beneficiaries' WTP for that marginal change. If the beneficiaries are few or well-coordinated, PES agreements may arise without government involvement (as predicted by the Coase theorem). When the goods have higher degree of non-rivalness and non-excludability, government intervention may be required to realise a move towards a more socially optimal provision of ES, through government-initiated PES schemes. There are such beneficiary PES schemes to be "harvested" as long as the sum of WTP for the ES are higher than the costs (WTA, the reservation price) of the land owners and the costs of doing the transaction.

In a similar way to other environmental policy instruments, the assumptions underlying efficient PES schemes are rarely fulfilled in practice. For example, the uncertainty about the link between certain management activities and the level of ES and the difficulty of measuring ES, complicates the design of payments to ensure environmental effectiveness. Also, the costs of these management actions (and opportunity costs of changing land use) may only be known to the land owner. There is asymmetric information which may be used by land owners to extract so-called information rents. This problem can be somewhat reduced, as discussed earlier, through the use of e.g. auctions.

Further, since the ES typically are site specific, it is not so easy for the government to create standardised payment schemes, e.g. on a regional or national scale. This drives up transaction and administration costs. The problem is similar to problems associated with standard command and control regulations for more classic environmental issues. Finally, PES schemes may suffer from similar problems as other subsidy schemes,

e.g., perverse incentives in terms of excess entry and production for example in sectors generating negative ES externalities, since average costs of land owners are reduced. Another problem with subsidies, of course, is the demand they put on government budgets. Raising these funds through taxes has well-known distortionary effects throughout the economy.

Hence, it is difficult to move the analysis of environmental policy instruments from the textbook to real world applications – and to judge the suitability of instruments on a general level. Similar to other environmental policy instruments, then, when assumptions of the ideal case is violated to varying degrees, PES schemes may function best if backed-up by or combined with other types of instruments. In the case of payments to forest owners for biodiversity benefits for example, it may be very effective to combine a payment scheme with information/educational instruments to reinforce the effect of both instruments (e.g. as seen in the area of energy efficiency where price and information campaigns work together making consumers more alert).

In the next chapters, specific cases are analysed to give examples of areas where PES schemes are used and how such schemes have worked – shedding light on the suitability of PES schemes compared to other environmental policy schemes.

4.4 Beneficiaries of ES

In order to identify different types of beneficiaries of ES, we have based the analysis on the ES that provide a direct utility to stakeholders. The groupings that we have identified benefit in a number of different ways from nature's provision of ES. The differences among the groups of beneficiaries can be related to:

- the type of benefit that is demanded (i.e. adequate resources, protection, benign physical & chemical environment and socio-cultural fulfilment, see Table 2–1);
- the type of use of the service (i.e. direct use value, non-use value or indirect use value, see Figure 4–1); and
- the type of public/private good that is demanded (i.e. private, pure public, open access or club good, see Figure 4–2).

Beneficiaries of ES can be grouped into i) individuals and communities; ii) commercial entities; and iii) the public or semi-public sector at the local, regional and global level. The same groupings apply for future generations. Table 4–2 lists the different types of beneficiaries at different spatial scales and examples of beneficiaries.

In terms of public/private goods, commercial entities tend to manage their activities in order to maximise the private good service delivery of

nature[18] by harvesting natural resources such as fish, timber and crops whereas individuals, communities and the public sector demand and profit from services that are generally pure public, club goods or services with open access. In terms of benefits derived from ES, commercial entities demand primarily the provision of "adequate resources" from nature in order to process and sell these on the market, whereas individuals, communities and the public sector demand to a large extent "protection" from nature's whims and "socio-cultural fulfilment'[19]. The public sector acts as the intermediary between citizens and commercial entities, through the collection of taxes and other revenue related to resource rents, concessions and tourism and the redistribution of revenue to the benefit of the general public. The public also acts as an intermediary in regulating and otherwise using positive or negative incentives to influence land-owners' management of natural resources, balancing off the preferences of commercial entities and community.

Table 4–2 Beneficiaries of ES with focus on Nordic Conditions

Present/Future Generations	Local	Regional	Global
Individuals/communities	Local users (e.g. recreational anglers, recreation, housing)	Households within catchment area; tourists, consumers	Tourists, consumers
Commercial entity	Local industry (e.g. farmers, foresters, fishermen, food & timber processing, water producers, entrepreneurs, traders, artisans)	Economic sectors (e.g. farming, food processing, water producers, forestry, fishery)	Global enterprises, global sectors
Intermediaries (public & semi-public sector)	Local government	Regional/national government	International community

4.5 Distribution of Rights

Conflicts arise when beneficiaries of ES are adversely affected by actions undertaken by landowners reducing or degrading ES either within or outside the landowner's own property. The conflict is in essence a conflict between "rights" of a land owner to do as he/she wishes and the "right" of other members of society to be free from the unwanted effects of land uses.

A property right gives the legal ability to ignore the wishes of those without such rights (Bromley and Hodge, 1990). It is however rare that a

[18] Commercial entities indirectly depend upon the well-functioning of a number of pure public goods such as pollination, water regulation and soil formation, however commercial entities rarely manage their business in order to optimise the level and quality of pure public goods.

[19] We imply that in the western world, apart from leisure activities such as angling and hunting, individuals and communities do not demand the benefit 'adequate resources' directly from nature as most of these goods are traded on the market and delivered by commercial entities. This is of course different in developing countries with a high degree of subsistence economy.

land owner enjoys pure property rights by holding *all* the rights to the resource. Most property rights contain some restrictions, which are often placed on certain behaviours by the state along with cultural and social restrictions. For instance, a land owner is in most European countries not allowed to undertake clear felling of larger areas of forest without an authorisation via e.g. a felling licence and a farmer is not allowed to bring out manure during certain periods of the year or use certain types of pesticides.

Despite the legal and cultural restrictions that land owners operate under, the existing property rights in land remain the product of an earlier time when the greatest priority was given to the production of food, fibre and timber. Preferences in society today towards e.g. landscape aesthetics, clean waterways, biodiversity and recreation services have however increased to a level where the traditional management of landscapes and catchment areas does not seem to deliver a socially optimal level of ES[20].

4.6 Summary

ES can be captured in economic terms as providing direct, indirect or non-use values to human society. Total Economic Value (TEV) is the welfare concept behind these economic values and it represents a useful tool for thinking about who are the beneficiaries, what ES are important for them, and what kind of value beneficiaries attach to ES. If decision makers need to know the value of an ES to a specific part of the population, TEV can help guide which valuation methods are appropriate to apply for which kind of economic values and type of ES. The integrated ecosystem/economy framework flags up the importance of considering spatial and temporal scales when managing ES. Spatial and temporal considerations are important in terms of identifying beneficiaries, understanding the dose response relationship, in terms of assessing the level of welfare impacted by a change in the ES where there is an important time lag between implementation of a project and the full extent of the benefit and in terms of analysing the full extent of the ES.

Public-private good aspects of ES are essential elements in understanding which ES are relevant for a PES scheme. Negative externalities most often occur for ES that are non-rival and/or non-excludable, i.e. when ES are pure public goods, club goods and/or are subject to open access. The complexity of understanding how different ES fit into the public-private goods space and how these can be best managed is not just a function of ecosystem dynamics, but also dependent upon the social system, technological possibilities and specific use of ES.

[20] An indication of these preferences is higher income elasticities of demand in the industrialised countries for rural amenities such as improved environmental quality and viable rural communities than for increased food and fibre production (Bromley and Hodge, 1990).

ES do not lend themselves readily for standard taxes and subsidies (or tradable permit schemes), levied on the source of the environmental problem across many sources. ES are typically very site specific – and so are the costs of providing them and the ES benefits of certain actions. Equivalently to other externalities, the socially optimal provision level of an ES is the point at which the marginal cost to a land owner of providing that service (or the management activities giving rise to that service) equals the beneficiaries' WTP for that marginal change. If the beneficiaries are few or well-coordinated, PES agreements may arise without government involvement (as predicted by the Coase theorem).Moving from textbooks to the real world introduces many complexities in the choice of suitable environmental policy instruments. PES is no exception and comparison with other instruments is best carried out on a case by case basis. PES schemes may in a second-best world be more efficient if combined with other instruments, e.g. information campaigns.

Beneficiaries of ES can be grouped into individuals and communities; commercial entities; and public or semi-public sector at the local, regional and global level. The same groupings apply for future generations. Conflicts due to sub-optimal delivery of ES are oftentimes a conflict between rights of a landowner to do as he/she wishes and the right of other members of society to be free from the unwanted effects of land use. Although it is rare that a land owner enjoys pure property rights as legal restrictions to some extent are in place, there is increasing demand from the public for improved provision of pure public goods such as clean waterways, biodiversity and high quality recreation services. This may indicate that the traditional management of landscapes and catchment areas does not deliver a socially optimal level of ES.

5. Examples of PES Schemes in OECD countries

There is a variety of existing PES schemes in place throughout the world. In the following, examples of existing PES schemes in OECD countries with relevance for the Nordic countries are briefly described. The examples are chosen to provide a diversity of approaches, types of ES and payment schemes to illustrate some of the issues discussed in previous chapters. The examples are presented under four main headings, according to their contractual set-up:

- Fixed-level grant payments
- Competitive tendering
- Conservation banks
- User-financed PES scheme

Chapter 6 will use the theoretical and conceptual discussion in Chapters 2–4 and the practical examples presented here to analyse two Nordic PES cases more in detail. Chapter 7 will draw out the main issues and options related to PES for the Nordic

5.1 Examples of PES with Fixed Level Grant Payments

High level stewardship, agri-environment scheme in England

Environmental Stewardship is a government scheme targeting farmers in England, rewarding good stewardship of the land to improve the quality of the environment. The scheme is a key part of the Government and EU funded Rural Development Programme for England 2007–2013. Entry Level Stewardship (ELS) is a basic underlying scheme that is open to all farmers and land managers adopting specified management options across England. There are over 50 management options to choose from, suitable for most farm types (e.g. hedgerow management, providing wild bird cover and creating buffer strips). Land entered into the scheme receives £30 per hectare per year, and agreements last for five years.

Higher Level Stewardship (HLS) builds upon the ELS, but includes more complex types of management. Unlike ELS, the level of payment received under the HLS is connected to the amount and quality of ES delivered. Funding is also available for different kinds of capital works including hedging, pond creation and historic building restoration. 110

areas across England have been identified as target areas for HLS in order to maximize environmental outcomes and cost-effectiveness. Target areas cover roughly one third of the country. Land outside the target areas can also be considered for HLS based on regional and national priorities.

A Farm Environmental Plan (FEP) identifying the important environmental features on a farm needs to be prepared and submitted together with the HLS application, and the land also needs to be included in ELS. Farmers applying for HLS will receive advice and support form experienced advisors from the start of the application process and through the duration of the agreement to help ensure that the agreement is successful and objectives are achieved. Participating farmers receive payments for the agreed management options every six months. Payments for capital works may be claimed on completion, and depending on the area of the land at least £395 may be granted to complete a FEP. HLS agreements last for 10 years (Natural England, 2009).

BIOSA network of land owners for nature conservation in Austria

In Austria contractual nature conservation are widely used for conservation purposes. Programmes for contractual nature conservation exist in all federal provinces and on the national level. BIOSA (Biosphere Austria) is an association for owners of agricultural land and forests who voluntary dedicate land to cultural landscape research, scientific projects or the development of a new form of dynamic conservation. BIOSA offers nature conservation services to public bodies or private organisations, and have many years of experience with voluntary contract conservation. Because landowners on a voluntarily basis can choose to protect valuable biotopes and in many cases get paid for it, contract conservation is preferred to enforcement. BIOSA receives offers on biotopes including streams, lakes and ponds, moors, wetlands, dry pastures, hedgerows, alpine grazing, woodlands, caves, forest verges and orchards. Together with the landowner and scientists, BIOSA develops an individual project for each biotope. The project may take the form of an eco-management project or a project involving scientific research. The involvement and responsibilities of the owner is defined and included in the contract. BIOSA are responsible for conservation contracts covering 3000 hectares, and are also involved in educational, public information and eco-sponsoring projects (BIOSA, 2009).

Blue mussel farming to improve water quality in Lysekil Municipality, Sweden

In Sweden, several initiatives and pilot projects are underway to use blue mussels to catch eutrophying nutrients leading to improved water quality and to use the mussels as forage or nutrient for organic agriculture. Eutro-

phication is the most severe environmental problem in the Baltic Sea today (Baltic Sea 2020). Whereas much has been undertaken over the past decades to reduce point source pollution (e.g. waste water treatment plants), little has been done to reduce nutrient leakage from diffuse sources such as agriculture. Blue mussels may prove to be an effective environmental measure in this regard. Until recently, however, there have been few economic incentives to harvest mussels with the aim of improving water quality, either due to pollution from point sources or diffuse sources.

In Lysekil Municipality, a payment mechanism has been set up whereby the polluter (the local waste water plant) pays a mussel farmer to remove nutrients from the coastal waters. Payments are based on the content of nitrogen and phosphorous in the harvested mussels. The mussels are located a couple of kilometres from the point source on 20m depth and are subject to the same quality requirements as commercially sold mussels. The waste water treatment emits yearly 39 tonnes of nitrogen to Saltöfjorden. Project results show that 3,500 tonnes of blue mussels per year help remove 100% of the nitrogen emissions of the waste water treatment plant. Minimum requirements for the plant are 70% removal of nitrogen. As an add-on the mussels also capture phosphorus and organic material which would otherwise put stress on the marine environment. The use of mussels to clean the nitrogen content of the Lysekil waste water plant saves the municipality close to EUR100,000 per year compared to using a traditional technique (Lindahl and Lovén, 2008; Holm and Loo, 2005).

Other projects underway are three test farms in the Trosa Archipelago and Kalmar Strait in Sweden and in Puck Bay in Poland between 2009 and 2012 (Baltic Sea 2020), where the project for instance will seek to identify whether blue mussel farming can provide alternative income to Polish fishermen.

Compensation payments for voluntary forest conservation in Norway

Norway uses a voluntary forest conservation scheme to increase the protection of biodiversity and related ES in accordance with its commitments under the Convention on Biological Diversity. This is more a traditional compensation scheme than a modern PES scheme, but it still has interesting elements. There is cooperation between the Ministry of Environment and the largest private forest owner association to identify forest areas relevant for conservation contracts[21]. Individual forest owners report land which is then assessed regarding biological qualities. If the forest area fulfils certain biological requirements, the government will enter into negotiations for purchase of the land for establishing forest reserve (where forestry and certain other extractive uses will be banned). The compensation is for loss of timber values according to a standard formula

[21] Norges Skogeierforbund

and payments either made one-off or annually. In a recent high-profile case ("Trillemarka"[22]), the government negotiated with several landowners and the municipality government for several adjoined plots of land. The contract included, in additional to compensation for loss of timber, a fund set up among the affected municipalities to stimulate investment in alternative economic activities to replace loss of future economic activities on the land (e.g. building of recreational cabins). The use of a development fund made it easier for local communities to accept the purchase of forest areas of this size for setting aside. The experience from the Norwegian voluntary scheme to date is that the size and number of enrolled forest areas are still small and the process relatively slow. A problem is that the most productive forest land, which is also the type of forest lacking the most from the protected area network, is also the most expensive to protect and owners of these areas are reluctant to participate. It is likely that more measures (voluntary or otherwise) are required to reach the biodiversity targets set by the government.

5.2 Examples of PES with Competitive Tendering

US Conservation Reserve Program

The US has extensive experience from paying farmers for ES. Voluntary land retirement has in particular been important for the US agri-environmental policy. Traditionally, land was retired to improve crop prices or protect the soil, but from the early 1990s reducing environmental damage from agricultural production has come increasingly into focus. The Conservation Reserve Program (CRP) is the largest agri-environmental programme in the US. It offers 10–15 year contracts for retirement of land from crop production. To be enrolled in the programme land has to have a history of crop production, be highly erodible, and be located in a national or state Conservation Priority Area, or be devoted to wetland restoration, streamside buffers, or conservation buffers. In exchange for land retirement the land owners can receive cost-sharing for establishment of new cover (like grass or trees) on the land, and annual payments to compensate foregone profit and maintenance costs. Land owners who want to participate have to offer bids specifying the land they are willing to give up for retirement, what kind of cover they would establish, and what kind of compensation they will accept. The incoming bids are ranked using the Environmental Benefit Index (EBI), and the best contracts are accepted. Prior to the early 1990s all bids under a pre-specified limit was accepted, but this practice has been abandoned to encourage farmers to bid against each other to reduce costs.

[22] See: http://www.regjeringen.no/nb/dep/md/pressesenter/pressemeldinger/2008/trillemarka.html?id=538245

The EBI factors used to rank bids are related to wildlife, water quality, erosion, enduring benefits, air quality and cost. Land owners may improve their EBI score and thus enhance their chances of being accepted into the programme for example by asking for lower annual payments, forego cost-sharing, or establish cover that is more effective as wildlife habitat. Research shows that the EBI has increased environmental benefits from CRP, but that environmental benefits from the programme could be further increased by altering the weighting of EBI factors, putting more emphasis on enhancing water quality and wildlife habitat relative to soil productivity maintenance. Cost-effectiveness would be increased as the same amount of funding would then lead to a higher delivery of environmental benefits (Claassen et al., 2008).

BushTender I & II, Australia

The BushTender was initiated by the Victoria government in Australia in 2001. The aim of the tender was to test the idea according to which auctions could efficiently purchase public environmental goods from private landholders. The good in question was biodiversity as captured through improved "bush" management. "Bush" in Australia refers to the original deep rooted ligneous vegetation prior to clearing and farming, which in agricultural areas survives today usually in isolated patches. Key issues in the initiative was to test how to ensure a sufficient number of landholders participating in the tender and whether an auction could be more cost-effective, budget wise, than a traditional fixed price payment scheme.

Under the BushTender, micro-regions were designated and a budget of A$400,000 was allocated in the first round and A$800,000 in the second round. Expressions of interests were called for and government officers subsequently visited the farms and the proposed land areas up for tender. Ecological data was collected from the sites to construct a spatially specific biodiversity benefits index, defining a benefit to cost ratio for the government. Contracts were negotiated on a one-to-one basis whereby a land management plan would be set up as a proxy for payment of the ES. Contract durations were set at 3 years in round 1 and 6 years in round 2. A sealed-bid discriminatory price auction was used to "reveal" the price of the farmers for providing their pre-negotiated services. Bids were ranked according to the biodiversity benefits index until the budget constraint was hit.

Lessons learnt from the auction were generally positive. The government found that auctions work and contracts are allocated, whereby the marginal cost curve information is revealed and they show improved cost-effectiveness over fixed pricing schemes. The government found that revealing all information on e.g. the biodiversity benefits index to the farmers is best despite the risk of collusion, which they also found was a non-issue. In addition, the government found that auctions are popular

with landholders as biodiversity is translated from a complex idea to practical actions. A total of 300 contracts were allotted (Latacz-Lohman and Schilizzi, 2007b).

Auction for Landscape Recovery, Australia

The Auction for Landscape Recovery (ALR) was part of a wider national programme in Australia to try different types of market-based instruments and different types of auction schemes. The ES targeted were multiple including biodiversity enhancement, salinity control, and groundwater recharge abatement because recharge compounds salinity.

A total of A$200,000 were made available for farmer payments in the Avon River Catchment in the state of Western Australia. The auction was conducted as a simple sealed-bid price discriminating auction, similar to the BushTender and the reward procedure was similar to the BushTender. Evaluation was based on a regional metric of "biodiversity complementarity" developed by natural scientists, accounting for synergistic aspects due to number, size and distance of several areas. Unlike in the BushTender the metric did not focus on the individual value of each land area. The metric was a comprehensive scoring index for ranking multidimensional auctions.

Lessons learnt from the trial were mixed. By including multiple ES in the payment scheme, the index of evaluating different bids necessarily involved a relative weighting of different ecological benefits, which for farmers and policy makers remained implicit and unknown. Additionality appeared to be weak, as some farmers bid below their opportunity costs. It turned out, that these landholders would have carried out the conservation works even in the absence of payment, whereas other landholders demanded at least their opportunity costs plus a rent to be paid. The auction revealed these differences, which from a budgetary point of view is useful. The differences between landholders in the catchment area, however, raise serious equity issues when designing a PES scheme. Nevertheless, basing PES on an auction improved cost-effectiveness compared to uniform price scheme by 315%–207% in round I and 165%–186% in round II (White and Burton, 2005, cited in Latacz-Lohman and Schilizzi, 2007b).

Challenge Funds (UK)

In Scotland, challenge funding was introduced into Scottish forestry policy in 1997 with the launch for the Grampian Challenge Fund and a year later the Central Scotland Challenge Fund, both operating under the Woodland Grant Scheme (WGS) but offering additional grants to the standard WGS grants for extending the woodland area in specific geographical areas (CJC Consulting, 2004). Targeted ES are multiple, including wildlife control, recreation, landscape aesthetics, habitat quality and timber productivity.

The challenge funds operated on a competitive basis, where landholders were asked to prepare and submit planting plans. Applicants had to pass a set of eligibility criteria relating to size, location and suitability of planting to deliver timber output. Bids were evaluated based on their value for money in relation to the aims of the challenge fund, using a scoring system. High-score, low-cost bids were selected first. Beyond that, the judging panel traded off score against cost in a subjective way.

Lessons learnt showed that the funds were very successful in rapidly expanding the land area under forestry and increasing harvestable timber output. Under the Grampian Challenge Fund, forested area (3000 ha) exceeded the target more than twice. Evaluations that were carried out after the two challenge funds, however, showed that although the Forestry Commission found the competitive tendering cost efficient, encouraging good standards and showing high additionality, landholders disliked the uncertainty in the tendering process, finding it "unfair" either because neighbours received more cash, because it was hard to know what to bid or because bidders found out they had underbid (CJC Consulting, 2004). As a result the Forestry Commission introduced a new fixed-price scheme in 2003, the Scottish Forestry Grant Scheme (SFGS), replacing the WGS and the two challenge funds, with locational premia (GBP2,000/ha for farmed landscapes in Central Scotland and GBP 1,500/ha in Grampian). The competitive bidding under the two challenge funds had helped inform the level of the locational premia (Latacz-Lohman and Schilizzi, 2007b).

Grassland Conservation Pilot Tender, Germany

A pilot auction was carried out in North Rhine-Westphalia in 2003 to 2005 as a response to a very low interest by farmers in a fixed price payment scheme on maintaining low-intensity grazing systems (Holm-Müller and Hilden, 2004, cited in Latacz-Lohman and Schilizzi, 2007b). Through the auction, the conservation agency hoped to reveal the excess payment needed for farmers to participate and to assess whether an auction would represent a cost-efficient mechanism to encourage broader participation in agri-environmental schemes.

Farmers were asked to specify in a sealed-bid process the amount of compensation they would need on top of the fixed payment in order to participate in the scheme. Bids which were 53% higher than the fixed payment (reserve price) were excluded and all bids below were granted compensation. In the second round, bids which were below a reserve price of 43% higher than the fixed payment were granted payment. Results showed an average bid of EUR92/ha in the first round and EUR46/ha in the second round. However, fewer farmers than expected participated, thus missing the aim of reaching a broader audience for agri-environmental management. Due to perceived land scarcity, reluctance to

lower the intensity of their grassland, and uncertainty about the latest CAP reform, farmers were generally not interested in agri-environment management despite the possibility of a top-up payment. This showed that a number of factors influence the decision to participate in voluntary schemes in addition to the level of compensation.

Auction trial with outcome-based payment scheme, Germany

A novel and experimental auction trial took place in Lower Saxony, Germany, in 2004. It aimed at compensating landholders for taking out intensively cultivated cropland and replacing it with grassland of high ecological and floral biodiversity quality. Payment was based on the quality of grassland achieved and not on the management practice undertaken as is most often found in land-based PES schemes. Grassland quality was categorised into three classes of biodiversity quality and payment was made one year after implementation where the level of payment was made conditional on the class of grassland quality achieved.

The auction was a budget constrained (EUR30,000), sealed-bid, discriminatory price auction with a contract duration of one year. A total of 288 ha were accepted for payments. The output oriented auction seems to have been popular with farmers and policy officers alike (Groth, 2005; cited in Latacz-Lohman and Schilizzi, 2007b). The auction revealed a wide range of bid prices, which gave the administration a good scope for selecting the most cost-effective producers. A comparison with a fixed price scheme for one of the quality classes showed that the auction average bid price was 53% lower.

A contributing reason for the success of the auction was that only one relatively simple ecosystem was targeted and a simple categorisation of the ecosystem quality was applied.

Other Conservation Auction Schemes

A number of conservation auction schemes in areas of agri-environmental policy have not been described. They include the RiverTender targeting riparian vegetation, PlainsTender applied to grasslands, BushIncentives applied to coastal vegetation and EcoTender targeting salinity control, biodiversity enhancement and water quality (Latacz-Lohman and Schilizzi, 2007b) and an auctioning scheme to create landscape linkages for wildlife (Windle et al, 2009). All of these have been carried out in Australia. Outside agri-environmental policies, conservation auction schemes are known from contracts to decommission fishing vessels, usually allocated through competitive bidding (OECD, 2009) and in the US, auctions are used to buy back water abstraction licenses from farmers in order to preserve minimal instream flows in years of drought (Laury, 2002).

5.3 Examples of PES as Conservation Banks

Biodiversity Conservation Bank in France

The Biodiversity Conservation Bank in France (CDC Biodiversité) is a subsidiary of the French investor Caisse des Dépôts, and works to support public and private actors in their biodiversity development projects in France and other European Countries. It conducts initiatives for restoring, managing, enhancing and offsetting biodiversity. The bank buys or leases land from private landowners and pays them to manage the land in favour of biodiversity. The land managed to protect biodiversity is in turn sold or contracted to projects that need to compensate environmental losses. CDC Biodiversité offers its services to project managers that need to compensate the environmental losses of their projects due to environmental legislation. CDC Biodiversité thus operates as an intermediary between contracting authorities for infrastructure (real estate, transport, etc.) and the public authorities who set the rules concerning ecology and biodiversity. Its role is to implement and secure long-term management of ecological obligations (EFI, 2009).

BioBanking in New South Wales, Australia

The New South Wales Department of Environment and Climate Change (DECC) is assessing the challenge of biodiversity loss through an innovative biodiversity banking and offsets scheme. The scheme works by creating a market for biodiversity credits which gives incentives to protect biodiversity values, and the scope is limited to biodiversity values including threatened species listed under the Threatened Species Conservation Act 1995. Under the scheme land owners who establish biobank sites generate biodiversity credits by agreeing to carry out a set of management actions, which over time are expected to improve biodiversity values. The number and types of credits are calculated using the BioBanking Assessment Methodology and Credit Calculator developed for the scheme. Two types of credits exist. Ecosystem credits are created for all ecological communities, as well as threatened species that can be reliably predicted as occurring on site, using the presence of vegetation that provides habitat for a given ecological community or threatened species. Species credits are created for threatened species that cannot be reliably predicted using habitat surrogates, based on targeted survey reports. Landowners decide which areas of their land they will turn into a biobank site, and they can also decide who they will sell their credits to. Credits can for example be sold to organisations or government seeking to secure conservation outcomes, or they can be sold to developers who want to minimise and offset their impact on biodiversity. Participating developers can offset impacts

in some areas through purchasing credits, but still need to oblige to avoid especially important areas for conservation of biodiversity values.

All biobanking contracts are registered on the land title, and are binding for both current and future owners. The price of biodiversity credits is determined by the characteristics of the biobank site and existing supply and demand. The minimum price paid is the estimated cost of management and reporting for the life of the agreement (called Total Fund Deposit), but the landholder may in addition negotiate additional return from the buyer. The Total Fund Deposit from credit sales is paid into the Bio-Banking Trust Fund which invests Total Fund Deposits from all biobank sites and secures annual payments back to the individual sites in perpetuity. This provides a financial incentive for biobank site owners to stick to their contract, and ensures that if a site is sold the new owner will have the capacity to continue to manage the site in favour of biodiversity values. To secure that the scheme is working according to the intentions the methodology will be reviewed and updated on a regular basis, biobank site owners have to report performance annually, DECC will publish an annual report, information about all agreements are available to the public, and the DECC will monitor participants. Monitoring is undertaken in order to ensure compliance with legislative requirements and biobanking contracts, and make sure appropriate action is taken if offences are detected (DECC, 2007).

5.4 Example of a User-Financed PES scheme

Vittel pays for drinking water protection in France

Vittel (Nestlé Waters) is one of the largest producers of bottled water in the world. Its most important water sources in France are located in heavily-farmed watersheds. In order to secure water quality to its highest standard, they have conducted a PES-programme that includes Vittel compensating farmers in the area for managing the land for drinking water protection. The programme is fairly complex in design, combining conditional cash payments with technical assistance, reimbursement of incremental agricultural labour costs, and purchasing of farmland which is leased back to the farmers or user rights are granted in other ways. The contracts run from 18 to 30 years and payments are negotiated on a farm to farm basis based on opportunity costs. Both land use and water quality are monitored closely. Organic land management and other low impact farming practices are encouraged and all 27 farmers in the area have been persuaded to reconvert their land management and participate in the PES-programme. Paying the farmers in order to manage the land for drinking water protection has been more cost effective than building filtration plants, and Vittel has been able to offer the participating farmers profitable terms (Wunder et al., 2008 and EFI, 2009).

5.5 Summary

There is a wide variety of existing and trial PES schemes throughout the world. Two main types of PES schemes exist: i) nature conservation contracts which can be either user financed or financed through an intermediary such as the government or a NGO and ii) market creation, where ES is traded as permits, as land development rights or sold as part of an environmentally friendly product such as shade-grown coffee or certified timber.

Nature conservation contracts are traditionally designed as fixed-payment schemes, where landholders receive a fixed monetary compensation independent of their marginal costs of implementation or their opportunity costs. As the schemes are voluntary, mainly landholders with low costs or low additionality participate and areas with the highest potential provision of ES may not opt for the PES payments. This may indicate social and financial inefficiency described under Section 3.2.3. Examples of PES with fixed level grant payments are the agri-environmental schemes in the EU, the BIOSA network of landowners for nature conservation in Austria or compensation payments for voluntary forest conservation in Norway.

Where the costs structures among landowners differ, competitive tendering can improve efficiency by providing value for money and it can help broaden the rate of participation from landowners. Various auction styles can be found, such as a sealed bid process with several auction rounds. Examples of conservation contracts awarded based on competitive tendering include the US Conservation Reserve Program, the BushTender and Auction for Landscape Recovery in Australia, the Challenge Funds in Scotland and the Grassland Conservation Pilot Tender in Germany.

Under market creation, a number of conservation banks exits where land developers are required to offset degradation or destruction of ecosystems or biodiversity by buying conservation credits from a conservation bank, that purchases conservation credits from land owners, who restore or protect specific types of habitats. Such conservation banks are in place e.g. in New South Wales in Australia (BioBanking), in France, (CDC Biodiversité) and in the USA (mitigation banking).

In the OECD countries, very few user-financed PES schemes can be found (an example is Vittel in France paying landowners to protect the drinking water resource). The example of paying a mussel farmer for removing nutrients from a local waste water treatment plant in Sweden is an example where a polluter makes a direct agreement with a private agent to remove the pollution. Also, most schemes are action oriented (i.e. paying for a certain management practice) and very few schemes are output oriented such as the trial in Lower Saxony in Germany paying for the ecological quality of grassland achieved.

6. Two PES Cases from Nordic Countries

Two very different case studies from Denmark (agri-environment) and from Finland (forestry) have been chosen to describe and analyse the application of PES and PES-like schemes in the Nordic countries. The analysis is based on the concepts and frameworks described in Chapters 2–4. The case studies provide a background to the PES followed by an analysis of the ES aspects (ecosystem, ES typology, economic value and public/private good aspects); the institutional set up (beneficiaries and providers of ES; distribution of rights and other legal aspects) and PES programme characteristics (output or action based; payment type; who pays and administers; scale of programme; monitoring and sanctions in place). Based on short expert interviews and available reviews of the PES schemes, the case studies indicate lessons learnt to date. The case studies do not attempt to provide an extensive evaluation of the schemes, which lies outside the scope of this report.

6.1 Case Study: Agri-environment Schemes applied in Denmark

6.1.1 Background

In Europe, a shift in the Common Agricultural Policy (CAP) was made with the reform in June 2003, which moved away from direct commodity payments towards agri-environmental and rural development programmes. The underlying logic has been the position that these offer additional benefits that are typically not marketable and, consequently, would be under-produced relative to the levels desired by society without the agri-environmental payments. The types of pollution targeted through the EU agri-environment schemes relate to the risk of losing high nature-value farming systems either due to intensification or abandonment of farmland (Baldock et al, 2003).

The reform of the CAP also allowed the European Union to move from the Amber Box (trade-distorting domestic support measures) to the Green Box (subsidies with minimal linkage to the quantities produced, the inputs used or prices paid) in the Uruguay Round Agreement on Agriculture.

Since 2005, farmers receiving Pillar I[23] payments in terms of single farm payment (income support) have to comply with a set of minimum Good Farming Practices (GFP), which are defined by each member state in detail. The compliance requirement is called "cross compliance" and is based in particular on the maintenance of a "good agricultural and environmental condition'. Although this "cross compliance"[24] is voluntary, it is in reality compulsory because few farmers can stay in business without Pillar I support. If farmers exceed the GFP baseline, they can access additional payments in the form of environmental payments under Pillar II[25]. Also, in some countries in the EU, farmers do generally no longer need to sow certain crops or raise certain livestock in order to obtain financial support, but receive the single farm payment based on the level of direct payments received during 2000–2002 (Schmid et al., 2007). A criticism often raised relating to the cross compliance is that the environmental restrictions defined in each member state are relatively modest in order not to distort competition between countries.

6.1.2 Agri-environmental Policies and PES

The EU CAP pays both for positive and negative externalities resulting from agricultural activity. Examples of payments for positive externalities include preservation of for instance limestone grasslands in Öland, Sweden, from bush and tree encroachment on pastures and hay meadows. Examples of payments for reducing negative externalities include the promotion of organic farming, i.e. assuming that extensification of agricultural practices reduce negative externalities. It is assumed that fewer external inputs will result in reduced environmental damage. On this basis, it can be said that the agri-environmental policies in the EU are only indirectly linked to the attainment of ES as payments are made on the basis of less intensive farming. In the following we go through the criteria for PES at a general level of agri-environmental policies. Subsequently we go more into depth with how one particular agri-environmental policy (establishment of wetlands) is applied in Denmark and discuss this in the light of PES schemes.

PES Criteria 1: Voluntary transaction

Compensation for meeting the minimum standards required by cross-compliance under Pillar I cannot be classified as PES according to the

[23] Pillar I covers agricultural markets and direct payments, regulated under Reg. 1782/03. Measures cover decoupled payments, cross compliance and modulation.

[24] Cross compliance covers respect of environmental, food safety, animal and plant health and animal welfare standards, as well as the requirement to keep all farmland in good agricultural and environmental condition.

[25] Pillar II measures are aimed at supporting rural communities to develop and diversify. The range of measures includes: agri-environment measures, farm adaptation, forestry, processing and marketing of agricultural produce, training and development, and less favoured area support. Pillar 2 is regulated through Reg. 1257/1999, amended in 1783/2003 (Art. 21a – d) and implements rules 817/2004.

definition in Box 2–3. The requirement however plays an important role in ensuring the efficient delivery of environmental services.

Enrolment under Pillar II is voluntary from the part of the ES providers. There is often no or little competition. Environmental payments under Pillar II can qualify as PES in terms of voluntary transaction.

PES Criteria 2: Well-defined ES

Most of the EU agri-environmental measures do not explicitly target measurable environmental outputs. It is typically sufficient to commit to certain agricultural input choices and management options such as conversion to pasture, set aside, organic farming or enhancing the welfare of livestock and/or technologies that have been designated as environmentally friendly. This means that payments are made on the basis of proxies of ES rather than on the achievement of the ES themselves. Proxies can be reduced nitrogen use (reducing input), changes in manure handling practices (technology change) or conversion of arable land to pasture or wetlands (extensification of farming practices). Often, however, the link between the land use practice and the achievement of the ES is not clear and payments are not dependent upon the achievement of the ES. Payments are also generally made regardless of whether the techniques are used on a sensitive land such as a riparian area or on a parcel where the technology change will have little environmental impact.

A few payments are based on more well-defined ES. This is the case for payments related to the cultivation of the landscape by preserving traditional farming, such as terraces, stone fences and the raising of certain rare breeds of farm animals. Also the attempts to limit abandonment of farmland in remote and mountainous parts of Europe, where farming is unprofitable, shows that land is perceived to attain its highest environmental value when used for farming. The preservation of cultural landscapes and rare breeds are considered as being desirable outcomes in and of themselves, i.e. these are considered to be the ES provided by the farmers, and can therefore be seen as public goods and positive externalities supplied privately by farmers, for which they should be compensated.

PES Criteria 5: Conditionality

Some EU programmes pay farmers for reducing their use of chemical inputs with the objective to reduce environmental pollution from agriculture. However, the payment is not linked to reaching the ES of reduced nitrogen run-off and the overarching benefit of cleaner waterways and as such cannot be said to be conditional on the ES.

Where payments are made conditional on proxies for ES such as management practices and land use, the conditionality is limited to the achievement of the proxy and is rarely made dependent on the link between management practices and ES quality actually being efficient.

Type of Transaction

Under Pillar II, farmers are offered an amount per hectare based on the individual member state's calculation of the income foregone. There are possibilities to receive a discretionary payment of up to 20% to induce farmers with higher opportunity costs and presumably higher ES to subscribe. However, there is no room for inclusion of individual opportunity costs, as would be the case through the use of competitive tendering or auctioning. Payments can, though, vary spatially e.g. for Environmental Stewardship in England.

Efficiency Issues

A general risk associated with fixed-priced payments that are not spatially targeted is a low level of additionality, i.e. the payments may flow to land managers who would undertake the actions anyway or the payments may flow to land managers located in areas that are not environmentally-sensitive. Associated risks are that the level of compensation is either too low for the land steward to take on the action or the payment is too high compared to the minimum payment that the land steward would have accepted to adopt the desirable land use (social inefficiency).

Leakage Effects

The good farming practice, which forms the basis for the cross-compliance requirements under Pillar I, includes the requirement for "maintenance of the land in a good agricultural condition'. This has the aim to significantly retard the abandonment of farmland but it also prevents afforestation in regions where forest and farmlands are alternative land uses (Schmid et al., 2007). This can be classified as a perverse incentive from a perspective of optimising ES, under the presumption that forests provide better or more ES than farmland.

Side-effects

Agri-environmental schemes are part of a wider policy set-up seeking to achieve multiple objectives in terms of rural development, job creation, livelihoods, global competitiveness and sustainability. The transfer of subsidies from the former direct payments to the use in agri-environmental schemes also sought to reduce the level of harmful subsidies (OECD 2004).

Permanence

Depending on the measure, permanence is assured for instance for 5 years such as maintenance of grass and nature areas or up to 20 years such as in wetland conversion or afforestation. In measures with relatively short duration of the payment, experience shows that land use frequently returns to the land use prior to the PES.

6.1.3 Agri-environmental measures in Denmark

In this section, we give an overview of the different agri-environmental schemes in Denmark and go more into depth with one measure to discuss the PES criteria and various issues relating to an efficient set-up of a PES scheme described in the section above.

Agri-environmental measures in Denmark are based on a number of independent projects that can receive full or part support from the state and the EU. We have identified seven relevant support measures that fall within "PES-like" schemes. These are listed below. We have chosen the scheme "conversion to and management of wetlands" to go more into detail. Based on interviews with the administrators of the scheme, we also give some preliminary insight into the issues and lessons from the scheme. This is not intended to be a thorough review of the measure, as this lies outside the scope of this report.

- Support to pilot projects and demonstration use of *technology* that reduces environmental impacts, improve working environment and reduce negative impacts on nature;
- Support to the *creation of wetlands* covers up to 100% of expenditure eligible for public funding and maximum 15,000dkr per ha with possibility of dispensation. All landowners can apply regardless of their status. Eligibility conditions include that the area must be within Environmentally Sensitive Areas (ESAs) and will contribute i.a. to a reduction of phosphor leakage and enhance fauna and flora. During 2009, three rounds of applications are open.
- *Maintenance of grass and nature areas* covers a per hectare support for grazing (1400dkr/ha) and grazing and/or hay cutting (800dkr/ha) in areas classified as ESAs. Agreements have a duration of five years;
- Support to *reduce the use of nitrogen and stop use of pesticides*, targeting all farmers in Denmark, including ecological farmers, regardless of location and type of farm. The application for this support was open during 3 months in 2009;
- Support to *set-aside of riparian zones at open streams and lakes* larger than 100m2 targets all farmers and intends to function as an incentive for farmers to locate their obligatory set-aside area along lakes and streams. The objective is to reduce the leakage of nitrogen, phosphor and pesticides to the water environment;
- Support to *ecological farming* covers three sub-categories of support directly to farmers. These are i) per hectare support; ii) support for the conversion to ecological farming; and iii) support to reduce the use of nitrogen, and stop the use of pesticides.
- Support to *plantations improving the countryside and biotopes* (e.g. windbreaks), where the public support covers 40–60% of total costs. Projects can be applied by individual land owners or by a group of minimum seven land stewards. Objectives are to preserve and enhance

> biodiversity by creating good conditions for animals and plants; preserve and enhance environmental, nature and cultural as well as landscape values and recreative values; establish landscape corridors and increase the share of small biotopes and create natural limits around technical plants. Permanence should be assured a minimum of five years after the final payment. The second round of applications originally planned during 2009 has been postponed to 2010.

Payment for the Establishment and Maintenance of Wetlands in Denmark

As part of the national Water Environment Plan III (Vandmiljøplan III/VMP III), Denmark has set the goal of reducing the leakage of nitrogen by more than 400 tonnes per year by the end of 2009. The programme to establish and maintain wetlands has been in place since 2005 and has by mid 2009 achieved an estimated reduction of nitrogen of 282 tonnes, converting a total of ca. 2,525 ha of agricultural land to wetlands[26] (Kristian Gadegaard, Danish Food industry Agency, personal communication). Also the use of pesticides and phosphorous emissions should be reduced, albeit a quantitative goal has not been set. The overarching objective is to improve water quality and natural flora and fauna.

The establishment of wetland areas under the agri-environment schemes under Pillar II plays an important role in this plan as it contributes to enhancing the ES: water purification and waste treatment. Wetland areas also contribute to increasing biodiversity by providing rich habitats for birds, insects, amphibians, spawning areas for fish and the basis for a high diversity of plants.

The payment for establishing and maintaining wetland area in Denmark is an example of PES as a conditional performance contract, placed in the tool box of direct market-based voluntary instruments. It is a *voluntary* measure that is *government-financed*, i.e. the government acts as buyer of the ES. The measure is constructed such that *sellers* of ES are paid for activities that are intended to lead to the *provision of ES*, i.e. sellers are paid a *proxy* of the provision of the ES.

The ES that is indirectly targeted through this measure is primarily water purification and water treatment capacity of wetlands. *Additional ES* being provided through the activity include natural hazard regulation and water regulation. These are however not specifically targeted by the buyer of the ES.

The expected *intermediate products* and *final products* of the ES being provided depend on who the beneficiaries are. If we take anglers, intermediate services are improved water body quality and final service is the fish population. If we take the local and regional population valuing the protection from nature's whims, intermediate products are specific

[26] Of the 282 tonnes of nitrogen reduction per year and 2525 ha of wetland from 2005-2009, 821ha and 80 tonnes of nitrogen are applications from 2009 which have not been finally approved in August 2009.

regulating and supporting mechanisms in wetlands that provide the ES regulation against natural hazards. If we take the national population valuing a high level of biodiversity, the intermediate product comprises specific regulating and supporting functions of wetlands providing habitats and clean water for a diverse flora and fauna. When assessing the value to human society of the PES scheme, it is useful to distinguish which ES is the main target and who are the beneficiaries, at a local, regional and national scale.

Beneficiaries of the conversion to wetland scheme pay only indirectly for the provision of the ES through general taxation to the Government. As such, the Government pays for the provision of the ES on behalf of the whole population in Denmark, regardless of where the actual conversion to wetland takes place. From this perspective, beneficiaries can be said to be the national population. In reality, the local and regional population benefits through improved angling opportunities, recreation and flood control protecting housing and installations.

In terms of *Distribution of rights*, sellers of the ES have clearly substantial rights on their land. Referring to the different types of property rights described under 3.2.2, owners of the land in this case have the right to extract and produce products on the land prior to the implementation of the scheme (Right of withdrawal); the right to regulate internal use patterns and transform the resource (Management right); the right to determine who will have access or withdrawal right and how those rights may be transferred (Exclusion right) and finally the owners also have the right to transfer the rights of management and exclusion to other parties (Right of alienation). The buyer (here the Government) of the ES has no or little legal right to demand that the land stewards ensure a significant reduction in nitrogen and phosphorous leakage neither does the buyer have the right to demand that the land stewards do not damage waterways and biodiversity and hence that they should pay for any damage to the environment caused by the production systems in place.

The proxy for the ES, e.g. conversion from farmland to wetland, is fairly *well-defined.* The new wetland established must be able to reduce a specific quantity of nitrogen per hectare per year, reduce phosphorous leakage and provide positive effects on flora and fauna. The latter two aspects are not quantified further. *Conditionality* is relatively well established as the applicant land owner needs to provide the buyer with effectively occurred costs of implementation, and these need to be approved by a state authorised public accountant and a proof that the wetland is noted in the land registry.

The government periodically opens calls for applications and any land owner regardless of their institutional status can be eligible. *Seller selection* is based on a number of criteria. The main parameter is the potential capacity of the proposed wetland to reduce nitrogen leakage by a minimum of

100kg per hectare per year[27]. Sites that are larger rather than smaller are also prioritised. If applications exceed the amount of funding available in a year, the Government prioritises those plots of land located within zones defined in the Planning Act as being potentially applicable to wetlands. Emphasis is also put on accept and motivation of land owners to participate if local authorities are the applicants. Applicants also need to argue for a reduction in the leakage of phosphorous and improvement of natural flora and fauna. Since 2005, a total of 1704ha[28] have been granted support for the establishment of wetlands. Local authorities have increasingly made use of the support for wetland establishment, thus increasing the average size of projects from 15ha in 2005 to 20–33 ha in 2007–2008. To date, there have not been an excess of applications compared to the yearly budget of ca. DKR45 million (Kristian Gadegaard, Danish Food industry Agency, personal communication). Some rejections have been made on the basis of the above-mentioned criteria.

In order to ensure that the goal of reducing nitrogen leakage has a lasting effect, the agri-environment scheme has a built in *permanence* assurance by requiring a declaration on the land that the wetland area may not be removed, once established. When providers of ES apply for the payment, a requirement is made that they also make a registration on their land that the established wetland may not be removed and that they apply for an additional fund for the compensation of lost income over 20 years. Hereafter, the payment stops, but the wetland may not be destroyed.

Payment for conversion of the wetland is a fixed one-off payment covering up to 100% of the establishment costs and the compensation for maintaining and/or managing the wetland area is based on the previous type of land use on the site. The more intensively managed the land, the higher the compensation. Table 6–1 lists the different levels of payment according to the prior land use. The payment, however, is not spatially explicit. It is not linked to the capacity of the wetland to provide the demanded ES on the particular plot, nor is it made dependent upon the total size of the wetland or the presence of other converted wetlands in the vicinity, e.g. providing an agglomeration bonus if the neighbouring land manager joins the PES scheme.

The fixed-rate payment, despite the efforts to allocate the payment according to opportunity costs, does not take into account individual cost structures of farmers. Competitive tendering or auctioning may prove a more efficient way of allocating reserved funds for wetland establishment such that more wetland is converted for each Kroner spent. An associated risk with fixed rate payments is that the fixed level of compensation during the 20 years is either set too high or too low causing social inefficiency. As

[27] The estimation of the capacity of the land to absorb nitrogen is based on a model by DMU where input data such as local soil conditions, precipitation, catchment area, and crops are used to calculate the level of nitrogen that can be expected reduced.

[28] By mid 2009, 29 applicants covering 821 ha have applied funding. The evaluation was not finalised by the time of this report.

the scheme is relatively untargeted and undifferentiated in spatial and economic terms, there is a risk of *weak additionality* in terms of paying for conversion to wetland that would have been adopted anyway.

Experience from the 5 years of funding mechanism indicates that the compensation for keeping and managing the wetlands primarily attracts marginal land with low opportunity costs. (Kristian Gadegaard, Danish Food industry Agency, personal communication). Owners of land with a high nitrogen reduction potential and high opportunity costs are not applying for the fixed payment compensation. The evidence of the scheme not having attracted more applications than yearly budgets available, also indicates that the offer from the Government is not sufficiently attractive to landowners, leaving room for increasing efficiency.

The wetland conversion scheme is fairly well targeted towards an environmental objective, without including a wide range of *side-effects* such as job creation, competitiveness and rural regeneration under the Rural Development Plan. This generally ensures a relatively high degree of meeting the environmental objectives of the scheme. However, the main focus of nitrogen leakage reduction has led to unwanted effects, where the conversion to wetland in areas in or close to protected areas have had negative effects on flora and fauna.

Table 6–1 Overview of a Wetland Conversion PES scheme –Example from Denmark

Name of PES scheme	Establishment of Wetlands
Ecosystem service aspects	
Type of ecosystem (e.g. forest, wetland, agro-ecosystem)	Wetlands
ES or benefits to be delivered	Reduction of nitrogen of min. 100 kg/ha; Reduce phosphorous leakage; positive effect on wild flora and fauna;
Type of services (provision, regulation, cultural, supporting)	Regulating (water regulation, water purification and waste treatment, natural hazard regulation)
Kind of value (direct use, non-use, indirect use)	Indirect use (water regulation & water purification) & direct use (natural hazard regulation)
Type of good (club, open access, pure public)	Pure public
Institutional set up	
Beneficiaries	Local and regional users such as recreational anglers, recreation, housing, tourists, and households within catchment area
Suppliers	Private landowners, public companies & institutions, foundations, associations, organisations and community co-operations
Distribution of rights	Suppliers have the rights of withdrawal, management, exclusion (on private land) and alienation (in the case of communities owning the land)

PES programme characteristic	
Land use or practice paid for (linked to ES or benefit)	Payment for the conversion of land to wetland in order to reduce nitrogen and phosphorous leakage and improve flora and fauna biodiversity. I. Compensation of up to 100% is paid to cover the implementation costs: • Feasibility studies • Archaeological studies • Investigations that become necessary but which were not foreseeable at the time of the application • Indirect costs related to the use of own machinery • Salaries to personnel active in the project • Salary to the project manager • Clearing of vegetation • Registration • Project reporting • Review and evaluation II. Compensation is paid for the maintenance and management of the project area
Kind of payment	I. One-off payment to cover *implementation* costs of maximum 15,000dkr /ha. IIa. yearly compensation for *keeping* the area as a wetland during a 20–year period to maintain and manage the area range from 3500dkr/ha for arable land that has not been laid out as pasture during the last 5 years to 300dkr/ha for nature areas (excl. forests). IIb. Yearly payment for the *management* of the wetland range from 3350dkr/ha for grazing of particularly valuable and difficult to access grass- and natural areas to 200dkr/ha for a yearly clearing of vegetation. All Payments are taxable.
Who are the buyers? (ES users, government, other?)	Government and EU Commission
Who administers the programme?	Danish Ministry of Food, Agriculture and Fisheries
How are sellers of ES selected?	Potential level of nitrogen leakage reduction must be more than 100kg/ha per year. Larger areas are prioritised. Very small areas are excluded. In case of several landowners in one application, all must show written motivation and accept of project. If applications exceed the available funding, the Ministry prioritises according to areas located in zones that in the Planning Act are specified as potentially suitable for wetlands (this has not been the case in reality)
Other requirements	The project must be carried out based on natural hydrology and it may not lead to a net leakage of ochre. Sellers may only be compensated for the conversion to wetlands if they also apply for funds to maintain and manage the wetland over 20 years.
Scale of programme (local, regional, national, global)	National. In reality most funded areas are found in Jutland are included in the programme due to the weather patterns (excess precipitation causing excess nitrogen leakage).
Monitoring	Payment for implementation costs are based on costs reviewed by a state authorised public accountant and the changes to the land needs to be registered in advance. NERI has received funding to undertake an environmental evaluation of the programme. This has not been carried out to date.
Sanctions	No sanctions are known.

6.1.4 Final Remarks on Agri-environment Schemes

EU member states are required to evaluate their agri-environment programme with respect to their socio-economic, agricultural and environmental aspects (Article 16, EC Regulation 746/96). These evaluations assess the uptake patterns of different schemes but miss to assess whether the stated objectives of the scheme will be met and they can often not infer effects of the changes in management due to the agri-environment schemes. In addition, biodiversity and environmental objectives are rarely defined and evidence shows that the agri-environment schemes have produced little additional biodiversity benefits (Kleijn and Sutherland, 2003). The wetland establishment case from Denmark has clear targets for nitrogen leakage reduction, but vague targets on phosphorous emission reduction and biodiversity. Evaluation has not yet been carried out, but is planned to be undertaken by NERI.

Establishing the link between the proxies paid for in the EU agri-environmental schemes and the achievement of any number of ES would necessitate information on environmental characteristics of the fields in question and detailed information on the benefits produced by any one or a combination of actions. This is of course significantly more data intensive than the current practice. In the case study from Denmark on conversion to wetlands, prioritisation of plots is based on local data and model estimation. Regular monitoring of the actual quantity of nitrogen reduced is not carried out.

The general use of fixed-rate payments suggests that the agri-environment schemes are not cost-effective. Using competitive bidding can significantly increase the cost-effectiveness of conservation contracting (Latacz-Lohmann and Schilizzi, 2007a; Schilizzi and Latacz-Lohmann, 2007), especially when cost-structure are heterogeneous. Equity issues should in that case be taken serious, as experience in places have shown discontent with differences in payments (See Section 5–2).

6.2 Lessons from the Danish case study

The Danish example of an agri-environment scheme showed that the conversion of farmland to wetland since 2005 was not sufficient to meet the environmental target to reduce nitrogen leakage. The target was missed by a third with 282 tonnes of nitrogen reduced per year compared to an objective of 400 by the end of 2009. Several contributing factors can be identified:

- *Reform of the local authorities* at the beginning of the scheme in 2005 led to a delayed interest from the part of local authorities. Towards the end of the scheme, where municipalities were more consolidated to

take an interest in the programme, larger sites have been proposed by municipalities in cooperation with several landowners.
- Lack of economic incentives to agglomerate areas spatially has resulted in generally *small and isolated projects*, where municipalities have not acted as initiator. This has especially been the case in the beginning of the programme;
- *Fixed-rate payments* for the maintenance of wetlands may have contributed to the relatively low uptake of the scheme and the compensation levels have most probably excluded the highest performing plots of land;
- *Output-based assessment* of the applications (i.e. capacity of the specific plots of land to reduce nitrogen leakage) has been successful in targeting areas meeting a minimum level of nitrogen reduction, ensuring a minimum degree of environmental efficiency;
- There is scope for streamlining application processes and evaluating the applications with regard to biodiversity impacts. Competitive tendering has not been considered as an option to date.

6.3 Case Study: Forest Biodiversity Programme for Southern Finland (METSO)

6.3.1 Background

Finland is the most forested country in the EU. More than two-thirds of the country is covered by forest, and large parts consist of small holdings owned by local families. Most privately owned forests are located in the south while state owned forests are located in northern Finland. In the north 28.6 percent of the land is protected, compared to only two percent in the southern parts of the country.

The steering guidelines for Finnish forest policy were articulated in Finland's National Forest Programme 2010, where ecological, social, and cultural aspects connected to forest use in the country is taken into account. In 1999 a group of experts made a report assessing the need for conservation in forests in southern Finland and Ostrobothnia. They concluded that forests in the northern parts of Finland were sufficiently protected, while the present network of protected areas in hemi-, south- and midboreal regions were insufficient to safeguard all endangered and threatened species (Horne et al., 2009). A working group set up by the Government in 2000 made a plan for how conservation should be increased, and on the basis of this plan the Government decided to supplement the National Forest Programme 2010 by an action programme to safeguard biodiversity in Finnish forests. This programme is called Forest Biodiversity Programme for Southern Finland (METSO), and aims to preserve valuable forest habitats while also allowing forests to be com-

mercially utilised to the benefit of rural economies and livelihoods, thus helping to promote sustainable development in rural regions of Finland.

The fist phase of the programme ran from 2003 to 2007 and was a 17–point plan including measures within four main categories (UNEP, 2008):

- Habitat restoration and management in protected areas;
- Pilot projects involving new conservation means (included natural values trading, competitive tendering and cooperation networks) (see below);
- Improvements in the natural forestry methods used in commercially managed forests; and
- Research.

The new means introduced to increase conservation under the METSO programme were all based on voluntary participation of forest owners and compensation for foregone revenue. Total funding for the programme was 60 million Euros. Criteria defined by conservation biologists were used to identify the forest habitats and ES most important to focus on, and sites that got protected under the programme were chosen according to these criteria. The response from forest owners was good, and more sites were offered than it had funding for. By late 2006, 268 contracts were made, and almost 2000 hectares of forest were protected, mainly through fixed-term contracts. Less than 200 hectares of forest were permanently conserved (Horne, 2009).

The new METSO Programme running from 2008 to 2016 aims to halt the ongoing decline in the biodiversity of forest habitats and species, and establish favourable trends in Southern Finland's forest ecosystems by 2016, in line with internationally defined biodiversity targets (METSO Newsletter, 2008). This programme consists of a 14–piont action plan taking a lot from the first phase of the programme further, while focusing on collaboration and cooperation between different interest groups, training of professionals and to advice forest owners. Voluntary conservation schemes are continued in this new METSO programme, and total funding for the programme is 180 million euro until 2012. The site selection criteria are being updated based on findings from a new evaluation of the status of biotopes in Finland.

6.3.2 Examples of voluntary incentive-based measures in METSO

As mentioned above, several voluntary incentive-based measures to safeguard biodiversity in Finnish forests have been tested under the METSO programme. In this section, we will first give a brief introduction of two of these schemes before we go more into depth with a third scheme to discuss it more thoroughly in relation to the PES criteria and various issues related to PES schemes presented earlier in this report.

Under the *nature values trading scheme* forest owners were given the opportunity to set aside forest areas for conservation and receive compensation for foregone revenue. Participation in the scheme was always voluntary for the forest owner, and they were given the chance to present their views on the compensation to be paid. Price and terms of the contract were negotiated on a case-by-case basis, and if the forest owner and the Government agreed, the forest owner could enter into a fixed-term contract lasting for 10 to 13 years. When the contract period ends, the forest owner is free to manage the area according to his own wishes.

A *cooperation network* were created in order to promote innovation, cooperation and interaction, and to create new operating traditions in biodiversity conservation. Land owners, local authorities and NGOs are participating in the network, and the idea was to protect biodiversity on a local level based on voluntary participation and land owner's own initiative. Cooperation projects could for example be connected to a national park, a hiking or recreational area or commercial forests. There is no requirement that the cooperation project area is continuous or clearly defined, but all land owners wanting to participate in order to enhance biodiversity conservation were allowed to take part in the network (Horne et al., 2009).

Competitive tendering

As a part of METSO's aim to preserve valuable forest habitats, competitive tendering was introduced as a way of increasing the network of protected forest areas. Key features of the scheme are presented in Table 6–2. The ES delivered by forests are numerous, including biodiversity, carbon sequestration, water purification, reindeer husbandry, game, berries, mushrooms, lichen aesthetic, recreational and spiritual services. Habitats identified as especially important are heathland forests with plenty of decaying wood, herb-rich woodlands, spruce mires, swampy woodlands, sunlit esker slopes, wooded pastures and meadows, and natural forests along emerging coastlines.

The establishment of conservation areas by the use of competitive tendering is an example of contractual nature conservation. The scheme is government financed as the government act as the buyer of the ES, and the scheme is voluntary for both contracting parties. The forest owner will only make a tender he or she finds satisfactory, and the government will only accept tenders providing the kind of ES they are looking for at an acceptable price. Forest owners are paid for conservation actions that are intended to lead to the provision of demanded ES, which means that the sellers are paid for a proxy of ES. Contracts may be for a fixed term, where it in practice is established as a privately owned nature conservation area, or the state can purchase the site as a nature conservation area. Which method that is chosen depends on the characteristics of the site, its location and the forest owner's tender proposal.

Biodiversity of forests is the ES that is primarily targeted through this scheme, but like mentioned above is a wide range of additional ES being provided through conservation activities. Many of these ES will be delivered even though the ES buyer does not target these services specifically.

Intermediate products and *final products* expected to be delivered from the ES that are provided is dependent on which beneficiaries that are being considered. Seen from a hunters perspective intermediate products may be improved hunting areas and final service the game population. Both tourists and local population may value new and/or improved hiking and recreational areas as intermediate products, and barriers, mushrooms etc as final products. For a population that values a high level of biodiversity, the various regulating and supporting functions in a protected forest and the provision of habitats and favourable conditions for flora and fauna make up the intermediate products.

Beneficiaries enjoying the ES resulting from increased forest conservation are only paying for the provision of the ES through the national tax system. This means that the Finnish government is paying for the provision of ES on behalf of the whole Finnish population even though forest conservation is taking place in certain parts of the country. Based on this, beneficiaries can be said to be the whole Finnish population (e.g. for the non-use value related to biodiversity conservation), but in practice local and regional population probably benefit most.

When it comes to the issue of *property rights*, the forest owner and ES seller have most of the property rights presented in section 3.2.2. Before entering into a conservation contract the forest owner has the right to access the forest (access right), the right to extract timber and cut the forest (right of withdrawal), the right to decide how the forest is managed and change management patterns (management right) and the right to transfer his property rights to others (right of alienation). The forest owner does however not have the right to decide who can access the forest (right of exclusion). The buyer who in this case is the government has little legal right to interfere with the forest owner's management or clearing decisions in order to improve biodiversity conservation without taking over his or her property rights. The traditional approach to nature conservation in Finland has been for the government to set ecological goals and then acquire the required sites to reach these goals. This approach has certainly not been appreciated by forest owners, and has often led to conflict.

The link between the proxy that it is paid for (conservation of forest) and the ES that is demanded (biodiversity) is well documented, and the site selection criteria used to determine which tenders that are accepted are based on nature conservation biology and prepared by an expert working group appointed by the Ministry of Environment. As mentioned above seven habitats especially important for biodiversity are identified: heathland forests with plenty of decaying wood, herb-rich woodlands,

spruce mires, swampy woodlands, sunlit esker slopes, wooded pastures and meadows, and natural forests along emerging coastlines. The sites ecological structure, extent and location are also taken into account. Sites containing habitats that are well preserved in their natural state or can easily be restored, sites that host rare or endangered spices or sites that are close to already protected areas are especially favoured. On a smaller scale there is particular focus on conserving forests that are rich in biodiversity because they contain features like: dying wood, burnt or charred wood, mature broad-leaved trees, large aspen trees, nutrient rich soils, and springs, brooks and other natural water features.

Finish legislation puts some obligations on forest owners related to conservation of biodiversity in commercially managed forests. In addition, many forest owners already conserve biodiversity in their forests by leaving set-asides or manage some areas based on environmental goals on their own initiative. A PES scheme paying for these kinds of action may suffer from *weak additionality* because it may pay for biodiversity conservation that would have been carried out anyway.

Permanence is assured for the duration of fixed-term contracts, but at the end of the contract the forest owner is free to manage the forest according to personal interests. Because forest owners can choose to conserve part of their forests and continue to commercially manage other parts, the possibility exist that conservation in one area lead to increased clearing at another location. This may lead to *leakage effects*.

Table 6–2 Overview of a Forest Conservation PES scheme – Example from Finland

Name of PES scheme	**METSO, the component of competitive tendering**
Ecosystem service aspects	
Type of ecosystem ES or benefits to be delivered	*Forest* Preserve forest habitats valuable to halt the ongoing decline in biodiversity
Type of services (provision, regulating, cultural, supporting)	Provisioning (reindeer husbandry, game, berries, mushrooms, lichen etc.), regulating (biodiversity, carbon sequestration, water purification etc.) and social & cultural (aesthetic, recreational, spiritual etc.)
Kind of value (direct use, non-use, indirect use)	Direct use (reindeer husbandry, games, barriers, mushrooms, aesthetic, recreational, spiritual etc.) and indirect use (water purification, carbon sequestration etc.) Non use from knowing biodiversity is preserved
Type of good (club, open access, pure public)	Pure public (e.g. biodiversity), club good (hunting), common property resources (berries, mushrooms etc)
Institutional set up	
Beneficiaries	Local, regional and national users such as reindeer farmers, tourists, hikers, and hunters
Suppliers	Primarily private forest owners but some state owned forest is also included in the project
Distribution of rights	Forest owners have the rights of access, withdrawal, management and alienation

PES programme characteristics	
Land use or practice paid for (linked to ES or benefit)	Payment to conserve areas corresponding to criteria set by the authorities. In practice conservation is obtained either by establishing a privately owned nature conservation area through a fixed-term agreement or by the state purchasing the area as a nature conservation area.
Kind of payment	In a tender the forest owners present basic information on the site and reveal personal views on compensation or sales price. The government then chooses the offers that provide most of the ecological services they want at an acceptable price. Protection means, delimitations and level of compensation are subject to negotiations.
Who are the buyers? (ES users, government, other?)	Finish government
Who administers the programme?	The Ministry of the Environment and Ministry of Agriculture and Forestry
How are sellers of ES selected?	An expert working group appointed by the Ministry of the Environment has prepared ecological criteria based on forest structures and habitat types important for biodiversity. Location of a site in relation to other protected areas is also important.
Other requirements	Regional factors including impacts on local businesses, recreation, tourism and cultural values are also considered.
Scale of programme (local, regional, national, global)	Regional
Monitoring	A special monitoring group is assigned to review how well resources have been allocated and assess the need for further resources. Impacts of the actions of METSO will also be monitored.
Sanctions	No sanctions are known.

6.3.3 Lessons from the METSO case

Because the first phase of the METSO programme has been carried out in limited pilot areas, total impact from the use measures involving voluntary commitments will not be evident before the measures are applied to larger areas. Many ES also evolve over long time and impacts on biodiversity are not readily available yet. Still, preliminary results and experiences from the first phase of the METSO programme (2003–2007) were considered when the new METSO programme was prepared for 2008–2016.

The fact that conservation measures were carried out on a voluntary basis has contributed to making conservation more acceptable to forest owners, and also to improving the public opinion on forest conservation. It has been suggested that one of the programmes biggest achievements is that it has led to a more positive attitude towards conservation (Koskela et al., 2006).

Main criticism of the first phase of the METSO programme has been related to the lack of clear targets concerning preferred conservation area, low involvement of forests owned by the state or municipalities, and insufficient knowledge of which areas outside existing conservation areas that are especially ecologically valuable. Still, evaluation of the METSO

programme has concluded that the use of voluntary conservation measures should be expanded. As a part of this, METSO should ideally also be developed to cover all the habitats identified as especially valuable for biodiversity, and to cover larger or better connected conservation networks. This might however be difficult to secure through these voluntary measures. However, interest from forest owners has been considerable, indicating that significant areas of forest could be protected by the use of voluntary measures (Horne et al., 2009).

The use of fixed-term contracts has been criticised for being an uncertain solution in the long run. If the result of this is that conservation sites is constantly changing, the effectiveness of the conservation will be smaller than if sites were conserved permanently. Short fixed-term contracts are not compatible with the fact that populations that do not spread easily are dependent on stable conditions in order to survive. In addition, ecological features like wood decay continuum and dead but still standing trees take a long time to develop (METSO, 2006). This kind of features is important in the site selection criteria. At the same time, short time contracts targeting habitats with temporary ecological values (like fire sites) or habitat in need of active management can be a good solution. Most forest owners also prefer contracts that do expire, and that gives them the opportunity to maintain property rights and the option to alter management decisions in the future. Forest owners would however prefer a system where the state is obliged to continue the contract if the forest owner wishes to do so (Horne et al., 2009).

Evaluation results also point out that attention should be given to linking compensation paid more closely to ecological values and ES generated. This would give forest owners an incentive to enhance generation of such values (METSO, 2006).

6.4 Summary

PES schemes are already in use in the Nordic countries for many years. The two case studies we have presented in this section indicate that PES schemes can be a useful measure to help secure the provision of demanded ES. It has also shown that there is more scope for experimenting and improving the set-up of existing schemes to improve the level of uptake, the general accept in the population, permanence of the ES and to reduce leakage effects.

In Denmark the agri-environment scheme to establish wetlands has been in place since 2005. It has led to the establishment of 2525 ha of wetland on agricultural land reducing an estimated 282 tonnes of nitrogen leakage per year. The voluntary contracts cover up to 100% of the investment costs and depending on the previous land use, different levels of yearly compensation for foregone income are offered. Also, landowners

can apply for funds to cover costs of managing the wetlands. Permanence is efficiently ensured and ecological minimum standards with regard to nitrogen leakage potentials are used as qualifying criteria in the selection of the plots along with an emphasis on motivation of the land owner to carry out the projects. Efficiency may be improved by introducing a competitive tender in the selection of the plots along with agglomeration bonuses to ensure that larger and continuous plots of land are converted to wetlands. The scheme has not met the national target of reducing nitrogen leakage by 400t per year.

Through the METSO programme in Finland, various voluntary measures have been tested as a way to preserve biodiversity. The voluntary measures have been welcomed by the forest owners, and the programme received more offers on sites for participation than it had funding for. From 2003 until late 2006, 268 contracts were agreed upon, and almost 2000 hectares of forest were protected. The vast majority of the land included was protected through fixed-term contracts. This has led to some criticism due to the uncertainty related to how this will effect forest protection in the long run. Still, the METSO programme has been extended until 2016, and further use and development of the voluntary measures are a part of this. The voluntary aspect of the programme has been pointed out as an important factor in changing people's attitude towards conservation in a positive direction.

7. PES in the Nordic context: Issues, options and future directions

7.1 Some lessons learnt from current PES schemes

PES is a fairly novel way of managing natural resources socially more optimally. Although it functions similarly to a targeted subsidy, it offers new ways of addressing market failures and it provides a different way of looking for solutions to reduce an under provision of demanded ES. In this section, we briefly flag out how PES works differently from other natural resource management policies, what is the scope for PES to manage different ES, and when is PES suitable to use.

7.1.1 What does PES do different from other natural resource management measures?

PES provides a direct conditional way of *buying* conservation. From this perspective, PES offers an innovative supply-driven conservation/management of ES, where the ES provider secures the ES provision based on a conditionality between payment and service delivery (Ferraro and Kiss, 2002). This is particularly interesting for services where beneficiaries are global and/or values are non-use, such as in the case of carbon sequestration and biodiversity. However, many PES schemes are in reality payment for management actions where the delivery of environmental outcomes is uncertain.

Likewise, PES offers a way to *integrate demand and supply sides* of ES where payment for ES is secured in a sustainable way (user pays) and the provision is delivered based on the payment (provider gets) (Pagiola and Platais, 2007). This is particularly useful in situations where beneficiaries are local and values are direct use values such as in watershed services or landscape aesthetics.

7.1.2 What is the scope for PES to manage different ES?

Existing and previous PES and PES-like schemes tend to focus on four main types of ES (Wunder 2009):

- Protection of *landscape beauty* for recreation and amenity purposes. This is an important area in OECD countries (e.g. agri-environment

schemes targeting restoration of stone walls, repair of traditional farm buildings, or management and restoration of traditional farmland habitats such as hedge rows) and growing in BRIC countries;
- Protection and regeneration of *watersheds.* This is found e.g. in Mexico (PSAH Program) and New York City's watershed protection programme;
- Protection and regeneration of *biodiversity*. Examples are found in Australia (e.g. the BushTender and ALR); in the US (US Conservation Reserve Program) and in the EU (agri-environmental schemes, the BIOSA network in Austria and METSO in Finland); and
- Protection and sequestration of *carbon* in forests and land-based systems. Examples can be found e.g. in China (Sloping Land Conservation Programme) in the UK (Challenge Funds in Scotland) and under the UNFCCC CDM mechanism (afforestation and reforestation projects).

To a lesser extent, PES schemes are found in the area of marine environments. Examples include sea turtle nesting; compensation to release sea-turtles as by-catch; protection of sea-grass habitats and protection of corals for recreative purposes (Paul Ferraro, 2009a). The main reason for the small uptake of PES in marine areas is the difficulty of overcoming the hurdles of non-rivalry and non-excludability of mobile natural resources of e.g. fish population.

The way in which PES functions necessarily limits the scope for using PES for different ES and for different qualities of ES. It targets a strategic sub-spectrum of ES through the following aspects (Wunder, 2009):

- The use of PES should optimally be based on *positive externalities* (See Section 3–1) that land stewards provide to beneficiaries other than to himself. For instance, a PES schemes should not pay a farmer for enhancing on-farm soil fertility if this only benefits himself. PES should, however, pay a farmer for enhancing downstream flood protection, benefitting people or installations downstream.
- Among all the positive externalities or public goods, only *credibly threatened ES* will be paid for. This is based on the principle that people will only pay for services that they would not otherwise receive, did they not ensure the continued delivery through compensation to the land manager.
- Among threatened externalities, only those perceived as *most valuable* are paid for, i.e. where the willingness to pay to ensure a provision of a specific ES is greater than the willingness to accept the loss or reduction in provision.

Limiting factors in applying PES schemes is the voluntary nature of the mechanisms. If an ES is on the edge of collapse (and is highly enough valued by human society) voluntary measures are not sufficient to ensure

the continued delivery of the service. Also, if society judges that a particular ES should be guaranteed at a certain minimum level on *all* sites within a specific area or region, a voluntary approach would not ensure a general provision of the service, but regulation could.

Specific contract design in PES, however, can help ensure that activities are pooled spatially to achieve a maximum effect of the ES, such as agglomeration bonuses where land stewards receive e.g. a double payment if the neighbouring land steward also participates in the PES scheme or landowners only receive payments if habitats are arranged in an ecologically favourable configuration (See e.g. Dreschler et al., 2009; Parkhurst et al, 2002).

Biodiversity is probably the case where designing PES schemes becomes particularly challenging. Biodiversity covers a number of ES and economic values ranging from the maintenance of ecosystem functioning through to option and existence values, and most are intangible and rarely consumed by a clearly identifiable group of people. In addition, threshold effects are essential in the supply of biodiversity, e.g. forest areas or wetland areas below a certain size will fail to deliver the demanded biodiversity. This makes it difficult to portion out the services to individual ES providers on a voluntary basis. Efforts to try and solve some of these problems are however made, such as in the Finnish METSO programme (See Section 6.3) or in the Australian trial scheme of conservation auctions for wildlife corridors in the southern Desert Uplands bioregion in Queensland aiming to biodiversity management on rangelands area (Windle et al., 2009).

7.1.3 When is it appropriate to use PES?

ES should ideally be a positive externality

PES are equivalent to a targeted subsidy and can in theory be applied where a positive externality are undersupplied in order to correct for the market failure. Taxes and charges should be applied in cases where a negative externality causes unintended harm on the local, regional or global population. However, for an externality to be regarded as positive or negative really depends on the situation to which it is related (See discussion in Box 3–2). In reality, PES are used to prevent actions that lead to negative externalities i.e. PES play the role of taxes and charges.

An associated issue to address when discussing whether to apply a PES-like scheme or to introduce a tax or a charge, for instance, is the fact that subsidies are often applied for serving primarily the interests of stakeholder groups. Rent-seeking behaviour of public and private organisations is one reason why subsidies often do not efficiently meet their targets.

Appropriate economic trade-off is required

A precondition for applying PES is the value of the trade off between the first-best land use for the private land owner and the value of the socially desirable ES. The value of the ES to the buyer(s) is based on the willingness to pay (WTP) for the ES. If the WTP is higher than the willingness of the seller to accept (WTA) a compensation plus the transaction cost (TC) of setting up and running the scheme (i.e. WTP>WTA+TC), then PES can function and have an effect. If however WTP<WTA+TC, the PES will not take off as the sellers will not find trade off to be profitable.

Clarify public-private good issues or resolve to proxies of ES

Ideally, in order to market environmental services, it is necessary to overcome the hurdles of non-excludability and non-rivalry to make the ES marketable. In most cases, this is extremely difficult, or the ES need to be fairly simple to assess and monitor such as in the example of a trial PES scheme in Germany on grassland (See Section 5–2). For this reason, the majority of PES schemes resolve to defining proxies for ES in terms of land use management activities or changes in land cover types. Ensuring that the change in activities of the land steward translate into the demanded level of ES is central to the efficiency of PES.

Competitive markets are not a requirement

PES does not necessitate a readily established market to function, as the basis for the scheme is the contract set up between the buyer and the seller. In fact, in a normally functioning market, the transaction costs of the PES would in most cases lead to a stop of PES. Markets and competition are neither necessary nor sufficient preconditions for PES (Wunder, 2008), although competition between private landowners is needed for cost-effective delivery.

Cultural conditions matter

Where there are strong intrinsic values placed on ES by the service providers, introducing monetary payments on top may lead to adverse effects such as undermining rather than strengthening conservation efforts. Real life examples exist for similar situations, where kindergartens introduced a penalty payment for parents picking up their children too late. The result was that parents felt that it had become morally acceptable to come late, as long as they pay the penalty, and the number late pick ups increased instead of decreasing (Gneezy and Rustichini, 2000).

Using non-monetary PES payments can in some situations be preferable (Wunder, 2008) such as a rural development fund in Norway established to enhance investment in alternative economic activities (See Section 5–1 “Compensation payments for voluntary forest conservation in Norway’).

Institutional conditions matter

A fundamental aspect for the well-functioning of PES schemes is trust between the sellers and the buyers of ES. For the sellers, it's important to know that the buyer is not trying through the back way to take away rights. For the buyers, it's important to have confidence, that the sellers have a genuine interest in providing the service, as monetary payment alone will not ensure the provision of the ES.

Where there are particularly deep conflicts between users of ES and providers, PES cannot be applied. PES can however provide an opportunity to improve natural resource management in situations where command and control policies or taxes are difficult to impose, e.g. in private farming and forestry in OECD countries due to historically claimed management rights. It can also provide a sense of fairness and equity through a compensation for obligatory changes, or it can provide useful features such as the conditionality feature of the cross-compliance mechanism under Pillar I of the EU CAP.

7.1.4 Useful Aspects to Take into Account in PES

Information requirements are high

The need for information in the start-up phase of PES schemes is typically high. This is due to setting up and negotiating the contract between buyers and sellers, undertaking the environmental-service baseline assessment (e.g. measuring hydrological linkages to scientific standards) and design of the whole PES system. In the operational phase, information requirements are lower, though some is needed for monitoring, enforcement/sanctioning and administration purposes (Wunder, 2008). In government-financed PES schemes, transactions costs can be streamlined and cut, whereas user-financed PES schemes with often multiple and diverse sellers and buyers may stumble and fall over the high start-up costs. The transaction costs related to defining and negotiating the contract is one cost item that differs from other natural resource management policies. This is one of the reasons, why PES is typically not found in areas with many buyers and sellers.

Combining PES with regulatory approaches can work well

Setting up successful PES schemes often depends on the emergence of supporting regulatory and cooperative arrangements. PES should not be seen as an alternative to non-market institutions but be part of a combined solution between regulation, cooperation and market based instruments that suit local conditions. An example is the cross compliance requirement under the EU CAP where landowners need to meet minimum environmental standards before being eligible for the voluntary agri-environment schemes. PES can successfully function as an incentive to

do more than the legal minimum requirements while providing authorities with a policy measure that is generally accepted by land owners.

Government can help by playing an active role

A number of aspects need to be clarified when establishing a payment mechanism for ES, and governments play a central role in this. These aspects comprise general awareness-raising of the concept among landowners; a clear identification and definition of services; these need to be linked to land management activities that will ensure their delivery; costs and benefits may need to be evaluated, and potential resistance should be pin-pointed; type and level of property rights need to be agreed or defined and in the case of competitive bidding mechanisms, the trading infrastructure need to be set up. Time is needed for piloting, possibly laboratory experiments, feedback, evaluation and gradual improvements.

Appropriate Design of PES is crucial for efficiency

If payments for ES are not carefully designed, they may yield only small gains in services of interest, and may even harm the production of other services and biodiversity conservation. In the Willammette Basin in Oregon, United States, it has been found that policies aimed at increasing carbon sequestration do not necessarily increase species conservation and vice versa. Good design of PES schemes, however, can allow for efficient incentive schemes targeting multiple (and often time competing) objectives. (Nielsen et al, 2008).

Whether uniform price schemes or auctions will generate lower or higher measures of efficiency depends largely on the relative degree of heterogeneity in the opportunity costs, the environmental benefit and the covariance between them (White and Burton, 2005) in addition to the amount of bid shading by bidders (Latacz-Lohman and Schilizzi, 2007b). Also fixed-price schemes appear to be less vulnerable to rent-seeking than are auctions. Table 7–1 summarises the necessary and useful conditions of PES described in this section and where appropriate links to examples of different types of ES and ecosystems.

Table 7–1 When is PES suitable?

Necessary conditions of PES	Reason	Examples of ES excluded from PES	Examples of ES included in PES
i) Resolve public/private goods issues *OR* ii) Resolve to defining proxies of ES	i) PES is best suitable where it is possible to overcome the hurdles of non-rivalry and non-excludability. ii) Typically, however, land use practices are used as a proxy for delivering a specific ES -> challenge to ensure link between action and level of ES provision	i) ES that constitute mobile resources are typically more difficult to include in PES schemes, e.g. marine biodiversity, conservation of fish populations.	i) Carbon sequestration ii) Establishment of wetlands; conversion of arable land to grassland; set-aside of forest or farm land.
Positive externality	PES should ideally be applied where a positive externality is	ES that benefit only the landowner	Watershed services, carbon

Necessary conditions of PES	Reason	Examples of ES excluded from PES	Examples of ES included in PES
	undersupplied as a correction to market failure.	should not be included in a PES scheme, e.g. enhancement of on-farm soil fertility.	sequestration, landscape amenity values, biodiversity.
Credibly threatened ES /size of externality	PES should only target ES for which there is a genuine interest to pay for the service *and* where the ES would not be provided in the absence of the payment.	The size of externality depends on landscape ecological assessments.	Clean drinking water; biodiversity; climate stability; soil erosion.
Appropriate economic trade-off	PES can only function where WTP>WTA+TC. This implies that where TC is prohibitively high, PES is not workable and where the gap between WTP and WTA is narrow, TC cannot be high for PES to function.	Depends on local conditions. Where there are many buyers and sellers, TC is usually prohibitively high.	Depends on local conditions, contract design, and social set up.
Trust between buyer(s) and seller(s)	Sellers: important to know that the buyer is not trying through the back door to take away rights. Buyers: important to have confidence, that the sellers have a genuine interest in providing the service.	Independent of type of ES.	
Appropriate design of PES	Design of PES has direct implications on the efficiency and the environmental performance of the scheme.	Independent of type of ES.	
No strong intrinsic values placed on ES	Monetary payments may undermine conservation efforts in case of strong intrinsic values.	Depends on local cultural conditions and traditions.	

Desirable/useful conditions	Reason	Examples of ES	
Financial Efficiency/strong additionality	Contract design can help avoid paying for actions that would have happened anyway.	Independent of type of ES.	
Social Efficiency	Contract design can help avoid problems of paying too low (no or too low take-up) or too high (inefficient use of resources) levels of compensation.	Independent on type of ES. Many nature conservation contracts appear to have a low level of social efficiency.	
Spatial coordination	Targeting of land owners or agglomeration bonuses can help ensure continuous areas under PES across private borders	Most PES schemes in place today have weak or no efficient spatial coordination in place.	Landscape linkages for wildlife; riparian land for water quality.
Permanence	Long-term contracts and assurance or monitoring of no leakage of externalities outside the PES area.	Independent of type of ES.	
Competition between landowners with heterogeneous cost structures	Enables a cost-efficient delivery of ES, e.g. through the use of auctions and competitive bidding.	Independent of type of ES.	
Active role of Government	Starting up new PES necessitates awareness rising along with defining sellers/buyers, ES, negotiating contracts and monitoring delivery.	Independent of type of ES.	

7.1.5 How do User-financed and Government-financed PES schemes compare?

User-financed schemes are generally more efficient than government financed schemes (Wunder, 2008). Examples include Vittel paying for drinking water protection in France (See Section 5–4), Pimampiro municipal watershed-protection scheme in Ecuador (Wunder & Albàn, 2007), many watershed and carbon sequestration services. User-financed PES has the advantage that it targets one specific ES and does not attempt to include a number of side objectives such as multiple services, or enhance local economic activities, as is often observed in government financed PES. User-financed schemes also often target ES that provide a high level of service in high-threat areas. The main reason here is that the buyers are only willing to pay for a service upon which they depend or upon which they place a high value. User financed schemes also many times apply differentiated payments according to the costs of the land managers, making the scheme overall more cost-efficient. The two main challenges with user-financed schemes, however, are to i) keep the transaction costs in installing PES low and ii) avoid a tendency of free-riding among the buyers of the ES.

Government-financed schemes are generally large-scale, covering a whole country such as the PSA Pioneering environmental services programme in Costa Rica covering 270,000 ha; the PSAH National Program for Hydrological Environmental Services in Mexico covering 126,000 ha, the US Conservation Reserve Programme covering about 14.5 million ha and China's Sloping Land Conversion Programme covering 7.2 million ha of land retired and 4.9 million ha of afforestation (Wunder, 2008). Government-financed schemes can also be region-wide, e.g. agri-environmental schemes in the EU and often include numerous ES and have multiple side-objectives such as wider rural development issues, job creation, and improvement of competitiveness of agriculture on the global markets or supporting farm incomes in marginal upland areas. They are therefore generally less focused compared to user-financed schemes and less efficient in delivering ES. The disadvantage of most current government financed PES schemes is the use of flat uniform payments that are not linked to the value and level of the ES provision. The additionality is generally very low as payment is frequently made widespread with little monitoring and sanctioning. The advantage of these schemes is no doubt the economies of scale keeping transaction costs relatively low and the avoidance of free-riding among buyers of ES. The overall challenge with government-financed schemes is to make them more targeted and efficient.

7.2 Options for PES in the Nordic Countries

In this section, we argue for the options of PES in the Nordic countries.

7.2.1 PES is already in use in the Nordic Countries

Conditional, voluntary payment mechanisms to preserve and enhance ES are already in use in the Nordic countries. Agri-environmental schemes aiming at increasing biodiversity or reducing nutrient leakage exist in all Nordic countries; biodiversity preservation and groundwater protection schemes exist in forestry in Denmark, Norway, Sweden and Finland; and buyout schemes of fishing vessels exist in Denmark and Norway in order to reduce pressure on fishing stocks.

Experience from Denmark on paying land owners for creating and maintaining wetlands show a generally positive outcome with 1,704 hectares wetland created in four years and estimated 282 tonnes of nitrogen leakage avoided (20005 to 2009). However, compared to the target under VMP III of reducing nitrogen leakage by 400 tonnes by the end of 2009, the scheme missed the target by more than one fourth. A contributing reason was an insufficient number of participating landowners, which may be linked to the fact that the scheme was based on a fixed-payment that was not spatially targeted and with compensation at a level not attractive enough for landowners with high nitrogen leakage reduction potential.

In Finland a programme paying forest owners for conserving or managing forest in favour of biodiversity were tested from 2003 to 2007. Experiences from this programme have mainly been positive, and the project has now been developed and extended until 2016. Forest owners are generally positive to this kind of voluntary conservation, and the number of sites offered for the project exceeded the amount of funding available. By late 2006, 268 contracts were agreed on, from which 241 are fixed-term contracts and 27 are permanent contracts, and a total of almost 2000 hectares of forest were protected as a result of the project (Horne, 2009).

7.2.2 There is scope to improve the current use of PES in the Nordic countries

Traditionally, PES-like schemes in the Nordic countries are based on fixed-rate payments with no or little spatial targeting or on individually negotiated levels of payments based on e.g. the amount of timber on the plot of land and a fixed level compensation. This may indicate that there is room for improving social and ecological efficiency of such schemes.

There is, however, very little experience with using competitive bidding in PES in the Nordic countries and to our knowledge no experience in using economic incentives to obtaining spatially connected areas. Auc-

tion schemes for forest conservation are currently being considered in both Norway and Sweden, at least by researchers (see Romstad et al 2009). The Finnish METSO program has generated many relevant experiences also for Sweden and Norway (and to a lesser extent the other Nordic countries).

In this respect, there is scope to experiment with PES contract designs. Where opportunity costs are likely to be heterogeneous among landowners, competitive bidding and auctioning may prove more efficient than fixed-rate payments. In addition, finding the right level of compensation in fixed-rate contracts may also profit from auctions, where landowners "reveal" their prices.

7.2.3 There is scope to expand the use of PES in the Nordic Countries

PES can be combined with existing natural resources regulation as a "top-up', where landholders can obtain compensation for undertaking more environmentally friendly action than the minimum regulation requires. The EU CAP agri-environmental schemes are already such an example, but in other areas, this can be expanded.

There is also scope for expanding the application of PES into areas, where regulation by landholders is traditionally perceived as very negative, and where property rights are very strong. PES could be an option, where PES substitutes partly or fully regulation on the grounds that regulation in any case is inefficient. This is the case in forestry. In Norway, for example, the existing voluntary forest conservation program has struggled to enrol new conservation areas fast enough to reach political targets. There may be ample scope both to develop PES schemes that are more attractive to forest owners and which also reveal their opportunity costs through e.g. auctioning of contracts. New PES schemes could be made more attractive not just through increasing payments (as limited government funds will always be constraint), but through the structure of contracts. In Finland, for example, it is more acceptable for forest owners to enter into time-limited contracts than to transfer land titles to the government for eternity. By designing PES schemes that are more sensitive to such issues, more conservation may be achieved for similar budgets.

Current legislation hold possibilities for integrating PES schemes in the policy mix. An example is the Water Framework Directive (WFD 2000/60/EC), where water users could pay for the groundwater protective services of forests via their water bill either for the investments in establishment of forests and/or the appropriate maintenance and management of existing forest ecosystems (IUCN, 2009). Public agencies have between 2009 and 2012 to put programmes of measure into place[29].

[29] WFD requires Member States (MS) to publish the first River Basin Management Plan (RBMP) and to establish programmes of measures (POM) in each River Basin District by 2009 (art. 13 & 11). By 2010, MS need to report on activities from 2009 and to introduce water pricing measures (art. 9)

Finally, there is significant scope for private sector engagement in biodiversity conservation (Bishop et al., 2008) with opportunities for positive financial returns as well as real biodiversity benefits. One avenue is the un-bundling and marketing of biodiversity benefits at landscape-level activities (e.g. organic farming, aquaculture, conservation credits or offsets of sustainable forestry or carbon sequestration). Another avenue is the creation of biodiversity "banks" in both terrestrial and marine/aquatic ecosystems to offset degradation due to land development (Bishop et al., 2008). Businesses in the Nordic countries may very well benefit from international experiences in this field. The role of Nordic governments in this area would be to create the enabling conditions for such trades to take place and to make sure that they are supplementary and not contradictory or overlapping with other natural resource management regulation.

As this report has demonstrated, there are a number of practical PES schemes in place internationally, working under similar regulatory environments as in the Nordic countries. It has been outside the scope of this report to assess the suitability of these specific schemes, but is clear than many of them hold promise for implementation also in the Nordic countries. A more careful assessment of the most promising of these schemes is required to make specific recommendations.

7.3 Future Directions of PES

Based on discussions with reviewers of this report and other academic resources in the field, a number of empirical issues and future directions for PES emerged. These are described below.

More use of auctions/other competitive schemes

Theory states that where costs are heterogeneous across landowners, competitive schemes may provide higher efficiencies and hence better value for money. There are however not a lot of empirical experience with competitive bidding in nature conservation in the EU and even less in the Nordic countries. More pilot auctions and evaluations would benefit the advancement of efficient PES schemes and provide needed insights into the issues of equity, participation and quality of land enrolled.

Paying for environmental outputs

Little is known of the merit of choosing PES schemes that are output based rather than action based. Frequently, action based PES schemes are set up in order to reduce the risk of delivery of the landowner and be-

and by 2012, MS need to ensure that all POMs are operational and report progress in implementing the first RBMPs (art. 11 & 15).

cause too little is known about the ecological system, especially when multiple ES and benefits are included in a scheme. Depending on the ES and circumstance, it could however be interesting to investigate whether it is more efficient to let the landholder decide which action to take in order to improve a specific ES (e.g. non-point pollution from farming practices) and have the payment be based on the outcome of the action. Challenges remain in terms of how to monitor and measure outputs.

Spatial coordination

Ecosystems and the quality and quantity of ES are spatially explicit. Because of the spatial aspects, PES schemes that create ecological corridors or enable larger continuous areas across private borders of land, are, all else equal, superior to isolated and smaller plots of land under PES. Most PES schemes in place have some level of spatial component, determining in which larger administrative regions or type of ecological region, PES schemes may apply. None to our knowledge, however, implement an active spatial coordination at the individual level of PES plots. There are some experimental cases in the literature of using agglomeration bonuses to enhance the connectedness between plots under PES. More real-life examples of how to target landowners and to encourage cooperation between them are needed.

Marine applications

PES is typically found implemented on land-based ecosystems, where open access is more easily regulated, private property rights are more clearly established and ES tend to stay within one spatially defined area. PES in marine areas are to date few in numbers due to the challenges of open access and different spatial conditions of ES. Also, far less is known from an ecological perspective on marine ecosystems than is the case on land-based ecosystems. This does not necessarily mean that PES in marine areas cannot function (See e.g. the blue mussel farming example from Sweden). Given the serious ecological threats to e.g. the Baltic Sea, and the inefficiency of current regulatory mechanisms to ensure e.g. an appropriate water quality, there is room for testing the scope for PES in marine areas.

Empirical impact evaluation

Key to implementing efficient regulation or market-based instruments is robust empirical impact evaluation. Evaluation should be able to attribute changes in status and trends to a policy or programme intervention separate from other factors (Ferraro, 2009b). However, only few well-designed empirical analyses assess even the most common conservation

measures (MA, 2005). Furthermore there is little evidence on environmental and socioeconomic impacts of long-running regulatory approaches like protected areas. There is even less evidence of impacts on voluntary approaches (Ferraro, 2009a). There is therefore scope and need for improving the design of PES schemes that also help establishing inferences and identifying the counterfactual (e.g. knowing what outcomes would have looked like in the absence of the intervention).

8. References

Boyd, J., Banzhaf, S., 2007. What are ecosystem services? The need for standardized environmental accounting units. Ecological Economics 63 (2–3), 616–626

Binning, Cork, Parry & Shelton (2001). Natural Assets: An Inventory of Ecosystem Goods and Services in the Goulburn Broken Catchment. The Ecosystem Services Project, Australia.

BIOSA, 2009. http://www.biosa.at/index.htm (Accessed 25.06.09)

Baldock, D., Dwyer, J., Sumpsi, Vina, J.M., 2002. Environmental Integration and the CAP. A report to the European Commission. Institute for European Environemntal Policy.

Bishop, J., Kapila, S., Hicks, F., Mitchell, P., and Vorhies, F., 2008. Building Biodiversity Business.. Shell International Limited and the World Conservation Union: London, UK and Gland, Switzerland.)

Bockstael, N. E. et al., 2000. On measuring environmental values for nature. Environmental Science and Technology 34: 1384–1389.

Brander, L. et al., 2008. Scaling up ecosystem services values: methodology, applicability and a case study. European Environment Agency.

Bromley, D.W., Hodge, I., 1990. Private property rights and presumptive policy entitlements: reconsidering the premises of rural policy. European Review of Agricultural Economics 17: 197–214.

Bulte, E.H., Lipper, L., Stringer, R., Zilberman, D., 2008. Payments for ecosystem services and poverty reduction: concepts, issues, and empirical perspectives. Environment and Development Economics 13, 245–254, Cambridge University Press.

Cason, T.M., Gangadharan, L., Duke, C., 2003. A laboratory study of auctions for reducing non-point source pollution. JEEM 46: 466–471.

Cason, T.M., Gangadharan, L., Duke, C., 2005. A laboratory study of auctions for reducing non-point pollution. Land Economics 81:51–70.

CJC Consulting (2004). Economic Evaluation of the Central Scotland Forest and Grampian Challenge Funds. Final report for Forestry Commission Scotland.

Claassen, R., Cattaneo, A. and Johansson, R., 2008. Cost –effective design of agri-environmental payment programs: U.S. experience in theory and practice. Ecological Economics 65: 773–752.

Coase, R.(1960).The problem of social cost. Journal ofLaw and Economics, 3, 1–44.

Costanza, R., dArge, R. et al., 1997. The value of the world's ecosystem services and natural capital. Nature 387 (6630), 253–260.

Danish Food Industry Agency, 2009. Danish approach to land consolidation. http://ferv.fvm.dk/Danish_Land_ Consolidation.aspx?ID=16605

Daily, G.C., 1997. Introduction: what are ecosystem services. In: Daily. G.C. (ed.), Nature's Services. Island Press, Washington DC.

DECC, 2007. Bio Banking – Biodiversity Banking and Offsets Scheme – Scheme Overview, Department of Environment and Climate Change New South Wales

Defra, 2006. Valuing our Natural Environment. Final Report, NR0103, 20 March 2006.

Defra, 2007. An introductory guide to valuing ecosystem services. London.

De Groot, R.S., Wilson, M.A., Boumans, R.M.J., 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. Ecological Economics 41, 393–408.

Dreschler, M., Johst, K., Wätzold, F., Shogren, J.F., 2009. An agglomeration payment for cost-effective biodiversity conservation in spatially structured landscapes. Draft manuscript.

Econ Pöyry, 2009. The use of economic instruments in Nordic environmental policy 2006–2009. Nordic Council of Ministers.

EFI, 2009. Innoforce Database of Innovation Cases in Forestry, Innoforce EFI Project Centre http://cases.boku.ac.at/(Accessed 25.06.09)

EFIMED – European Forest Institute (2008) Study on the development and marketing of non-market forest products and services. DG AGRI, Study Contract No: 30-CE-0162979/00-21

Eftec, 2005. The Economic, Social and Ecological Value of Ecosystem Services: A Literature Review, Final report. Defra.

Engel, S., Pagiola S., Wunder, S. 2008. Designing payments for environmental services in theory and practice: An overview of the issue. Ecological Economics 65, 663–674.

Farber, S., R. Costanza, D.L. Childers, J. Erickson, K. Gross, M. Grove, C.S Hopkinson, J. Kahn, S. Pincet, A. Troy, P. Warren & M. Wilson. 2006. Linking Ecology and Economics for Ecosystem Management, BioScience, 56(2):121–133.

Ferraro, Paul, 2003. Conservation Contracting in Heterogeneous Landscapes: An Application to Watersheds Protection with Threshold Constraints. Agricultural and Resource Economics Review 32/1:53–64.

Ferraro, Paul., Kiss, A. 2002. Direct Payments to Conserve Biodiversity. Science 298:1718–1719.

Ferraro, P. J., 2009a. Environmental Protection Approaches, Lecture in Payment for Environmental Services and Market-based Instruments. PhD course at University of Copenhagen, June 15–19.

Ferraro, P. J., 2009b. Counterfactual thinking and impact evaluation in environmental policy. In M. Birnbaum & P. Mickwitz (Eds.), Environmental program and policy evaluation. New Directions for Evaluation, 122, 75–84.

Fischer, B., Turner, K.R., Morling, P., 2009. Defining and classifying ecosystem services for decision making. Ecological Economics 68: 643–653.

Gneezy, U., Rustichini, A., 2000. A Fine Is a Price. Journal of Legal Studies 29

Gilpin, M.E., Diamond, J.M., 1980. Subdivision of nature reserves and the maintenance of species diversity. Nature 28:567–568.

Groth, M. 2005. Ausschreibungen in einem Konzept zur ergebnisorientierten Honorierung ökologischker Leistungen – Eine transaktionskonstenökonomische Analyse. Paper at the 45th annual conference of the German Agricultural Economics Society (GEWISOLA), Göttingen, Germany, October 2005.

Jack, B. K., Kousky, C., Sims, K. R. E., 2008. Designing payments for ecosystem services: Lessons from previous experience with incentive-based mechanisms. PNAS 105 (28), 9465–9470.

Higgs, A.J., Usher, M.B., 1980. Should nature reserves by large or small? Nature 285:568–569.

Hodge, I., 1989. Compensation for Nature Conservation. Environment and Planning A. 27(7) 1027–36.

Hodge, I., 2000. Agri-environmental relationships and the choice of policy mechanism. Blackwell Publishers Ltd.

Holm, T., Loo, L.O. (2005) Musselodling – Nytt verktyg mot övergödningen. Havsutsikt, 3.

Holm-Müller and Hilden (2004). Ausschreibung von Agrarumweltprogrammen am Beispiel der Grünlandextensivierung. Contributed paper at the 44th annual conference of the German Agricultural Economics Society (GEWISOLA), 26–28 September 2004, Berlin, Germany.

Horne, P., Arovuori, K. and Kniivilä, M, 2009. Innovative mechanisms in natural resource policy for safeguarding biodiversity. Draft report

Horne, P., 2009. Forest valuation and policy: Experiences from Finland. Presentation for Euroforex, Oslo 19.05.09.

IUCN, CEPF, 2009. Study on the Economic value of groundwater and biodiversity in European forests. European Commission, Directorate General Environment.

Kleijn, D., Sutherland, W.J., 2003. How effective are European agri-environment schemes in conserving and promoting biodiversity? Journal of Applied Ecology 40:947–969.

Koskela, T., Horne, P. and Syrjänen, K., 2006. Monitoring and assessment of the ecological, economic, and social impacts of the METSO Forest Biodiversity Programme for Southern Finland, II interim report, English summary. Finish Forest Research Institute and Finish Environment Institute.

Landell-Mills, T. and Porras. I. T. 2002. Silver Bullet or Fools' Gold: A global review of markets for forest environmental services and their impact on the poor. International Institute for Environment and Development, London

Latacz-Lohmann U. and Schilizzi S. 2007a. Quantifying the benefits of conservation auctions. EuroChoices 6: 32–39

Latacz-Lohmann U. and Schilizzi S. 2007b. Auctions for conservation contracts: a review of the theoretical and empirical literature. Report to the Scottish Executive Environment and Rural Affairs Department. Project No: UKL/001/05.

Lindahl, O., Lovén, S. (2008) Musselodling för miljön – nu även i Östersjön. Havsutsikt 3.

Lindahl, O., Lovén, S. Farming blue mussel as an environmental measure. Baltic 2020.

Lindhjem, H. and Navrud, S. (2008) How Reliable are Meta-Analyses for International Benefit Transfers? Ecological Economics 66(2–3): 425–435.

Lindhjem, H. (2007) 20 Years of Stated Preference Valuation of Non-Timber Benefits from Fennoscandian Forests: A Meta-Analysis". Journal of Forest Economics 12: 251–277.

Martin-Lopez, B., C. Montes & J. Benayas, 2008: Economic Valuation of Biodiversity Conservation: the Meaning of Numbers, Conservation Biology, 22(3):624–635.

Mayrand, K. and Paquin M. 2004 Payments for Environmental Services: A Survey and Assessment of Current Schemes. Unisféra International Centre for the Commission for Environmental Cooperation of North America.

METSO Forest Biodiversity Programme for Southern Finland, 2006. "METSOn jäljillä" –Research report of the Forest Biodiversity Programme for Southern Finland, English summary.

METSO Newsletter No. 2 2008. Finland's Ministry of Agriculture and Forestry & Ministry of the Environment.

Millenium Ecosystem Assessment, 2005. Washington, DC, Island Press.

Natural England (2009) http://www.naturalengland.gov.uk/ourwork/farming/funding/es/ default.aspx (Accessed 17.08.09)

OECD, 2002. Handbook on biodiversity valuation. A guide for policy makers.

OECD, 2004. Agricultural Policies 2004. OECD, Paris.

OECD, 2009. Reducing Fishing Capacity. Best Practices for Decommissioning Schemes. OECD, Paris.

Pagiola, S., Platais, G., 2007. Payments for Environmental Services: from Theory to Practice. World Bank. Washington, DC.

Parkhurst, G.M., Shogren, J.F., Bastian, C., Kivi, P., Donner, J., Smith, R.B.W., 2002. Agglomeration bonus: an incentive mechanism to reunite fragmented habitat for biodiversity conservation. Ecological Economics 41: 305–328

Romstad, E., M. Bomann and H. Lindhjem (2009) Managing biological diversity in Nordic forests. Draft report in the Report Series of the Expert Group for Environmental Studies, Swedish Ministry of Finance

Schilizzi, S., Latacz-Lohmann, U., 2007. Assessing the Performance of Conservation Auctions: An Experimental Study. Land Economics 83(4):497–515

Schmid, E., Sinabell, F., Hofreither, M.F., 2007. Phasing out of environmentally harmful subsidies: consequences of the 2003 CAP reform. Ecological Economics 60:596–604.

Smith, M., de Groot, D., Perrot-Maître, D.,Bergkamp, G. 2006. Pay – Establishing payments for watershed services. Gland, Switzerland: IUCN. Reprint, Gland, Switzerland: IUCN, 2008

Romstad, E., M. Bomann and H. Lindhjem, 2009. Managing Biological Diversity in Nordic Forests. Report Series of the Expert Group for Environmental Studies, Swedish Ministry of Finance

UNEP, 2008. Compilation of views, experiences, and options in the implementation of the programme of work on incentive measures, Note by the

Executive Secretary, Conference of the parties to the convention on biological diversity, Ninth meeting

US EPA, 2009. Valuing the protection of ecological systems and services. A report of the EPA Science Advisory Board, May 2009.

Whitcomb, R.F., Lynch, J.F., Opler, P.A., Robbins, C.S., 1976. Discussion in "Island biogeography and conservation; strategy and limitations'. Science 193:1027–1032.

White, B., Burton, M.P., 2005. Estimates of administrative and allocative efficiency of the Auction for Landscape Recovery. Provisional Report for the National Market Based Instruments program.

Willis, E.O., 1984. Conservation, subdivision or reserves and the anti-dismemberment hopothesis. Okios 42, 396–398.

Windle J., Rolfe J., McCosker J. and Lingard A. 2009. A conservation auction for landscape linkage in the southern Desert Uplands, Queensland. The Rangeland Journal 31: 127–135.

Wunder, S., 2005. Payments for environmental services: some nuts and bolts. Occasional Paper No. 42. Bogor, CIFOR.

Wunder, S., 2008. Necessary Conditions for Ecosystem Service Payments. Economics and Conservation in the Tropics: A Strategic Dialogue, Conference Paper.

Wunder, S., Albàn, M., 2008. Decentralized payments for environmental services: The cases of Pimampiro and PROFAFOR in Ecuador. Ecological Economics 65: 685–698.

Wunder, S., Engel, S., Pagiola, S. 2008. Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries. Ecological Economics 65, 834–852

Wunder, S. 2009. Lecture notes in "Payments for Environmental Services and Market-Based Instruments". PhD course, Forest and Landscape, Copenhagen, June 2009. http://en.sl.life.ku.dk/forskning/forskerskolenrefolana/activities_courses/student.teacher.presentation.aspx?

Zandersen, M., Termansen, M., Jensen, F.S., Trier, L., 2007. Værdisætning af Friluftsliv i Offentlige Skovrejsningsprojekter [The valuation of recreation in public afforestation projects] Dansk Skovbrugs Tidsskrift 92(2): 41–61

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Sammendrag

Resymé

Denne rapporten analyserer og beskriver det teoretiske grunnlaget for og praktisk implementering av betaling for økosystemtjenester (PES), med fokus på forhold som er av særlig relevans for de nordiske landene. Det vises at PES er solid forankret i gruppen av klassiske incentivbaserte virkemidler, men samtidig bidrar med en ny måte å forvalte økosystemtjenester (ES) på. PES innebærer en direkte måte å "kjøpe" naturvern, og integrerer tilbud- og etterspørselssiden etter ES. PES er praktisert enten i form av naturvernkontrakter eller i form av opprettelse av nye markedsprodukter som økosystemkreditter eller øko-merking. Rapporten foreslår å skille mellom overgangs- og endelige naturgoder som en hjelp til å sette opp effektive PES-systemer. Den identifiserer på et overordnet nivå hvem som drar nytte av ES; rettighetsfordelingen mellom kjøpere og selgere av ES; diskuterer forskjeller mellom kollektive og private goder i forhold til ES; og foreslår et rammeverk for integrering av økosystem- og økonomiske verdier. En rekke eksempler på PES fra ulike OECD-land er presentert for å vise variasjonen i utformingen av PES-kontrakter, og for to eksempler fra Danmark og Finland gås det mer i dybden for illustrere forskjellige erfaringer med PES i Norden. Rapporten konkluderer med at det er rom både for å forbedre og utvide dagens bruk av PES i de nordiske landene.

Bakgrunn og formål

Nordisk Ministerråds miljø- og økonomigruppe har initiert studien "Betaling for og forvaltning av økosystemtjenester: Utfordringer og muligheter i en nordisk kontekst" med mål om å gi en oversikt over status på metoder og tiltak innen verdsetting av og betaling for økosystemtjenester (PES[30]), og å gi eksempler på slike betalingssystemer eller andre lignende forvaltningsmekanismer. Studien søker videre å bidra med diskusjon og råd om hvordan PES og PES-lignende systemer kan anvendes innen ulike områder og for ulike økosystemtjenester (ES).

[30] PES er akronym basert på den engelske terminologien "Payment for ecosystem services".

Konklusjoner og anbefalinger for de nordiske landene

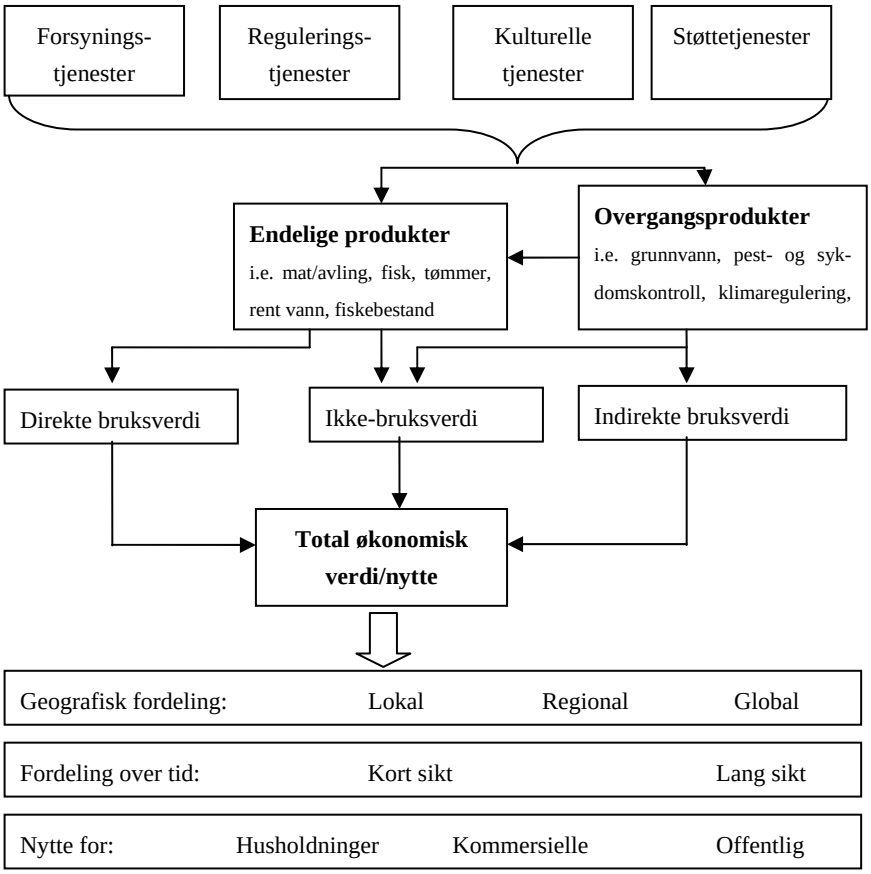
PES er solid forankret i gruppen av klassiske incentivbaserte vikemidler

PES er solid forankret i gruppen av klassisk incentivbasert miljøregulering. PES er en markedsbasert frivillig tilnærming som, i sin reneste utgave, er basert på kontrakter knyttet til oppnådde resultater. Den fungerer på tilsvarende måte som målrettede subsidier, men med PES kan minst en av partene (kjøper eller selger) avslå og betalingene er knyttet til resultater som overvåkes og hvor troverdige sanksjoner brukes i tilfelle brudd på avtalen. PES virker ved at minst en kjøper av ES betaler minst en tilbyder av ES for å sikre en positiv miljøeksternalitet som rent vann, vakker utsikt eller karbonopptak. Den maksimale betalingen som kan bli gitt tilsvarer betalingsvilligheten til de som nyter godt av ES, og minimumsbetalingen er kostnaden som akkurat kompenserer landeieren for å avstå fra sin lovfestede rett til å forvalte sin eiendom på en spesiell måte pluss transaksjonskostnader forbundet med å bygge opp og holde PES-systemet gående. Prisen kan forhandles direkte mellom kjøper og selger eller det kan settes en fast pris, som ofte blir gjort når mellomledd slik som myndigheter eller organisasjoner opptrer som kjøpere av ES.

Nyttig å skille mellom overgangs- og endelige økosystemtjenester

ES har blitt et viktig konsept for å knytte økosystemenes funksjoner til menneskers velferd. ES oppnår økonomisk verdi når de påvirker velferd enten direkte (for eksempel rekreasjon) eller indirekte når de benyttes som innsatsfaktor i produksjon av varer (for eksempel matvarer) eller påvirker nytte (for eksempel avverger flomskader). ES kan oppfattes som "endelige naturgoder" (*final products of nature*). Disse er et resultat av biofysiske strukturer, prosesser og funksjoner av økosystemer, som kan oppfattes som "overgangsgoder" (*intermediate products*). Skillet mellom overgangs- og endelige naturgoder er nyttig som et analytisk verktøy for å fatte beslutninger om naturressursforvaltning siden det er en hjelp til å unngå å dobbelttelle verdiene av ES. Det forenkler verdsettingen av komplekse naturprosesser og spesielt kan det bidra til å klargjøre hvilke naturprosesser og -komponenter som gir verdi som ES til de ulike gruppene som drar nytte av ES.

Figur 1 Link mellom økosystemtjenester og økonomi



Nødvendige og ønskelige/nyttige kriterier for implementering av PES

Basert på erfaringer fra fullskala og testimplementering av PES-systemer samt teori, kan det formuleres en rekke nødvendige og ønskelige/nyttige forutsetninger. Disse er presentert i Tabell 1.

Tabell 1 Oversikt over nødvendige og ønskelige/nyttige kriterier for PES

Nødvendige kriterier for PES	Forklaring	Eksempler på ES ekskludert fra PES	Eksempler på ES inkludert i PES
i) Løse problematikken knyttet til kollektive og private goder *ELLER* ii) Bestemme seg for å definere variable knyttet til ES som kan måles (*proxies*) for ES	i) PES er best egnet når det er mulig å komme utenom utfordringene knyttet til ikke-rivaliserende og ikke-utestengende produkter/tjenester ii) Ulik landforvaltningspraksis brukt som målbare variable (*proxies*) for leveranse av spesifikke ES -> utfordring å sikre sammenhengen mellom handling og nivå på ES levert.	i) ES som består av mobile ressurser er typisk vanskeligere å inkludere i PES-systemer, for eksempel marin biodiversitet, vern av fiskepopulasjoner.	i) Karbonopptak ii) Etablering av våtmarksområder; omgjøring av dyrket mark til gressmark; ta jordbruks- eller skogbruksland ut av produksjon.
Positiv miljøekstrnalitet	PES bør ideelt benyttes i situasjoner der en positiv eksternalitet er lavere enn optimalt, som en korreksjon til markedssvikt.	ES som kun gagner landeieren skal ikke inkluderes i et PES-system, for eksempel økt fruktbarhet av jorder for en bonde.	Vannressurstjenester, karbonopptak, landskapsestetikk, biodiversitet.
Reelt truede ES /størrelse på miljøeksternalitet	PES bør kun rette seg mot ES som det er en genuin interesse for å betale for *og* der ES ikke ville blitt levert i fravær av betalingen.	Størrelsen på miljøkesternaliteten avhenger av landskapsøkologiske vurderinger.	Rent drikkevann, biodiversitet, klimastabilitet, jorderosjon.
Riktig økonomisk avveining	PES kan bare fungere der WTP (betalingsvillighet) >WTA (kompensasjonsbeløp) +TC (transaksjonskostnader). Dette antyder at når TC er uoverkommelig høy er ikke PES brukbart, og når differansen mellom WTP og WTA er liten, kan ikke TC være høye for at PES skal fungere.	Avhenger av lokale forhold. Der det er mange kjøpere og selgere er TC ofte uoverkommelig høye.	Avhenger av lokale forhold, kontraktsutforming og sosiale forhold.
Tillit mellom kjøper(e) og selger(e)	Selgere: viktig å vite at kjøperen ikke prøver å frata en rettigheter Kjøpere: viktig å stole på at selgeren er oppriktig interessert i å levere tjenesten	Uavhengig av type ES.	
Riktig utforming av PES	Utforming av PES har direkte betydning for effektiviteten og miljøresultatene til mekanismen	Uavhengig av type ES	
Ingen sterke moralske/"iboende" verdier knyttet til ES	Betalinger kan undergrave motivasjon og verneinnsats i tilfeller med sterke moralske/iboende verdier.	Avhenger av lokale kulturelle forhold og tradisjoner	

Ønskelige/nyttige betingelser	Forklaring	Eksempler på ES	
Finansiell effketivitet/sterk addisjonalitet	Kontraktsutforming kan bidra til at det ikke betales for aktiviteter som ville blitt utført uansett av landeier	Uavhengig av type ES	
Sosial effektivitet	Kontraktsutforming kan bidra til at det ikke betales for lite (ingen eller for få som vil delta) eller for mye (inneffektiv bruk av ressurser) i kompensasjon	Uavhengig av type ES. Mange naturvernkontrakter ser ut til å score dårlig på dette kriteriet.	
Geografisk koordinering	Målrettet tilnærming til landeiere eller gruppebonuser kan bidra til å sikre sammenhengende områder under PES på tvers av private grenser.	De fleste PES-systemer i funksjon i dag har svak eller ingen effektiv koordinering av områder.	Sammenhengende landskapsområder for dyr; elvebredder eller strender for vannkvalitet.
Permanens (varighet)	Langtidskontrakter og garanti eller overvåking av at det ikke oppstår lekkasje av uønskede eksternaliteter til områder utenfor PES-området.	Uavhengig av type ES.	
Konkurranse mellom landeiere med heterogen kostnadsstruktur	Muliggjør en kostnadseffektiv leveranse av ES, for eksempel gjennom bruk av auksjoner og anbudskonkurranser.	Uavhengig av type ES.	
Myndighetene tar en aktiv rolle	Oppstart av nye PES nødvendiggjør bevisstgjøring parallelt med definering av kjøpere/selgere, ES, kontraktsforhandling og overvåkning av leveranse	Uavhengig av type ES	

PES-systemer har en tendens til å fokusere på fire typer ES

PES-systemer har en tendens til å fokusere på fire områder, nemlig landskapsestetikk, vassdrag, biodiversitet og karbonfangst. Eksempler på eksisterende PES-systemer for hvert av disse områdene er listet opp under:

- vern av landskapsskjønnhet for rekreasjon og estetiske opplevelser. Dette er et viktig område i OECD-land (for eksempel landbruksmiljøordninger som er rettet mot istandsetting av steinmurer, reparasjon av tradisjonelle gårdsbygninger, eller forvaltning og gjenopprettelse av tradisjonelle jordbrukshabitat som for eksempel hekker) og økende i BRIC-land (Brasil, Russland, India og Kina);
- vern og gjenopprettelse av vassdrag. Eksempler på dette finnes for eksempel i Mexico (PSAH Program) og i New York Citys verneprogram for vassdrag;

- vern og gjenopprettelse av biodiversitet. Eksempler finnes i Australia (for eksempel the Bush Tender og ALR); i USA (US Conservation Reserve Program) og i EU (landbruksmiljøsystemer, BIOSA-nettverket i Østerrike og METSO i Finland; og
- vern og opptak av karbon i skoger og landbaserte økosystemer. Eksempler finnes i Kina (Sloping Land Conservation Programme), i Storbritannia (Challenge Funds i Skottland) og under UNFCCCs CDM-mekanisme (skogplantingsprosjekter).

Fokuset på disse fire områdene er imidlertid ikke en indikasjon på at PES ikke kan eller bør rette seg mot andre ES, som for eksempel marine ES.

PES er allerede i bruk i Norden

Betingede, frivillige betalingsmekanismer for å verne og forbedre ES er allerede i bruk i Norden. Landbruksmiljøordninger (*agro-environmental schemes*) rettet mot å øke biodiversitet eller redusere avrenning av næringsstoffer eksisterer i alle de nordiske landene; systemer for vern av biodiversitet og beskyttelse av grunnvann eksisterer i innen skogbruk både i Danmark, Norge, Sverige og Finland; en innovativ betalingsordning for blå muslinger for å ta opp næringsstoffer langs kysten i Sverige og systemer for å kjøpe ut fiskebåter eksisterer i Danmark og Norge for å redusere press på fiskebestander.

Erfaring fra Danmark knyttet til å betale landeiere for å etablere og vedlikeholde våtmarksområder viser generelt positive resultater med 1,704 hektar våtmark etablert i løpet av fire år og estimert 282 tonn redusert nitrogenavrenning (2005 til 2009). Sammenlignet med målet i VMP III om å redusere nitrogenavrenning med 400 tonn innen utgangen av 2009 har imidlertid systemet mislykkes i å nå målet med mer enn en fjerdedel. En medvirkende årsak var at antall landeiere som deltok ikke var tilstrekkelig høyt nok. Dette kan ha sammenheng med det faktum at systemet var basert på en fastpris som ikke var geografisk differensiert og med kompensasjon på et nivå som ikke var attraktivt nok for landeiere med stort potensial for å redusere nitrogenavrenning.

I Finland ble et program som betaler skogeiere for å verne eller forvalte skogen til fordel for biodiversitet testet ut fra 2003 til 2007. Erfaringer fra dette programmet har i hovedsak vært positive, og prosjektet har nå blitt utviklet og utvidet inntil 2016. Skogeiere er generelt positive til denne typen frivillig vern, og antall områder som ble tilbudt prosjektet oversteg de finansielle midlene som var tilgjengelig. Mot slutten av 2006 var det inngått 168 kontrakter, hvorav 241 var tidsbestemte kontrakter og 27 var permanente kontrakter, og totalt var nesten 2000 hektar skog vernet som et resultat av prosjektet.

Det er rom for å forbedre dagens bruk av PES i Norden

Tradisjonelt har PES-lignende systemer i de nordiske landene basert seg på fastprisbetalinger med ingen eller lite rom for målrettet eller individuelt forhandlet nivå på betalingene, basert for eksempel på mengden tømmer på en eiendom og en fastpriskompensasjon. Dette indikerer at det kan finnes rom for å forbedre både den samfunnsøkonomiske og økologisk effektiviteten i slike systemer.

Det er imidlertid veldig lite erfaring med bruk av anbudskonkurranser innen PES i de nordiske landene, her er METSO-programmet i Finland et unntak, og så vidt vi vet ingen erfaring med å bruke økonomiske incentiver for å erverve tilstøtende landområder.

På dette området er det rom for å eksperimentere med design av PES-kontrakter. I tilfeller der alternativkostnader med stor sannsynlighet er heterogene mellom landeiere kan konkurranseanbud og auksjoner vise seg å være mer effektive enn fastprisbetalinger. I tillegg kan auksjoner der landeierne "avslører" sine priser bidra til å finne rett nivå på kompensasjonen i fastpriskontrakter. Flere av PES-systemene som for tiden benyttes internasjonalt kan vurderes testet også i Norden.

Det er rom for å utvide bruken av PES i Norden

PES kan kombineres med eksisterende naturressursreguleringer, for eksempel ved at landeiere kan oppnå en kompensasjon for å opptre mer miljøvennlig enn det minimum reguleringen krever. EUs CAP landbruksmiljøordning er allerede et slikt eksempel, men på andre områder kan dette utvides.

Det er også rom for å utvide bruken av PES inn på områder hvor reguleringer tradisjonelt er oppfattet som veldig negativt av landeiere, og hvor eiendomsretten står sterkt. PES kan være en mulighet i situasjoner der PES helt eller delvis erstatter regulering på grunn av at regulering uansett er ineffektivt. Dette er situasjonen innen skogbruk.

Eksisterende lovgiving gir muligheter for integrering av PES-systemer i politikken. Et eksempel er Vannrammedirektivet (Water Framework Directive), hvor vannforbrukere kunne betalt for skogenes ES som beskytter grunnvannet via regningen de betaler for vann, enten for investeringene i å etablere skog og/eller for hensiktsmessig vedlikehold og forvaltning av eksisterende skogøkosystemer. Offentlige myndigheter har tiden fra 2009 til 2012 for å få tiltak på plass.

Til slutt er det også betydelig rom for at privat sektor kan engasjere seg i vern av biodiversitet med muligheter for positiv økonomisk avkastning i tillegg til gevinsten knyttet til forbedret biodiversitet. En mulig vei er oppdeling og markedsføring av biodiversitetsgoder på landskapsnivåaktiviteter (for eksempel økologisk jordbruk, akvakultur, vernekreditter eller kompensasjon for bærekraftig skogbruk eller karbonopptak). En annen mulig vei er etableringen av "biodiversitetsbanker" både i jord- og marine-/vannøkosystemer for å kompensere for redusert biomangfold som følger av utvikling av landområder. Bedrifter i Norden kan dra nytte av internasjonale erfaringer. Rol-

len til myndighetene i de nordiske landene innenfor dette området ville være å legge forholdene til rette for å muliggjøre slik handel og se til at de er supplerer og ikke står i motsetning til eller overlapper andre reguleringer eller politikk innenfor naturressursforvaltning.

Annex 1 Group I Classification of ES

Ecosystem Services	**#1**	**#2**	**#3**	**#4**	**#5**	**#6**
Millennium Ecosystem Assessment (2005)	*Provisioning* (food, fibre, fresh water and bio-chemicals, natural medicines and pharmaceuticals, ornamental resources)	*Regulating* (regulation of air quality, climate, water, erosion, pest, natural hazard and disease, pollination	*Cultural Services* (spiritual and religious values, educational values, inspiration, social relations, recreation, heritage values)	*Supporting Services* (soil formation, photosynthesis, primary production, nutrient cycling, water cycling)		
Farber et al. (2006)	*Provisioning* (water supply, food, raw materials, genetic resources, medicinal resources, ornamental resources)	*Regulating* (regulation of gas, climate, disturbance, biological, water, waste, nutrient, soil retention)	*Cultural Services* (recreation, aesthetic, science and education, spiritual and historic)	*Supporting Services* (nutrient cycling, net primary production, pollination and seed dispersal, habitat, hydrological cycle)		
De Groot (2002)	*Production functions* (food, raw materials, genetic resources, medicinal resources, ornamental resources)	*Regulation functions* (regulation of gas, climate, water, nutrient, disturbance prevention, water supply, soil retention, oil formation, waste treatment, pollination, biological control)	*Information functions* (aesthetic information, recreation, cultural and artistic information, spiritual and historic information, spiritual and historic information, science and education)	*Habitat functions* (refugium function, nursery function)		
UNEP & IUCN (2008)	*Carbon sequestration*	*Biodiversity protection*	*Watershed protection*	*Scenic Beauty*		
Eftec (2005)	Purification & detoxification (filtration, purification and detoxification of air, water and soils)	Cycling processes (nutrient cycling, nitrogen fixation, carbon sequestration, soil formation)	Regulation & stabilisation (pest and disease control, climate regulation, mitigation of storms and floods, erosion control, regulation of rainfall and water supply)	Habitat provision (refuge for animals and plants, storehouse for genetic material)	Regeneration & Production (production of biomass providing raw materials and food, pollination and seed dispersal)	Information / Life-fulfilling (aesthetic, recreational, cultural and spiritual role, education and research)

Annex 2 Choice of valuation methods for different Ecosystem services

Valutation method	Element of TEV captured	ES valued	Benefits of approach	Limitations of approach
Market prices	Direct and indirect use	Those ES that contribute to marketed products e.g. timber, fish, genetic information	Market data readily available and robust	Limited to those ES for which a market exists
Cost-based approaches	Direct and indirect use	Depends on the existence of relevant markets for the ES in question. Examples include man-made defences being used as proxy for wetlands storm protection; expenditure on water filtration as proxy for value of water pollution damages.	Market data readily available and robust	Can potentially overestimate or underestimate actual value
Production function approach	Indirect use	ES that serve as input to market products e.g. effects of air or water quality on agricultural production and forestry output	Market data readily available and robust	Data-intensive and data on changes in services and the impact on production often missing
Hedonic pricing	Direct and indirect use	ES that contribute to air quality, visual amenity (e.g. forests), landscape, quiet i.e. attributes that can be appreciated by potential buyers	Based on market data, so relatively robust figures	Very data-intensive and limited mainly to services related to property
Travel cost	Direct and indirect use	All ES that contribute to recreational activities	Based on observed behaviour	Generally limited to direct use values and recreational benefits. Difficulties arise when trips are made to multiple destinations.
Random utility	Direct and indirect use	All ecosystems services that contribute to recreational activities	Based on observed behaviour	Limited to use values
Contingent valuation	Use and non-use	All ecosystem services	Able to capture use and non-use values	Bias in responses, resource-intensive method, hypothetical nature of the market
Choice modelling	Use and non-use	All ecosystem services	Able to capture use and non-use values	Similar to contingent valuation above

Source: Based on Defra (2006 & 2007)