



**Economic and Social
Council**

Distr.
GENERAL

MP.WAT/SEM.5/2005/4
23 August 2005

ORIGINAL: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

**MEETING OF THE PARTIES TO THE CONVENTION
ON THE PROTECTION AND USE OF TRANSBOUNDARY
WATERCOURSES AND INTERNATIONAL LAKES**

**Seminar on environmental services and financing for the protection and sustainable use
of ecosystems**

Geneva, 10-11 October 2005

**WATER-RELATED ECOSYSTEMS FOR WATER MANAGEMENT:
ENVIRONMENTAL SERVICES AND FINANCING FOR THE PROTECTION AND
SUSTAINABLE USE OF ECOSYSTEMS ***

Prepared by the Swiss Agency for the Environment, Forests and Landscape in consultation
with the World Conservation Union (IUCN) and the secretariat of the Ramsar Convention on
Wetlands, with the assistance of the UNECE secretariat

Introduction

1. During the past decade, the ecosystem approach has been increasingly applied in water management, encompassing inland water resources and riparian vegetation, wetlands, riverine floodplains and associated wildlife, habitats and human beings. In the UNECE region, the Guidelines on the Ecosystem Approach in Water Management (UNECE, 1993) promoted the idea that water resources should not be managed in isolation from other ecosystem components, such as land, air, living resources and humans present in the catchment area. The catchment area is thus considered as an entire ecosystem. The protection, sustainable use and

* Late submission for consultations among the different partners involved in the seminar preparation.

restoration of its components are essential for the sustainability of water resources management.

2. The 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) firmly embeds the ecosystem approach. Work in this area had been developed even before the Convention was adopted. At their third meeting, the Parties decided to include in the 2004-2006 work plan two seminars on this topic: the first on the role of ecosystems as water suppliers (Geneva, 13-14 December 2005) and the second on environmental services and financing for the protection and sustainable use of ecosystems.

3. At the first seminar, government officials, experts from international organizations, non-governmental organizations and the private sector highlighted the role of water-related ecosystems (wetlands and forests) in water management and made recommendations for an effective implementation of the ecosystem approach.¹ The utmost importance of mechanisms to finance the protection and restoration of water-related ecosystems was particularly underlined.

4. The present document focuses on the protection and maintenance of ecosystem services provided by forests, wetlands and soils to ensure sustainable water management and the supply of good quality water through the use of economic instruments, such as payments for ecosystem services (PES). It is intended to provide background information and examples of current practice for the Seminar on environmental services and financing for the protection and sustainable use of ecosystems.

5. Knowledge on experience and good practices in Europe, particularly in non-EU countries is less extensively documented than experience from Canada and the United States. The Seminar is therefore expected to supplement the available information by providing other examples, adding more details on current practice, draw lessons from existing applications and provide guidance on future policy development and implementation.

I. ECOSYSTEM SERVICES

6. The recently published Millennium Ecosystem Assessment has highlighted the consequences of ecosystem changes for human well-being and options for responding to those changes, and has put numbers on the value of individual ecosystems and the services they provide. It also revealed that the degradation of ecosystems together with their services could get significantly worse during the first half of this century.

7. Three of the key messages from the Board that governs the Millennium Ecosystem Assessment also underpin the present document:

- “Everyone in the world depends on nature and ecosystem services to provide the conditions for a decent, healthy and secure life;

¹ See <http://www.unece.org/env/water/meetings/ecosystem/seminar.htm>.

- Humans have made unprecedented changes to ecosystems in recent decades to meet growing demands for food, fresh water, fiber, and energy;
- The loss of services derived from ecosystems is a significant barrier to the achievement of the Millennium Development Goals to reduce poverty, hunger and disease”.²

8. Generally speaking, ecosystem services refer to the range of conditions and processes through which natural ecosystems, and the species that they contain, help sustain and fulfil human life. These services regulate the production of *ecosystem goods*, the natural products harvested or used by humans such as wild fruit and nuts, forage, timber, game, natural fibres, medicines and so on. More importantly, particularly for those in less developed economies, *ecosystem services* support life by regulating essential processes, such as purification of air and water, pollination of crops, nutrient cycling, decomposition of wastes, and generation and renewal of soils, as well as by moderating environmental conditions by reducing the risk of extreme weather events, mitigating droughts and floods, and protecting soils from erosion.

9. Ecosystem services can be grouped into six categories broadly based on both their ecological and economic function:

- (a) **Purification and detoxification:** filtration, purification and detoxification of air, water and soils;
- (b) **Cycling processes:** nutrient cycling, nitrogen fixation, carbon sequestration, soil formation;
- (c) **Regulation and stabilisation:** pest and disease control, mitigation of storms and floods, erosion control, regulation of rainfall and water supply;
- (d) **Habitat provision:** refuge for animals and plants, storehouse for genetic material;
- (e) **Regeneration and production:** production of biomass providing raw materials and food, pollination and seed dispersal; and
- (f) **Information/life-fulfilling:** aesthetic, recreational, cultural and spiritual role, education and research.

10. In the past, water management usually focused on the protection, restoration and use of aquatic ecosystems, such as rivers and lakes, and their surrounding environment. But in recent years, policies, strategies and actions have increasingly recognized the role of forests, wetlands and soils and their services to ensure sustainable water management, supporting inland waters and their basins from mountainous areas to the sea.

² Living Beyond Our Means: Natural Assets and Human Well-being, Statement from the Board of the Millennium Ecosystem Assessment, available at <http://www.millenniumassessment.org/en/Products.BoardStatement.aspx>. For other basic statements in the entire document consult the selected bibliography at the end of the paper and the given web addresses for further reading.

11. Considering the ecosystem services that water-related ecosystems can provide, forests, soils and wetlands can:

- (a) Improve water quality, withhold sediments and reduce erosion;
- (b) Regulate water flows and water supply, encourage water infiltration in the soil, help to recharge groundwater and store water; and
- (c) Prevent and reduce the risk of water-related disasters, mitigate floods, store water in areas of flood formation and maintain water supplies through dry seasons and droughts.

12. Maintaining ecosystem services is often cost-effective compared to water-construction works, such as dams and embankments, and water-treatment facilities, which can be far more expensive than protecting or restoring ecosystems that can provide the same services. In the short term, the logging of a forest or its conversion into agricultural land might bring more immediate resources for the local inhabitants. In the long term, however, the destruction of the original ecosystem services could be very costly, to the extent that its inhabitants might be forced to leave and others downstream might suffer from the loss of the services.

II. VALUATION OF ECOSYSTEM SERVICES

13. Ecosystem services have often been taken for granted and have therefore been considered free. At best they are undervalued. Although most ecosystem services are positive externalities and many economic activities depend on them, those who are dealing with markets usually ignore them. Economy is looking mainly at raw materials and products. These only represent a small proportion of the total value of ecosystems.

14. Valuation of ecosystem services is a prerequisite for making the right choices on their protection and sustainable use, including conservation rather than conversion. This highlights their importance for different economic activities that depend on them.

15. The **total economic value** of ecosystems incorporates all of the different present and future, marketed and non-marketed goods/services that ecosystems generate in relation to water. It is usually made up of four categories of ecosystem values:

- (a) **Direct values:** water-based or water-dependent raw materials and physical goods which are used directly for production, consumption and sale, such as timber, fodder, fuel, non-timber forest goods, fish, meat, medicines and wild foods;
- (b) **Indirect values:** ecological services that maintain and protect natural and human systems, such as maintenance of water quality and flow, flood control and storm protection, carbon sequestration, nutrient retention and microclimate stabilization, and the production and consumption activities they support;
- (c) **Option values:** the premium placed on maintaining a pool of water-based or water-dependent species, genetic resources and landscapes for future possible uses, some of which

may not be known now, such as leisure, commercial, industrial, agricultural and pharmaceutical applications and water-based developments;

(d) **Existence values:** the intrinsic value of water-related ecosystems (“it exists”) and their components, regardless of their current or future use possibilities, such as cultural, aesthetic, heritage and bequest significance (“it can be passed on to descendants”).

16. In conventional economics, measures of economic value should be based on what people want or prefer. The maximum amount of one thing a person is willing to give up to get more of something else is considered as a fair measure of the relative value of the two things to that person. This can be described by their “willingness to pay”. For example, people would pay more for their water if it were clean. It can also be the amount of money people would pay to avoid flooding. The willingness to pay should be a prerequisite for any payment for ecosystem services.

17. Ecosystem services values are usually applied to decision-making through cost-benefit analysis by measuring the net gain/loss to society of an action (for example, to protect/restore ecosystems). It is therefore necessary to assess the monetary value of ecosystem services.

III. SOME METHODS TO ASSESS THE MONETARY VALUE OF ECOSYSTEM SERVICES

18. The economic valuation of ecosystem services is challenging and sometimes limited. This tool should therefore be used with caution, knowing its limitations. As it only looks at economic aspects, which might not be the most socially/environmentally acceptable, it is advisable to supplement it with information, for example, on equity, property/water rights, actors affecting ecosystem management and the status of the ecosystems.

19. The **market price method** estimates the economic value of ecosystem goods or services that are bought and sold in commercial markets. There are, however, limitations to the use of this method: it is not suitable for ecosystem services as they often do not have markets. When there are markets, those are not competitive, so price has a limited comparable value. In addition, many markets are distorted by subsidies (e.g. subsidies for drinking water). Furthermore the market price method does not indicate the willingness to pay. Alternative methods need to be used as stated below.

20. The **productivity method** estimates the economic value of ecosystem goods or services that contribute to the production of commercially marketed goods, such as the protection of a catchment area and water quality services. For example, water filtered by forest soil can be of such good quality that no pre-treatment is needed before distribution; forests will therefore save money for drinking-water production. There are also limitations to the use of this method. The productivity method can only be applied if the ecosystem services are linked to a marketed product, but not all services from an ecosystem give rise to goods, so it may undervalue the ecosystem. Scientific information is needed to link the actions to improve the ecosystem and the actual outcomes of those actions (restoring a wetland and improvement of water quality). This is usually difficult to predict and to demonstrate.

21. The **damage cost avoided, replacement cost, and substitute cost methods** estimate economic values based on cost of avoided damage resulting from lost ecosystem services; cost of replacing ecosystem services with man-made or artificial products; or cost of providing substitute services (erosion and flood protection, water purification). The money saved through maintenance of an ecosystem service versus its replacement can indicate its value.³ Because these methods make of costs to estimate benefits, it is important to note that they do not provide a technically correct measure of economic value which is properly measured by the maximum amount of money or other goods that a person is willing to pay to have a particular good, less the actual cost of the good. Furthermore, it is often difficult to find perfect replacements or substitutes for ecosystem goods and services that would provide an equivalent level of benefits to the same population. These methods do not take into account social preferences for ecosystem services, nor behaviour in case of absence of these services.

22. Absence of prices or markets for ecosystem goods and services, of close replacements or substitutes, or of links to other production or consumption processes, does not mean that they have no value to people. The **contingent valuation method** infers the value that people place on ecosystem goods and services by asking them directly what is their willingness to pay for them or their willingness to accept compensation for their loss, under the hypothetical situation that they could be available for purchase. A major strength of contingent valuation techniques is that, because they do not rely on actual markets or observed behaviour, they can in theory be applied to any situation, good or service. They remain one of the few methods that can be applied to option and existence values, and are widely used to determine the value of ecosystem services. Contingent valuation techniques are often used in combination with other valuation methods, in order to supplement or cross-check their results. One of the biggest constraints arises from the fact that they rely on a hypothetical scenario which may not reflect reality or be convincing to respondents. The fact that the contingent valuation method is based on asking people questions, as opposed to observing their actual behaviour, is also the source of enormous controversy.

23. The **benefit transfer method** estimates economic values by transferring existing benefit estimates from studies already completed for another location or issue. Benefit transfer is often used when it is too expensive and/or there is too little time to conduct an original valuation study, yet some measure of benefits is needed. It is important to note that benefit transfers can only be as accurate as the initial study.

24. There are also other valuation methods, such as the **travel cost techniques**, which look at the recreational/leisure value of ecosystems through the amount of time spent to visit them. Another example is the **hedonic pricing techniques** which look at how the presence, absence or quality of ecosystem goods and services will influence the price people are ready to pay for other services/goods such as housing (effects of wetlands on property prices).

25. It should be noted that it is rarely necessary, appropriate, or even possible, to quantify each and every component of the total economic value of an ecosystem. In most cases, the

³ In Switzerland, for example, natural infrastructures, such as forests that protects against avalanches, are valued some 2.3 to 2.8 billion €/year which are a substitute for built infrastructures. The high quality groundwater coming from forested catchment areas, used as a source of drinking water, is estimated to save Switzerland some 52 million € per year, while it saves 0.77 €/m³ in Germany.

focus will be only on certain elements of the total economic value of an ecosystem. The elements taken into consideration and the scope of the valuation will depend very much on the aims, focus and water management issue that is being addressed, and the type of decision that is being analysed and will define which is the most appropriate valuation method.

IV. PAYMENTS FOR ECOSYSTEM SERVICES

26. Traditionally, governments have protected catchment areas through law and law enforcement measures. However, the protection of forests, wetlands and soils against pollution, and the sustainable use of forests and wetlands have not always been a priority of State budget allocation. Often lack of financial resources as well as political, economic and technical choices of development, without a long-term perspective, have caused destruction of these ecosystems with negative consequences for water resources. Lack of awareness of the role and functions of water-related ecosystems and the services they provide has sometimes been a drawback of the “Command and Control” approach.

27. To reduce the pressure on these natural resources and provide incentives to protect and restore water-related ecosystems, other tools - complementary to the “Command and Control” approach - have emerged in the last decade. Such tools include market-based economic instruments, especially payments for ecosystem services (PES).

Payments for ecosystem services (PES)

The expression “payments for ecosystem services” is not universally adopted. Many different terms are used, also depending on cultural and political situations. In some instances, “recompense”, “compensation” or “reward” are utilized. PES projects are also referred to as “improved management of hydrological resources” or “reciprocal arrangements.” Payments for ecosystem services are as well called “incentive-based cooperative agreements”, “stewardship payments” or “economic incentives”, “compensatory schemes” or even “performance payments”.

28. In the long term, PES can be seen as a multipurpose tool. By improving the ecosystems, water resources and land productivity as well as by offering new sources of income and developing local institutions and cooperative arrangements, PES encompass the three pillars of sustainable development. Payments for ecosystems services, a benefit-sharing scheme, contribute to the internalization of externalities represented by ecosystem services.

29. Within a catchment area, the upstream communities or individuals - called “providers” - who exercise a proper stewardship (i.e. sustainable management) over the natural resources they own are compensated by the beneficiaries of the services or “buyers”, often downstream populations. These “payments for ecosystems services” provide an incentive for good resource stewardship and protect some essential ecosystems against other land-uses which might look competitive in the short term, but detrimental in the long term.

V. TYPES OF PES CONTRACT

30. Over the past decade, three main types of contract have been developed: public payment schemes, self-organized private deals and trading schemes. In reality, many projects have been a combination of these three types.

A. Public payment schemes

31. Public payment schemes are by far the most common type of contract. They are established when a municipality, regional or national government decides to finance upstream activities such as land retirement or reforestation. In return the government entity expects, for example, improvement in hydrological services for downstream companies. Specific features are:

- Buyers are public authorities such as municipalities or national governments;
- Public authorities establish PES which will protect ecosystems so that they can provide safe drinking water or a sustainable water flow;
- Types of PES: user fees, land purchases, land easement, etc. Usually no valuation of ecosystem services is performed.

1. Public payment schemes in Europe

The nitrate strategy of Switzerland

32. In Switzerland, precipitation generates drinking water to the value of € 3,200-4,500 per hectare of agricultural land. As intensive farming, not adapted to the local conditions, was the main cause of groundwater nitrate pollution, further measures had to be taken in addition to a strong legislation on water protection and agriculture; these include voluntary programmes promoting extensification⁴, integrated production with fewer pesticides and fertilizers and biological farming.

33. The objective is to decrease the nitrate leaking in the groundwater recharge area (or more precisely the area where most - about 90 % - of groundwater extracted at drinking water wells originates) so that water would not contain more than 25 mg NO₃/l. The Federal State fixed the conditions for compensation, while the Cantons apply the relevant measures (contracts with farmers, payments and control/evaluation).

34. Additional measures to prevent groundwater pollution include the promotion of extensification and financial compensation. Both the Federal Law on the Protection of Water and the Federal Law on Agriculture were amended, allowing farmers to be compensated for up to 80% of the extra costs (within the credits voted by Parliament to that end) incurred by them when taking preventive measures, which go beyond good agricultural practice (extensification), to guarantee the quality of surface water and groundwater.

⁴ On extensification in agriculture, see Water Series No.1 - Protection of Water Resources and Aquatic Ecosystems, Part Three, Prevention and control of water pollution from fertilizers and pesticides, Economic Commission for Europe (ECE/ENVWA/31).

35. Compensation can be given in case of restrictions of exploitation, in case of new/required investments or disinvestments, including income reduction due to the change of practice. Financial support is allocated by a contract and a one-time payment per year during a maximum of 6 years, after which the farm is evaluated and required follow-up activities/funding are examined. Different amounts will be paid: between € 130 per hectare and year for measures in open cultures and up to € 520 for keeping or enhancing the meadows surface. It is known that the conversion of open culture to meadow can lower the nitrate content by 60% (from 50 to 20 kg per hectare and year). To re-enrol farmers into such a scheme, the Swiss Agency for the Environment, Forests and Landscape, the Federal Office of Agriculture and the Federal Office for Public Health carried out an information campaign called "ActionN" from 2002 to 2004. In addition to contacting all institutions, holding farmers' lobbies, organizing meetings and issuing a newsletter, a website was created (www.nitrat.ch_englisch/frameset_e.html). At present, some 18 regional projects are under way for a total of 3,000 hectares. Such projects could be recommended for a total of 50,000 hectares. More projects are in preparation.

EU Common Agricultural Policy (CAP)

36. Among the 55 UNECE member countries, 25 which are also Member States of the European Union have to apply EU policies, programmes and legislation. The EU Common Agricultural Policy (CAP) is one of the most important sources of PES for these countries.

37. The CAP, a multifunctional tool, is geared towards ensuring food production and food safety, providing a reasonable standard of living for EU farmers, ensuring that farming continues in all regions of the European Union and preserving the environment. Its two pillars are:

(a) Pillar 1: "Market and Income Policy" to provide income support through market measures and direct payments. The farmers must comply with environmental requirements, laid down in some 20 Regulations and Directives on environmental protection, food and feed safety, animal health and animal welfare, as a condition to benefit from direct payments (principle of "cross-compliance"); and

(b) Pillar 2: "Rural development" to support agriculture as a provider of public goods in its rural and environmental functions (agri-environmental measures, early retirement schemes, forestry and payments in "Less Favoured Areas (LFAs)").

38. The CAP has evolved over the years. A decoupling is taking place between production and aid paid to farmers. The second pillar is taking more weight than the first one. As of January 2005, Member States are obliged to cut direct payments in favour of the development of rural areas (2005: 3%, as of 2007: 5%). Furthermore, the main focus of the CAP reform for 2007-2013 will be rural development. Regarding land management/environment, it is foreseen that payments should aim at ensuring the delivery of environmental services through agri-environmental measures in rural areas and at preserving land management, including LFAs. Better use will be made of "Natura 2000", the European Union Network of Protected Areas, which complements the CAP, can provide more funds for enhancing the value of sites of interest selected under Natura 2000, such as forests. The main goals of the co-financed activities should be combating climate change, improving water quality, enhancing biodiversity and reducing natural disasters.

39. Pillar 1 will have a new fund in 2007 (European Agricultural Fund for Guarantee - EAFG), as will Pillar 2 (European Agricultural Fund for Rural Development - EAFRD). EU co-financing will be between 20 and 50%, and up to 80% for convergence regions.

Agri-environmental and other measures for rural development and their application in EU Member States

40. Agri-environmental measures (AEMs) are incentives to encourage farmers to protect and enhance the environment on their farmland. Farmers are paid in return for a service. They sign a contract with an official institution (administration) and are paid for the additional cost of implementing such commitments and for any loss of income due, for example, to reduced production. The two main objectives are to reduce environmental risks and preserve nature and cultivated landscapes. AEMs go beyond usual Good Farming Practice (legal obligations and levels of environmental care that each farmer has to comply with anyway, compiled in “regional” codes submitted by Member States to the Commission for approval).

41. Some AEMs concern productive land management, such as input reduction (reduction of fertilizers and plant protection products, crop rotation measures, organic farming, extensification of livestock, conversion of arable land to grassland, under-sowing, cover crops, farmed buffer strips, prevention of erosion and fire and rotation measures, conversion of arable land, actions in areas of special biodiversity/nature interest such as late mowing) genetic diversity, maintenance of existing sustainable and extensive systems, farmed landscape and water use reduction measures. Other AEMs concern non-productive land management, such as setting aside, upkeep of abandoned farmland and woodland, upkeep and maintenance of the countryside and landscape features.

42. The 2003 mid-term assessment of AEMs showed that these measures improved soil and water quality although it was difficult to quantify all benefits. Forests were maintained, but this had no impact on social and economic aspects of rural development. The average agri-environmental payment was € 89 per hectare and year (from € 30 to 240), and € 186 per hectare and year for organic farming (from € 40 to 440). Trends in community expenditure on agri-environmental measures between 1993 and 2003 showed that expenditure in Sweden, Austria and Italy was higher than the EU average, i.e. 50% of the total amount paid by the CAP fund (European Agricultural Guidance and Guarantee Fund - EAGGF), while Spain, Belgium, the Netherlands and Greece hardly reached 30%.

43. In their rural development programmes 2000-2006, EU country profiles list agri-environmental measures among their main priorities; examples include Germany, Italy, the Netherlands, Spain and the United Kingdom. The enthusiasm for AEMs varies among regions within a country. It depends, inter alia, on the structure of the farm, its size, the age of owners, and their level of skills.

44. In addition to AEMs, other measures concerning forestry, such as afforestation of agricultural land (new planting) and support for the plantation of forests on agricultural land have been used. An annual grant to compensate for the loss of income due to change of land-use is also available; examples include Denmark, Germany, Greece, Italy and Spain.

45. Apart from the above-mentioned sets of measures, compensatory allowances are given in LFAs and areas with environmental restrictions (vulnerable environments or areas with a high ecological value). Such areas include mountain areas or areas where the soil or climate limits the production (e.g. in Greece, Italy and Portugal). The 2003 mid-term assessment of AEMs showed that the average compensatory allowances for LFAs amounted to € 2,319 per holding and € 71 per hectare and year.

46. Austria through its Environmental Programme (ÖPUL), in line with the CAP, provides public financial support with the aim to protect the environment and ensure incomes for its farmers since EU accession. Some 8.5% farms receive funding for organic production. Three-quarters of all farms get some funding (90% of agricultural area) with the most popular measure being extensive farming. Consequently, Austria's nitrogen balance is very small (29Kg/ha).

47. Since 1997, Estonia has been developing agri-environmental schemes thanks to the Dutch funding for "Agri-Environmental Programmes in Central and Eastern Europe". Further funding came through the EU PHARE programme ("Action plan for implementation of an agri-environmental programme for Estonia"). The agri-environmental measures were first applied in pilot projects in 2001. The State budget for 2002 allocated € 3.1 million for these measures and € 1.2 million for nature conservation support in protected and semi-natural areas. In 2003, support for the agri-environmental programme amounted to € 1.8 million. Although this has made farmers aware of agri-environmental measures, the main problem in applying such measures has been the insufficiency of advisory services, e.g. to facilitate the conclusion of management contracts between municipalities and farmers.

48. Ireland has adopted specific measures on rural protection, including protection of soil quality, biodiversity and landscape and conversion to organic farming. In 2003, about 33% of the agricultural land was farmed according to those requirements, including some 30,000 ha of organic farms. In 2002, Irish farmers received € 439 million (27% of total payments to agriculture) for agri-environmental measures. The Irish Rural Environment Protection Scheme (REPS) is designed to reward farmers for carrying out their farming activities in an environmentally friendly manner and to bring about environmental improvement on existing farms. It is co-financed 75% by the EU and 25% by the Irish Exchequer.

How many euros will a farmer receive in Ireland under REPS?

- An annual payment of € 200 per hectare for the first 20 hectares, € 175 per hectare for the next 20 hectares, € 70 per hectare for the next 15 hectares and € 10 per hectare for the remaining hectares.
- An annual payment of € 242 per hectare for eligible Commonage land, Natural Heritage Areas, Special Areas of Conservation and Special Protection Areas up to a maximum of 40 hectares. € 24 per hectare is payable for areas above 40 hectares and under 80 hectares, € 18 per hectare for areas above 80 and under 120 hectares and € 5 per hectare for areas over 120 hectares.

Source: Irish Department of Agriculture and Food
(see <http://www.agriculture.gov.ie/index.jsp?file=areasofi/reps.xml>)

49. Sweden has decreased the nutrient content by limiting the surface of arable lands that can be left fallow during autumn and winter (release of nitrogen if soil uncovered). The increase in biological farming (6% between 1995 and 2000) was funded through the EU agri-environmental programme of compensation. Financial support was provided to farmers for keeping some specific landscapes to restore and preserve sensitive areas. In 2002, payments to farms under the agri-environmental programmes amounted to SEK 3,358 million (34% of total payments to agriculture) and were co-financed by the EU at an average rate of 45%.

50. AEMs in Spain have included, among others, organic farming, prevention of fires, measures to encourage cultural practices which protect fauna and flora in humid areas, and promotion of integrated management of holdings to help preserve agro-sylvo-pastoral systems. In addition, Spain has implemented measures to afforest agricultural land to prevent soil erosion and desertification.

2. Public payment schemes in Northern America

Approaches and experiences in Canada

51. In Canada, within the Agricultural Policy Framework (APF), the National Agri-Environmental Health Analysis and Reporting Program (NAHARP) takes care of an environmentally responsible production while improving air, water and soil quality and conserving biodiversity through agri-environmental measures. The Federal Government, Provinces and Territories finance these policies.

52. Among the Canadian agri-environmental programmes, the Riparian Stewardship Program (RSP), created by the Manitoba Habitat Heritage Corporation (MHHC), was established in 1994 by the Manitoba Habitat Heritage Act of 1986 to “conserve, restore and enhance fish and wildlife habitat” in partnership with private landowners, farm organizations, corporations, conservation groups and government agencies. The Riparian Stewardship Program has helped landowners establish managed grazing plans, perennial forage buffer strips and establish and maintain willow cuttings to stabilize and rehabilitate severely damaged stream banks with a view to protect and restore riparian habitat for wildlife, fish and cleaner water. It pays Can\$ 30/acre for seed to establish permanent forage buffer strips on cultivated lands adjacent to permanent waterways and lakes and finance cost/shared fencing of riparian and associated lands to a maximum of Can\$ 2,500 with 10 years contracts. This provides healthy riparian areas, helps control erosion and over-bank flow velocities, and protects water quality. Some 20,000 acres of pasture were reverted to more sustainable grazing management practices, in addition to enhancing 125 miles of shoreline and 3,300 acres of riparian habitat.

53. Another agri-environmental programme is the “Greencover Canada”, a five-year national programme with Can\$110-million funding to improve grassland management practices, protect water quality, reduce greenhouse-gas emissions, and enhance biodiversity and wildlife habitat. It focuses on four components: land conversion (converting environmentally sensitive land to perennial cover with 10 years land-use agreements); critical areas (managing agricultural land near water); technical assistance for producers to adopt

beneficial management practices and undertake a watershed evaluation of these beneficial management practices; and shelterbelts (i.e. planting trees on agricultural land).⁵

Approaches and experience in the Unites States

54. The New York City-Catskill watershed management programme is a striking example of public payment schemes in the United States. The Catskill and Delaware watersheds are providing ninety percent of the water consumed by the city of New York. As the quality of water decreased in the 1990s, the United States Environmental Protection Agency (EPA) required that all surface water should be filtered, unless safe water could be provided under natural conditions. The construction of a filtration plant was estimated at US\$ 6-8 billion with yearly operating costs of US\$ 300-500 million. Instead of building a filtration plant, the city authorities decided to invest US\$ 1.5 billion over 10 years in a watershed programme, which was to be administered by the Catskill Watershed Corporation, a non-profit organization. The programme is based on improvements in farm and forestry practices in order to reduce water pollution in the upper watershed. The PES scheme was initiated with money from the city of New York, the State and the Federal Government. Now it is financed by a tax included in the New York water users' bills.

55. The United States Conservation Reserve Programme (CRP), financed annually with some US\$ 2 billion from general tax revenue, is a voluntary programme for agricultural landowners. It provides technical and financial assistance to eligible farmers and ranchers to address soil, water and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The programme is funded through the Commodity Credit Corporation (CCC). The CCC makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices. CRP contracts last between 10 and 15 years. The aim of the CRP is to reduce soil erosion, protect the ability to produce food and fibre, reduce sedimentation in streams and lakes, improve water quality, establish wildlife habitat, and enhance forest and wetland resources by converting highly erodible cropland or other environmentally sensitive acreage into vegetative cover, such as tame or native grasses, wildlife plants, trees, filter strips, or riparian buffers.

56. There are a number of other schemes applied in the United States, including:

- Development rights: the authorities of a State/region allocate development rights to landowners up to a certain limit and allow them to purchase additional rights. These are tradable and not attached to a specific piece of land;
- Land retirement: agricultural land is bought by local authorities to stop agricultural activities on it. This leads to a decrease in tax revenue for the State, but also to increasing benefits in terms of water supply, especially if the land was previously irrigated;
- Land easement: a legally binding agreement that allows landowners to voluntarily restrict or limit development that may occur on their land. It ensures that the land is protected, stays in private hands and on the tax rolls;

⁵ Source: Agriculture and Agri-Food Canada, see http://www.agr.gc.ca/env/greencover-verdir/webs_e.phtml#mgt.

- Watershed leases: upstream land is leased to downstream populations for them to undertake protection measures;
- Environmental Quality Incentives Programme (EQIP): a voluntary conservation programme for farmers and ranchers. It promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. EQIP may cost-share up to 75 percent of the cost of certain conservation practices. Incentive payments may be provided for up to three years to encourage producers to carry out management practices they may not otherwise adopt without the incentive;
- Grassland Reserve Programme (GRP): it aims to protect and restore grasslands in order to reduce soil erosion and protect biodiversity. Payments are made according to different contracts (long and short-term contracts) while activities incompatible with grassland conservation are prohibited;
- Wetlands Reserve Programme: private landowners are helped to restore, enhance and protect wetlands to maximize wetlands' biodiversity, functions and values.

B. Self-organized private deals

57. Contracts are designated as self-organized private deals, if payments are made voluntarily by members of the private sector, such as private companies or associations of water users, with little or no government involvement. Specific features are:

- Providers and buyers are fully private;
- Payment for the management of the catchment area with little or no government involvement;
- Types of PES include user fees, transfer payments, land purchases, cost sharing arrangements, and/or low interest credits.

58. An example of self-organized private deal is given by Nestlé Waters' practice in France. Nestlé, which owns the natural mineral water sources of Vittel in North-Eastern France, protected the spring catchment area, which was intensively farmed (nutrient run-off and pesticides), by purchasing agricultural land and reforesting it. It also reduced further non-point pollution by passing 18-30 years contracts with the local farmers to reduce nitrate pollution by adopting extensive and optimal cattle ranching practices and replace corn production with alfalfa. The yearly payments are based on the opportunity cost of technological change. Vittel also finances all investment costs. Nestlé pays US\$ 230 per hectare and per year for a period of 7 years to cover the reduced profitability. The scheme was possible because existing French laws on water-quality standards: (a) were sufficient to develop such a scheme; (b) provided the suitable regulatory framework; and (c) provided also the right framework to enforce contracts. Equity was respected as farms of all sizes had access to the PES.

C. Trading schemes

59. Trading schemes usually occur where governments set either very stringent water-quality standards or a cap on total pollution emissions. For example, under nutrient trading, a

polluter with a nitrogen or phosphorus discharge level lower than the required standard may sell this “water-quality credit” to a polluter with a “water-quality deficit”. Specific features are:

- Precondition: a strong legislative framework shall fix the total emissions for point sources;
- Providers: in the case of nutrient trading schemes, the “providers” are the point sources’ and non-point sources’ polluters, whose emissions are below the allowable standards. They have not “spent” all their amount of permitted emissions so they can trade what is unused as credits;
- Buyers: in the case of nutrient trading schemes, the buyers are the point sources’ polluters whose discharges are above the allowable standards. This means they have gone over the emission limits they are entitled to, given the size of their enterprises. They need to buy emission credits;
- PES: trading nutrient reduction credits among industrial and agricultural emitters;
- The management and costs of transactions are borne by the point sources’ polluters and no longer by the State. In some countries, trading is seen as politically more acceptable than taxes.

60. Nutrient trading is commonly practiced in the United States. Non-point pollution sources, such as agriculture, represent more than 80% of nitrogen and phosphorus discharges. Best agricultural practice can reduce these inputs. It is usually less expensive to change tilling, planting and fertilization practices than to invest in industry to control point source emissions. Under the nutrient trading scheme, farmers sell their “nutrient credits” to those industries, which, by buying such credits, can go over the allowable emission standards, rather than invest in pollution abatement technologies. The scheme seems to be flexible and cost-effective. Through PES, the scheme provides an incentive to reduce emissions.

61. The management of the Chesapeake catchment area is another example. Although Chesapeake Bay is mid-way through a clean-up plan (“Chesapeake 2000”), the restoration goals for 2011 require additional measures. Thus, the State of Virginia passed in March 2005 legislation to create a water-quality programme. An agreement on water-quality standards among the seven political bodies sharing the catchment was also necessary to allow trading of water credits, equivalent to nutrient credits, which will be up for sale so as to pay farmers to reduce their non-point sources emissions of nitrogen and phosphorus. The unit of exchange will be “dollar for pound of nitrogen and phosphorus”. The market usually determines the unit of exchange which is also affected by the cost of upgrading a facility so that it pollutes less.

62. A third example is the Pennsylvania-Conestoga River, where a reverse auction will be organized by the US Department of Agriculture and the broker NatSource to reduce pollution in the Chesapeake Bay. Some US\$ 90,000 will be auctioned. It will allow the lowest bidder to receive funding for one or more best management practices that reduce nitrogen, phosphorus and sediment run-off on farms.

63. There are also other forms of trading scheme, such as the one based on wetlands mitigation credit trading. Specific features are:

- Precondition: a strong legislative framework shall exist, such as the United States Federal Water Pollution Control Act, to achieve “no overall net loss of remaining wetlands in the United States”;
- Providers: owners of protected wetlands;
- Buyers: developers which will impact on wetlands with their projects;
- PES: wetland mitigation credits;
- The management and the costs of transactions are borne by the providers and buyers and no longer by the State.

64. The Wetland Mitigation Banks is such an example. Wetland Mitigation Banks have been created through the United States Federal Water Pollution Control Act in 1988, for wetland mitigation and compensation to achieve the above-mentioned “no overall net loss of remaining wetlands in the United States”.

65. A mitigation/conservation bank will service a developer that cannot avoid impacting on wetlands by offering him to purchase credits to offset/compensate losses of natural resources at an off-site location where wetlands are protected. The money will be paid to the landowners that have put some of their property’s areas or habitats under the conservation bank to protect/maintain such special habitats as wetlands.

66. The mitigation banking projects can only operate through a system of permits. All mitigation banks have a set of performance standards that they must meet before selling any credit, approved by several government agencies. The creation of any mitigation bank according to the United States Federal Rules is open for comments from the public. Mitigation helps moderate and put a cost on the impact of developers’ activity. However, banks have been criticized for selling credits before the replacement wetland was actually under protection. The destruction of a wetland in one place to improve another one elsewhere is also disputed as such wetlands are not automatically equivalent in terms of flood prevention or other water management activities. And the size of the restored/protected wetland is also to be taken into account. Thus, it is preferable that mitigation occur as close as possible to the impact site.

VI. LESSONS LEARNED FOR THE ESTABLISHMENT OF PES

67. The above overview provides only a few examples of existing mechanisms for payment of ecosystem services. Even if there are no universal rules to ensure their success, as this will depend on various factors such as PES objectives and policy choices regarding investment, trade, subsidies, taxation and regulation, lessons learned from Europe and other regions of the world suggest that the following steps be taken into consideration when establishing payment for ecosystem services:

- To identify a problem or concern over water management that cannot be addressed through a command and control approach;
- To identify the providers: willingness to provide and need to clearly define and enforce property rights;
- To identify the buyers and their potential willingness to pay;
- To raise awareness about problems and opportunities;
- To obtain political support;

- To have functioning political institutions and legislative framework;
- To identify and quantify the services within a catchment area as a package (empirical or strong scientific data);
- To identify possible institutional and legal constraints;
- To select contract type;
- To identify and implement the land use management practice that will guarantee and maximize these services and monitor compliance;
- To establish financial mechanisms with clear rules for the cooperation of providers and buyers;
- To establish an adequate framework for information and its dissemination, consultation, discussion and negotiation;
- To guarantee self-sustaining long-term programme financial support. External funding should only be used for pilot projects and capacity building. Transaction costs are to be reduced as much as possible. To guarantee equity, government must ensure that all sectors of society benefit from such schemes;
- To remove perverse incentives, especially if they subsidize overuse of natural resources and decline of ecosystem health;
- To adapt the project to local conditions by involving all stakeholders in project design and implementation. Involvement must be multisectoral/multidisciplinary.
- To create partnerships between all stakeholders (public-public, private-public, private-private) with vested interests in the proper use of resources and in emitting little pollution;
- To share experience with other projects and design pilots as learning projects;
- To monitor and enforce compliance.

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