Policy Brief

Nordic Ecosystem Services

**Nordic Council
of Ministers**

Nordic Ecosystem Services

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PREFACE

The concept of ecosystem services got international attention following the Millennium Ecosystem Assessment (MEA) report in 2005. Since then, much effort has been put in to making the concept more clear and in developing methods that make the concept useful in actual decision making.

Work on this matter has also been initiated on behalf of the Nordic Council of Ministers (NCM). The aim of this report is to improve the communication of how the ecosystem services approach has been implemented in several NCM-projects and show the connections between these projects. Thus, the report synthesizes the results and main messages from previous projects, and illustrates which ecosystem services we receive from Nordic nature and the importance of these. Examples of how the ecosystem services approach has been and can be used in management of nature in the Nordic countries are given and

some knowledge gaps are identified. Our hope is that this report can contribute to more decisions being informed by the value and importance of ecosystem services and biodiversity in the Nordic countries.

The report was funded by the Nordic Council of Ministers and prepared by the Menon Centre for Environmental and Resource Economics in cooperation with the Environment and Economy Group (MEG) and the Terrestrial Ecosystem Group (TEG).

The authors in Menon are Kristin Magnussen and Siri Voll Dombu. Ståle Navrud has been quality assurer and Caroline W. Gierløff has contributed to the discussion.

November 2018

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BRIEF SUMMARY

Nature provides us with a multitude of goods like food and fiber, drinking water, medicines, protection against floods and storms, carbon storage and recreational services like swimming and bird watching. Our welfare and well-being depend on these goods and services – often called ecosystem services. However, many of these goods and services are not traded in markets and hence have no market price. The welfare cost to people and society that results from degradation of these goods and services is therefore not reflected in our commonly used accounting systems, at least not in the short term.

In recent decades, there have been many initiatives with the purpose to better incorporate these non-market goods and services in decision-making. The concept of ecosystem services received international attention following the Millennium Ecosystem Assessment (MEA) report in 2005. MEA defined ecosystem services as “the benefit people directly and indirectly obtain from nature”. We often distinguish between four categories of ecosystem services. Supporting services are those services that are “necessary to produce all other ecosystem services” and regarded as the basis for the three other categories: provisioning, regulating and cultural ecosystem services.

The Nordic Council of Ministers (NCM) has through different working groups, especially the Environment and Economy Group (MEG) and the Terrestrial Ecosystem Group (TEG), over the last several years executed a series of projects regarding ecosystem services. Most of these have resulted in published reports in the TemaNord series.

This report aims to sum up and show some examples of the results of the ecosystem services projects carried out for NCM on an aggregated level. We want to illustrate which ecosystem services we receive from Nordic nature and the importance of these. We also want to show some examples of how the ecosystem services approach has been and can be used in management of nature in the Nordic countries, and to point out some knowledge gaps.

The report starts with an introduction to the concept of ecosystem services and the Nordic ecosystem services. It provides examples and a summary of results on an aggregated level in the main part (chapter 2 and 3). Chapter 2 describes the ecosystem services identified, quantified and in some cases also valued from main Nordic ecosystems, while chapter 3 shows some examples of how the ecosystem services approach has been applied or is suggested

applied, and points at some knowledge gaps. Appendix provides a systematic description of all the NCM reports discussing ecosystem services, organised according to which ecosystem they cover.

Ecosystem services from freshwater and marine and coastal waters are particularly well documented in the NCM reports. This may reflect the fact that waters of all kinds are important ecosystems in all Nordic countries and have many uses. Not all ecosystems are covered equally well by the NCM reports, however. Terrestrial ecosystems like mountains, urban areas, agricultural land and some other types of low altitude areas (except cultural ecosystem services in cultural landscapes) are not included in any of the reports. For some ecosystems, like forests and peatlands, only a few ecosystem services have been identified and described. In addition, there is a lack of economic value estimates for some ecosystem services. Thus, future studies should try to close these knowledge gaps in terms of missing ecosystems, ecosystem services and their economic values. Such monetary estimates may be useful for many policy applications, since transfer of benefit estimates from the same country or a neighbouring Nordic country results in more reliable estimates for the same ecosystem services.

Further, the ecosystem services approach is very relevant in general natural resource management and planning; the report shows that there are examples of useful and promising applications for instance in freshwater management, marine spatial planning and landscape planning. The role of ecosystem services in climate change mitigation and adaption has been emphasised more and more in recent times. This topic is not central in the reports reviewed here, although some of them do touch upon the subject. This role of ecosystem services and particularly the use of semi-natural ecosystems as green infrastructure to increase resilience seem to be a timely and useful approach for going forward. We suggest that development and examples of *applications* of the ecosystem services approach in nature management and decision-making tools and processes may be an area where Nordic cooperation will be most useful in the future, as experience from one or more Nordic countries may also be applicable to others.

Figure 1. Ecosystem services – categories and examples

Source: Menon Economics.

CHAPTER 1

INTRODUCTION AND BACKGROUND

Our welfare and well-being depend on ecosystem services

Nordic nature provides us with a multitude of goods like food and fiber, drinking water, medicines, protection against floods and storms, carbon storage and recreational services like swimming and bird watching. Our welfare and well-being depend on these goods and services – often called ecosystem services. However, many of these goods and services are not traded in markets and hence have no market price. The welfare cost to people and society that results from the degradation of these goods and services is therefore not reflected in our commonly used accounting systems, at least not in the short term.

In the last decades, there have been many initiatives with the purpose to better incorporate these non-market goods and services in decision-making. The concept of ecosystem services received international attention following the Millennium Ecosystem Assessment (MEA) report in 2005. MEA (2005) defined ecosystem services as “the benefit people directly and indirectly obtain from nature”. We often distinguish

between four categories of ecosystem services, see figure 1. Supporting services are those services that are “necessary to produce all other ecosystem services” and regarded as the basis for the three other categories. These are:

- i) Provisioning services, which include the material products like food, fodder and fiber that are obtained from the ecosystems;
- ii) Regulating services, which are the benefits that are obtained from nature's regulating functions, like greenhouse gas storage and sequestration in forests and wetlands, and flood protection from wetlands; and
- iii) Cultural services, which can be described as the “nonmaterial benefits people obtain from ecosystems” and include services like recreation, aesthetic beauty of landscapes and natural heritage (non-use values).

Later, international initiatives like The Economics of Ecosystem services and Biodiversity (TEEB) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem

Services (IPBES) have confirmed the ecosystem services approach¹ as an important framework for ecosystem-based management of nature, and as a way of integrating the natural and human welfare systems.

The Nordic Council of Ministers (NCM) has through different working groups, especially the Environment and Economy Group (MEG) and the Terrestrial Ecosystem Group (TEG), over the last several years financed a series of projects regarding ecosystem services. Most of these have resulted in published reports in the TemaNord series.

Table 1 summarizes the ecosystem services reports executed by NCM and assessed in this report. A more thorough description of each study is given in appendix. Marine and coastal water, freshwater, peatland, and forest ecosystems are covered in separate, designated reports, while landscapes are treated in two reports. Further, one early report, called the Nordic TEEB, aimed to

include all ecosystem services from all ecosystems. A few other reports have a more theoretical or methodological approach. For marine and freshwater, almost all ecosystem services have been identified, and to a certain degree mapped and assessed – in monetary terms, quantitatively in physical units or only qualitatively. The landscape reports have concentrated on cultural services. The peatland and forest reports look at one or a few regulating services, particularly greenhouse gas regulation. While the peatland and forest reports have a more ecological approach, some of the marine, freshwater and landscape reports look at ecosystem services from an economic point of view. All Nordic countries are covered, although for some services the Baltic Sea seems to be particularly well documented.

The early reports produced for each ecosystem type mainly seem to focus on identification and classification of services for the ecosystem in question, and the potential for valuation and

¹ By the ecosystem services approach and ecosystem services framework we mean an analytical framework where ecosystem services are derived from ecosystem functions and represent the realized flow of services for which there is demand. For the purposes of this framework, ecosystem services also encompass the goods derived from ecosystems. People benefit from ecosystems (goods and services). These benefits are, among others, nutrition, access to clean air and water, health, safety and enjoyment and how they affect (increase) human well-being - which is the key target of managing the socio-economic systems (COM 2013: Mapping and Assessment of Ecosystems and their Services).

Table 1: Summary of TemaNord reports on ecosystem services

Type of ecosystem	Report title (year)	Type of ecosystem service(s) ²	Nordic countries/ area covered
All	Socio-economic importance of ecosystem services in the Nordic Countries. Synthesis in the context of The Economics of Ecosystems and Biodiversity (TEEB) (2012)	All	All Nordic
Marine	Ecosystem Services in the Baltic Sea. Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea (2014)	Provisioning Cultural Regulation & maintenance	Baltic Sea
	Marine Ecosystem Services. Marine ecosystem services in Nordic marine waters and the Baltic Sea – possibilities for valuation (2016)		Baltic Sea
	Ecosystem Services in the Coastal Zone of the Nordic Countries (2016)		All Nordic
	Ecosystem services in Marine Spatial Planning (MSP) (2017)	All	All Nordic, case from Baltic Sea
Freshwater	Valuation of Ecosystem services from Nordic Watersheds – from awareness raising to policy support? (VALUESHED) (2012)	All	All Nordic
	Ecosystem Services. In Nordic Freshwater Management (2014)	All	All Nordic, most cases from DK and NO
Peatlands	Peatlands and Climate in a Ramsar context. A Nordic-Baltic Perspective (2015)	Regulation & maintenance	All/methodological
	Peatlands, climate change mitigation and biodiversity conservation. An issue brief on the importance of peatlands for carbon and biodiversity conservation and the role of drained peatlands as greenhouse gas emission hotspots (2015)	Regulation & maintenance	All/methodological
Forest	Ecosystem Services in Forests – How to assess and value them? Nordic Workshop, Oslo, Thursday 13th September 2012 – Conference report	Regulation & maintenance Cultural	All/methodological
	Biodiversity, carbon storage and dynamics of old northern forests (2013)	Regulation & maintenance	All
Landscapes	Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making	Provisioning Cultural Regulation & maintenance	All/methodological
	Kulturarv og økosystemtjenester. Sammenhenger, muligheter og begrensninger (2015)	Cultural	All/methodological
	Landscape experiences as a cultural ecosystem service in a Nordic context. Concepts, values and decision-making (2015)	Cultural	All
	Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects – From concept to practice (2017)	Cultural	All
No particular ecosystem	Natural Capital in a Nordic context. Status and Challenges in the Decade of Biodiversity (2013)	Regulation & maintenance	All/methodological
	Payment for and Management of Ecosystem Services. Issues and Options in the Nordic Context (2009)		All/methodological
	Framing a Nordic IPBES-like study. Introductory Study including Scoping for a Nordic Assessment of Biodiversity and Ecosystem Services, based on IPBES methods and procedures (2016)	Regulation & maintenance	All/methodological

² Based on the EU CICES typology. Abiotic services are not included. <https://cices.eu/cices-structure/>

available valuation methods. The more recent reports, however, tend to look more at how the ecosystem services approach may be applied in management of Nordic resources. Recent studies in particular discuss the implementation and applicability of the ecosystem services approach in environmental impact assessments (EIAs), Cost-Benefit Analyses (CBAs), Marine Spatial Planning (MSP), Payment for Ecosystem Services (PES) etc. This enhances the usefulness of the approach for the Nordic governments.

Aim of this report

The main aim of this brief report is to sum up and show some examples of the results of the ecosystem services projects carried out for NCM on an aggregated level. We want to illustrate which ecosystem services we receive from Nordic nature and the importance

of these. We also want to show some examples of how the ecosystem services approach has been and can be used in management of nature in the Nordic countries and point at some knowledge gaps.

Organisation of the report

We organise this report by providing examples and a summary of results on an aggregated level in the main part of the report (chapters 2 and 3). Chapter 2 describes the ecosystem services identified, quantified and occasionally valued from main Nordic ecosystems while chapter 3 shows some examples of how the ecosystem services approach has been applied or is suggested applied. Appendix 1 gives a systematic description of all the NCM reports discussing ecosystem services, organised according to which ecosystem they cover.

CHAPTER 2

NORDIC ECOSYSTEM SERVICES

Why the ecosystem service concept is useful in nature management

Ecosystem services are all the goods and services people receive from nature that bring benefits and contribute to people's welfare and well-being. An important aspect of the concept is the link between the ecosystem (nature) and the welfare of people, and thus society as a whole. This relationship is shown in figure 2. This illustrates the close connection between the ecosystems and the welfare of people, and how changes in nature will affect people's well-being. It further emphasises that changes we implement in society – the socio-economic system – influence nature, and this again will impact the quality and quantity of the services we receive from nature.

The Millennium Ecosystem Assessment (MEA 2005) described and classified the number of ecosystem services that different ecosystems provide us with and made an assessment of the status and development for these and related ecosystem services on a global scale. The assessment showed that the status of many important ecosystems and ecosystem services is deteriorating at high speed and illustrated how deteriorating ecosystems affect ecosystem goods and services that people depend upon, and which therefore

have a huge impact on our current and future welfare.

This line of reasoning, illustrating the relationship between changes in nature and goods and benefits to people, is also seen in several of the NCM reports. For example, the reports covering fresh and salt water show how pollution from sewage, industry and agriculture affects the quality of fresh and salt water, respectively. When we implement measures to reduce this pollution, water quality is improved. Fish and shellfish production may increase and be healthier, and swimming and diving is much more pleasant. Thus, the ecosystem services approach makes it obvious how nature and people are connected and provides us with a framework for exploring this relationship.

TEEB (2010) states that the ecosystem service approach can be used either to *recognize values, demonstrate values or capture values* (TemaNord 2012:506). *Recognizing values* of ecosystem services implies that we are aware of the ecosystem services we receive from the sea, the lake or the forest, and that these benefits are relevant and important for people's well-being and should be taken into account. This can be done for example by identifying and describing the

Figure 2. The ecosystem services approach

Source: Based on Maes 2013.

goods and benefits we receive from the Baltic Sea, the Nordic forests or lakes in Norway.

Demonstrating values implies that we want to state the importance or magnitude of these values. For example, we want to say how important the fish and shellfish production in the Baltic Sea is, describe the magnitude of recreational activities and timber production in Nordic forests, or the value of the drinking water we receive from Norwegian lakes. As we will see below, these values may be demonstrated in different ways.

Capturing values means that we give an estimate of the value of the goods and benefits, and the purpose is often to use these values in decision-making tools like cost-benefit analysis (TemaNord 2017:536) or establish the amounts to be

paid in payment for ecosystem services (PES) (TemaNord 2009:571). This is the most demanding use of values and requires the greatest level of reliability and accuracy.

Assessment of the values of ecosystem services

The ecosystem services approach has been launched as a bridge between ecology and economy. Therefore, economic valuation of ecosystem services is often emphasised, also in the NCM reports. However, several of the Nordic council reports, as well as other literature on ecosystem services, also emphasise the need to use a broad spectre of methods to assess the benefits of ecosystem services. This is for instance the case in the pre-project for a Nordic IPBES-like study, TemaNord 2016:525, but several other reports also discuss this

Figure 3: Way of assessing the value of ecosystem services (ES), with examples from forests

Source: TEEB. (2010).

issue. Furthermore, many of the reports stress that even if we aim for economic valuation of ecosystem services, only some of the services will be valued in monetary terms in practice, some may be quantified in physical units, and others described only qualitatively. Figure 3 illustrates this for forests.

In the reports that perform economic valuation, the aim is to find the total economic value (TEV) of the services, consisting of use values as well as non-use values. See Box 1 for an illustration of the different value components, and examples of these.

The use values are generally easiest to assess and value in monetary terms. They include values of food and timber for instance, which are valued in TEEB Nordic (TemaNord 2009:571). Such goods can be valued using market prices. Another direct use value is recreation, which is valued for marine areas in TemaNord 2016:501 and fresh water in TemaNord 2014:561. Most regulating services give us indirect use values (see Box 1), like flood control and carbon sequestration, which are discussed for freshwater and peatland in TemaNord 2012:506 and TemaNord 2015:544, respectively. These services can be valued by market-based methods like the production function

Box 1. The Total Economic Value (TEV) of ecosystem services consists of use values and non-use values

1) Use values

- a) Consumptive use (fishing, recreational fishing, hunting)
- b) Non-consumptive use (catch-and-release-fishing, visiting cultural landscapes)
- c) Indirect use values (water purification, climate regulation, climate adaption)
- d) Option values (the value of keeping the possibilities for future use)

2) Non-use values

The value of ecosystem services without aims of using the service but preserving it for ourselves and others today (Existence value) or for future generations (Preservation value).

Quasi-option value

Correction factor for irreversible changes in ecosystem services (loss of species, irreversible changes in landscapes).

approach. However, for peatlands the carbon sequestration effect was assessed in terms of tons of CO₂. The non-use values (see Box 1) are values people place on having ecosystems and ecosystem services present, even though they do not use them themselves. Important non-use values are the legacy of biodiversity and "knowing" that the seas, or rivers, wetlands and forest are preserved for the future. Such values can be estimated by using so-called stated preference valuation methods, like the Contingent Valuation method. Such values are more seldom found in the Nordic literature. However, some examples of non-use values for instance

for freshwater and landscapes are reported in TemaNord 2014:561 and TemaNord 2015:549.

Ecosystem services from the main Nordic ecosystems

The TemaNord reports on ecosystem services cover many of the main ecosystems in the Nordic countries; i.e. the marine and coastal areas, freshwater, peatland, forests and to some degree cultural landscapes, mainly in agricultural and forest areas. One of the very first TemaNord reports on ecosystem services, called TEEB Nordic, in principle covered all main ecosystems for all Nordic countries. Since marine

areas and watersheds are important to all our countries, it is perhaps not a surprise that these ecosystems are so well covered. However, there is a need to cover the terrestrial ecosystems as well.

Some ecosystems seem to be missing here but may be included in the overall or more methodological reports. These are ecosystems like the mountains and urban areas, and some of the lowland terrestrial ecosystems.

Table 1 shows that four of the TemaNord reports discuss ecosystem services in marine areas, while two cover fresh water and peatlands, respectively. Thus, ecosystems in watery environments are covered very well.

Fresh and marine waters are important for provisioning, regulating and cultural goods and services

Freshwater, salt water and wetlands are important ecosystems and important for provisioning as well as regulating and cultural ecosystems in the Nordic countries.

The tables below give summaries of important ecosystem services from fresh water and marine waters, respectively.

Table 2 gives an overview of provisioning, regulating and cultural services in lakes, waterways/rivers, wetlands and groundwater. We can see that freshwater supplies us with fundamental services of all categories. The emphasis in these reports is mainly on identifying the relevant ecosystem services in Nordic freshwater and marine waters. These reports may act as "check lists" to see which ecosystem services and benefits may be affected by socio-economic activity and should be taken into account in decision-making.

Table 3 gives examples of coastal and marine ecosystem services in the Baltic sea and the resulting goods or benefits.

Table 2: Ecosystem services in Nordic freshwater

Source: TemaNord 2014:561.

Freshwater	Provisioning	Regulating	Cultural
Lakes	Fish, drinking water, cooling water, water for agriculture, transport	Retention and recirculation of nutrients, carbon sequestration	Recreation; bathing water, sailing, walking along the shoreline on beaches, tourism, angling/recreational fisheries
Waterways, rivers	Fish, drinking water, cooling water, water for agriculture, transport	Retention and recirculation of nutrients, carbon sequestration	Recreation; bathing water, sailing, walking along the riverside, tourism, angling/recreational fisheries
Wetlands	Can be used for cattle (grazing)	Retention and recirculation of nutrients, carbon sequestration	Wildlife/bird watching, hunting, picking mushrooms and berries, walking
Groundwater	Drinking water	Retention	No

Table 3: Examples of coastal and marine ecosystem services in the Baltic Sea

Source: TemaNord 2014:563.

Intermediate service	Final services	Goods/benefits
Nutrient cycling Primary production Water cycling Habitat maintenance Biodiversity maintenance	Fish/shellfish Aquaculture Water quality Wild species diversity Raw materials Climate regulation	Energy Food Recreation Tourism Education Aesthetic/inspiration Existence

Table 4: Degree of importance of ecosystem services provided by four different coastal ecosystems. The study emphasises that these are subjective judgments based on a few scientists' opinions

Source: TemaNord 2016: 552.

Ecosystem service	Kelp forests	Eelgrass meadows	Blue mussel beds	Bays and inlets
Supporting				
Habitat and biodiversity	High	High	Medium	High
Primary production, food webs and nutrient cycling	High	High	High	High
Biological control	High	High	Medium	High
Provisioning				
Resource utilization and bioprospecting	High	Medium	High	Low
Commercial and subsistence fisheries	Medium	High	Low	Medium
Regulating				
Maintenance of resilience	Medium	Medium	Medium	Medium
Carbon storage and sequestration	High	High	Medium	Medium
Eutrophication mitigation	High	High	High	High
Water purification, filtering and removal of hazardous substances	High	High	High	High
Coastal defence	Medium	High	Medium	Medium
Cultural				
Recreational fisheries	Low	Medium	Low	High
Tourism	Medium	Medium	Medium	Medium

Another report focuses on the ecosystem services from specific coastal ecosystems of the Nordic countries, such as kelp forests, blue mussel beds, eelgrass meadows and shallow bays and inlets, and shows how each of them provide a number of supporting, provisioning,

regulating and cultural ecosystem services to the local communities as well as the wider population which benefit from them. This report further gives an overview of the importance of ecosystem services from these coastal ecosystems, see table 4. The table illustrates that

all four coastal ecosystems are of high importance for many regulating services like eutrophication mitigation and water purification. Kelp forests and eelgrass meadows are also of high importance for carbon storage and sequestration, while blue mussel beds and bays and inlets are of medium importance for this service. This is an example of a study that aims to identify, describe and demonstrate the values of ecosystem services in different areas of the Nordic coastal waters.

Peatlands are important for climate regulation and adaption and for non-use values of nature preservation

The report discussing peatlands (TemaNord 2015:544) illustrates another application of the ecosystem services approach. This report focuses on a few regulating services from the ecosystem, particularly the peatlands' contribution to carbon storage and sequestration, and gives us information about how this service is connected to the size of peatlands in different countries. One important aspect discussed is that drained peatlands emit large amounts of carbon dioxide in the Nordic and Baltic countries, which are included in this report. It also shows how re-wetting of drained peatlands leads to a substantial reduction of annual greenhouse gas emissions. Re-wetting of peatlands will also benefit another ecosystem service:

the cultural service of preservation of nature and wildlife. This report does not emphasise the climate adaption services of wetlands.

Valuation of goods and benefits from watersheds

TemaNord 2012:506 "Valuation of Ecosystem Services from Nordic Watersheds" provides examples of previous valuation studies that directly or indirectly value relevant goods and benefits from watersheds (fresh water) in monetary terms. It systematically counts the number of valuation studies for each relevant ecosystem service and concludes that the number of studies is limited in all the Nordic countries.

As an example of the existing studies, the report refers to an interesting Danish study (Schou et al. 2003, as reported in TemaNord 2012:506 about Nordic watersheds) that makes a valuation study of the effects of pesticide use. In their case study encompassing valuation of the effects of pesticide-free buffer zones along field margins, the authors found that respondents were willing to accept an increase in the price of bread of DKK 0,57 (4 per cent) if the survival of partridge chickens increased by 10 percent points. Similarly, respondents accepted an increase in the price of bread of DKK 0,07 (0.5 per cent) if the

number of wild plants increased by 10 percentage points. Based on their findings, the authors of the report conclude that economic valuation studies of the effects of pesticide use can be performed based on current knowledge and existing methods.

In Finland, the significance of streams for the residents of the City of Helsinki was estimated using a Contingent Valuation study. The beneficiaries of the restoration measures were the residents of Helsinki, with foreseen benefits including both use and non-use values. In the survey, the respondents stated their willingness-to-pay. The results of the survey indicated that residents with high income, low age, exercising outdoors and living near the streams of Tapaninkylänpuro, Tapaninvainionpuro or Longinoja were willing to pay more for the improvement in streams. The total benefit estimate was approximately 1.4 million Euros (2010) per year and about 7.2 million Euros (2010) for the five-year-period of the hypothetical and regional Small Water Fund. The estimated total value exceeded the total budget targets to restoration manifold. Furthermore, respondents' previous experiences of the outcomes and benefits of restoration measures may explain their high willingness-to-pay in specific watersheds. The study concludes

that the contingent valuation method fits well for the purpose of monetizing ecosystem services in stream waters. The contingent valuation study, when implemented from a societal point of view, may give essential information on ecosystem services to the general public and stakeholders and contribute to decision-making (TemaNord 2012:506).

Forest ecosystem services

Two reports focus on terrestrial ecosystems in forests. The report "Ecosystems in forests – how to assess and value them" gives an overview of relevant ecosystem services in forests, providing us with timber, mushrooms, berries and wild meat, regulating services like carbon storage and sequestration, and recreation and aesthetic services (TemaNord 2014:534).

The other forest-related report, "Biodiversity, carbon storage and dynamics of old northern forests", gives a scientifically based overview of the role of old forests in the carbon cycle and how carbon uptake may represent a co-benefit to the well-documented value of old forests for biodiversity (TemaNord 2013:507). This is important. As we will see in the next chapter, the ecosystem services approach may be used to make trade-offs between different ecosystem services – if we cannot have

Box 2. Illustration of mapped flow of ecosystem services in a landscape

Source: TemaNord 2014:561.

Figure A: Average values of bundles of ecosystem services in a landscape

Source: Raudsepp-Hearne (2010). Reproduced from TemaNord 2014:516.

First, the ecosystem services are divided into "service bundles", with a content of hunting, carbon sequestration, tourism, etc., which is indicated in the circle at the bottom right of figure A. Then the areas are classified into six different types on the right side in the figure, depending on which of the services dominate (as indicated in each of the six circles). These six kinds of areas can be retrieved on the map on the left with their specific number. This is an elegant way to illustrate how ecosystem services are distributed in the landscape, by this kind of management which gives a very heterogeneous exploitation.

all in maximum amounts. However, this report suggests that biodiversity as well as carbon uptake may be optimal in old forests.

Illustrations of mapped flow of ecosystem services

TemaNord 2014:561 "Ecosystem Services in Nordic Freshwater Management" shows some illustrations of mapped assessments of average values of ecosystem services per unit of area for a landscape. Two of these examples are

reproduced in Box 2 and Box 3. Such mappings are good illustrations of how the values of ecosystem services are spread in a country or a region. They can also be used to illustrate different scenarios for future supplies of ecosystem services given varying policies etc. Mappings like these have become more widely used. However, you need good data to produce good maps, and lack of good valuation data for ecosystem services still limits the use of mappings.

Box 3: Analysis of bundles of ecosystem services in landscapes

Source: TemaNord 2014:561.

Figure A: Ecosystem service bundle types in a landscape

Source: Turner et al. (2014). Reproduced from TemaNord 2014:561.

The same type of analysis bundling ecosystem services in Danish landscapes is performed by Turner et al. (2014). Figure A illustrates Turner et al.'s (2014) assessment of 11 ecosystem services that were mapped at 10 km × 10 km grid scale, covering most of Denmark. The aim is to describe the spatial distribution as well as the interactions between the ecosystem services. The authors identified trade-offs between regulatory and cultural services on one hand and provisioning services on the other hand. The figure shows the identification of six ecosystem service bundle types which indicate interactions at landscape level. The analysis reveals, taking the underlying data and assumptions for granted, that the cultural services (mainly recreation) are localised on the coast, mainly because the indicator for this service was «summerhouses», while there are more multifunctional mixed-use bundle types around urban areas. As mentioned by the authors, the bundling results are sensitive to the input data, the indicators, available to define the services.

Box 4: Socio-economic importance of reindeer herding in Finland, Sweden and Norway

Source: TemaNord 2012:559.

Country	Herders	Reindeer (no.)	Organisation	Value of production (2012-mill. EUR)		
				2004	2005	2006
Finland	5,600 Sami and non-Sami	186,000	57 reindeer hunting cooperatives	>10	>10	13
Sweden	3,500 Sami, 1,000 non-Sami	227,000	51 Sami villages	<5	<5	7
Norway	2,936 Sami	165,000	80 reindeer herding districts	<10	<10	<10

Reindeer herding provides provisioning ecosystem services in Finland, Sweden and Norway. The value of production and number of herders are highest in Finland. The number of herders and reindeer and the organisation and value of production are shown for each country.

Important ecosystem services across ecosystems

All ecosystems provide ecosystem services of many kinds, and we have described a few important goods and services from a variety of ecosystems described in TemaNord reports in the preceding sections. In this section, we describe a few examples of goods and services that are important in Nordic countries across ecosystems, based on information from the TemaNord reports.

Provisioning services

Important provisioning services from Nordic ecosystems include timber and non-timber products like meat and berries from forests. Fish and shellfish

from the sea and coast are huge sources of income for the countries, and marine fibre and energy sources are becoming more and more important. Freshwater supplies people with the life essential drinking water. Agricultural landscapes provide agricultural produce, etc. All these are important ecosystem services, and well-known and accounted for in all countries.

Some less well-known, but important provisioning services from nature are described in the boxes below, illustrating the importance of reindeer herding and berries and mushrooms in the Nordic countries.

Box 5: Quantities and values of berries and mushrooms picked for markets in Finland, Norway and Sweden

Source: TemaNord 2012:559.

Country	Berries		Mushrooms	
	Quantity (tonnes/year)	Value (mill. Euro)	Quantity (tonnes/year)	Value (mill. Euro)
Finland	12,027	11,862	426	1,019
Sweden	13,790	32,435	Not available	Not available
Norway	350	0,524	500	1,873

Some numbers for quantities and values of berries and mushrooms for markets in Finland, Norway and Sweden respectively are shown in the table below.

Berries and mushrooms are picked for people's own use as well, although the trend for berry-picking is pointing downwards, and the quantities and values of these are largely unknown.

Berry and mushroom picking are also part of recreational activities, and in this case the number of days used and the experience of the activity may be more important than the quantity of goods gathered.

Box 4 illustrates that reindeer herding is an important ecosystem service in three of the Nordic countries, particularly in the northern parts.

Box 5 gives some numbers for quantities and values of berries and mushrooms for markets in Finland, Norway and Sweden. Berries and mushrooms are picked for people's own use as well, although the trend for berry-picking is pointing downwards, and the quantities and values of these are largely unknown.

Climate regulation and climate adaption services

The ecosystems' climate regulation services have been emphasized for some time in Nordic as well as global

literature. Forests are key terrestrial ecosystems in the global climate system, representing major components of the carbon cycle. The study on old northern forests (TemaNord 2013:507) discusses the climate regulation services from old growth forests of different kinds and concludes that old growth forest is good for climate regulation as well as nature and biodiversity conservation.

Several marine and particularly coastal ecosystems are also important for carbon storage and sequestration, this is noted in table 4 about the importance of kelp forests and eelgrass meadows.

The peatland study (TemaNord 2015:544) shows the climate regulation services

Box 6: Peatlands contribute to climate regulation and biodiversity conservation

Source: TemaNord 2015:554.

Peatlands are highly space-effective carbon sinks: they cover only 3 per cent of the land, but contain more carbon than the entire forest biomass of the world.

When peatlands are drained, the hitherto well-preserved carbon and nitrogen are released in the form of greenhouse gases to the atmosphere and nitrate to the surface water.

Worldwide, as much as 15 per cent of the peatlands have been drained. Almost half (45 per cent) of the peatland areas in the Nordic and Baltic states have been drained and now emit almost 80 megatons of CO₂ annually, i.e. 25 per cent of the total CO₂-emissions of these countries. These numbers are however lower in Sweden and Norway (15 and 10 per cent) and even lower in Denmark (below 10 per cent).

A substantial reduction of emissions can be achieved by restoring and rewetting these peatlands. The net greenhouse gas emissions from rewetted peatlands are low compared to the previous drained situation.

Rewetting of drained peatlands will also contribute to preservation of the peatlands as important areas for biodiversity and other ecosystem services.

from peatlands and how these are changed if the peatlands are drained and how they may be restored by removing the drainage. This report shows the importance of Nordic and Baltic peatlands for carbon storage, see Box 6.

As the signs of climate change are getting clearer, both globally and in the Nordic countries, there has been more and more emphasis on the ecosystems' climate *adaption* services. Many ecosystems supply us with climate adaption services and contribute to nature-based solutions to climate

change. Wetlands are important to avoid flooding and reduce pollution, as are intact forests and vegetation along water courses. These services are mentioned in some of the TemaNord reports. However, they are not given as much attention in the reports as they may deserve.

Cultural services

Nature contributes to several cultural services, and one of the most discussed is recreation. Forests are very important for recreation, and we have already mentioned that they are used for berry

and mushroom picking and hunting, while the most widespread recreation activity in forests is probably walking and hiking in the woods. Coastal areas are very important recreation areas for Nordic people as well, although these have not been given so much attention in the TemaNord reports. The importance of freshwater is discussed thoroughly, though. Also, areas that are not covered at all, for instance the mountain areas in Norway, Sweden and Finland and some inland cultural landscapes, are important recreation areas in the Nordic countries.

An assessment of the value of coastal recreation in pilot studies in Denmark and Sweden is made in TemaNord 2016:501: "Marine ecosystems services

in Nordic marine waters and the Baltic Sea – possibilities for valuation". The pilot study is to be followed by a larger valuation survey that will assess the value of this ecosystem service and investigate how the value of the ecosystem service is affected by changes in water quality, litter, congestion and substitute recreation sites. It uses choice experiments to allow for an analysis of how several attributes of the ecosystem service "recreation" influence the value of recreation. The report describes how the pilot surveys are carried out in Denmark and Sweden. Box 7 reports some main results and conclusions from the pilot studies, reproduced from TemaNord 2016:501.

Box 7: Results and conclusions from pilot studies assessing the value of coastal recreation in Denmark and Sweden

Source: TemaNord 2016:501.

Some of the main findings from the pilot study as reported in TemaNord 2016:501 are reproduced here.

Both Danish and Swedish respondents generally have a very positive perception of the water quality in coastal areas. Around 90 per cent of the Danish as well as the Swedish respondents describe the water as being either clear or very clear, and well or very well suited to important recreational activities such as swimming, bathing, angling and rowing/boating.

The number of recreational trips to forests is much higher in the Swedish than in the Danish sample. The mean distance to the most frequently visited site is nearly half in Denmark as compared to Sweden (15 km versus 28 km). While coastal trips are more common than forest trips in Denmark, the opposite is the case in Sweden. This may be due to the season the survey was conducted in: summer in Denmark and autumn/early winter in Sweden. In both countries, coastal areas are important for recreation.

Of the presented attributes, water quality, number of visitors, litter situation and distance from home, water quality and litter seem to concern the Swedish respondents the most and are possibly also what people value the most. For the Danish respondents, congestion seems to be important as well. The results further indicate that distance to a place might have different relevance for the respondents in the two countries, as the Swedish respondents are willing to travel longer to their most frequently visited site.

The most frequently visited coastal areas are located further away from the respondents than the closest available coastal areas. That is, the Danish and Swedish respondents do not seem to be discouraged from travelling longer distances to get to their preferred recreational sites.

CHAPTER 3

APPLICATION OF THE ECOSYSTEM SERVICES APPROACH IN ECOSYSTEM MANAGEMENT

Increased focus on mainstreaming the ecosystem services approach into decision-making

The early reports financed by the Nordic Council of Ministers that used the concept of "ecosystem services" mainly concentrated on describing and discussing the notion, the relationship between ecology and economy, and the potential usefulness of – and problems with – the term etc. This also applied to most of the other literature taking the ecosystem services approach in use. To start with, it was necessary to explore and discuss the concept and identify and describe the ecosystem services from differing ecosystems. This work is not finished yet, and much research literature still discusses and analyses this relationship and the challenges in using the term theoretically.

More recently however, the emphasis has moved to *applications* of the ecosystem services approach. Some of the more recent TemaNord reports are attempting to mainstream the ecosystem services approach into decision-making. These reports investigate the possibilities and challenges in applying the ecosystem services approach for better management. Several suggest practical tools or steps to incorporate the ecosystem services approach into decision-making processes. The second

NCM report on freshwater (TemaNord 2014:561) focuses on giving examples on how the ecosystem services approach may be used for assessing benefits and costs according to the EU Water Framework Directive. It suggests that using the ecosystem services approach provides relevant information about the benefits of improved water status, that it can be used to compare benefits and costs, and even for assessment of disproportionate costs.

The most recent report on marine ecosystems (TemaNord 2017:536) develops a stepwise approach for applying the ecosystem services approach as a tool in Marine Spatial Planning (MSP). The most recent report on cultural landscapes (TemaNord 2017:510) investigates and suggests how the ecosystem services approach may be used to assess environmental effects, particularly in Cost Benefit Analyses (CBAs).

An early attempt at showing how the ecosystem services approach may be used was the report on Payment for Ecosystem Services (TemaNord 2009:571), which shows how valuation of ecosystem services can be used as basis for PES as a tool for taking environmental concerns into consideration. Also the report that

investigates if and how the ecosystem services approach fits with the cultural heritage tradition (TemaNord 2015:540) is a way of mainstreaming the ecosystem services approach into decision-making in a neighbouring field of research. We describe some of these applications and suggested applications in the following as examples of how the ecosystem services approach is or may be applied in a variety of management tools and decision-making frameworks.

Examples of application of the ecosystem services approach in nature management

Using the ecosystem services approach to assess costs and benefits for application in the Water Framework Directive

The Water Framework Directive (WFD) is the main directive regulating the quality and the use of freshwater as well as coastal waters in the EU-countries, and Norway and Iceland have adopted the requirements in the directive as well. The aim of the WFD is to maintain and improve the aquatic environment in order to obtain good ecological status (GES). The ecosystem service approach can be used in several ways in this work, and the report TemaNord 2014:561: "Ecosystem Services in Nordic Freshwater management" gives many examples of how this is done in

the Nordic countries. In Norway, the approach has been used to assess the benefits and costs of measures in urban rivers. The categories of ecosystem services were used as a check list to see all the benefits that the affected population will receive if the water status is improved. Some of these benefits are valued by use of value transfer, other benefits are quantified, while others are qualitatively described only. These benefits are compared to the costs in a benefit cost assessment. While the costs of measures tend to be easy to calculate, the benefits are often intangible and without market prices. Both in Norway and in Denmark, valuation studies have been conducted in order to estimate the benefits of improved water status, and values from these valuation studies have been transferred in order to estimate the values of Swedish water courses as well. These studies show that people value improvements in water quality and thus that improved water quality has large welfare effects. The report concludes that the use of the ES framework can be very helpful in assessing and illustrating how goods and services are affected by implementation of the WFD, and the trade-offs between different goods and services. In particular, the approach can illuminate how different water policy implementation strategies might lead to different results for

Figure 4: Conceptual model of the stepwise methodology suggested for use of the ecosystem services approach in marine spatial planning

Source: TemaNord 2017:536.

the provision of ecosystem services and hence demonstrate differences between the total benefits of different implementation strategies and the distribution of benefits between different users or beneficiaries across space and time.

Using the ecosystem services approach in Marine Spatial Planning

Marine Spatial Planning (MSP) is intended to promote sustainable usage of the resources of the sea. By reconciling the potentially conflicting needs of different economic sectors, and by safeguarding the structure and functioning of the marine ecosystem,

MSP also directly and indirectly supports the provision of ecosystem services by the sea. In TemaNord 2017:536: "Ecosystem Services in Marine Spatial Planning" a practical tool for assessment of impact on ecosystem services from maritime activities is developed and applied to a case study. This example shows how the ecosystem services approach can be applied together with other established tools and practices in order to get a better picture of the changes in benefits to people that are affected by changes in the environment. Figure 4 shows the conceptual model of the methodology suggested.

Using the ecosystem services approach to improve decisions regarding landscape and cultural services from landscapes

TemaNord 2017:510: "Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects. From concept to practice" develops a simple step-wise approach that uses the ecosystem service categories to assess, value and incorporate impacts of landscape experiences in practice. This method can be applied in environmental impact assessments (EIA) and cost benefit analyses (CBA) to help incorporate and quantify people's preferences and views. As stated in the report, the impacts that projects such as transportation and energy infrastructure may have on landscape experiences depend very much on location, scale and visual impacts. Impacts in the "everyday landscapes" in and around large population centres may be more important in welfare terms than impacts on more remote "iconic", low population density landscapes. The step-wise approach is applied to a couple of examples in Denmark, Finland and Norway.

The method consists of two main steps:

- Level 1: Screening
- Level 2: Detailed assessment

The screening serves to determine the level of impacts that a given infrastructure or construction project may have on the different cultural ecosystem services associated with landscape experiences. The list of cultural ecosystem services may be used as a check list in this screening process in order to see which ecosystem services may be impacted.

The detailed assessment consists of several steps:

- Score the changes likely to occur
- Score the impacts for the relevant population
- Assess the importance of a change in services to people, e.g. the welfare consequences based on the combination of the abovementioned scores. Scoring changes and impacts is based on a rating from no impacts or not relevant (score=0) to high (score=3) for each of the cultural ecosystem services identified.

Table 5: Welfare consequence by cultural ecosystem service – case of windmills in Kalvebode Syd, Denmark

Source: TemaNord 2017:510.

Importance (value) to people					
	Ranking	0-not relevant in the area	1-low	2-middle	3-high
Recreational Degree of impact	3-high	0	0	--	--
Aesthetic Degree of impact	3-high	0	0	--	--
Natural heritage Degree of impact	2-middle	0	-	0	0
Cultural heritage and identity Degree of impact	1-low	0	0	0	0

When this methodology is applied to a case of windmills in Kalvebode Syd in Denmark, the welfare consequences are assessed as in table 5.

Finally, a value assessment of a bundle of cultural ecosystem services related to landscape was conducted in Iceland and reported in TemaNord 2017:510.

Box 8: The case for using economic valuation methods to assess impacts of energy projects in Iceland

Source: Reproduced from TemaNord 2017:510, built on Cook et al. 2016.

Introduction to case

Hydropower and geothermal energy stand for almost 100 percent of electricity generation and 85 percent of primary energy use in Iceland. No effort has been made to date to quantify the environmental impacts in monetary terms to be compared with the economic gains of the projects.

Cultural ecosystem services and value assessment

In an Icelandic context, Cook et al. (2016) note that the potential non-use value associated with preserving potential hydropower and geothermal sites may represent a considerable proportion of total economic value, especially for any future energy projects relying on hydropower resources located in the nation's remote and uninhabited central highland region. They further note the challenge of correctly identifying the population affected by such impacts. Some sites, such as the future geothermal projects of Hverahlíð and Eldvörp, also have potential recreation value that will be reduced. In Iceland, like in other Nordic countries, knowledge of visitor numbers and distribution is low, and data often have to be collected first, for example in a travel cost survey.

Cook et al. (2016) mention a particular case where they argue that economic valuation of environmental impact could have been important, and that it was not weaknesses of the EIA process that led to what they think may have been the wrong decision from a welfare perspective. There was a heated debate concerning the environmental impacts of the 690 MW Karahnjúkar Hydropower plant in eastern Iceland, the largest such project in Iceland since 2007. The purpose was to provide electricity for a large aluminum smelter. The impacts were predicted to be long-lasting and severe, diminishing both the landscape value of the area and its biodiversity. Many of the impacts were considered irreversible. This case was not subject to economic valuation of landscape and other impacts, where such information might have been useful for the decision of whether to approve the project or not.

The authors mention a few other previous valuation studies in Iceland where willingness to pay to prevent environmental impacts was estimated (e.g. hydropower projects in Skagafjordur and Karahnjúkar) (see Lienhoop and MacMillan 2007). Lienhoop and MacMillan (2007) estimated people's willingness to accept (WTA) compensation for reduction in wilderness and landscape qualities associated with the hydropower development at Karahnjúkar. A new deliberative group-based approach to contingent valuation, called the market stall approach, was applied to achieve this, as it gives members of the public the opportunity to discuss and learn about the environmental change, to consult with family and friends, and to reconsider their WTA. Mean WTA was estimated at about 62€ per household per year at the time. However, the results were not used in decision-making, to our knowledge.

Lessons learned

Cook et al. (2016) offer a few concluding observations. Using the total economic valuation framework (including the ecosystem service approach, and both use and non-use values) can be a very effective means of identifying the specific ecosystem services providing environmental benefits to society. They mention two upcoming CV surveys on the geothermal areas of Hverahlíð and Eldvörp that can serve as an illustration of a carefully conceived methodology that could be applied to a future Icelandic energy project. Many of these are set to occur in remote areas where a significant proportion of their total economic value may derive from non-use value. In all cases, however, it is necessary for project-specific consideration to be given to identifying the most suitable non-market valuation technique(s) for estimating the environmental benefits about to be sacrificed.

Source: Cook et al. (2016).

Concluding remarks

Nearly 20 ecosystem service related studies have been supported by the NCM over the last decade. These are summarised in table 1 and a short description of each study is given in Appendix 1.

The studies cover the following ecosystems:

- Marine
- Freshwater
- Peatland
- Forests
- Cultural landscapes
- "All Nordic ecosystems"

There are also a few studies that do not consider specific ecosystems but rather discuss how payment for ecosystem services or natural capital accounting can use the ecosystem service approach.

The NCM studies have provided a good description of ecosystem services from different ecosystems, and to some degree assessed the magnitude and/or importance and/or values of these. It seems that for each ecosystem, the first NCM study identifies relevant ecosystem services for that ecosystem, assesses these in some way and discusses the way this assessment may be done – in economic or non-economic terms.

Some of the reports also provide interesting and important examples of ecosystem services, and their magnitudes and values in different countries.

All Nordic countries are covered, although for some services, particularly marine areas, the Baltic Sea seems to be particularly well documented.

Especially in the more recent studies, the implementation and applicability of the ecosystem services approach in environmental impact assessments (EIAs), Cost-Benefit Analyses (CBAs), Marine Spatial Planning (MSP), Payment for Ecosystem Services (PES) etc. are discussed, and this brings the usefulness of the approach for the Nordic governments further ahead.

Knowledge gaps and future work

Not all ecosystems are covered by the NCM reports. Several terrestrial ecosystems are still missing. These include mountains, urban areas, agricultural land and some of the other low altitude areas (except cultural ecosystem services in cultural landscapes).

For some ecosystems, like forests and peatlands, only a few ecosystem services are identified and described.

In addition, there is a lack of economic value estimates for many or most ecosystem services.

Thus, future studies should try to close these knowledge gaps in terms of missing ecosystems, ecosystem services and their economic values.

Since the work with ecosystem services has come a long way since the first NCM report in 2009, it should no longer be necessary to start the report for each new ecosystem review with a discussion of the ecosystem service classifications, identifications and discussion of assessment methods, as this is well covered in previous reports.

It is, however, still useful to provide updated overviews of all economic value estimates for the different services from each type of ecosystem, as these overviews are still largely missing. Such monetary estimates are useful for many policy applications, since transfer of benefit estimates from the same country or a neighbouring Nordic country results in more reliable estimates for the same ecosystem services.

Furthermore, the ecosystem services approach is very relevant in general natural resource management and planning, and there are useful and promising applications within freshwater management, marine spatial planning and landscape planning. These are also the areas where Nordic cooperation may be most useful, as experience from one or more Nordic countries may also be applicable to others.

The climate regulation and climate adaption services of ecosystems are only partly covered for a few Nordic ecosystems, and the magnitude of these services is barely described at all. The role of ecosystem services in climate change mitigation and adaption has been emphasised more and more recently. This topic is not central in the reports reviewed here, although some reports do touch upon the subject. Concentrating on this role of ecosystem services and particularly the use of semi-natural ecosystems as green infrastructure to increase resilience seems to be a timely and useful approach going forward.

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TemaNord 2016:501: *Marine Ecosystem Services. Marine ecosystem services in Nordic marine waters and the Baltic Sea – possibilities for valuation.*

TemaNord 2016:525: *Framing a Nordic IPBES-like study.*

TemaNord 2016:552: *Ecosystem Services in the Coastal Zone of the Nordic Countries.*

TemaNord 2017:510: *Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects. From concept to practice.*

TemaNord 2017:536: *Ecosystem services in Marine Spatial Planning (MSP). Ecosystem services approach as a common Nordic understanding for MSP.*

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NORSK SAMMENDRAG

Nordisk natur forsyner oss med en rekke ulike goder som mat, fiber, drikkevann, medisiner, beskyttelse mot flom og stormer, karbonlagring, og rekreasjonstjenester som bading og fuglekikking. Vår velferd og velvære avhenger av disse godene og tjenestene – ofte kalt økosystemtjenester. Men mange av dem selges ikke på markeder og har derfor ingen markedspris. Velferdstapet for folk og samfunn som følge av reduksjoner i kvalitet og kvantitet av disse godene synes derfor ikke i våre vanlig brukte regnskaper, iallfall ikke på kort sikt.

De siste 10-årene har det vært mange initiativ som har hatt som formål bedre å inkorporere disse godene og tjenestene uten markedspriser i beslutningsprosesser. Begrepet økosystemtjenester fikk stor oppmerksomhet da The Millennium Ecosystem Assessment (MEA)-rapport ble lansert i 2005. MEA definerte økosystemtjenester som "den nytten folk direkte og indirekte får fra naturen". Vi skiller ofte mellom fire kategorier av økosystemtjenester. Støttende tjenester er tjenester som er "nødvendige for å produsere alle andre økosystemtjenester" og anses som grunnleggende for de tre andre kategoriene: forsynende, regulerende og kulturelle tjenester (opplevelses- og kunnskapstjenester).

Nordisk ministerråd (NMR) har gjennom ulike arbeidsgrupper, særlig miljøøkonomigruppen (MEG) og terrestrisk økosystemgruppen (TEG), fått utarbeidet en rekke rapporter om økosystemtjenester. De fleste av disse har resultert i rapporter i TemaNord-serien.

Denne rapporten har som mål å summere opp og gi noen eksempler på økosystemtjenester som er gjennomført for NMR på et overordnet nivå. Den gir eksempler på økosystemtjenester vi får fra nordisk natur og viktigheten av disse. Den gir også noen eksempler på hvordan økosystemtjenestetilnærmingen har blitt og kan bli brukt for forvaltning av naturen i de nordiske landene og peker på noen kunnskapshull.

Rapporten starter med å gi en introduksjon til begrepet økosystemtjenester og nordiske økosystemtjenester. Den gir eksempler og en oppsummering av resultater på et overordnet nivå i hoveddelen (kapittel 2 og 3). Kapittel 2 beskriver de økosystemtjenestene som er identifisert, kvantifisert og i noen tilfeller verdsatt. Kapittel 3 viser noen eksempler på hvordan økosystemtjenestetilnærmingen har blitt benyttet eller er forslått benyttet, og peker på noen kunnskapshull. Vedlegg 1 gir en systematisk beskrivelse av alle NMR-rapportene som diskuterer

økosystemtjenester, organisert ved hvilket økosystem de dekker.

Økosystemtjenester fra ferskvann, marine områder og kystvann er spesielt godt dokumentert i NMR-rapporter. Dette kan reflektere det faktum at vann av ulike slag er viktige økosystemer i alle nordiske land og for mange typer bruk. Ikke alle økosystemer er like godt dekket av rapporter fra NMR. Terrestriske økosystemer som fjellområder, urbane områder, landbruksareal og noen typer lavlandsområder (unntatt kulturelle økosystemtjenester i kulturlandskapet) er ikke inkludert i noen av rapportene. For flere økosystemer, som skog og myrområder, er det bare et fåtall økosystemtjenester som er identifisert og beskrevet. Videre mangler det økonomiske verdier for mange, for ikke å si de fleste økosystemtjenestene. Fremtidige studier bør derfor søke å lukke disse kunnskaps-hullene i form av manglende beskrivelse av økosystemer, økosystemtjenester og deres økonomiske verdier. Slike økonomiske verdsettingsestimater kan være nyttige i mange policyanvendelser, fordi overføring av nytteestimer fra samme land eller et nordisk naboland gir mer pålitelige estimer for same økosystemtjeneste.

Videre er økosystemtjenestetilnærmingen svært relevant i generell forvaltning av naturressurser, og rapporten har vist at det finnes eksempler på lovende anvendelser for eksempel i forvaltning av ferskvann, marin arealplanlegging (MSP) og i landskapsplanlegging. Vi foreslår at utvikling og eksempler på anvendelser av økosystemtjenestetilnærmingen i naturforvaltning og beslutningsprosesser kan være et område der nordisk samarbeid kan være mest nyttig i fremtiden, fordi erfaringer fra et nordisk land kan være anvendbare også i andre.

ECOSYSTEMS AND ECOSYSTEM SERVICES IN NCM REPORTS

In our assessment of the TemaNord reports on ecosystem services, the first categorization we make is one of the different types of ecosystems and ecosystem services that are included in the reports. We have classified the reports into covering marine, freshwater, peatland and forest ecosystems, landscapes and "all ecosystems". However, some reports do not fall into these categories, and are categorised as "methodological studies".

This appendix starts with an overarching overview of the reports in table A1. The following sections provide an overview of reports and results for each ecosystem

covered, starting with "all ecosystems", followed by marine, freshwater/ watersheds, peatlands, forests and landscape. The final section discusses the reports that do not describe one particular ecosystem, but general or methodological issues.

Table A1 shows which ecosystems the Nordic reports cover, and which categories of ecosystem services are identified for each ecosystem and report. The table further gives an overview of which services are assessed in monetary terms, quantitatively or qualitatively.

Table A1: Categorization of TemaNord reports on ecosystem services

Type of ecosystem	Report title (year)	Provisioning	Cultural	Regulating	(Supporting)	Monetary	Quantitative	Qualitative
All	Socio-economic importance of ecosystem services in the Nordic Countries. Synthesis in the context of The Economics of Ecosystems and Biodiversity (TEEB) (2012)	X	X	X		X	X	X
Marine	Ecosystem Services in the Baltic Sea. Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea (2014)	X	X	X	X	X		X
	Marine Ecosystem Services. Marine ecosystem services in Nordic marine waters and the Baltic Sea – possibilities for valuation (2016)	X	X	X		X		X
	Ecosystem Services in the Coastal Zone of the Nordic Countries (2016)	X	X	X	X		X	X
	Ecosystem services in Marine Spatial Planning (MSP) (2017)	X	X	X	(X)	(X)	X	X
Freshwater	Valuation of Ecosystem services from Nordic Watersheds – from awareness raising to policy support? (VALUESHED) (2012)	X	X	X	X	X	X	X
	Ecosystem Services. In Nordic Freshwater Management (2014)	X	X	X	(X)	X	X	X
Peatlands	Peatlands and Climate in a Ramsar context. A Nordic-Baltic Perspective (2015)			X			X	X
	Peatlands, climate change mitigation and biodiversity conservation. An issue brief on the importance of peatlands for carbon and biodiversity conservation and the role of drained peatlands as greenhouse gas emission hotspots (2015)			X			X	X

Forest	Ecosystem Services in Forests - How to assess and value them? Nordic Workshop, Oslo, Thursday 13th September 2012 - Conference report	X	X	X				
	Biodiversity, carbon storage and dynamics of old northern forests (2013)			X				X
Land- scapes	Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making (2009)		X					
	Landscape experiences as a cultural ecosystem service in a Nordic context. Concepts, values and decision-making (2015)		X			X	X	X
	Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects – From concept to practice (2017)		X			X	X	X
Methodo- logical	Natural Capital in a Nordic context. Status and Challenges in the Decade of Biodiversity (2013)			X				X
	Kulturarv og økosystemtjenester. Sammenhenger, muligheter og begrensninger (2015)		X					X
	Framing a Nordic IPBES-like study. Introductory Study including Scoping for a Nordic Assessment of Biodiversity and Ecosystem Services, based on IPBES methods and procedures (2016)	X	X	X				
	Payment for ecosystem services (PES)	X	X	X		X	X	X

Source: Menon Economics.

All ecosystems

One of the earliest reports supported by NCM concerning ecosystem services was the "Nordic TEEB" report which "presents a synthesis of the socio-economic importance of ecosystem services in the Nordic countries":

TemaNord 2012:559: Socio-economic importance of ecosystem services in the Nordic Countries. Synthesis in the context of The Economics of Ecosystems and Biodiversity (TEEB).

This report aims to cover and give a monetary value for all ecosystem services in all Nordic countries. It provides estimates for agricultural products, forest production in terms of timber and non-timber forest products, hunting and other recreation, regulating services and to some degree also cultural services. It further gives an assessment of status and trends for ecosystems in the Nordic countries. As the report has a broad perspective, it does not go into depth with regards to values. However, it gives an interesting overview of the benefits people in the Nordic countries receive from nature in a broad sense. The assessment of these ecosystem services is made in monetary terms for some of the services, like agricultural and forest production. Other goods and services are quantified, like the number of large

predators and number of hunters. The report concludes that "it is evident that a range of ecosystem services are of high socio-economic significance for the Nordic countries, either based on their market value or estimated value for the broader public". It also stresses that several of the ecosystem services have been seriously degraded and others face serious risks.

Marine ecosystems

Marine ecosystems are diverse and widespread in the Nordic countries. They consist of both open marine areas and coastal zones, and both enclosed seas such as the Baltic Sea and open ocean areas such as the Norwegian Sea and coastal areas.

Four reports cover marine ecosystem services:

- i) TemaNord 2014:563: Ecosystem Services in the Baltic Sea. Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea.
- ii) TemaNord 2016:501: Marine Ecosystem Services. Marine ecosystem services in Nordic marine waters and the Baltic Sea – possibilities for valuation.
- iii) TemaNord 2016:552 (Ecosystem Services in the Coastal Zone of the Nordic Countries).

iv) TemaNord 2017:536 (Ecosystem services in Marine Spatial Planning (MSP). Ecosystem services approach as a common Nordic understanding for MSP).

The first two on the list look mainly at the Baltic Sea area, while the two others look at the Nordic marine areas in general. All four reports discuss all the categories of ecosystems. The two first reports (TemaNord 2014:503 and TemaNord 2016:501) include supporting ecosystem services, while the last two follow more recent categorisations, and report supporting services as intermediate services, but do not value them.

The first two reports on marine ecosystems are methodologically oriented. The very first from 2014 describes important ecosystem services in all four categories in qualitative terms and does not quantify or monetise any of the services. This report may be seen as a first attempt to explore the possibilities for implementation of the ecosystem services approach for meaningful governance of the Nordic marine areas and identifies important marine ecosystem services.

The next on the list, TemaNord 2016:501, is also methodologically oriented, and discusses different classification

systems and compares them in a marine ecosystem services context. It further describes and discusses ways of valuing these marine ecosystem services and concludes that this is possible and should be done. It also includes an assessment of relevant valuation studies of marine ecosystem services. The report gives an overview of the number and characteristics of valuation studies of different ecosystem services/categories. It also provides some valuation estimates and examples for one ecosystem service in each category, namely wild fish for food, the regulating service treatment of eutrophication, and recreation. It suggests that further work on valuation of ecosystem services should start with the identification of relevant ecosystem services, continue with mapping and assessing, and finally valuing them. It also suggests that this work should be linked to the indicators in the EU Marine Strategy Framework Directive.

The third marine report, TemaNord 2016:552, concentrates on some selected important ecosystems within the marine areas: kelp forests, eel grass meadows, blue mussel beds and shallow bays and inlets. For each of these, relevant ecosystem services are identified and assessed qualitatively. It ends with a table describing the importance of the ecosystem services from each ecosystem.

Table A2: Reports about marine ecosystem services

Report	Content	Methodology	Results/conclusions
TemaNord 2014:563	Overview of the ecosystem services and associated benefits provided by the Baltic Sea, and information on applied approaches of assessing and valuing these ecosystem services in the region.	Literature study, input from workshop.	Concludes that there is still limited knowledge on the functioning of the Baltic Sea ecosystems and their connection to ecosystem services.
TemaNord 2016:501	The report aims to provide suggestions on how the ecosystem condition assessments, being based on the Marine Strategy Framework Directive (MSFD) and the HELCOM indicator-based assessments for the Baltic Sea, could be used for the assessment of ecosystem services.	Review of economic and marine literature Case study (pilot) demonstrating how recreation can be valued. Review of 12 valuation studies of Nordic marine ecosystem services (mostly Baltic Sea).	Existing data and results can be used to link ecological status to values of ecosystem services. Descriptors and indicators (of the MSFD and HELCOMs BSAP) can be used to assess the current status of ecosystems. Good ecological status will be useful as the policy scenario for new valuation studies.
TemaNord 2016:552	Overview of the available information on the benefits and values of kelp forests, eelgrass meadows, blue mussel beds, and shallow bays and inlets.	All four ecosystems are examined in the light of supporting, provisioning, regulating and cultural ecosystem services in the Nordic coastal zone.	The four ecosystems are to a large extent examined as providers of medium or highly important ecosystem services.
TemaNord 2017:536	Development of a new tool for assessing ES in marine spatial planning, together with practical application of the method.	A new stepwise methodology on how to include ecosystem services assessment in maritime spatial planning processes.	The methodology is promising, although there is potential for improvements, and the methodology should be applied to real world case studies.

Source: Menon Economics.

The latest TemaNord report on marine ecosystem services, TemaNord 2017:536, includes all ecosystem services, aims to develop a practical tool that can be used in marine spatial planning, and shows with an example how this can be done in practice. This is a more applied way of using the ecosystem services approach for management, which builds on the earlier reports which have explored the possibilities and identified and classified the ecosystem services.

Table A2 provides an overview of the four marine reports and their most important characteristics.

Freshwater/watersheds

Fresh water provides important ecosystem services in all countries: as a source of safe drinking water (which is essential for human life and well-being), as a source of recreation, wildlife, aesthetic services, and it has important regulating functions.

Two reports discuss freshwater ecosystem services:

- i) TemaNord 2012:506: Valuation of Ecosystem Services from Nordic Watersheds; and
- ii) Tema:Nord 2014:561: Ecosystem Services in Nordic Freshwater Management.

The first report was mainly theoretical and provided the foundation for how to deal with ecosystem services in a water framework directive setting. It also collected relevant valuation studies of ecosystem services in fresh water in the Nordic countries. The latter report is about the use and usefulness of the ecosystem service framework in freshwater management in general, and in relation to the EU Water Framework Directive (WFD) in the Nordic countries in particular. This report includes several examples which illustrate that the ecosystem services framework is used increasingly in freshwater management in the Nordic countries. Relatively few studies in the Nordic countries value ecosystem services in monetary terms, although some earlier studies value improved fresh water status including good ecological status without using the ecosystem services framework. There are only a few comprehensive Cost Benefit Analyses and analyses of "disproportionate costs" (according to the WFD) that apply the ecosystem services framework in the Nordic countries. However, this report suggests that the ecosystem services approach may be useful for identifying, assessing and potentially also valuing ecosystem services, and that this fits well with the ideas and principles in the WFD. Further, it says that applying this approach may

Table A3: Reports on freshwater ecosystem services

Report	Content	Methodology	Results
TemaNord 2012:506	The report moves from a review of valuation studies in Nordic countries in comparison to international experiences, looks at detailed examples of valuation studies from two Nordic watersheds, leading to a discussion of methodological challenges and possibilities for policy application.	Literature study and thorough assessment of valuation studies.	Gives monetary estimates from literature for several freshwater related ES, in all Nordic countries. Shows that modeling of regulating services such as flood reduction and pollution control needs to be spatially explicit if it is to address economic interests and their locations, and in turn be policy relevant.
Tema:Nord 2014:561	Explores the use and usefulness of the ecosystem services approach in freshwater management in the Nordic countries.	Theoretical and practical assessment.	Shows several results from all Nordic countries, but mostly from DK, NO and FI, of how the ES approach has been used and can be used, particularly for assessment of benefits, costs, and disproportionate costs according to the Water Framework Directive.

Source: Menon Economics.

be useful in assessing disproportionate costs, and assessing standard costs and benefits needed in analyses of measures according to the WFD (which all the Nordic countries have implemented).

Table A3 provides an overview of the reports on fresh water.

Peatlands

Peatlands contribute with many ecosystem services, and play a role in global climate regulation, by constituting the largest terrestrial store of carbon per hectare, compared to other ecosystems such as grassland or forests.

The Nordic reports on ecosystem services from peatlands include one report and one policy brief:

- i) TemaNord 2015:544: Peatlands and Climate in a Ramsar context. A Nordic-Baltic Perspective.
- ii) Joosten (2015): Peatlands, climate change mitigation and biodiversity conservation. An issue brief. Nordic Council of Ministers.

The report and brief include country profiles for peatlands for all Nordic and Baltic countries. The focus is on the regulating ecosystem service, greenhouse gas regulation. The report and policy brief

Table A4: Reports about peatland ecosystem services

Report	Content	Methodology	Results
TemaNord 2015:544	Drained peatlands emit a lot of CO ₂ in the NorBalWet countries. Rewetting of drained peatlands leads to a substantial reduction of annual greenhouse gas emissions.	Country by country assessment, on emissions from drained peatlands. GIS analysis.	Peatland Ramsar sites could be centers for raising awareness on conserving and restoring the climate regulation function of the world's (and the Nordic countries') peatlands.
Joosten 2015	Information on greenhouse gas emissions from drained peatlands and the opportunities for climate change mitigation by peatland rewetting.	Policy brief built on TemaNord 2015:544.	Underlines the importance of wetlands for the regulating service of climate regulation, and that this service can be combined with other ecosystem services from peatland.

Source: Menon Economics.

discuss the climate regulation service from natural versus drained peatlands and show how natural peatlands are net carbon sinks while drained peatlands are net carbon emitters.

The amount and share of drained peatlands vary considerably between countries. In total for the Nordic and Baltic countries, 44 percent of peatlands are drained. However, for all countries but Norway and Sweden, the share is 2/3 or more. Globally, 12 percent of all peatlands are drained, while for Europe as a whole, approximately 60 percent of peatlands are drained.

Peatlands are (and have historically been) drained and used for agriculture

(mostly grazing), forestry and peat extraction.

The main message from the report and policy brief is that rewetting of peatlands might become a major contributor to the reduction of greenhouse gas emissions, in the Nordic and Baltic countries and across Europe and the world.

The studies do not value these services in monetary terms. They quantify carbon dioxide (CO₂) emissions from natural and drained peatlands. TemaNord 2015:44 further includes descriptions of relevant regulations for wetlands, including peatlands, like the Ramsar convention and the rich biodiversity which may

Table A5: Reports about forest ecosystem services

Report	Content	Methodology	Results
TemaNord 2013:507	Scientifically based overview of the role of old forests in the carbon cycle and how carbon uptake may represent co-benefits for the well-documented value of old forests for biodiversity.	Overview of knowledge, synthesize recent findings on the carbon balance of old forests in the Nordic countries.	Evidence is accumulating that forests serve as carbon sinks far beyond normal harvesting age. Comparisons of forest stands of different ages also indicate that older forests have higher carbon stocks than younger forests.
TemaNord 2014:534	Synthesis of the presentations in the workshop, and a brief summary of issues that were raised.	Summary of presentations at workshop.	The report concludes that even though the knowledge and understanding of ES and their value is improving, there is a long way to go before the Nordic countries can meet the targets of the Convention on Biological Diversity, which is to incorporate biodiversity values into all relevant decisionmaking processes.

Source: Menon Economics.

be found in natural peatlands. The ecosystem services related to biodiversity in peatlands are not described further.

Table A4 provides an overview of the report and policy brief, and their most important characteristics.

Forests

Forests provide provisioning, regulating and cultural ecosystem services.

Provisioning ecosystem services include all use of forest resources for food, energy and materials. Regulating ecosystem services include biodiversity and carbon storage, and cultural services include the recreational value from forests.

Two TemaNord reports look at ecosystem services from forests:

- i) TemaNord 2013:507: Biodiversity, carbon storage and dynamics of old northern forests.
- ii) TemaNord 2014:534: Ecosystem Services in Forests. How to assess and value them? Nordic workshop, Oslo, Thursday 13th September 2012.

TemaNord 2014:534 summarises results from a workshop in 2012. The workshop covered several topics, including the concept ecosystem services in forests, and a brief description and discussion of applicable valuation methods.

The ecosystem services biodiversity, climate regulation and recreation were discussed in more detail.

TemaNord 2013:507 focuses on the regulating service carbon regulation in old growth forests. The report describes the forest and forest ecology and human impacts in Nordic countries in general. Its main message is that preservation of old growth forests is important for the ecosystem services greenhouse gas regulation as well as biodiversity, although in the general literature, the value of forests for biodiversity is better documented than the value of carbon storage. The findings indicate that for old growth forests, carbon uptake seems to represent co-benefits for their value for biodiversity. This report looks more at the biological/ecological structure than at the benefits to people.

The reports about forest ecosystem services and their results are summarised in table A5.

Landscapes

A landscape may be defined as: "... an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (European Landscape Convention 2000). Landscapes therefore consist of different ecosystems and

their interaction with human activity. In the Nordic countries, landscapes vary considerably between countries, as well as the perceptions and importance attributed to them (TemaNord 2015:549).

In the TemaNord context, assessment of landscape experiences as a cultural ecosystem service has been the topic of two reports, where TemaNord 2017:510 builds on the work from TemaNord 2015:549. In addition to these two reports, we give a brief on Groot et al. (2009), which is an early examination of challenges in integrating the ecosystem services concept in landscape planning, management and decision making.

The landscape reports are:

- i) Groot et al. 2009: Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making.
- ii) TemaNord 2015:549: Landscape experiences as a cultural ecosystem service in a Nordic context.
- iii) TemaNord 2017:510: Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects. From concept to practice.

Table A6: Reports about landscape ecosystem services

Report	Content	Methodology	Results/conclusions
Groot et al. 2009	Approaches to analyse trade-offs involved in land cover and land use change, and discussion on challenges and developments in the inclusion of ecosystem services in landscape planning and decision-making.	Review of state-of-the-art on ecosystem assessment and valuation.	Suggest relevant ecosystem services from landscapes and how ecosystem services may be included in landscape planning and decision-making.
TemaNord 2015:549	Landscape experiences as a cultural ecosystem service in a Nordic context.	Literature review.	Identifies cultural ecosystem services from cultural landscapes, particularly agricultural and forest landscapes.
TemaNord 2017:510	Assessing landscape experiences as a cultural ecosystem service in public infrastructure projects. From concept to practice.	Literature review and desktop case studies.	Use a stepwise methodology to assess the impact on cultural ecosystem services from infrastructure projects like wind farms, railways and power transmission lines.

Source: Menon Economics.

Table A6 provides an overview of the landscape ecosystem services approach and the main results.

General/methodological studies

A few of the Nordic ecosystem service reports do not cover any particular ecosystem but have a broad or methodological focus. These are described in this section. The four studies identified are:

- i) TemaNord 2009:571: Payment for and Management of Ecosystem Services. Issues and Options in the Nordic Context.

- ii) TemaNord 2013:526: Natural Capital in a Nordic context. Status and Challenges in the Decade of Biodiversity.
- iii) TemaNord 2015:540: Kulturarv og økosystemtjenester. Sammenhenger.
- iv) TemaNord 2016:525: Framing a Nordic IPBES-like study.

The 2009 report on payment for ecosystem services discusses the concept of payment for ecosystem services (PES) and gives examples of use of the concept. This is an early discussion, providing suggestions for how the ecosystem services concept and

valuation of ecosystem services may be used in practical management and policy to pay for the benefits obtained from ecosystems.

The report states that PES schemes tend to focus on four areas: landscape beauty, watersheds, biodiversity and carbon sequestration. It provides examples of implemented PES schemes for each of these four areas. However, the report suggests that PES schemes could be used in other areas, like marine ecosystems, as well. Many of the examples on PES in the report are from outside the Nordic countries. However, it shows that PES is in use in the Nordic countries as well, although there might be room for expanding the use of PES in the Nordics, according to the report.

The report on natural capital evaluates the strengths and weaknesses of five of the most prominent international approaches to natural capital accounting, in light of the policy goals, conditions and institutions in the Nordic countries. One of the findings is that none of the Nordic countries consider it a priority to develop monetary accounts of ecosystem services to use such values with the specific purpose of adjusting GDP (and accounts of national wealth more generally) for ecosystem degradation and loss of associated capacity to deliver ecosystem

services. Also, this was not seen as practical or feasible as the empirical base would not be considered robust enough, and because international standards do not yet exist. A system of indicators is considered a more practical way to respond.

The Norwegian report on cultural heritage and ecosystem services explores the similarities and differences between ecosystems and values obtained from ecosystems with cultural heritage and the values society obtains from this heritage. It discusses the possibilities of using an ecosystem service-like approach to value the benefits from cultural heritage, and stresses that values from ecosystems and cultural heritage both accrue in the cultural landscape. It concludes that the ecosystem service concept cannot be transformed or used directly for cultural heritage. However, aspects of the concept may be useful for cultural heritage in terms of raising awareness of the magnitude of economic values that cultural heritage provides to society.

The last report in this methodological section is a report on how to frame an IPBES-like study in the Nordic countries. This report explores the IPBES framework, the elements supposed to be part of IPBES-like studies, and to some

Table A7: Reports with general and methodological studies

Report	Content	Methodology	Results/conclusions
TemaNord 2009:571	Payment for ecosystem services (PES), in theory and practice.	Literature review, consultations with experts, case examples from OECD and Nordic countries.	Shows that the ecosystem services approach can be used to establish payment schemes for environmental benefits.
TemaNord 2013:526	Natural Capital in a Nordic context. Status and Challenges in the Decade of Biodiversity.	Literature review.	Concludes that none of the Nordic countries prioritised adjusting GDP with monetary accounts of changes in ecosystem services but worked with indicators as a proxy.
TemaNord 2015:540	Kulturarv og økosystemtjenester (In Norwegian: English title: Cultural Heritage and Ecosystem services).	Literature review and workshops on similarities and differences in the ecosystem services approach and the governance of cultural heritage.	The report discusses whether the ecosystem service approach may be applicable and useful in the management of cultural heritage. It concludes that the cultural heritage sector to a certain degree may learn from the ecosystem service approach, primarily by inspiration to development within the sector for assessment of the cultural heritage importance as a resource which has a value for society. It also emphasises that the understanding of historical depth is central to sustainable management of natural and cultural heritage.
TemaNord 2016:525	Framing a Nordic IPBES-like study.	Literature review and consultations with governmental agencies in the Nordic countries.	Suggestion for how a Nordic IPBES-like study may be carried out, with description of some main features in IPBES and IPBES-like reports.

Source: Menon Economics.

degree looks at which level and which ecosystems may be relevant for a Nordic IPBES-like study, although it does not actually conclude in this respect. This framework project was followed up by an

IPBES-like study of Nordic coastal areas, executed by the NCM, that was launched in summer 2018 (too late to be included in this overview).

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Nature provides us with a multitude of goods like food and fiber, drinking water, protection against floods and storms, carbon storage and recreational services like swimming and bird watching. Our welfare and well-being depend on these goods and services – often called ecosystem services, defined as “the benefit people directly and indirectly obtain from nature”. We often distinguish between four categories of ecosystem services; supporting, provisioning, regulating and cultural ecosystem services.

This report aims to sum up and show some examples of the results of the ecosystem services projects carried out for NCM. It illustrates which ecosystem services we receive from Nordic nature and the importance of these. It also shows examples of how the ecosystem services approach has been and can be used in management of nature in the Nordic countries, and points at some knowledge gaps.