Deltares

Ecosystem services in river basin management
Practical examples from Europe

Suzanne van der Meulen
Jos Brils

1205474-000

Deltares

Title
Ecosystem services in river basin management
Practical examples from Europe

Client	Project	Reference	Pages
Institute for Sustainable Futures University of Technology Sydney, Australia	1205474-000	1205474-000-BGS-0003	20

Keywords
Ecosystem services, water management, river basin management, European Water Framework Directive (WFD), application, practice

Summary
This report provides examples of application of the ecosystem services concept within the framework of European water management. The report starts with a brief description of the European (water) policy situation related to ecosystem services (chapter 2). Thereafter, a few examples of the ecosystem services application in water management practice are described (chapter 3). The report concludes with the lessons learned from that application (chapter 4).

Citation
Please refer to this report as:
Van der Meulen, E.S., Brils, J.M., 2011. Ecosystem services in river basin management - Practical examples from Europe. Deltares report 1205474-000-BGS-0003.

Version	Date	Author	Initials	Review	Initials	Approval	Initials
	6 December 2011	Suzanne van der Meulen Jos Brils		Jos Brils		Hans Gehrels	

State
Final version

Contents

1 Introduction

As the pressures from both anthropogenic and natural causes on aquatic ecosystems increase, it is no longer effective or efficient to deal with one issue at a time, since solving a singular problem often causes damaging impacts on other environmental compartments or in other places. We must consider the consequences of our actions on all parts of the environment in an integrated way and configure these actions to cope with an uncertain future. These challenges demand a different approach in order to achieve actual improvement of the ecological quality of our aquatic ecosystems, and thus sustain the goods and services they provide for the well-being of society. A common understanding of the value of the goods and services that a healthy aquatic ecosystem can provide, and how their present poor status due to our actions can be improved, is the key to a new approach to water management (Brils & Harris, 2009).

To date, many apply the ecosystem services concept in actual water management practices to improve that common understanding or for payment of ecosystem services. However, the results of such practical applications are hardly documented in scientific literature and reports are mostly written in local languages. This holds certainly true for the European situation.

Deltares is involved in the application of the ecosystem services concept in some European water management practices and has a good overview of the related European policies and their development. Therefore, Deltares was asked by the Australian Institute for Sustainable Futures (University of Technology, Sydney) to briefly document these examples, with a specific focus on surface and groundwater management.

This report starts with a brief description of the European (water) policy situation related to ecosystem services (chapter 2). Thereafter, a few examples of the ecosystem services application in water management practice are described (chapter 3). Chapter 3 also includes examples of water managing organizations that have applied the ecosystem services approach. The report concludes with the lessons learned from that application (chapter 4).

2 Ecosystem services in relation to European policy

2.1 Generic environmental policy

Over the last three decades, European environmental policy developed from aiming at conservation of single species to halting the loss of biodiversity and a more sustainable use of ecosystem services (see figure 2.1).

Year	Policy	Scope (exact extracts from policy text)
1979	Birds Directive	• **conservation** of all species of naturally occurring birds • measures to maintain the **population of the species** referred to in Article 1
1992	Habitats Directive	• measures … to maintain or restore, at favourable **conservation status**, natural habitats and species of wild fauna and flora
2000	Water Framework Directive	• prevents further deterioration and protects and enhances the status of aquatic ecosystems • achieve the objective of at least **good water status**
2002	Working document Natura 2000 network	• community-wide **network** of nature protection areas • … to assure the long-term survival of Europe's most valuable and threatened species and habitats.
2006	Proposed Soil Framework Directive	• preservation of **soil functions** • current scientific knowledge on soil biodiversity and its behaviour is too limited to allow for specific provisions
2008	Marine Strategy Framework Directive	• applying an **ecosystem-based approach** to the management of human activities while enabling a sustainable use of marine **goods and services**

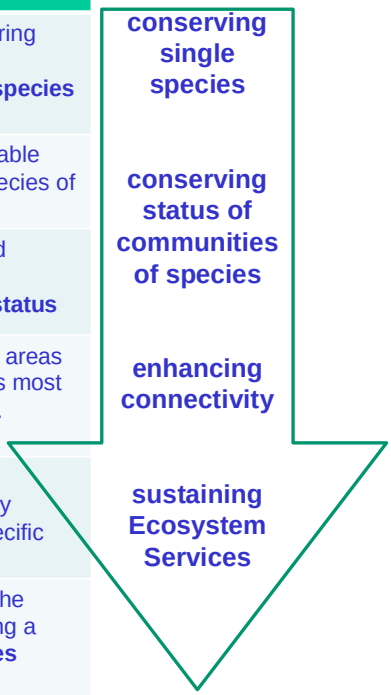

Figure 2.1 Development of European environmental policy (Brils, 2010).

To date, biodiversity protection and sustainable use of ecosystem services are at the core of European policy development and implementation[1].The European Commission (EC) recently adopted a new strategy to halt the loss of biodiversity in the EU by 2020 (COM (2011) 244). The loss of biodiversity – and with that of ecosystem services[2] – is a worldwide problem, even "the most critical global environmental threat alongside climate change", according to the EU-strategy document. Despite action taken to combat biodiversity loss since the EU 2010 biodiversity target was set in 2001, biodiversity loss is still appearing at unprecedented high rates. One of the main challenges is therefore to translate the strategy into action and policy that can halt this loss. Furthermore, the EC envisions that "by 2050 the EU's economy has grown in a way that respects resource constraints" and that "all resources are sustainably managed … while biodiversity and the ecosystem services it underpins have been protected, valued and sustainably restored" (COM(2011) 571).

1. *For more and information on developments, see: http://ec.europa.eu/environment/nature/index_en.htm .*
2. *The EC follows here the Millennium Ecosystem Assessment (MEA, 2005): biodiversity is regarded as the pillar under all ecosystem services.*

2.2 Water management related policy

2.2.1 Top-down EU policy

On 22 December 2000, the European Water Framework Directive (WFD) entered into force. The aim of the directive is to reach good chemical and a good ecological status of all European waters by a set date. For the first time in the history of water management, integrated water resources management principles are implemented at a wide international scale (Europe) based on a common legal framework, i.e. the WFD. River Basin Management Plans (RBMPs) of most of Europe's river basins have now been submitted to the EC in Brussels and are at an early stage of implementation (Brils et al., 2010).

Beyond any doubt the WFD is a formidable stimulus in the European Union to effectively evaluate risks and impacts on our deteriorated water systems and identify appropriate remediation measures. However, it is clear that in the first update of RBMPs, to be published in 2015, both the wide experience gained with the process of delivering RBMPs as well as new scientific knowledge will have to be taken into account (Brils et al., 2010). As such, there is currently special interest in 'new knowledge' on the potential of the ecosystem services for helping of the WFD implementation (see also section 3.3). Hereby there is the assumption that there is a connection between good ecological status and ecosystem services.

Directorate General (DG) Environment of the EC is aware that several different policy lines need to be combined in order to be able to reach the ambitious environmental policy goals such as the ones described in the WFD. This requires cross-sectoral cooperation (e.g. between sectors environment, spatial planning, agriculture, water safety etc). Therefore, DG Environment will publish in 2012 its "Blueprint to safeguard European waters" (Short: Blueprint 2012, see e.g. van Nood, 2010). In the Blueprint there will also be an explicit focus on ecosystem services, especially on its (e)valuation.

Also under European soil policy development there are links to aquatic ecosystem services. The proposed Soil Framework Directive (COM(2006) 232) establishes a framework for 'the preservation of the capacity of soil to perform (…) environmental, economic, social and cultural functions'. This statement refers to protection of ecosystem services that are delivered by the soil system and in the proposed directive are described as follows:
(a) biomass production, including in agriculture and forestry;
(b) storing, filtering and transforming nutrients, substances and water;
(c) biodiversity pool, such as habitats, species and genes;
(d) physical and cultural environment for humans and human activities;
(e) source of raw materials;
(f) acting as carbon pool;
(g) archive of geological and archeological heritage.
Especially category (b) refers to ecosystem services that are important for groundwater and surface water quality.

2.2.2 Bottom-up policy implementation and the potential of ecosystem services

There is a considerable difference between policy implementation and the effective realization of policy objectives. Policy implementation can be a 'paper exercise' while actual improvements of the natural system ask for 'action' on the field. The first generation of WFD River Basin Management Plans is now available. However, plans are only words: only the actual implementation of the selected measures will result in achievement of good ecological and chemical status, i.e. the principle objectives of the WFD (Brils et al., 2010).

The next part of this section synthesizes the findings and recommendations from: (1) the Living with Water project AquaTerra NL (2006-2009) that aimed at improving of the science-policy interface in the field of regional water management in relation to the WFD implementation; and (2) from the European Commission funded project RISKBASE that aimed to synthesize the state-of-the-art regarding risk-informed management of European river basins. Both projects focused on new, innovative ways to actually achieve the challenging objective to improve natural soil-sediment-water (eco)systems. Also the potential of the ecosystem services concept was discussed in these projects. The information is – unless indicated otherwise – extracted from Brils and Harris (2009), Brils et al. (2009) and Brils (2010).

Actual implementation of measures aimed to improve the quality of aquatic system is in the Netherlands mostly the concern of regional water managers, the so-called 'waterboards'. Although it is not clear yet who is responsible for what in relation to the WFD implementation, it is clear that waterboards increasingly feel committed to take the role as 'process initiator and coordinator'. Together with all the regional stakeholders, they seek to achieve an optimum balance between conflicting stakes. In that process waterboards focus on how they can improve the natural system, thus enabling its use (i.e. its goods and services) as well as nature development.

However, natural systems are extremely complex and dynamic and can respond in non-linear and unexpected ways. This makes it extremely complex to predict how such systems will respond to measures aimed to improve the system. Due to this complexity, and due to the impact of measures on economic activities (such as farming) and the uncertainty on how Brussels will top-down evaluate the program of measures, the level of ambition expressed in the 1st generation of river basin management plans is consciously kept very low in the Netherlands, and beyond.

Furthermore, the interaction between the natural and the social system leads to additional complexity. For instance, different policy domains 'govern' the natural system (agriculture, nature conservation, spatial planning, water, soil, ground water, etc.). All these different policy domains demonstrate and developed their own dynamics, (legal) standards and boundaries. Thinking and acting in complex systems and spanning of 'domain' boundaries is not at all a common approach yet. However, if we want to be effective with our measures that are aimed to improve the natural system, we have to apply a system-oriented approach, also in regional water management.

This opens up the European minds for a new approach to (regional) water management. Nowadays in Europe more and more (regional) water managers learn to see the WFD as an 'opportunity' rather than as an 'obligation'. In order to achieve the very ambitious European

environmental goals, the water manager will have to take an entrepreneurial approach and have to be aware of (get educated on) the different stakes that may be affected by improvement measures. Thus, the water manager will have to be creative in finding new ways to combine different, sometimes conflicting desired system functions and to raise support for the proposed solution. This may be possible by involving stakeholders as much as possible in regional water management. This will not only enable the stakeholders to bring in and represent their stake in the process, but also to bring in their essential local knowledge of the function of the system. However, it takes a lot of perseverance to get and keep all parties around the table and to make all aware that there is a shared responsibility for the natural system that needs to be managed together in an adaptive manner. We have to 'learn together to manage together' (Pahl-Wostl, 2007).

The WFD has developed its own 'jargon'. It enables trans-boundary communication between river basin managers, as all speak the same WFD 'language' and face the same objectives and same timelines, and it stimulates communication between the policy makers, implementers and scientists who have a stake in river basin management. However, at the regional water management practitioner scale, jargon does not easily facilitate communication with important stakeholder groups such as citizens or farmers. In this context, the few first practical experiences using the ecosystem services concept are more promising (see e.g. Van der Meulen and Brils, 2011). Social learning processes can benefit from this concept, as it seems to offer an easier 'language' to communicate stakeholder's positions and interests and to discover common interests in the land-water system. Some state that it may even facilitate the common implementation of different environmental policies. However, these very promising benefits have yet to be demonstrated in practice.

Regarding the potential use of ecosystem services as common language it can be stated that also farmers and citizens can easily visualize and then communicate in their own words what 'the natural system' offers for their 'well-being' (= definition of ecosystem services). This is certainly the case if in the discussion examples are mentioned to stimulate the thinking process (see further chapter 3). For the continuation of the stakeholder process, it is not at all relevant if you then call it a function, good or service what nature offers. It is more important that all stakeholders agree to use to same definition, for instance 'service'. Thereafter all involved stakeholders can think for themselves and then communicate to the other stakeholders which service is important to them and why. The services that are important for them and brought in the stakeholder involvement process by themselves are possible much more appealing to farmers and citizens than the 'abstract' WFD goal 'good ecological status'. In this way ecosystem services seems to provide a much easier language to communicate the interests of the different stakeholders and for joined exploration the common interest in natural soil-water systems.

For the first update of the WFD river basin management plans it is recommended to create pilot or testing areas – such as the Demonstration Test Catchments in the United Kingdom (see e.g. www.wensumalliance.org.uk) – where it is allowed to experiment (testing of measures) and to instantaneously apply the lessons learned. The experimentation should be done on basis of a carefully designed process (including the monitoring of the effectiveness of measures), for instance initiated by the waterboard and together with stakeholders, at a regional scale and by applying all available system knowledge: scientific as well as local knowledge. In the 'experimentation zone' (or test catchment) ecosystem services could be the common langue. Only in this way the effectiveness will be increased of measures that are

aimed to improve our natural systems and thus to ensure their provision of ecosystem services, now and in the future.

To date, we already have some perfect examples that demonstrate that this recommended approach can be highly successful in combating of diffuse pollution from agriculture. We have e.g. the classic example of the New York-Catskill-Delaware system (Brils and Appleton, 2011) as well as some smaller scale examples from the Netherlands and the United Kingdom (Brils & Grard, 2011). In these examples the involved parties jointly reached a level ("learned together …") were they regard sustainable management of the natural system as a shared responsibility and regard environment as a profit and not as a cost center. In these examples, farmers were not any longer regarded as 'enemies of the environment' but as 'environmental stewards', that enable ecosystem services for the benefit of society. Crucial elements to the success of these examples is 'Whole Farm Planning (WFP)" and the use of incentives (financial – such as PES – but also other incentives are possible such as avoidance of onerous regulatory oversight) to make WFP economically viable. Further key-factors to a successful application of the ecosystem services concept in these examples from practice are addressed in section 3.3.

3 Practical examples of application of the ecosystem services approach

3.1 Dommel case: Communication and assessment of effects of measures

3.1.1 Background

One of the Dutch water boards (who manage the water system at a local scale) is planning to initiate a river restoration project. In order to implement this plan, the water board has the intention and sees the necessity to cooperate with local stakeholders, mainly the farmers. During the process of stakeholder participation, communication turned out to be crucial here and a common language is desired.

The aim of the ecosystem services project was to assess whether the ecosystem services approach can support development of regional water management measures, in this case river restoration (see figure 3.1). More specific, the ecosystem services concept has been tested as a common language in a participatory process with local stakeholders.

The study is a rural area of about 5 km^2 (500 hectares) surrounding the small river Dommel and is located upstream of the city of Eindhoven.

3.1.2 Framework and methods applied

As a general framework for analyses, steps 1, 2, 3 and 5 as proposed by the World Resources Institute (see figure 3.2) have been conducted. The order of the steps in this framework can be changed in different contexts of application and feed back loops may be needed. The project has been carried out in the context of exploration of potential measures for river restoration; during this phase of the process, there was no need for monetary valuation of ecosystem services.

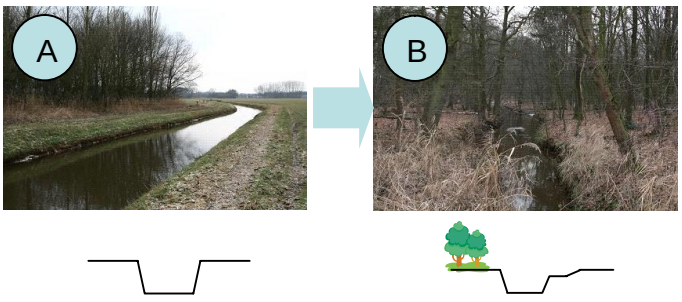

Figure 3.1 Assessing the effects of river restoration

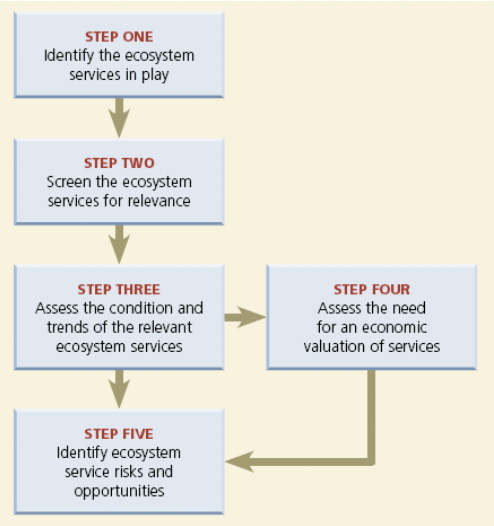

Figure 3.2 Source: ES guide to decision makers on ecosystem services (Ranganathan, 2008)

Step 1 Identification, step 2 Relevance, step 3 Condition and trends

Information about the social-ecological system was obtained via stakeholder interviews. Five stakeholders from the study area have been interviewed during individual interviews: water manager, farmer, policy maker municipality (environment and spatial development), and personnel of a local campsite. A structured framework for interviews about ecosystem services was developed. The interview consisted of two stages. First, open questions were asked about the character and the societal functions of the study area and about changes in the past and expected developments in the future. During the second stage, a prepared list of approximately 20 ecosystem services was used to talk about the presence of the services and the landscape elements that are relevant for provision of the services. Questions about general historic changes and expected developments in the future provided information about changes in ecosystem services as well. The relevance of ecosystem services has been made clear to some extend by asking about beneficiaries and links between ecosystem services and societal demands.

Step 3 Condition and trends

During a workshop with four specialists from the water board and four from Deltares, expected effects of an extended version of river restoration on ecosystem services have been explored. The changes were related to societal needs and to stakeholders who benefit or suffer damage because of those changes. The delegates covered the following fields of expertise: hydrology, ecology, communication, eco-toxicology, soil management, water quality water safety (water quantity), nature development and physical geography.

Step 5 Risks and opportunities

Based on step 1-3, risks and opportunities for societies needs in the study area in relation to changes in ecosystem services as a result of river restoration have been identified.

Measures

Examples of potential measures have been proposed to prevent or minimize the effects of damage to ecosystem services and maximize the use of opportunities of ecosystem services.

3.1.3 Results

Interviewees stated that the interview method was pleasant and broadened their scope. The discussion of the list of ecosystem services provided a lot of extra information on top of the information that interviewees provided during the first part of the interview. Based on experiences during internal test workshops, it was decided not to use the word ecosystem services; the expression *functions of the natural system* was used. It was also indicated by the first interviewee, that the expression *benefits* was not clear when questions about the beneficiaries were asked. Ecosystem services that were most difficult to understand are supporting and regulating ecosystem services, especially those that are relevant a larger spatial scale, such as climate regulation. Also ‘preventing damage due to natural disasters’ needed some explanation to demonstrate that this relates to relative small damages as well. However, specific ES were generally easily understood by the stakeholders.

Results show that just a few 'ES interviews' – so a relatively minor effort – made it possible to tap a lot of local knowledge and to come up with a very 'rich' description of the local ecosystem and its link to the socio-economic system.

Effects of river restoration and risks and opportunities included related to issues of for example water storage, agricultural production, habitat, water purification function of the soil (e.g. to prevent contamination of surface water by groundwater) and recreation.

The results of the project have been discussed with delegates from the water board, some of them were involved in this project. They concluded:

- Structured analyses of ES provides a framework that supports thinking;
- The interviews broaden the scope, prevent thinking along specific lines;
- Explaining effects of measures in terms of ES is expected to support communication with stakeholders and decision makers;
- Expectation that focus on benefits of measures for several policy goals/societies needs increases support (public and decision makers, underpinning investment decisions) ;
- Water board will use the results (risks and opportunities) when developing boundary conditions for river restoration.

3.2 Vecht case: Integral solutions for transboundary sustainable water management

3.2.1 Background

The German and Dutch ministries of the environment wanted to experiment with the ecosystem services approach in transboundary river basin management. There was a special interest in the potential for payment for ecosystem services.

The study area is part of the river basin of the river Vecht and includes a German and a Dutch part. It covers well over 100 km^2 and includes several villages and a rural area. The main societal challenge is sustainable development of the region in the situation of decreasing population.

3.2.2 Framework and methods

The general framework of WRI of ecosystem services assessment (figure 3.1) has been followed.

Because of the interest in payment for ecosystem services, also attention has been paid to the questions from the UNECE (2007) 'process of establishing PES' were at stake:

1. Are there any significant water management problems in the river basin?
2. Can ES help to at least partly address these water management problems? Can these problems be solved or mitigated by means of a project such as change in land use or management practice?

In order to assess the water management problems and to collect information to develop a description of the social-ecological system, the interview method as descried in section 3.1 has been applied. The list of ecosystem services has been tailor made for the study area and was more detailed than the one that was used in the Dommel case; it now included about specific 35 ecosystem services. Ten interviews were conducted: five in the Netherlands and five in Germany (see figure 3.3).

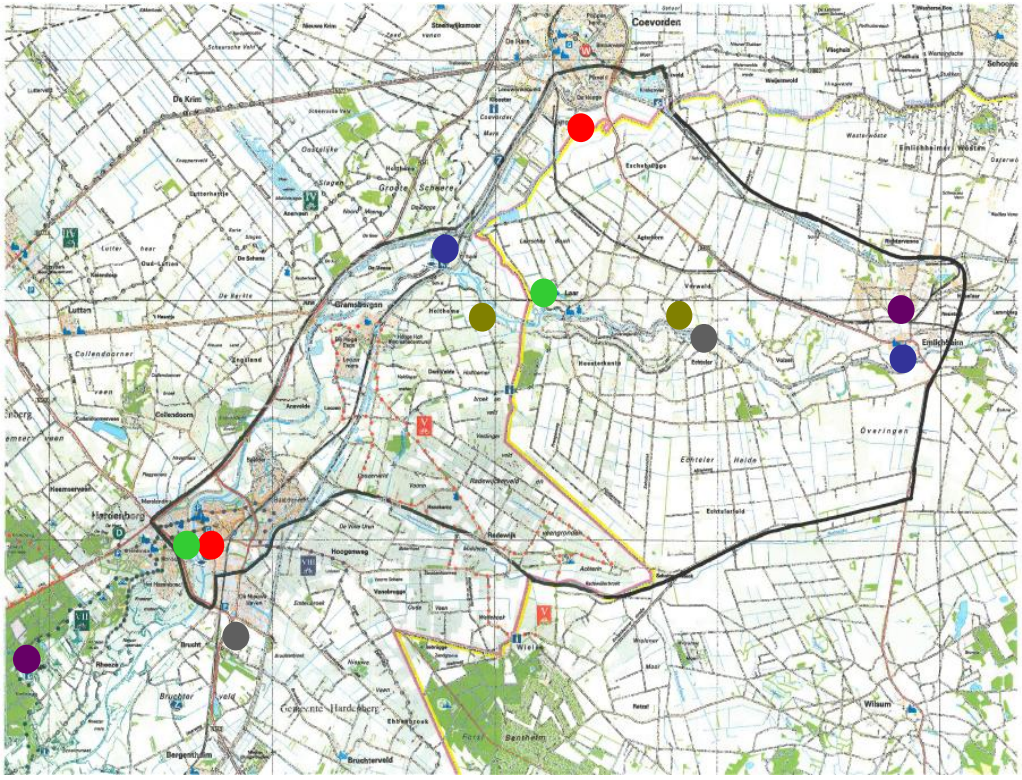

Figure 3.3 Location of interviewees from the following sectors/groups:
Local water management, Agriculture, Business / industry, Tourism / leisure, Nature protection, Inhabitants

3.2.3 Results

The interviewees provided a lot of information about the ecosystem and its relation to the social-economic system.

The specific ecosystem services were in general well understood by the interviewees. Some differences were observed between the German and Dutch stakeholders with respect to recognition of ecosystem services. This was related to differences in policy focus over the last decades. For example, during some interviews it seemed to be difficult to appreciate certain ecosystem services when those functions were traditionally considered human achievements.

For the purpose of the interviews, it was not necessary to explain the concept and from previous experience we know that it is difficult for many stakeholders to understand the concept at a abstract level.

The results of the project have been discussed with water managers (regional authority level), policy makers (municipal and national level) and the major of one of the municipalities in the study area. They concluded:

- The main added value of the ecosystem services assessment is expected to be to find better integrated solutions to the problems in the area, new funding opportunities for measures and more support by land owners and the public. It is appreciated that the ES approach combines the view of different stakeholders. The results of this projects, especially the identified risks and opportunities provide a broad perspective

in which ecology and economy are mingled and is cross-sectoral, while usually projects focus on one sector.
- Specific ecosystem services are easy to understand and therefore the concept can support communication with stakeholders. The ecosystem services approach might help to explain the aims of water management measures.

3.3 Cases at Brussels WFD ecosystem services event

As mentioned in section 2.2.1, there is currently special interest in the potential of the ecosystem services approach to support the implementation of European water policy. Therefore, the event "Implementation of the WFD: when ecosystem services come into play" was organized in Brussels at 29 and 30 September 2011[3]. The event aimed to explore how the ecosystem services approach can help the WFD and boost political levers for its implementation.

At the first day of this event, Brils and Appleton (2011) addressed in their keynote possible key-factors for a successful application of the ecosystem services approach in watershed management (and thus in WFD implementation). The factors are derived from the evaluation of the ecosystem services application in the 90's of the previous century in the US Catskill-Delaware-New York City watershed. These key-factors are:

1 The existence of a clear and urgent need by an important stakeholder for action;
2 The taking of an entrepreneurial approach, a.o. including the willingness:
  (a) to leave comfort zones, i.e. to take an adventurous road,
  (b) to learn together to manage together;
  (c) to regard the environment not as cost, but as profit center; and
  (d) to consider other then only 'Cmnd & Crtl' solutions;
3 The definition of, and sticking to clear targets; and
4 Facilitative leadership.

At the second day of the Brussels event, a Dutch and a UK case study where presented that showed remarkable resemblance – although at a considerably smaller spatial scale – to the US case study as presented by Brils and Appleton. Thus it was discussed after the presentations whether the key-factors above also applied in the two European cases. It was concluded that the four key-factors above applied were confirmed by the European experiences. Maybe this is the case because application of these key-principle is just a matter of 'common sense'. Furthermore, it was concluded that ecosystem services tell us why a good status of our ecosystems matters. However, it is contested what 'good' means from human well-fare point of view. Here we should not mix up (economic) valuation with what people actually want/appreciate (Brils & Grard, 2011).

3.4 Water managers in Europe applying the concept

As was stated in Chapter 1, there is not an overview of all water managers applying the ecosystem services approach. To demonstrate that the concept is being tested and applied in several European countries by different water managers, we hereby provide a list (which is not intended to be all inclusive) of examples of water managers that have applied the ecosystem services concept in their water management practice (table 3.1).

3. *For more background information to this event see: http://www.onema.fr/IMG/EV/cat1a-14.html*

Table 3.1 Some examples of water managers using the ecosystem services approach.

Country	Water managers	Application	Reference
The Netherlands	Waterboard[1] De Dommel	Stakeholder involvement (ES interviews) and assessment of effects of river restoration on ES.	This report
The Netherlands & Germany	Waterboard[1] Velt en Vecht, Vechteverband[1]	Exploration of potential for payment for ecosystem services and integrated water management within context of regional development.	This report
United Kingdom	Westcountry Rivers Trust	The upstream thinking project on paying farmers for improving/altering their practice to improve water quality on the River Tamar in SW England	www.wrt.org.uk
France	EPIDOR[2] and the regional Water Agency in the Dordogne region	Case study: ES approach for interaction with stakeholders and better way for implementation of WFD policy.	www.esawadi.eu/case-studies
Germany	NLWKN Meppen[3]	Case study: 'explore if the ES approach can support the economic requirements of the WFD in the Ems river, and if it can lead to a better understanding of basin oriented planning of the involved parties.'	www.esawadi.eu/case-studies
The Netherlands	Waterboards and drinking water suppliers	Payment for ecosystem services	Linderhof et al. 2009

[1] Regional management

[2] River Basin Public Board

[3] Regional water agency

[4] An environmental charity to secure the preservation, protection, development and improvement of the rivers, streams, watercourses and water impoundments in the Westcountry and to advance the education of the public in the management of water

4 Lessons learned

From the case studies presented in this document, we draw the following lessons regarding the application of ecosystem services approach in water management:

- Ecosystem services may be suitable as a common language that facilitates communication and thus stakeholder participation in water management.
- Regarding that potential it can be stated that stakeholders can easily visualize and then communicate in their own words what the 'natural system' offers for their 'well-being' (= definition of ecosystem services). This is certainly the case if in the discussion examples are mentioned to stimulate the thinking process[4]. For the continuation of the stakeholder process, it is not at all relevant if you then call it a function, good or service what is offered by the natural system. It is more important that all stakeholders agree to use to same definition, for instance 'service'. Thereafter all involved stakeholders can think for themselves and then communicate to the other stakeholders which service is important to them and why.
- Interviews with stakeholders/local people can be a practical and efficient method to obtain a lot of (local/regional) information about the relation between the ecosystem and the socio-economic system. The interviews broaden the scope and prevent thinking along fixed lines.
- The structured analyses of ecosystem services provides a framework that supports the thinking of water managers.
- Practical application confirmed that multiple scales should be addressed because it turned out that the relevance of some ecosystem services – such as CO_2 sequestration – was not considered relevant by the stakeholders at the scale that has been addressed.
- The ecosystem services approach is cross-sectoral and connects the ecosystem to the socio-economic system. This supports the development of integral solutions for sustainable development issues by identifying risks and opportunities, that provide a broad perspective in which ecology and economy are mingled, while usually the focus only is one sector. In this way it is expected to help in finding:
    - better solutions to the problems in the area,
    - new funding opportunities for measures, and
    - more support by land owners, public and decision makers.
- Possible key factors for the successful application of ecosystem services in watershed management are:

4. *In Appendix A, a list with examples of ecosystem services is provided. The list should be customized for the specific study area, so that ecosystem services that are certainly not present will be removed. Categories of ecosystem services, e.g. the categories from the Millennium Ecosystem Assessment can be helpful as inspiration. Make sure that stakeholders understand specific ecosystem services and provide examples to clarify. Find out what are the appropriate expressions to use when communicating with stakeholders about ecosystem services (e.g. functions) and benefits. This will be different in different languages and settings.*

- the existence of a clear and urgent need by an important stakeholder for action;
- the taking of an entrepreneurial approach;
- the definition of, and sticking to clear targets, and
- facilitative leadership.

References

Brils J. (2010). Water Framework Directive – From groundwater level controller towards initiator of regional policy processes. Het Waterschap (The Waterboard), (7/8):20-21 (in Dutch).

Brils J. (2010). Ecosystem services and risk-based river basin management. Presentation at the 3th international scientific Meusse river symposium "The Meuse district: challenges for Tommorrow", Luik, 23 april 2010. Available at: http://www.symposiummeuse-2010.be/download.htm

Brils J, Appleton A. (2011). Possible key-factors for success ful application of ecosystem services in watershed management - lessons learned from New York applied in the Dutch / German river Vecht. Invited presentation at WFD CIS SPI "2nd Water Science meets Policy" event, entitled "Implementation of the WFD: when ecosystem services (ES) come into play". Brussels, Belgium, 29 September 2011.

Brils J, Grard M. (2011). Report Round Table 2: Water quality and diffuse pollution resulting from dairy farming. WFD CIS SPI "2nd Water Science meets Policy" event, entitled "Implementation of the WFD: when ecosystem services (ES) come into play". Brussels, Belgium, 30 September 2011.

Brils J, Quevauviller Ph, Slob A, Blind M, Davy T, Carere M, Amorsi N, Brack W, Borchers U, Thomspon C, Villessot D. (2010). The European Water Framework Directive beyond 2010: let actions speak louder than words. J. Environ. Monit., 2010, 12, 2204–2206. Available at: http://pubs.rsc.org/en/Content/ArticleLanding/2010/EM/c005485m

Brils J, Bressers H, Coenen F, Dieperink C, Driessen P, Grift B van de, Joziasse J, Raadgever T, Rijnveld M, Rijswick M van, Slob A, Smit A, Tilburg M van, Vink J, Visser A. (2009). Better use of aqua-terra system knowledge for realisation of the WFD goals. Final report of the Living with Water project "AquaTerra NL", Living with Water, Gouda (in Dutch).

Brils J, Harris B. (Eds.). (2009). Towards Risk-Based Management or European River Basins: Key-findings and recommendations of the RISKBASE project, EC FP6 reference GOCE 036938, December 2009, Utrecht, The Netherlands. Available at: http://www.riskbase.info/

COM (2011) 244. Our life insurance, our natural capital: an EU biodiversity strategy to 2020. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. European Commission COM(2011) 244 final, Brussels, 3.5.2011

COM (2011) 571. Roadmap to a Resource Efficient Europe. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. European Commission COM(2001) 571 Final, Brussels, 20.9.2011

COM (2006) 232. Proposal for a directive of the European Parliament and of the council establishing a framework for the protection of soil and amending Directive 2004/35/EC. Brussels, 22.9.2006. COM(2006) 232 final

Linderhof, de Blaeij, Polman. 2009. Betalen voor ecosysteemdiensten: een interessante aanvulling op het waterprijsbeleid? Projectcode 211736&1&2009 Rapport LEI, Den Haag

Millennium Ecosystem Assessment (MEA). (2005). Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Pahl-Wostl C. (2007). Transitions towards adaptive management of water facing climate and global change. Water Resources Management, 21(1): 49-62.

Ranganathan et al., 2008. Ecosystem Services, A Guide for Decision Makers. World resources institute. ISBN 978-1-56973-669-2

UNECE (2007). Recommendations on Payments for Ecosystem Services in Integrated Water Resources Management. United Nations Economic Commission for Europe (UNECE), Convention on the Protection and Use of Transboundary Watercourses and International Lakes, United Nations

Van Nood M. (2010). Activities of the European Union on water and climate change. Presentation during “Workshop on water and climate change: how to develop an adaptation strategy in transboundary basins”, Genève 10-11 mei 2010. Available at: http://www.unece.org/env/water/meetings/transboundary_adaptation_workshop.html

Van der Meulen S, Brils J. 2011. Do ecosystem services provide a common language to facilitate participation in water management? Report of special session at Resilience 2011 Conference, Tempe, Arizona, March 2011, Deltares, Utrecht.

A Appendix: Inspiration list of ecosystem services

PRODUCTION	Food production (crops, fish, aquaculture)
	Energy (wind energy, solar energy, geothermal energy, hydropower[5], blue energy)
	Aquifer Thermal Energy Storage
	Biofuel crops and other energetic resources
	Fire wood
	Timber
	Pharmaceuticals
	Raw materials, fibers
	Fertilizer
	Genetic resources, medicine
	Mining
	Construction materials (sand, gravel, shells, clay)
	Irrigation water
	Drinking water
	Industrial processing water (/cooling water)
	Decorative material (e.g. shells or stones for jewellery)
REGULATION	Protection to natural disasters (flooding, storms, surges)
	Climate regulation (e.g. greenhouse gas emission)
	Water regulation (storage, drainage)
	Water purification
	Erosion regulation
	Disease-regulation
	Pollination
	Preventing salinization
CULTURAL	Recreational service (e.g diving, hiking, boating, wildlife watching)
	Aesthetic/inspirational services
	Education
SUPPORTING	Nutrient cycle
	Water cycle
	Connectivity of habitats
	Carrying capacity (e.g for building, infrastructure, plough)
	Transport
	Nursery
	Soil development (e.g. sedimentation)
	Habitat flora and fauna
	Primary production

[5] *Energy from River discharge, tidal energy, waves etc.*