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# Ecosystem services assessments and nature-based tourism

## Approaches focusing on monetary valuation methods

Eivind E. Aronsen, Graciela M. Rusch, Bart Immerzeel

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Norwegian Institute for Nature Research

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# Abstract

Aronsen, E.E., Rusch, G.M. & Immerzeel, B. 2024. Ecosystem services assessments to support nature-based tourism. NINA Report 2458. Norwegian Institute for Nature Research.

Ecosystem services assessments can provide important information to support the planning and development of nature-based tourism activities and businesses, both for exploring tourism opportunities, and considering and evaluating possible trade-offs between nature-based tourism activities and other important functions of nature in an area.

In this report, we review the different components of which ecosystem services assessments consist of, with a particular focus on monetary valuation methods. Following the conceptual framework of ecosystem services mapping, we point to the different components of the assessment including: (i) the areas with service providing units, (i) indicators that describe the condition of these areas with relevance for nature-based tourism activities, (iii) models estimating ecosystem services flows, (iv) identification of beneficiaries, and (v) monetary valuation approaches to assess the economic value of nature's contribution to tourism.

We first provide an overview and discuss the contexts in which ecosystem services assessments can be useful when planning and developing nature-based tourism activities. We describe and provide examples of how the 'service providing units' can be defined for nature-based tourism and highlight the challenges of identifying the actual contribution of nature in these kind of ecosystem services assessments in which physical human interventions (i.e. facilitation of accessibility of various kinds) are a necessary component for ecosystem services flows to be realized. Secondly, we provide an overview of how the condition of the landscapes, or the ecosystems can affect nature-based tourism. We refer to research within the Recreation Opportunity Spectrum (ROS) paradigm, which relates different levels of naturalness and human intervention with potential for nature-based tourism segmentation (i.e. ranging from areas with a high level of preparation/accessibility facilitation to areas with opportunities to experience wilderness). Further, we present an overview and examples of how, in nature-based tourism situations, visitors' management is related to the condition of nature and its capacity to contribute to nature-based tourism experiences. We also highlight and present examples of how the quality of the natural system contributing to nature-based tourism activities can be assessed and monitored in order to maintain its long-term sustainable use.

Thirdly, we present an overview of monetary valuation methods, including those used in national accounts (i.e. after SEEA EA), but not exclusively. The overview is general, but when relevant, we present specific examples related to nature-based tourism. Finally, we provide a series of examples of nature-based tourism in Norway, referring explicitly to (i) different monetary valuation methods of levels of nature recreation use, (ii) questions about visitors' management and the impact on the quality of the natural area and the tourism experience (and Lofoten islands), (iii) issues of nature-based tourism potentially conflicting with conservation goals in protected areas (Dovrefjell - Sundalsfjella National Park) and (iv) procedures for impact assessments and control of nature-based tourism in vulnerable natural areas.

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# Sammendrag

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I denne rapporten gjennomgår vi de ulike komponentene som økosystemtjenestevurderinger består av, med særlig fokus på monetære verdsettingsmetoder. I tråd med det konseptuelle rammeverket for kartlegging av økosystemtjenester peker vi på de ulike komponentene i økosystemtjenester vurderingen: (i) områder med tjenesteproduserende enheter, (ii) indikatorer som beskriver tilstanden til disse områdene med relevans for naturbaserte reiselivsaktiviteter, (iii) økosystemtjenestemodeller som brukes for å estimere økosystemtjenester strømmer, (iv) identifisering av brukere og (v) monetære verdsettelsesmetoder for å vurdere den økonomiske verdien av naturens bidrag til turisme.

Vi gir først en oversikt og diskuterer i hvilke sammenhenger vurderinger av økosystemtjenester kan være nyttige i forbindelse med planlegging og utvikling av naturbaserte reiselivsaktiviteter. Vi beskriver og gir eksempler på hvordan "tjenesteproduserende areal enheter" kan defineres for naturbasert turisme. Vi belyser deretter utfordringene med å identifisere naturens faktiske bidrag i denne typen vurderinger av økosystemtjenester der fysiske menneskelige tiltak (dvs. tilrettelegging av ulike slag) er en nødvendig komponent for å tilrettelegge at økosystemtjenestene skal kunne realiseres. For det andre gir vi en oversikt over hvordan landskapets eller økosystemenes tilstand kan påvirke naturbasert turisme. Vi viser til forskning innen ROS-paradigmet (Recreation Opportunity Spectrum), som ser på hvordan ulike nivåer av naturlighet og menneskelig tilrettelegging påvirker potensialet for segmentering av naturbasert turisme (dvs. fra områder med høy grad av tilrettelegging/tilgjengelighet til områder med muligheter for villmarksopplevelser). Videre presenterer vi en oversikt over og eksempler på hvordan besøkshåndtering i naturbasert turisme er knyttet til naturens tilstand og dens evne til å bidra til naturbaserte turismeopplevelser. Vi presenterer også eksempler på hvordan kvaliteten på natur som kan vurderes og overvåkes for å sikre en bærekraftig bruk på lang sikt for naturbaserte reiselivsaktiviteter.

For det tredje presenterer vi en oversikt over monetære verdsettingsmetoder, inkludert de som brukes i nasjonale regnskaper (dvs. etter SEEA EA), men ikke utelukkende. Oversikten er generell, men der det er relevant, presenterer vi eksempler knyttet til naturbasert turisme. Til slutt gir vi en rekke eksempler på naturbasert turisme i Norge, med eksplisitt henvisning til: (i) ulike monetære verdsettingsmetoder av bruk av naturen til rekreasjon, (ii) spørsmål om håndtering av besøkende og påvirkningen på kvaliteten på naturområdet og turistopplevelsen (Lofoten), (iii) spørsmål om naturbasert turisme som potensielt kan komme i konflikt med bevaringsmål i verneområder (Dovrefjell - Sundalsfjella nasjonalpark) og (iv) prosedyrer for konsekvensutredninger og kontroll av naturbasert turisme i sårbare naturområder.

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# Contents

# Foreword

This report has been written within the project “Valuation and implementation of ecosystem services (VAIES), a cooperation between the Bulgarian Ministry of Environment and Water (Directorate for Coordination of European Union Affairs and International Cooperation) and the Norwegian Institute for Nature Research (NINA). VAIES has been conducted under the Programme “Environment protection and climate change” (EEA FM - 2014-2021).

The overall objectives of VAIES have been to analyse the policy context development and gather experiences and good practices with regard to the valuation of ecosystem services in the tourism sector. The project aimed at developing methodologies for monetary valuation of selected ecosystem services in the tourism sector in Bulgaria and to assess monetary values of selected ecosystem services in the sector. Finally, VAIES aimed at testing natural capital integration in business planning, finance, and accounting systems for the tourism sector.

Specifically, the aim of this report has been to contribute to these objectives by providing an overview of ecosystem services assessments that can support decision-making related to nature-based tourism, with specific focus on monetary valuation methods. We provide an overview of approaches for integrated assessments of ecosystem services related to nature-based tourism by addressing issues of ecosystem condition and the potential impacts of nature-based tourism, and give examples describes the Norwegian literature, the components of the service providing units in the case of nature-based tourism, and provide a thorough overview of monetary valuation methods, with an analysis of limitations and suitable contexts for their application.

Trondheim, 29 April 2024
Eivind Aronsen

# 1 Introduction

## 1.1 Ecosystem services assessment

The Millennium Ecosystem Assessment (MA, 2005) which assessed the consequences of ecosystem change for human wellbeing and involved more than 1360 experts worldwide was important for putting the concept ecosystem services on the policy agenda (Gómez-Baggethun et al. 2010). The notion then was that ecosystem services could help reveal and communicate the role of critical functions of nature in supporting human well-being (MA 2005). Further, assessments of the linkages between ecosystem functions and human well-being would improve the knowledge base to support decisions about the sustainable use of ecosystems (e.g. Turner and Daily 2008, Haines-Young and Postchin 2010). Since then, a wide range of research areas and other forms of knowledge generation have aimed to help define ecosystem services as an analytical framework of socio-ecological systems, that integrates biodiversity and nature functions with social dimensions, including the economy (IPBES VA 2022). A wide range of research fields have been developed and integrated to advance theory (e.g. Jax et al. 2013, Primmer et al. 2015, Postchin-Young et al. 2017, Czúcz et al. 2018) and methods (Tallis et al. 2010, Maes et al. 2016, The MAES method explorer[1]) as well as to operationalize ecosystem services theory to support policy formulation and inform decision-making (Pascual et al. 2023).

In Europe, the work on mapping and assessment of ecosystem services was triggered with the formulation of the Biodiversity to 2020-strategy. In 2011 the European Union adopted the strategy, with the aim "to halt the loss of biodiversity and ecosystem services in the EU and help to stop global biodiversity loss by 2020". The strategy was aligned with the Convention on Biological Diversity "Strategic Plan for Biodiversity 2011-2020", which included the Aichi Biodiversity Targets[2], and specified as one of its five strategic goals "Enhance the benefits to all from biodiversity and ecosystem services". The EU Strategy explicitly formulated these goals into policy objectives: "…by 2020 ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystems" (Maes et al, 2020 p. 14). Further, action 5 of the strategy, Mapping and Assessment of Ecosystems and their Services (MAES) stated that "Member States, with the assistance of the Commission, would map and assess the state of ecosystems and their services in their national territory, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020" (ibid.)".

In a Norwegian context, a report by the Norwegian Environment Agency (2023) concerning a "first generation environmental account" states that a realistic ambition is to have accounts on a national / regional scale with area, condition, supply and use of ecosystem services. Further, it is stated that the long-term goal should be to have detailed nature accounts that can support territorial planning and ecosystem management, also at communal and local scale, when ecosystem services models are supported by data at the suitable resolution (Rusch et al. 2024).

## 1.2 What can ES assessments be suited for?

In 2021, the System of Environmental Economic Accounting – Ecosystem Accounting (SEEA EA) was adopted by the United Nations Statistics Office as a standard approach to expand the scope of national economic environmental accounts (United Nations 2021). The SEEA EA is a framework that builds on a form of operationalization of ecosystem services for reporting and accounting of ecosystem's contribution to the flow of benefits to the national economy, i.e. specific government sectors, households, and businesses. SEEA EA is particularly relevant for assessing the economic importance of nature-based tourism in national accounts since it expands the earlier production boundary from provisioning services only, to include regulating services

[1] https://database.esmeralda-project.eu/home
[2] https://www.cbd.int/sp/targets

and cultural ecosystem services, including nature-based recreation and tourism (NCAVES and MAIA 2022). At the same time, the integration of SEEA EA with the System of National Accounts (SNA) requires specific methodological approaches, especially regarding the economic and monetary valuation methods.

However, the SEEA EA is a framework that standardizes operationalization central concepts developed in ecosystem services research and practice for the purposes of compatibility with the system of national accounts It includes the definition of: (i) service providing units (SPU), (ii) indicators of ecosystem condition that can both be linked to the level of the ecosystems' contribution to human well-being and to human drivers of ecosystem change, (iii) metrics to quantify the physical contribution of ecosystems, (iv) the assessment of levels of use and finally, (v) the valuation of these contributions, presented predominantly as exchange value equivalents for compatibility with SNA reporting standards. However, a broader understanding of values in the context of ecosystem services assessments should consider a wider spectrum of values and valuation approaches, ranging from monetary value to other expressions of value that emerge from the interactions of humans with nature (IPBES 2022).

Beyond the SEEA EA, the process of systematically compiling information about components of human-nature interlinkages enables a transparent representation of these linkages by making explicit models and assumptions, as well as the empirical basis of the knowledge base. Further, since the ecosystem services approach entails disclosing and accounting for the multiple ways in which ecosystems contribute to human well-being, methods developed to capture multiple values, including those developed in the fields of stakeholder engagement and participation, multi-criteria valuation, etc. have been widely developed and used. Also, ecosystem services modelling is in essence spatially explicit because spatial patterns in ecosystem extent and condition affect quantities of supplied ecosystem services, and often the location of the ecosystem services providing units and where the ecosystem services outcomes are used or experienced occur in different geographical areas. Given these characteristics, ecosystem services assessments can be part of the knowledge base used to support multiple decision- and policy-making processes, where understanding of ecosystem functions, their condition, and how they link to human well-being is needed. Specifically, in the context of the tourism sector, ecosystem services assessments can be used, for instance: (i) to develop nature-based tourism plans (at national, regional, and local levels), (ii) to design mechanisms to promote investment in nature-based tourism, (iii) to help build networks of tourism actors centred on local nature values, (iv) to identify synergies and help solve trade-offs with other local and regional interests, and (v) to help plan and implement sustainable nature-based tourism.

# 2 Approaches to ecosystem services assessments

The theory and methods for ecosystem services assessments have developed considerably in the past decade (e.g. Bateman et al. 2013, Potschin et al. 2016, Maes et al. 2016, Barton et al. 2018, Smith et al. 2018, Turkelboom et al 2018, Vallecillo et al. 2018, Geneletti et al. 2020). Advances in ecosystem services research have also led to the adoption of ecosystem services concepts and methods as the standard framework to integrate the contribution of ecosystems into the system of national accounts (SEEA EA, United Nations 2021). However, and despite its potential, there are still important gaps in the integration ecosystem services assessments for decision-support. The recent IPBES report on nature valuation methods points to the limited uptake of ecosystem services information for decision-making and policy formulation (IPBES 2022).

In general terms, the ecosystem services framework can enable a structured and integrative analysis of socio-economic-ecological systems, based on a broad body of theories, methodological approaches, and applications. Because of this variety, both the purpose of the assessment and its socio-ecological context will determine the scope, the choice of approaches and data requirements (Barton et al. 2018). In the next sections, we describe, with examples, the components and approaches of ecosystem services assessments that can be suited to support decision-making and policies regarding nature-based tourism.

## 2.1 The nature-based tourism sector in national accounts

Specifically, the System of Environmental-Economic Accounting-Ecosystem Accounting (SEEA EA) is a framework aimed to expand the scope of the information gathered in national statistics by including accounts on the extent of ecosystems, their condition and the ecosystem services outcomes supported by them in biophysical terms. This information is the basis for assigning a monetary value to the contributions of ecosystems to the economy using a value exchange approach (Brander et al. 2018). In addition to this very specific operationalization of ecosystem services, the ecosystem services assessment and mapping framework can both be applied to other policy design and implementation contexts and encompass other metrics of human welfare, including human health and safety, as well as other dimensions of benefits (Barton et al. 2018).

The biophysical assessment of ecosystem services in the SEEA EA is compatible to ecosystem services mapping methodologies in the sense that “it is spatially based, integrated statistical framework for organizing biophysical information about ecosystems, measuring ecosystem services outcomes, tracking changes in ecosystem extent and condition, valuing ecosystem services and assets, and linking this information to measures of economic and human activity,” (United Nations et al, 2021) (p 1). The definition of ‘ecosystem’ in SEEA EA is adopted from the Convention on Biological Diversity (CBD): “An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.” The ecosystems are the focus of analysis in SEEA EA, and according to a special report on monetary valuation (NCAVES & MAIA 2022) the statistical framework integrates five different perspectives on ecosystems (Fig. 2.1).

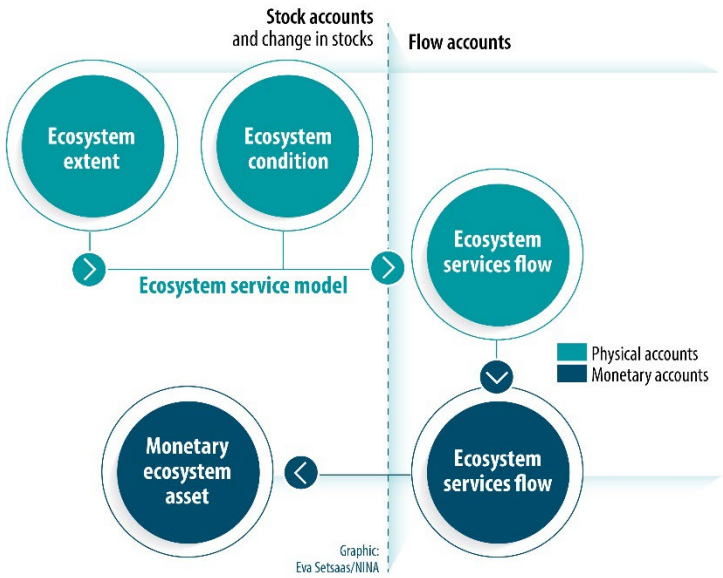


*Figure 2.1: Components of ecosystem accounts in the System of Economic Environmental Accounting – Ecosystem Accounting (SEEA EA). Adapted from United Nations 2022.*

1. First, the *extent of ecosystems* (i.e. the area of occurrence of an ecosystem type within a defined area or territory). This approach defines a geographically delimited ecosystem type occurrence as a statistical unit (and the service providing unit) and provides the same statistical unit across different accounts which facilitates the harmonization and integration of different datasets.

2. The second account refers to the ecological characteristics of an ecosystem unit that are affected by how the area is managed. *Ecosystem condition* accounts provide metrics about the state of the specific ecosystem occurrence and can therefore inform decisions on levels of use and sustainability. The two accounts combined provide an indication of the quality of the natural capital (the ecosystem assets). There are international commitments regarding ecological restoration stated first in the Aichi Targets[3] and further defined in the new strategic period of the CBD (The Global Biodiversity Framework (GBF) 2021-2030).

In the GBF, explicit targets refer to the condition of ecosystems. For instance, Target 2 reads: "Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity"[4]. To identify the need for ecosystem ecological restoration ecosystem extent accounting and assessment of ecological status is needed where good ecological status means that "biotic and abiotic conditions are sufficiently intact for the ecosystem to support a diversity of ecosystem services (ibid).

3. The third account is based on spatially explicit biophysical ecosystem services models (see e.g. Vallecillo et al. 2018, 2019, La Notte et al. 2021, Rusch et al. 2024) which integrate the area of ecosystems and their condition into socio-ecological ecosystem supply and use models whose outcomes are formulated as the contributions of ecosystems to society (i.e. different beneficiaries, including a specific national sector, private actors, households). These include for instance, water cleaning function of soils through nutrient retention and re-circulation in areas with pollutant inputs, the level of protection of the vegetation cover against soil erosion, and the occurrence of

[3] https://www.cbd.int/sp/targets
[4] https://www.cbd.int/gbf/targets

high-quality costal nursery habitats for population recruitment in fish species. These functions are associated directly or indirectly with the tourism sector, for instance by determining the quality of drinking water, and the opportunities for recreation in fresh water and marine ecosystems.

4. Both ecosystem services outcomes and ecosystem assets can be valued in monetary and other indicators for different beneficiaries (e.g. economic sectors, households). The benefits can also be of a relational character. The monetary valuation requires the identification of beneficiaries i.e. the economic and legal entities relevant for allocation of costs and benefits (United Nations et al. 2021 p. 26). This step can be of relevance for the nature-based tourism sector in the sense that it can help identify a diversity of beneficiaries and their economic interests and design economic instruments to regulate the tourism activity. Other forms of socio-cultural valuation methods can be used to identify synergies and potential conflicts among different contributions of nature for beneficiaries at various levels (Turkelboom et al. 2018).

5. Finally, ecosystem units and their condition can be considered as assets that can deliver services in the future. These are the basis for natural capital accounts in monetary terms. The SEEA EA defines ecosystem assets in biophysical terms as “contiguous spaces of a specific ecosystem type characterized by a distinct set of biotic and abiotic components and their interactions” (SEEA EA 2021 p.26).

‘Ecosystem services’ is defined in the SEEA EA as “the contributions of ecosystems to the benefits that are used in economic and other human activity,” (ibid p. 27). Benefits in this framework are the goods and services that are ultimately used and enjoyed by people and society (ibid. p. 27) which aligns with the earlier conceptualizations of ecosystem services as the ecological functions supporting human well-being, including the economic sphere. The SEEA EA definition is grounded in physical use for better alignment with SNA. Other operationalizations of ecosystem services are consider broader definitions of nature’s underpinning of human well-being. For instance, non-use values of ecosystem services such as the existence value of biodiversity, fit in the latter but not the former, although there have been attempts to model this service in physical terms (e.g. La Notte et al. 2021).

## 2.2 Ecosystem services assessment and nature-based tourism

In this section we clarify what nature-based tourism means in terms of the SEEA EA framework (see e.g. Table 6.3 of selected ecosystem services in SEEA EA 2021) and the CICES ecosystem services classification (Haines-Young & Potschin 2018). Further, we show that while tourism is a very large industry worldwide, and many European tourists report nature as a very important reason for choosing travel destinations, the research field of tourism has not yet been sufficiently integrated with the ecosystem service framework (ESF), at least not at all relevant spatial scales.

Then, we address what Wang et al (2022) have referred to as a two-way interaction process of ecosystem services and tourism development. Generally, development of nature-based tourism is based on natural features at the same time as there is a need to complement natural features with human interventions, which in the most basic form is the development infrastructure to facilitate accessibility (Fig. 2.2). This is in line with earlier recognition that, for the benefits that originate from nature to materialize, other forms of capital are often required to realize these benefits (Fisher et al. 2009). These interventions are central in ecosystem services modelling, which requires a definition of the level of use (either direct or indirect use). Wang et al (2022) refer to this kind of cultural ecosystem services models in connection with development of tourism, indicating that while ecosystems provide the opportunities, the ecosystem service models need to integrate a metrics of realized benefits, which we will address later in this section.

*Figure 2.2: The starting point of the Midsund staircase, one of the longest mountain stone staircases in the world[5]. Human-made infrastructure to facilitate access to natural areas determine the level and the kind of use, i.e. the flow of nature-base ecosystem services. Photo: O.T. Sandlund.*

Ecosystem services mapping can be a useful methodological framework for the planning process of nature-based tourism development, i.e. to identify synergies and potential conflicts with other ecosystem services, as well as to assess and monitor the development of the quality of the natural resource under use. Ecosystem services mapping can identify for instance, conflicts of use resulting from land-use change for other uses which can affect the value of the tourist attraction.

[5] https://www.visitnorway.com/places-to-go/fjord-norway/northwest/listings-northwest/midsundtrappene-r%C3%B8rsethornet-one-of-the-worlds-longest-stone-staircase/234015/

## 2.3 The significance of nature-based tourism in the economy

Looking at potential benefits, tourism is one of the world's largest industries. In 2015 the sector generated nearly 10 % of global gross domestic product (GDP). In the "corona year" of 2022 it represented 7,6% of global GDP.

Tourism is a large industry, but how important is nature for the sector? Nature-based tourism (NBT) may represent approximately 20% of the tourism sector according to Silva et al (2023). NBT may include several sub-categories or segments, such as cycling tourism, hiking tourism, fishing, ecotourism, wildlife watching, birdwatching. A rather depressing example at smartertravel.com (2018) is "last chance tourism" motivated by the desire to see diminishing or threatened species, or landscape characteristics like glaciers and coral reefs before they disappear. Silva, Silva and Vieira (2023) claim that there has been a certain ambiguity in the use of the NBT-concept in the literature. According to them, some studies have treated ecotourism and NBT as synonymous, while others reserve the term ecotourism for more responsible or sustainable NBT. Here, following Silva et al (ibid), NBT covers every type of tourism where the main attraction is nature or outdoor activities conducted in nature.

Looking at some important countries in the European market, the outbound tourism is important, and Germany is by far the most important market (99,5 million outbound overnight trips in 2019), France is the second largest market (29,6 million outbound overnight trips). See table 1 below. In 2021, 18% of holiday travelers listed nature as a primary motive for choosing a holiday destination in Germany. In France, the same number was 17%. Furthermore, among respondents that do not report nature as the primary reason for outbound tourism in these countries, many report nature as the secondary reason. E.g. 20% of German respondents report nature as the second most important motive. In addition, according to the United Nations World Tourism Organization (UNWTO), the EU accounted for roughly half of the world's international arrivals in 2018 (UNWTO, 2019).

*Table2. 1. Outbound overnight trips, nature as primary or secondary motive selected countries*

| **Country** | **Outbound overnight trips (million) (2019)** | **Nature primary motive (2021)** | **Nature second motive (2021)** |
|---|---|---|---|
| Germany | *99,5* | *18%* | *20%* |
| France | *29,6* | *17%* | *20%* |
| Netherlands | *22,0* | *29%* | *26%* |
| Belgium | *14,2* | *21%* | *21%* |
| Poland | *13,5* | *16%* | *22%* |
| Czech Republic | *7,3* | *12%* | *19%* |

*Source: adapted from cbi.eu (2023) with data from statista and Eurobarometer 499.*

Speculating from the numbers above and using the example of German tourists, if approximately 20% of approximately 99,5 million overnight stays have nature as their second most important motivation, almost 20 million German tourists will have other primary reasons than nature for the visit, but still find it important. In addition, nature is frequently reported among the most important reasons to return to a destination. Thus, nature is hugely important for respondents in these countries when selecting their travel destinations. However, this also obviously means that tourists may come for a bundle of attractions where nature may or may not be included, which will be discussed in more detail below.

The economic importance of tourism on the one hand, and the lack of data in the EU report on the other hand obviously points to a need for knowledge. Eurostat's 2023 edition of Tourism Satellite Accounts in Europe (Eurostat, 2023) makes no mention of nature-based tourism or ecosystems or relevant use of the word 'nature'. This might illustrate that there is a lack of integration of the ES-perspective and research on tourism. Pueyo-Rus (2018) states that the tourism research community should try to integrate the ecosystem service framework (ESF) in their studies of natural resources. There also seems to be a call for more accurate definitions of ES concepts related to tourism.

# 3 Mapping ES for nature-based tourism

## 3.1 Definitions of ES related to tourism

The 2020 EU report of progress in the MAES-process (Maes et al, 2020) provides a comprehensive overview of the state of knowledge of the ES mapping in the EU. However, it includes very limited information about tourism, which is likely due to the lack of suitable models and data constraints. Bagstad et al. (2021) discuss experiences with ecosystem accounting in Europe and the USA and point out lack of data as a general problem. The MAES report considers nature-based recreation, and it states: “Nature-based recreation is a cultural ecosystem service defined as the biophysical characteristics or qualities of ecosystems that are viewed, observed, experienced or enjoyed in a passive, or active way by people” (Maes et al, 2020, p.385). One could be pedantic here if the definition is entirely consistent with SEEA EA and CICES v5: It is called recreation-*related* services in the SEEA EA, and the *opportunity* provided by the characteristics and qualities mentioned is the cultural service, without including the use function. However, more important is the fact that recreation ES models are not fully equivalent to those of nature-based tourism, especially because the indicators of use will differ (Zulian and La Notte 2023). The MAES report (Maes et al. 2020) states that only “daily based recreation is covered by the assessment, longer trips for enjoying nature were not considered yet” (ibid. p 385). A search in the more than 450 pages long report for the term tourism yielded almost no information, the most concrete being in the context of sparsely vegetated lands, where the authors identify a potential degradation due to tourism but have no measurement at EU level (Maes et al, 2020, p.200).

It is important to know where to put nature-based tourism within the SEEA EA and CICES-framework. The SEEA EA definition of ecosystem services stated above: “the contributions of ecosystems to the benefits that are used in economic and other human activity,” and that benefits in this framework are the goods and services that are ultimately used and enjoyed by people and society. A search for the term ‘tourism’ in the SEEA EA gives few results. However, in annex 6.1, “Initial logic chains for selected ecosystem services”, we find that tourism is listed among “main users and beneficiaries” for “recreation related services” (pp. 154). This is important, as it provides the definition of ES in the context of the tourism business sector. In the executive summary of version 5 of The Common International Classification of Ecosystem Services (CICES), it is stated that there had been problems with previous classifications of cultural services, and that the 5.1 version was revised to better separate services from benefits and that “cultural services are now seen as the characteristics of elements of nature that provide *opportunities* for people to derive cultural goods or benefits” (Haines-Young and Potschin, 2018, p. iv, italics in original). In agreement with this notion, Barton et al. (2019) propose a definition of recreation services as “the biotic and abiotic characteristics of open space *that enable* health, recuperation and enjoyment through outdoor activities”, and clarify that “the point at which environmental structures and processes give rise to outputs that directly enter human preference functions (profit, utility, well-being) can be defined as an ecosystem service”.

There has also been some confusion about the meaning of the different types of ecosystem services, likely due to the fact that ES is a cross-disciplinary research field, where the meaning has contentiously changed between ES being the contributions of nature to society (an eco-centric view) (Díaz et al. IPBES) and the economic benefits received by society (for a discussion see Fisher et al. (2009)). For instance, Pueyo-Rus (2018) points that in early works, like MA (2005) and TEEB (2010) tourism seemed to be inconsistently treated as both a cultural ES *and* a business sector, despite both conceptualizations not being mutually exclusive. Further, Pueyo-Rus (2018) indicate that some scholars have even argued that tourism should be considered a provisioning service, especially for communities that depends on it, but this conceptualization seems to be at odds with that in the most recent literature and ES typologies, which limit provisioning ES as those functions associated with the production of biomass (United Nations 2021, SEEA EA Table 6.3). Both the SEEA EA and the CICES ES typologies define provisioning services from a biophysical point of view, as the provision of biomass (food, fibre, energy), regardless of whether the ES are used by an economic sector or not. Likewise, cultural ecosystem

services are included in the SEEA EA, which explicitly includes only ES that can be valued by an economic actor (e.g. a sector, households). Further, a 2013 literature review (Milcu, Hanspach, Abson, & Fischer, 2013) found that tourism is routinely considered a cultural service.

However, we see these conceptual developments and clarifications as part of the evolution of the ecosystem services research field in the past decades. Whether ecosystem services are the ecological features and functions or their use (i.e. the benefits received) has been a lengthy topic of between-disciplines debate, which has been largely clarified through the formulation of spatially explicit models of supply and use of natural attributes (e.g. SEEA EA, Vallecillo et al. 2018, Remme et al. 2018, Rusch et al. 2024).

However, there may be various reasons why there is limited integration of the ES-perspective and the tourism research. Chan et al (2012) argue that the inclusion of economics in the ESF led the ESF to adopt an essentially economic world view, and that this may has closed the door for other social perspectives. Especially for local-level planning of NBT, other approaches to map and assess the importance of ES, such as those used to value landscape aesthetics, cultural heritage and particular resources for local communities are important. We refer to these methods in sections 3.2.2 below.

Cultural services are seen as the characteristics of elements of nature that provide *opportunities* for people to derive cultural goods or benefits (Haines -Young and Potschin, 2018). The mapping of extent and condition of these characteristics are important first steps. Although nature-based recreation and tourism are not the same, the biophysical models developed to assess outdoor recreation (Paracchini et al. 2014, Vallecillo et al. 2018) and amenity services are relevant, at least as a starting point.

Potential benefits need to be realized and here we encounter the two-way interaction of ES and development of tourism (Wang et al, 2022). Generally, development of nature-based tourism is based on the ecosystem and will try to complement it. Mediated through changes in land use, changes in the regional ecosystem affect the attractiveness of the tourist experience. Tourism related changes in land use can, on the other hand have consequences on other sectors beyond tourism. As an example, it has been pointed out in the context of forest ecosystem services in Norway (Lindhjem & Magnussen, 2012) that it is “probably possible to increase the total value of the service flows by considering the trade-offs that exist between services. It is likely, for example, that recreational values could be increased through more recreation-sensitive forest practices in forests that are located near large population centres” (ibid. p. 4). Although that would imply a trade-off between maximizing provisioning services from forest and recreation, there may be opportunities to fulfil partially conflicting multiple objectives (Schröter et al. 2014). Tourism-tourism trade-offs may also occur between uses or preference for different kinds of nature experience (Soy Massoni et al. 2018). To identify these situations more data on tourist preferences, would be required.

Bundling of tourism products in the tourism sector is also common, making it difficult to distinguish the contribution of nature to the touristic attraction; a challenge for assessing tourism within the ecosystem services framework. Especially in assessments where high granularity and level of disaggregation of the NBT opportunities is desirable, nature attractions may be bundled with other kinds of attractions, where only some are nature-based. This may be reflected in a bundling of services advertised by the tourism sector and may take place at the business level. For instance, in the case of Lierne municipality in Norway, where nature-based tourism is currently a marginal economic activity, it has been recognized that bundles of tourism products that are sold and marketed can increase profit opportunities. For instance, in addition to selling hunting licenses, bundles could consist of packages including accommodation facilities and locally produced food (Eriksen et al. 2018). Frequently this kind of tourism development activities involves networks and local cooperation. This could mean, for instance, division of tasks combined with information sharing so that potential customers are directed to other businesses locally when it

is perceived that the attractions offered are more in line with the customer's preference (see discussion in Milford et al. 2016).

"Den gyldne omvei" (DGO; English: "The Golden Detour"; www.dgo.no) is one such example based on the agricultural landscapes in the Trøndelag county in central Norway with strong traditions and cultural significance. Local strengths and potential synergies have been identified and exploited successfully becoming a strong network of hotels, art exhibitions, handcraft, and locally produced food in the local cultural landscape. The DGO-network also shows that even if some of the tourism activity is nature-based, local bundles of attractions may also include art and other ES. Often, art, and other products offered are inspired in the local natural features (the landscape in paintings and other artistic creations) and or products (such as the use of local plants for dyeing, and herbal and scent products).

The obvious implication is that, capturing the significance of all the important elements affecting the attractiveness of the nature-based tourism products requires local assessments of high granularity. In addition, some services will not be feasible to capture with biophysical spatially explicit indicators (e.g. landscape attractiveness (see references in Rusch et al. 2024 by Köhler and Spielhofer), indicating that there will be considerable data requirements if ES assessments are meant to inform this kind of nature-based tourism development strategies.

Regarding the literature on the effects tourism development can have on ES, Liu et al (2022, introduction) observes that "although many innovative research methods have been introduced, they have failed to reveal the spatial heterogeneity of influencing factors on ecosystem service values from a local perspective". However, addressing the question of preferences and use and integrating this information with information regarding ES supply seems like a promising avenue for addressing this kind of local heterogeneity in ecosystem services supply and use.

## 3.2 ES models for outdoor recreation / nature-based tourism

The most used models of outdoor recreation consider: (i) the delineation of the area and the ecosystem types within it (the service providing unit), (ii) its qualities (e.g. the degree of naturalness (Paracchini et al. 2014), the water quality, and level of accessibility and other human infrastructure (e.g. Soy Massoni et al 2018)), (iii) the level of use (e.g. given by the number of visits or the time spent in the area (Venter et al. 2020), (iv) different kinds of benefits (e.g. Paracchini et al. 2014) and finally, (v) an assessment of the level of social and economic importance (e.g. through participatory GIS (see Speilhofer, R. in Rusch et al. 2024) or through monetary valuation when relevant (e.g. SEEA EA 2022) (Fig. 3.1).

This model of daily outdoor recreation model, developed within the KIP INCA project, was tested to explore its applicability to produce accounts for NBT. The ES flow in the ES model implemented in INCA is based on the ESTIMAP-recreation model (Paracchini et al. 2014, Zulian et al. 2018), which combines several nature-related characteristics of the territory (for instance, the presence of forests, natural riparian areas, protected areas, high nature value farmland, bathing water quality) and human-related inputs (road network and settlements) to produce a metrics for outdoor nature-based activities provided in each given location (Zulian and La Notte 2022). The outcome is the Recreation Potential Map (RP), a raster map which classifies the land in nine categories from low recreation value easily reachable to high recreation value located in remote areas.

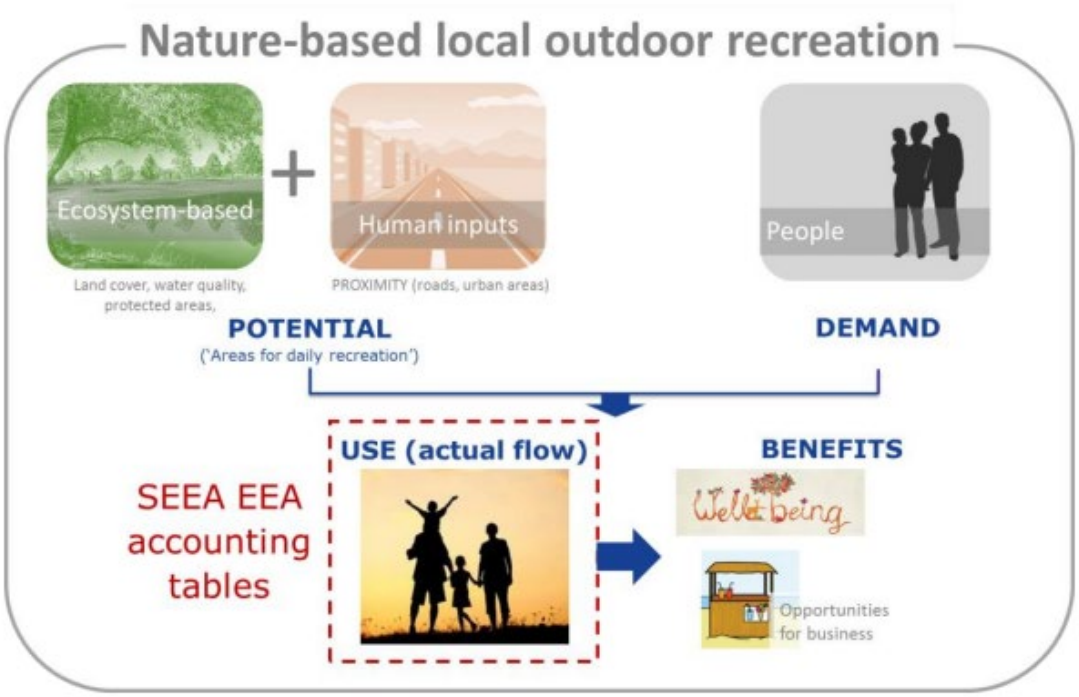


*Figure 3.1. Components required for accounting of nature-based outdoor recreation services proposed by the KIP INCA project. Source: Vallecillo et al. 2018.*

In the MAES-report (Maes et al. 2020), other components indicators of nature-based recreation were considered including potential, demand, use and unmet demand (Maes et al, 2020 p. 385). Nature-based recreation potential is an indicator of the availability of opportunities provided by nature, ranging between 0 and 1. (With 1 representing the highest nature-based recreation opportunities). This nature-based recreation potential is combined with proximity to users to define service-providing areas (SPA). Visits to natural areas have been calculated using a mobility function for inhabitants living closer than 4 kilometers from service areas. The number of inhabitants living further away than four kilometers were considered as value of unmet demand (the report only considered daily based recreation as opposed to longer trips for enjoying nature) (Maes et al, 2020). The potential for outdoor recreation has shown a stable trend from 2010 to 2020: Designation of Natura 2000 areas increased the ecosystem-based potential, but sprawl of artificial land decreased it. The increase in areas suitable for daily recreation together with an increase in population in need of recreation in nature led to an increase of nature-based recreation of 17% per decade. Unmet demand decreased with 8% per decade (Maes et al, 2020, p 386).

Zulian and La Notte (2022) provide a graphical representation of how the daily outdoor recreation model in ESTIMAP – KIP INCA was adapted to model NBT supply and use statistics (Fig. 3.2).

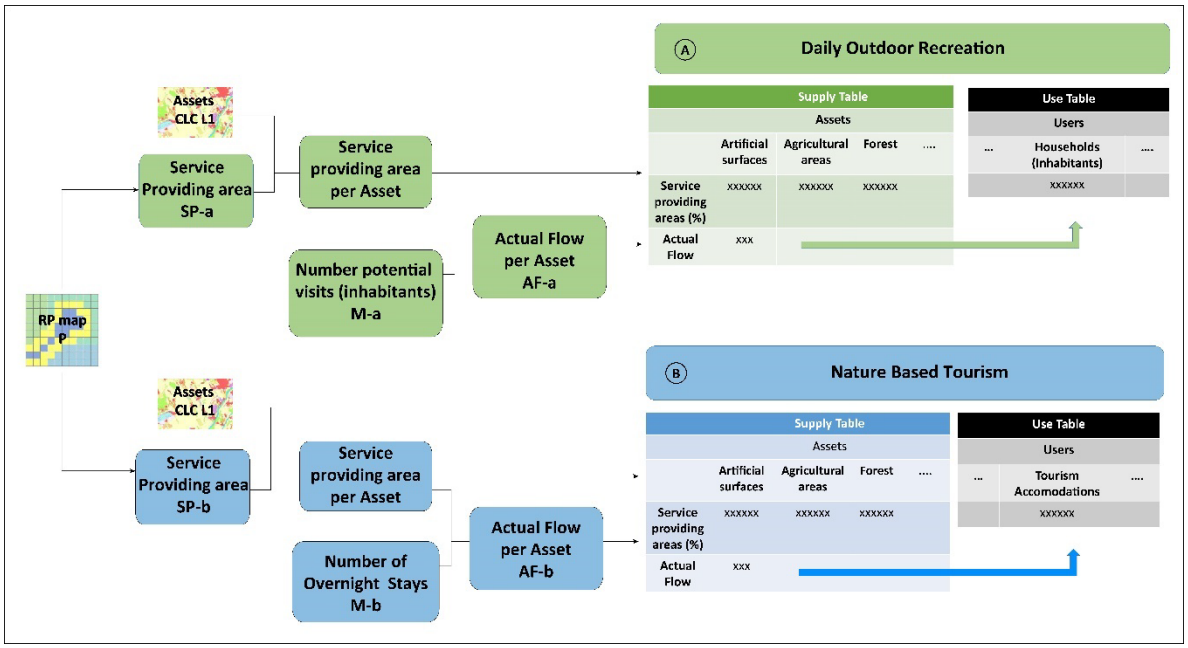


*Figure 3.2. Proposed accounting components in SEEA EA of the "recreation-related" services (green boxes) following the INCA ecosystem service model, and the adaptation for the physical ES flow account applied to NBT (blue boxes). Source: Zulian and La Notte (2022).*

**Box 3.1. Data flow used to compile Supply and Use Tables (SUTs) of nature-based tourism in Italy (Source: Zulian and La Notte (2022). See Figure 3.2).**

A two-step procedure was implemented in each territorial unit considered:
1. Recreation Potential raster map was combined with the ecosystem type classes (Corine Land Cover Classes (CLC) Level 1 (raster data were cross-tabulated).

2. the share of each possible combination was calculated and only data related to service providing areas for NBT were retained

3. the fraction of NBT overnight stays is computed by allocating the overnight stays in proportion to the share of service providing areas in each CLC Level 1 land type.

4. the total actual flow (a) is then allocated to the tourism/accommodation economic sector

In Zulian and La Notte's (2022) study of NBT in Italy, and adaptation of the daily outdoor recreation model to a NBT model, the service providing areas for NBT were defined by selecting areas with medium and high opportunities for recreation close and proximal to roads and settlements (four categories) (SP-b in Fig. 3.2); the assets were represented by the ecosystem types according to Corine Land Cover classes Level 1 (CLC L1 in Fig. 3.2); the physical metrics for the ES was the overnight stays, (M-b in Fig. 3.2); the actual flow of service are the overnight stays allocated to the service providing areas (AF-b in Fig. 3.2); and the users were 'tourism accommodation' defined as "any facility that regularly or occasionally provides overnight accommodation for tourists " (European Parliament, Council of the European Union 2011).

Since 2022, a new tool has been under development in the INCA project, called INCA-Tool[6]. This tool is designed to be a plug-and-play type tool that can be used with minimal technical knowledge and is meant to be aligned with the proposed European legislation on ecosystem accounts. It is a spatially explicit tool that generates maps and accounting tables for a selection of ecosystem services compatible with EUROSTAT reporting standards. Nature-based tourism is one of the included ecosystem services. In this tool, the service is quantified by first collecting statistics on the number of overnight stays within a reporting area, and then defining the contribution of ecosystems as a percentage of these overnight stays for the following three types of area: 'cities', 'towns and suburbs' and 'rural areas'. So, if for example rural areas in the accounting area receive a contribution factor of 0.8, 80% of the monetary value of overnight stays in rural areas will be valued as an ecosystem service. Additionally, specific geographic areas can be assigned a contribution factor for further spatial distribution. To map the supply of the service from ecosystem types, weights can be given to ecosystem types, which will then be used to spatially map what monetary value is assigned per service providing unit. Finally, further detail can be added by including spatial data on accessibility features, facilities, and attractiveness of the area. These only serve to redistribute the value from overnight stay statistics and do not alter the summed value for the accounting area. The results from NBT service modelling in INCA-Tool are presented in accounting tables of supply and use of the service, as well as maps showing the spatial distribution of value over the service providing units in the accounting area.

### 3.2.1 NBT service providing units

A first step in ecosystem services mapping is to identify and map the service providing units (SPU). This means the delineation and description of the natural areas, their features and qualities that support or can support nature-based tourism. For a regional or national level assessment a suitable approach could be one similar to that used by Zulian and La Notte (2022) based on currently available data which combine several nature-related characteristics of the territory (for instance, the presence of forests, natural riparian areas, protected areas, high nature value farmland, bathing water quality) and human-related inputs (road network and settlements) to produce a metrics for outdoor nature-based activities provided in each given location. The outcome is the Recreation Potential Map (RP), a raster map which classifies the land in nine categories from low recreation value easily reachable to high recreation value located in remote areas.

More detailed data would be required if the purpose of the assessment is to develop NBT opportunities. These could include for instance, ecological functional areas, like resting areas for migratory bird species, bird colonies, habitats and distributions of other attractive species (e.g. for hunting and fishing or whale watching), wilderness areas, and landscape aesthetics. However, the ecosystem accounting definition of a service providing unit is complicated by habitats for migratory species (see Barton et al. 2020).

One example from Norway, are the SPUs supporting ecosystem services based on fishing of Atlantic salmon (*Salmo salar*). The species has high cultural and economic importance, attracting both national and international tourism[7]. Salmon fishing takes place in rivers (Figure 3.3), fjords and the sea. There are around 450 Atlantic salmon rivers in Norway, and they occur from the border with Sweden in the south-east to the border with Finland and Russia in the north-east. Further, there are 10,000 agricultural properties that have fishing rights in salmon rivers[8] (Hindar, K. in Rusch et al. 2024). The area of salmon-bearing stretches in the watercourses where anadromous salmonids migrate has been calculated in 449 salmon rivers (Norwegian Scientific Advisory Committee for Atlantic Salmon (VRL) 2016) and for sea trout in 1279 watercourses (VRL 2022) (Hindar, K in Rusch et al. 2024). Maps of salmon rivers are available in public databases[3].

[6] INCA Tool | INCA Platform (europa.eu)
[7] https://www.visitnorway.com/things-to-do/outdoor-activities/fishing/salmon/
[8] https://lakseelver.no/nb/elver/lakselv

Maps of roads and other transport are also required. Open data bases with geographical information are a basic resource for planning.

*Figure 3.3: Angling in the Alta river. Photo: Tonje Aronsen.*

### 3.2.2 Ecosystem condition assessments for nature-based tourism

Two kinds of ecosystem condition indicators appear to be of utmost importance to evaluate and monitor the impacts of both tourism activities themselves and of other land-uses. The first group refers to those conditions that ensure sustainable NBT, i.e. the maintenance of important habitats and functional areas (e.g. breeding or migration areas) for biodiversity that directly supports NBT or otherwise. A second group refers to landscape level indicators, including aesthetic and cultural-heritage values. We refer to condition indicators that include the level of human interventions to facilitate access, and the number of visitors in the section on the Recreation Opportunity Spectrum (ROS), below.

**Species condition**

In the case of species of high importance for recreation and where tourism activities can be a threat, regulations and monitoring programs can be in place. Continuing with the example of Atlantic Salmon, Hindar (in Rusch et al. (2024) indicates that the Norwegian Scientific Advisory Committee for Atlantic Salmon[9] has in recent decades estimated both the number of salmon individuals that arrive to spawn on the Norwegian coast each year, as well as the number of salmon caught in sea and rivers. For salmon, it is therefore possible to estimate the state of the population, the size of the service supply, and the use in the form of number of catches. Calculations are also made of the actual catch in relation to the potential harvestable surplus, and of the actual spawning stock in relation to a spawning stock target that has been estimated for all

[9] https://www.vitenskapsradet.no/

Norwegian salmon rivers. These figures are presented on the Council's website[5]. The assessments have also been extended to other species with recreational and tourism importance, such as the sea trout[10]. Data on the number of slaughtered, and caught-and-released Atlantic salmon, sea trout, migratory char, rainbow trout and pink salmon in Norwegian rivers at municipal, county and national levels are reported to Statistics Norway[11].

Likewise, game hunting is highly regulated in Norway through different mechanisms, depending on the species with the aim to maintain desirable population sizes (Solberg, E. in Rusch et al. 2024). The number of individuals of several big and small game species which are hunted is reported to Statistics Norway[12,13].

The increasingly declining seabird breeding colonies[14] poses a severe threat to some iconic NBT attractions along the Norwegian coast[15].

**Habitat condition**

Tourism can have important negative impacts on habitats for native biodiversity and the structure of landscapes, especially affecting the movements and the use of certain areas by species that have large area requirements, as well as specific functional areas (for instance for breeding). Especially, infrastructure development to enhance accessibility to natural areas such as the construction of roads and accommodation facilities will result in such impacts.

Gundersen et al. (2023) illustrate the conflicts between the development of recreation and tourism facilities in the Hardangervidda plateau, which includes various conservation areas (Hardangervidda National Park and a series of landscape and other protected areas) as well as it is the habitat of one of the remaining wild reindeer populations in Norway and Europe. The study analyses and forecasts the impacts of projected mountain cabins and the infrastructure associated with this development.

Based on an analysis of municipal plans with national coverage, Blumentrath et al. (2022) estimated that the total land areas reserved for building recreational cabins located within wild reindeer areas in southern Norway was 109.2 km$^2$ (8% of the known areas reserved for cabin building). In total the statistics reveal 3 293 planned cabin development areas that lie wholly or partly in wild reindeer habitats, defined both as habitats and functional areas.

Further, quantitative spatial explicit assessments of habitat suitability and migration/dispersal routes are useful metrics to project the expected impacts on wildlife and other native species (Panzacchi et al. 2024, Fig. 3.4).

We provide further examples of potential impacts of tourism developments on the condition of habitats for native species in chapter 5. In section 5.2 we describe the conflicts generated around the maintenance and use of roads to access mountain cabins in an iconic national park, and in section 5.4 we present protocols and measures to guide the evaluation of impacts of tourism activities, specifically the assessment of impact of visitors in cruising disembarking sites, and the introduction of alien species in vulnerable arctic environments.

[10] https://vitenskapsradet.no/Nyheter/threats-to-sea-trout-in-norway
[11] https://www.ssb.no/en/jord-skog-jakt-og-fiskeri/fiske-og-fangst/statistikk/elvefiske
[12] https://www.ssb.no/en/jord-skog-jakt-og-fiskeri/jakt/statistikk/smavilt-og-radyrjakt
[13] https://www.ssb.no/en/jord-skog-jakt-og-fiskeri/jakt/statistikk/elgjakt
[14] https://www.nrk.no/trondelag/xl/hvorfor-forsvinner-fuglene-fra-fuglefjellene-syltefjord_-runde_-rost-og-hornoya_-1.16782705
[15] https://runde-boattrip.com/bird-cliffs-en/

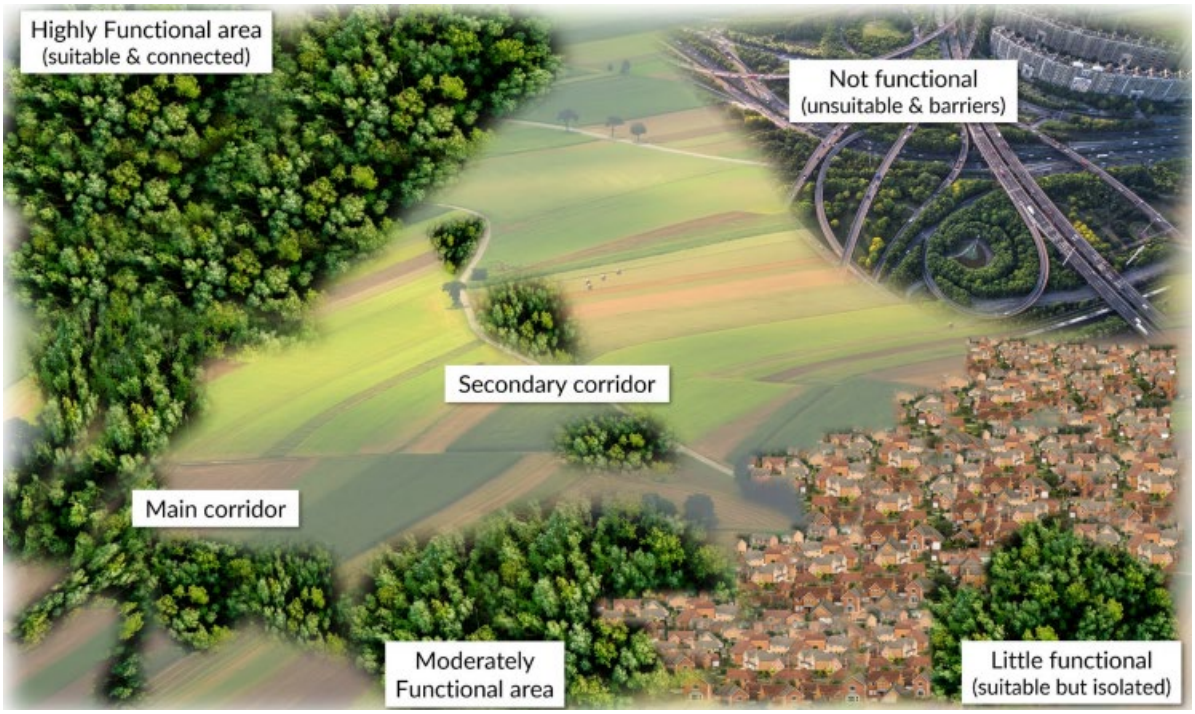


*Figure 3.4 Illustration of the 2 main components of an ecological network, or Green Infrastructure, for a hypothetical forest-dwelling species: (1) Functional areas (core areas), and (2) Movement corridors. The most functional areas are areas that offer both good resources and are little affected by human disturbance, while being well connected to other suitable areas. Source: Panzacchi et al. 2024.( https://sites.google.com/view/greeninfrastructureapp/home ).*

**Landscape aesthetics and its value for nature-based tourism**

The visual/aesthetic quality of the landscape is a result of both the physical characteristics of the landscape and the mental perception process, and a number of studies have considered this duality in spatially explicit models of the landscape's aesthetic quality. Often a combination of photo surveys and observational data to represent both people's perceptions and to calculate physical landscape metrics (Spielhofer, R. and Köhler, B. in Rusch et al. 2024). In geographic information systems (GIS), statistical relationships can be established between perceptual evaluation and landscape measurements or landscape elements. Based on these relationships, a wide range of spatially explicit indicators of visual landscape quality have been developed.
However, 'receptor-neutral' metrics of the landscape's aesthetic value can be developed based on landscape elements that are known to be important for recreation. Most of these explicit indicators are related to the naturalness, complexity, or diversity of the landscape. In addition, the presence of certain landscape elements, such as open forest, moderate topography, the presence of water bodies has been used to calculate visual quality indices (Thiele and Albert 2019). More recently, high-resolution LiDAR data has been used to calculate 3D landscape measurements (Spielhofer, R. and Köhler, B. in Rusch et al. 2024), as well as the degree of visibility of natural features (e.g. Cimburova and Blumentrath (2022) and Cimburova et al. (2023)).

Relevant examples of landscape aesthetics assessments in Norway related to nature-based tourism and recreation refer to the evaluation of the impacts of hydropower infrastructure in rivers, given the importance of rivers in Norway as destinations for tourists who value their aesthetic qualities. The landscape experience and aesthetics are important for different groups, such as fishermen, paddlers, bathing enthusiasts and others seeking recreation. These activities are integral parts of the overall nature experience (Köhler, B. in Rusch et al. 2024) and the landscape experience and aesthetics have been emphasised in guidelines and legislation (The Norwegian Water Resources and Energy Directorate).

Assessments of the importance of landscape aesthetics for the tourism sector are important to evaluate trade-offs among other land-uses, especially those emerging from the development of large infrastructure development projects as is the case of renewable energy projects (Fig. 3.4.).

*Figure 3.5: Some of Norway's iconic nature-based touristic destinations are based on experiencing the Norwegian coast from the sea with the Hurtigruten[16]. Due to favourable wind conditions, wind power parks have been developed in coastal areas. This infrastructure will likely conflict with the quality of the nature-based tourism experience, but there is currently no formal assessment of its potential impact on the tourism sector. Ecosystem services assessments could contribute to inform decision-making processes by capturing a broader range of values that can be made explicit, quantified, and weighted against each other. Photo: O.T. Sandlund.*

### 3.2.3 Biophysical assessment of use

**Segments of nature-based tourism based on the level of use**

After defining service provisioning units and their condition, the next step is to define the level of use, which determines the flow of NBT ecosystem services. The recreation opportunity spectrum (ROS) is one of the most used frameworks that seek to identify physical, social and managerial settings for outdoor recreation (Cerveny, et al., 2011). It is based on the evidence that different users in nature-based activity have different preferences, and recreation quality in the ROS-framework is understood as the degree to which environmental opportunities meet people's preferences. (Gundersen et al. 2015). The ROS-framework highlights that also relatively *similar* users, (e.g., hikers, bikers) may have different environmental preferences. Some will prefer a more

[16] https://www.hurtigruten.com/en-us

purist “wilderness” experience and others prefer facilities like toilets, waste bins, gravel roads, etc. (see e.g. Soy Massoni et al. (2018) for different preferences of outdoor recreation settings in urban areas). The demands of the latter group may reduce the quality of the experience for the former group. Simply put, the development of infrastructure to complement natural features in the form of bike tracks, ski lifts and so on, may not suit everybody’s taste. For instance, the increased frequency of biking visitors may come at the cost of less hikers or bird watchers. In addition, preferences of tourists are far from uniform, and it is to be expected that tourists do not generally exclusively go for nature-based activities. The preferences will involve bundles of activities, some of which are nature-based. Development of tourism will accordingly seek to match preferences according to local strengths, some of which can be nature-based, and others may involve for instance, art, cultural heritage and attractions in urban areas. In these cases, there will be a need of spatial planning, including zonation, and/or segmentation of the touristic offer, and visitor management measures, following an assessment that could be guided by the principles in the ROS-framework. The practical problem then becomes integrating this knowledge of preferences with knowledge about natural qualities in a spatially explicit way. We provide an example of this in the context of the forests around Oslo in the last part of this report.

**Managing the level of use to maintain the quality of natural features**

In addition to the theory of visitors’ management in nature-based recreation and touristic settings based on the ROS framework, considerations about the level and kind of use need to be made to manage the impacts of tourism activities on the natural features which either may attract visitors and/or which may require especial biodiversity conservation efforts. This is the case of protected areas, such as national parks, which frequently offer NBT opportunities, visitors management is particularly important, and it will require sufficient knowledge about the ecology of the biodiversity features that need to be protected and of the levels and kind of impact to be expected.

An example from Norway is that of the Dovrefjell - Sundalsfjella National Park, which is an iconic recreation and touristic destination promoted as “A varied landscape with a rich cultural heritage and breath-taking nature. The contrasts are great, from the dramatic almost alpine scenery with waterfalls in the northwest, to the rounded mountains and dry climate in the east. Great variation offers a range of experiences, and your options are as varied as the landscape. The park contains an almost intact ecosystem that includes wild reindeer, wolverines, arctic foxes, ravens and golden eagles, and the only Norwegian population of musk oxen also lives on Dovrefjell”[17]. Conflicts of touristic infrastructure with the use of the area by wild reindeer population, a species of which Norway has international responsibility to protect, have been the focus of much debate. Wild reindeer is a migratory species that uses different mountain ecosystem types during the year for mating, calving, and for grazing in the summer and winter. In addition, it has been shown that wild reindeer movement in the landscape is especially affected by infrastructure such as roads and powerlines (e.g. Panzacchi et al. 2016, Dorber et al. 2023). The risk of increasing negative impacts of touristic activities, such as disturbances due to vehicle traffic and tracking visitors (Gundersen et al. 2020), have led to much debated restrictions on access with e.g. private vehicles, including electric bicycles. Recognizing the challenge of harmonizing NBT with species conservation, Gundersen et al. (2019) compared the spatiotemporal overlap between tourism activities and the space use by wild reindeer, with the purpose to identify areas, periods, and conditions in which tourism exerted the highest negative impact in three Norwegian national parks. They find a large-scale segregation between visitors and the use of the area by wild reindeer during the summer season and discuss a management model to segregate tourists from wild reindeer in space and/or time during summer.

17 https://www.visitnorway.com/places-to-go/fjord-norway/northwest/listings-northwest/dovrefjell-sunndalsfjella-national-park/11877/

# 4 Economic valuation of ecosystem services

## 4.1 Identifying beneficiaries and economic indicators of use

Following the SEEA EA accounting framework requirements of allocation of benefits to an economic sector, Zulian and La Notte (2022) used overnight stays to quantify the flow of NBT tourism. They argue that the choice respects the principle to allocate ESs to primary users, because "since tourists spend money to travel, domestically or from abroad, this feeds a range of economic activities, such as hotels, camp sites, bed&breakfast and other accommodation providers". Further, they state that although the final beneficiaries are individuals, "from an economic perspective, the primary users of NBT are the economic activities that host those individuals". In Norway, the broad range of economic activities connected with NBT based on fishing of Atlantic salmon is recognized in the white paper Agriculture and Food Policy stating that 1,000 different tourism companies offer organised salmon fishing (Meld. St. 9, 2011-2012). Hindar (in Rusch et al. 2024) highlights that recreational fishing is an important part of tourism and that it strengthens the business sector in many Norwegian rural areas. It refers to statistics estimating that fishing for atlantic salmon in the 50 most important rivers together generate a turnover of NOK 1 billion (ca 100 mill EURO) every summer. The Norwegian Environment Agency has shown that a quarter of this amount goes to landowners through the purchase of fishing rights, while the rest ends up in tourism businesses and in small businesses in the local community, such as supermarkets, petrol stations and sports shops (van der Meeren 2013, cited by Hindar in Rusch et al. 2024). Wildlife-based tourism in Norway is a growing sector in the tourism industry, which focuses on trips taken by tourists to view wildlife such as large carnivores, birds and iconic grazers such as muskox. A report by Linnell and Immerzeel (2023) estimates that of the 35.000 tourists engaging in wildlife-based tourism annually in Norway, spending an estimated 394 million NOK per year. About half of tourists self-organise, while the other half engage wildlife operating companies to organise their trip. Third-party companies are also part of the market by selling accommodation, gear, food and additional amenities, either to operating companies or to tourists directly. The complexity of the market makes it hard to estimate a total sum of value of this kind of NBT, and also creates risk of double-counting of the benefits provided by the ecosystem. Further, in Norway, it is common that income from nature-based tourism is a part-time job in addition to other employment, with some common challenges including strong seasonality of the tourism activity and distance from the densely populated centres.

## 4.2 Economic valuation of NBT ecosystem services

As part of the development of ecosystem services research and practice, there has been some controversy in the field of economics about whether economic valuation involves a "commodification of nature", but recent theoretical advances consider value plurality as an inherent component of ecosystem services assessments (Pascual et al. 2023). In the IPBES methodological assessment report on the diverse values and valuation of nature (IPBES, 2022) key concepts to understand value diversity are discussed. Some are broad concepts like worldviews, knowledge systems, broad values, and life frames (for more details see IPBES, 2022, p xxiv). According to this framework, monetary valuation relates to a specific sphere of values, i.e. judgements regarding the importance of nature in particular situations. Specific values can be grouped into instrumental, intrinsic, and relational values. Relational values refer to the meaningfulness of people-nature interactions and interactions between people (including across generations) through nature. Intrinsic values refer to nature that is valued for its intrinsic qualities, not for any instrumental use or other type of interaction with it. Instrumental values refer to "things that are a means to be desired" like capital, assets and resources. Capturing this diversity of values attached to nature is relevant to identifying and understanding the motivations of visitors to engage in NBT.

Monetary valuation pertains typically to the group of instrumental values. In addition, and specifically referring to economic valuation in the SEEA EA framework, it requires specific approaches to economic valuation (i.e. the use of exchange value). The guidelines (United Nations 2021) emphasize both that exchange value and other economic valuation approaches will not fully

reflect the importance of ecosystems and highlight the need of considering a wide range of other valuation approaches and data. These considerations are worth to be considered in different steps and areas of application of ecosystem services assessments to guide decisions in the tourism industry. In this context, we refer to the special report on valuation (NCAVES & MAIA 2022) where valuation means “the expression of flows of ecosystem services and stocks of ecosystem assets in monetary units” (ibid, p. 7, see also SEEA EA chapters 8-11). The main reservations against monetary valuation approaches recognized in NCAVES & MAIA (2022, p. 10), include:

1. The framing for valuation of nature stocks and flows. The concept of framing refers to the way that something is expressed, and the ideas and meanings that are associated with this so that people understand it in a particular way.

2. The potential of monetary valuation to support decision making and the ability to produce reliable estimates in monetary terms in practice (NCAVES & MAIA 2022). A reoccurring theme in practice is data availability, and there is a lack of precision in some of the economic methods used to estimate exchange values. Both factors influence the potential to support decision making (Termansen et al. 2023).

3. A third difference of view recognized is the role of national statistical offices to produce statistics fit for purpose in this area.

## 4.3 Monetary valuation approaches

### 4.3.1 Exchange value-based valuation and welfare-based valuation

As mentioned above, monetary valuation pertains typically to instrumental values. Economic theory distinguishes between two different concepts of monetary value, exchange value and welfare, respectively.

Exchange value-based valuation is consistent with national accounts, although there is recognition of the large limitations of this approach to assess the economic value of ecosystem services (Brander et al. 2018). The definition of exchange value given in NCAVES and MAIA (2022, p.14) is intuitive: “the values at which goods, services, labour or assets are in fact exchanged, or else could be exchanged for cash”. Generally, for provisioning services, this would be recorded as market prices. For the kind of goods that are in fact exchanged in a market, the market price is a straightforward and reliable monetary measure. On the other hand, these exchange values are generally lacking for most regulating and recreational services. In these cases, other methods exist to estimate an exchange value. These methods will be discussed below. Exchange values do not provide information about welfare, and a change in exchange values does not necessarily imply a change in welfare.

Welfare-based valuation attempts to quantify total welfare effects, which is a broader definition of value than exchange value-based valuation. If the market price (exchange value) is lower than the willingness to pay, there is a net surplus of economic welfare that is not accounted for in the market price. The sum of this for all consumers is called the consumer surplus. Similarly, firms may sell at a profit. The price could be lower, and they would still be willing to sell. The difference between price and willingness to sell aggregated over all producers s called the producer surplus. Consumer and producer surplus are welfare-based valuation: they quantify an increase in welfare for either consumer or producer as a result of a market exchange that is not included in the price of the good or service Welfare values are used in most economic assessments of ecosystem services (Brander et al, 2018), except for the system of national accounts.

### 4.3.2 Purpose and scope of monetary valuation

For some purposes the monetary valuation, or the ES assessment, does not need to be extremely precise. This is discussed in Gómez-Baggethun and Barton (2013), in Barton et al. (2018) and in earlier studies in the context of the value transfer method by Navrud and Pruckner

(1997). If the purpose is awareness raising, or just to communicate the economic significance of the ES, imprecise estimates may be sufficient. On the other hand, in a legal context with damage and compensation claims the estimates need to be precise. There is also a spatial dimension to the valuation context. A more local analysis demands higher resolution data. Higher data resolution and precision demands raise information costs, as discussed in Gómez-Baggethun and Barton (2013) for an urban context.

Tourism is a large economic sector where ES assessments could support various kinds of decision-making and policies, including territorial planning and the design of economic instruments. ES assessments could also support the design of mechanisms that can promote different aspects of social-ecological and economic sustainability of nature-based tourism, including issues of wealth distribution, equity and environmental justice. ES assessments can also help identify potential negative impacts on nature of other activities in the tourism sector (see section 3.1.4). Thus, ES economic valuation assessments in the tourism sector for awareness-raising purpose seem to be of limited importance, although there may be local cases where pilot studies of a more awareness raising nature may be relevant. This points to the need of higher precision and more data for planning the supply of NBT, which means higher information costs (Barton et al. 2018). Data requirements will be an important focus in the following discussion of valuation methods.

Several different purposes of valuation can also be discussed more specifically related to NBT: The first and most obvious purpose in the context of this report is for accounting purposes in the SEEA EA which aims at assessing and monitoring the contribution of NBT to the national economy (through estimates of the contribution to the sector, and to the GDP). Valuation methods will then be based on the accounting requirements in the SEEA EA which will be discussed in the next section. However, other purposes could be to facilitate the design or the implementation of policies, at national, regional, and local scale, or even at the business level. We will discuss this through a five-step procedure originally developed for Corporate Ecosystem Services Review (ESR) (Hanson, 2012) and discussed in Brander et al (2018, p. 50):

1. Select the scope. This could be a market, a business unit, major customer segments among others.
2. Identify priority ecosystem services, which means to evaluate dependence and impact on key ES for the unit chosen in step one, e.g. a regional tourist sector.
3. Analyse trends in these priority ES.
4. Identify business risks and opportunities. In this step the discussion above on the ROS is relevant both for identifying opportunities, and for evaluating risks.
5. Develop strategies, e.g. through visitor management strategies.

It has been pointed out that the use of ES accounts for management and policy has been very limited (e.g. Rujis and van Egmond, 2017) especially at local scales, and the availability of data seems to be a major the reason for the lack of uptake (Grilli et al, 2021; Bagstad et al, 2021). Grilli et al (2021) state that this is particularly true at the local government level. A procedure like the five steps above can be of help in gathering the most important data first, ensuring relevance for other applications than the SEEA EA accounting, and for involving different levels of participation in the scoping and priority-setting steps.

## 4.4 Methods to assess monetary value of nature-based tourism

As mentioned above, the theory of monetary valuation in the context of ES assessments has been the subject of much discussion. We will briefly repeat some few but important overview references for this development:

1. IPBES (2022): The methodological assessment report on the diverse values and valuation of nature.

2. Brander et al (2018): Economic mapping and assessment methods for ecosystem services. Deliverable no D3.2 of the EU Horizon 2020 project ESMARALDA. When monetary valuation is appropriate, this report has a very good overview over relevant methods.
3. Barton et al (2019): Discussion paper 10: recreation services from ecosystems. Paper submitted to the expert meeting on advancing the measurement of ecosystem services for ecosystem accounting. This paper contains valuable information on how to avoid overlapping definitions and double counting of recreation services.
4. NCAVES & MAIA (2022): Monetary valuation of ecosystem services and ecosystem assets for ecosystem accounting using exchange value-based valuation. Describes conceptual foundations, the purpose of valuation in SEEA EA and lays out the key valuation principles used and recommended in SEEA EA.

The four references above develop the theoretical considerations for monetary valuation of ES. However, it is also important to recognize practical considerations. Regarding the methods recommended in NCAVES & MAIA (2022) for tourism and recreation, Zulian and La Notte (2022) observes that they require an extremely demanding effort to be implemented consistently and over time across Europe.

In the SEEA EA framework there is an agreed order of preference for the choice of valuation methods (NCAVES & MAIA 2022; p. 16):

1. Methods where the price for the ecosystem service is directly observable.
2. Methods where the price for the ecosystem service is obtained from markets for similar goods and services.
3. Methods where the price for the ecosystem service is embodied in a market transaction.
4. Methods where the price for the ecosystem services is based on revealed expenditures (costs) for related goods and services.
5. Methods where the price for the ecosystem service is based on expected expenditures or markets.

The correspondence between these five categories of methods and particular methods is laid out in table 4.1 below:

*Table 4.1: Categories of monetary valuation methods in NCAVES & MAIA (2022)*

| **NCAVES & MAIA (2022) category** | **Methods of monetary valuation** |
|---|---|
| **I.** Price directly visible | Market prices |
| **II.** Price obtained from similar goods and services | Market prices for substitutes |
| **III.** Price of ES embodied in a market transaction | 1) Residual value and resource rent methods<br>2) Productivity change method<br>3) Hedonic pricing method |
| **IV.** Price based on revealed expenditures (costs) for related goods and services | 1) Averting behaviour method<br>2) Travel cost method |
| **V.** Price based on expected expenditures or markets | 1) The replacement cost method<br>2) Damage costs avoided |

*Source: NCAVES & MAIA (2022).*

These five points will be referred to below in the presentation of currently used monetary valuation methods within the SEEA EA. However, there are other valuation approaches that are not used for accounting in the SEEA EA, that may be more suitable for policy design or support for sustainable investments in the tourism sector. It should be noted that the SEEA EA (2021, p.176) observes that “the recommendations in chapters 8-11 on valuation reflect the latest knowledge, methods, and techniques to measure and organize information about ecosystems; it is expected that this knowledge, as well as the data sources and techniques used to compile the accounts, will evolve over time with ongoing implementations of these accounts. Consequently, as with all statistical methodology documents, it will be necessary to refine and revise it in the future.” It is also recognized that data constraints and the use of estimation techniques will require compilers

to consider issues of data quality and uncertainty (ibid. p. 176). These data constraints and the uncertainty of estimations will be a reoccurring theme in the following. NCAVE & MAIA (2022) recommended counting number of visits with the purpose of spending time in nature as a physical indicator of the value of recreation, if possible, with numbers of time use. In line with this, Eurostat (2022) recommended counting "overnight stays at hotels, hostels, camping grounds etc. that can be attributed to visits to ecosystems with the purpose of spending time in nature" as an indicator for the value of NBT. This is the basis for the valuation in Zulian and La Notte (2022) and INCA-Tool.

As mentioned above, although nature-based recreation and tourism are not the same, the biophysical models developed to assess outdoor recreation (Paracchini et al. 2014, Vallecillo et al. 2018) and amenity services are relevant, at least at a starting point. It is therefore likely that the data gathering process for nature-based recreation and NBT can be synchronized. In examples below both NBT and nature-based recreation will be mentioned. In accommodation related data in Eurostat (2021), there is a distinction between residents and non-residents, and this is a national concept. A visitor at e.g. a hotel in some region in Italy (as in the Zulian and La Notte (2022) study) from a different region in Italy is still considered as a resident.

### 4.4.1 Directly observable prices

As mentioned above, the first preferred method of monetary valuation involves directly observable prices. This could be the case in agriculture if the production area for agricultural production is rented. NCAVES & MAIA (2022) also give an example of a form of Payment for Ecosystem Services (PES) by which a wetland provides water purification services where the owners of that wetland can charge for the service. The SEEA EA cautions against using values from PES-schemes directly as these payments may reflect broader considerations like income support in rural areas, ecosystem restoration work, etc. The recommendation in SEEA EA is to avoid using values from PES-schemes unless there is clear evidence that the value provides a proxy for a market exchange value (NCAVES & MAIA 2022). It is also noted that there is a development in the implementation of PES-schemes and that the advice may change accordingly.

In the context of NBT, directly observed prices may include overnight stays at hotels or other accommodation (see e.g. Zulian and La Notte 2022). However, the fact that tourists consume bundles where some attractions may be nature-based and some not, makes it necessary to gather additional information to be able to distinguish the purpose and preference of the areas visited. For instance, to assess how many visitors consider that the natural features in the area are important, but still choose to sleep in urban accommodation due to other attractions. Some observable prices that may be considered directly relevant are hunting permits and fishing permits (Rusch et al. 2024), entry fees to national parks, local transportation and guiding to nature attractions, and local stores may sell fishing or hunting equipment. Data is needed to determine what proportion of the tourists that visit the location because of the nature attractions, and to define more precisely which economic benefits are derived from NBT.

An example from the Norwegian context is fishing of Atlantic salmon. Some prices are directly observable, like prices for fishing permits and for accommodation. Note that in Barton et al (2019, p.11) "subsistence and own consumption fishing and hunting, foraging and gathering of non-forest timber products like berries and mushrooms are considered provisioning services, with market substitutes for the physical products". But there is a distinction here between subsistence consumption and tourism activity in the sense that, in the case of modelling a provisioning service, the indicator of ES supply (outcome) will be expressed in terms of biomass (see definition in SEEA EA Table 6.3, and CICES), e.g. kg of fish caught, kg of game meat (see statistics in Rusch et al. (2024).To relate this to tourism it is necessary at least to include data on the origin of the recreational fishers (whether local or non-local). Further, data about the average number of fishing days for both locals and non-locals are relevant data to assess the monetary value of the service for the tourism sector.

In Norway, to get a more complete picture of the importance of the activity, data on fishing licenses are combined with information regarding the average consumption per fishing day for both locals and non-locals, preferably with data on how much of the consumption can be attributed to fishing permits, accommodation, and other services. This requires surveys, and in Norway this is done both at the local scale (e.g. Fiske et al. 2012, Brendehaug et al. 2017) and the national scale (Stensland et al. 2015). Based on survey findings, the share of the consumption that goes to the landowner (rights to fishing in Norway belong to the landowner) is around 39%. In addition, indirect effects on the economy are important. Fiske et al. (2012) used 1,35 as a conservative multiplicator to estimate the indirect effects of angling on the local economy.

## Prices obtained from markets for similar goods and services

The second preferred monetary valuation method is, as stated by the SEEA EA: "if there is no appropriate market in which a particular good or service is currently traded, the valuation of a transaction involving that good or service may be derived from the market prices of similar goods and services by making adjustments for quality and other differences" (NCAVES & MAIA 2022 p. 25). In the section above about directly observable prices, an example of rented agricultural land was mentioned. If we now consider an area where rented agricultural land is not common e.g. if land is privately owned, but there exists data regarding rental of agricultural land from other areas, this would be a similar good and service recognizing that there may be differences in quality that must be accounted for. The prices that are used in this case are *ex post* and for a given institutional setting, which means that care must be applied when values are transferred from one setting to another. In addition to the risks associated with value transfer from different institutional contexts, the issue of similarity between the actual goods and services that are evaluated is highly relevant. How close, both conceptually and methodologically, the good or service that is the focus of the valuation exercise is related to the service for which monetary valuation data are available will largely influence the precision of estimate. In an example related to recreation from Norway along paths by the Oslo fjord, Chen et al. (2019) used prices for gym memberships as an illustration of the value of the physical exercise provided by the recreation. This is far from a precise estimate of the value of recreation, but it was used in a context where the value of the health benefits of physical activity was considered, and it may serve as an awareness raising number as discussed above, especially when combined with other estimates.

## Prices embodied in a market transaction

This is the third preferred group of valuation methods in NCAVES and MAIA (2021) and three different methods within this category is listed:

1. Residual value and resource rent methods.
2. Productivity change methods.
3. Hedonic pricing methods.

### (i) Residual value method and resource rent methods

The principle in the residual value and resource rent methods is to estimate the value of an ES by first taking the gross value of the final product to which the ES contributes, and then subtract the costs of all other inputs like e.g., labour and capital. The intermediate consumption must be subtracted to avoid double counting, and taxes or subsidies must be accounted for. For details see United Nations (2021; para 9.36) and SEEA central framework (2012; p. 153). In principle, what is left should reflect the contribution of nature to the monetary value of the ES. Limitations to this approach includes for instance when unpaid work is common, as could be in the case of family enterprises in the tourism sector. When subtracting labour this unpaid work is frequently omitted, yielding an over estimation of the contribution of the ecosystem service. (See also MAIA and NCAVES, 2021, ch 4 & 5).

Further, it is noted in the SEEA EA that this method is most readily applied using "broad industry level data and the resulting price estimates may lack the granularity required for developing location specific monetary values" (United Nations, 2021, para 9.37). As discussed above, nature-based tourism development will frequently involve complementing the contribution of nature to the value of the service with various types of infrastructure, especially those that facilitate access,

such as transport, hiking-paths, etc. When estimating values of tourism related ES, these investments need to be subtracted. We are not aware of any studies that have done this so far for nature-based tourism, but in the context of the SEEA EA, the method has been applied to estimate the ecosystem's contribution from managed ecosystems, such as provisioning services from cropland (Remme et al. 2018). In the section above, about directly observable prices, we mentioned that subsistence hunting, fishing or berry and mushroom gathering in Barton et al (2019), due to concerns about double counting, are considered provisioning services. There are cases at least in Norway where the price for hunting permits for e.g. grouse, and the expected size of the quotas, a much higher value than substitutes in the markets is implied. In 2023 hunting permits for grouse in one popular area (Mastukåsen in Dalsbygda) were sold for a price that implied an expected value per grouse of 5 666 Norwegian kroner, or more than 480 euros (jeger.no, 2023). This is obviously more than meat value, and with a logic like the residual value method the provisioning service (meat value) could be subtracted in the process to estimate recreation value.

**(ii) Productivity Change methods**

Frequently, a resource is not consumed directly by humans, but provides services to other goods that are consumed and provide benefits. The productivity change method is based on this model which understands an ecosystem service as an input into the production of a final good. In the context of biophysical ES assessments, these ES are considered 'intermediate ES'. Valuation of an intermediary ES with these methods is accordingly a valuation of the productive capacity in terms of its contribution to the production of final goods (Brander et al, 2018). In the SEEA EA biophysical accounts, intermediate ES are typically regulating services that are produced by a unit of an ecosystem and used by another. This is the case of, for instance, pollination services used by pollinator dependent crops which are generated by semi-natural grasslands that support resources for pollinators in the agricultural landscape, and which are located within flying distances to the cropland. According to SEEA EA, productivity methods involve considering the ES as an input in the production function of a marketed good (UN,2021 para 9.38). Accordingly, it is sometimes called input-output models (see e.g. Brander et al, 2018) Thus, changes in the ES will lead to changes in the output of the marketed good, other things being equal. Still according to the SEEA EA, the value of the service is derived in three stages:

- First, the marginal contribution of nature is estimated, i.e. the change in production of the marketed good because of a marginal change in the quality of the ecosystem providing the service.
- Second, this marginal increase in production is multiplied with the market price for the marketed good.
- Third, this marginal value is multiplied with the physical quantities of the ES to obtain the economic value of the ES.

This terminology may seem strange in the context of NBT. The marketed good in this context must be a bundle of attractions where at least some are nature-based, and where an ES is considered an input to the bundle. The three-step description from the SEEA EA is obviously too brief to be useful in practice.

First, it should be clarified that, as shown above, not only physical quantities but also the condition of the ecosystems are important in the SEEA EA. Thus, we may consider both a marginal change in quantity and a marginal change in condition of the ecosystem in step one. Likewise, step two may consider price changes due to changes in quality. In addition, this brief three step description does not mention the possibility of behavioural changes. A 1995 United Nations Environmental Program publication (Grigalunas and Congar, 1995) has a useful section on the productivity method, where it is argued for the importance of considering behavioral change. A change in ecosystem extent and/or condition may induce behavioural change, which affects the benefits ultimately derived.

In the context of tourism, a negative change in ecosystem extent or condition (see section 3.1.3) can lead to tourists going other places or have a reduced willingness to pay. If they go for

destinations in other countries, the effects on income from tourism could be detected even at the national scale. Theoretically, if there are similar places (substitutes) within the same country, we may see negative effects on local tourism at one place and positive effects in other locations, which means income from tourism may not change much on a national scale, unless changes in natural capital in biophysical terms (the extent and quality of natural values) are accounted for. Local stakeholders will be affected, however. This points to the need for data relevant at the local and regional levels to guide investments supporting local and regional economies based on NBT.

(iii) **Hedonic Pricing**

The hedonic price method is used to estimate the monetary value of ES that directly impacts market prices, most often in the case of property markets. The basic idea is that environmental costs (noise, air or water pollution) or amenities (such as a nice view or proximity to recreational sites) will influence market prices for properties. Data on property transactions are needed, data on proximity to the amenity (for instance GIS-data) and obviously one needs to control for confounding factors affecting property prices. Thus, one needs data on neighbourhood properties like socioeconomic status, crime rates etc., and data on access to shopping, infrastructure, schools, kindergartens etc. as well as data on size and quality of the property like number of bathrooms, number of rooms, size, parking possibilities, technical standard and need for renovation, etc. When this data is available, it is possible to run a regression analysis with property price as the dependent variable and see how much of the price variation that is explained by the environmental quality of interest.

An example of an application of the hedonic pricing method is a study by Vågnes Traaholt (2014) that examined the correlation between prices of 9 441 apartments sold between 2004-2013 in Oslo, and proximity to different “blue-green spaces” like parks, parks with water features, cemeteries, open space, fjord shoreline, open space along fjord shoreline (offering additional view) and peri-urban forest (the Marka forest) border. The procedure was first to prepare digital map data. Property prices were detrended. Neighborhood amenity variables such as proximity to roads and public transport were obtained from Oslo municipality, the Norwegian Environment Agency and from the planning and building agency in Oslo. In the model testing and estimation of the marginal effects the natural logarithm of prices (P) was regressed on structural variables (S), neighborhood amenities (N) and environmental characteristics (Q). This brief description implies what has been called unusually exacting data requirements (Mitchell and Carson, 1989). As is standard in estimation techniques like this, an error term *e* is included, with the standard assumptions like expectation value equal to zero and no correlation with the explanatory variables:

$$LnPi = a + bSi + cNi + dQi + ei$$

The equation above was estimated with different statistical procedures, ordinary least squares (OLS), Fixed Effects (FE), Spatial Error Model (SEM), and Generalized Additive Model (GAM). In general, in procedures like these, when many of the observations have very similar characteristics, autocorrelation is a concern, and the marginal value of the environmental characteristics will be very sensitive to how this is identified and dealt with. From the estimations a marginal value Vij(d) in Norwegian kroner per proximity distance (NOK/m) to blue and green space (subscript j) was calculated. The distance *di* to each blue and green space was calculated for every apartment in Oslo. Then, it was possible to calculate marginal expected value of proximity to blue or green space for each apartment, as well as an aggregate value for each blue or green space. Vaagnes Traaholt (2014) found that results obtained from the OLS model showed the highest significance value of blue or green space, however this is also the method that has the least amount of adjustment for autocorrelation. The other estimation procedures aim to reduce bias from autocorrelation, but in this process, assumptions are made that cannot be verified. Thus, regarding reliability of the results, Vaagness Traaholt et al.(2014), (see also a very useful discussion in Barton et al. 2015) recommend not using the results for policy decisions, but “…for a scoping study, and for the purpose of awareness raising, the OLS results can be put forward

as hypotheses regarding the potential importance of blue green spaces for private property value (awaiting further data and testing) Barton et al. 2015 p 42).

However, simple OLS model for scaling values for urban ecosystem accounting fail to control for spatial effects in hedonic valuation. Based on Vaagness Traaholt et al. (2014) but taking advantage of data on non-environmental neighbourhood amenities and services not available in that study, Łaszkiewicz et al. (2022) tested a penalized spline spatial error model (PS-SEM) that controlled both for the presence of a spatially autocorrelated error term and allowed for continuous non-linear distance decay of the property price premium as a function of walking distance to greenspaces.

It may be observed from the preceding section that hedonic pricing is just a statistical analysis, in the context of property markets, and the above considerations for the analysis are relevant more generally for correlation analysis of spatial data. If statistical analysis is applied to relate economic data to spatial units, adjacent spatial units will in many cases share properties (leading to issues about spatial autocorrelation). The level of spatial autocorrelation will also depend on the spatial resolution, while similar concerns with autocorrelation will arise. In this context, Łaszkiewicz et al. (2022) caution against using non-spatial hedonic pricing models when aggregating values of greenspace amenities for policy analysis or urban ecosystem accounting purposes.

## Revealed expenditures for related goods and services

These methods are on the fourth priority level in NCAVES and MAIA (2021) and include the averting behaviour method and the travel cost method.

### (i) The averting behaviour method

Individuals or groups may spend money to avert damage or loss due to exposure to negative environmental influence (e.g. pollution) or negative developments in an ecosystem service. Economic theory suggests that people would not be willing to pay more to avert damage of e.g. an ecosystem than the value of the ecosystem, thus the amount people are willing to pay to avert this damage or loss is considered a lower bound estimate of the value of the ES. The strength of this method relies in its simplicity.

### (ii) The travel cost method

Maybe the most used method to estimate monetary values of nature-based recreation and tourism is the travel cost method (TCM) (Phaneuf & Smith, 2005). The premise of the method is that the time and travel costs people incur to visit a place can be considered a price for the access. The travel cost method has simpler and more complex variations and is the group of methods recommended by NCAVES & MAIA (2022) for recreation services. It is also the group of methods referred to by Zulian and La Notte (2022) as requiring “an extremely demanding effort to be implemented consistently and over time across Europe”, especially when considering that SEEA EA accounts are meant to be reported at regular time intervals.

With limited data, it is possible to use simple versions of the TCM. The simplest versions are often referred to as Zonal TCM. Here different zones are defined. This could be concentric circles around the site, follow administrative boundaries or other. The data needed is then number of visitors from each zone. This could be in the form of e.g. zip codes and nationalities. Then, round-trip expenses are calculated for each visitor, typically collected by conducting a questionnaire-based survey on a representative sample of respondents. Data on average costs of transport are usually taken from the literature.

More difficult, and contentious is estimating the value of time, and value of time is not included in the SEEA EA. In essence, the method considers that the time spent in recreation or tourism activities can be valued in terms of the salaries paid for labour. In principle, if someone with a flexible work contract chooses to visit a site with natural qualities rather than to work, the value of time is the wage. However, this flexibility in the contract is not common and generally we do

not know the involved trade-offs for the visitors. Fully employed people might require higher hourly pay to work more, and under-employed people might prefer to work even with a lower-than-average pay. For this reason, a review of cultural services valuation methodology for Office of National Statistics in the UK (Ricardo Energy & Environment, 2016) uses only full time (30+ hours) and part time employed (8-29 hours) for calculation of median salary, and e.g. unemployed and full-time students are excluded. Fezzi et al (2014) argue that 75% of the average hourly wage rate is a reasonable approximation for the value of travel time, and this was used by the Office for National Statistics (ONS) in the UK for initial and partial monetary estimates of monetary natural capital in the UK (ONS, 2014). Hundred per cent of the average wage was used as value of travel time in a report prepared for google by the consultant company Oxera (2013). The method used by Fezzi et al. (2014) implies that the value of travel time for respondents above 60 years old is on average about 30% lower than younger age groups, whether this is reasonable in the context of recreation could be discussed.

A variation of the travel cost method does not involve the value of time at all, only a sum of expenses which can then be considered an exchange value to access the site.

Finally, in a more complicated approach, individual responses are used to estimate demand functions and simulated exchange values. Simulated exchange value can also be estimated from stated preference studies, i.e. surveys (see next section). The simulated exchange value approach and the hedonic price method have somewhat different conceptualizations of how to define the good of outdoor recreation according to Barton et al (2019). Whereas hedonic pricing reveals willingness to pay for the opportunity of access, the simulated exchange value is theoretically found where the willingness to pay for visits is equal to costs of current recreation management.

Difficulties with travel cost methods include the somewhat arbitrary valuation of time. It is also hard to account for travels to e.g. a recreation area where the travel has several purposes. Then surveys asking how large share of the benefit comes from the recreation area are necessary. An application of the travel cost method is discussed below more extensively in section 5.1 based on Barton et al (2015).

### Expected expenditures or markets

These are the least preferred methods in NCAVES and MAIA (2022) and include the replacement cost method and damage costs avoided.

The replacement cost method estimates the cost of replacing an ES with a man-made substitute. An example could be water storage and filtration by wetlands replaced by reservation and filtration plant (Brander et al, 2018). This method overestimates the value of an ES if the society does not have the willingness to pay for the substitute, and it underestimates the value if the man-made substitute does not provide all the benefits of the original ES, which may be the case in many instances.

The damage costs avoided method involves estimating value of damage avoided due to the ecosystem service, and typical examples include coastal protection by dunes or landslide protection by forests. A limitation with this method is that it is difficult to quantify changes in risk of damage correlated to changes in ecosystem quality, but improved quantitative physical models of the ES supply would considerably improve the estimates of value.

## 4.4.2 Value Transfer / Benefit transfer

The discussion of methods for monetary valuation (see Table 4.1 above) are based on primary data. The value transfer or the benefit transfer method is the use of research results from existing primary studies at one or more sites or policy contexts (“study sites”) to predict welfare estimates or related information for other sites or policy contexts (“policy sites”) (Brander et al, 2018, p. 7). Brander et al (ibid.) describes the method as “relatively expeditious and inexpensive of obtaining estimates of ecosystem values and can be applied at geographic scales that are not feasible for

primary valuation applications". The accuracy depends on the similarities of characteristics study sites and policy sites and the extent to which differences are controlled for. Value transfer can be done relatively simply or by considering more complexity:

1. The simplest version, the unit value transfer, selects the appropriate values from existing primary studies. Ecosystems and socioeconomic contexts must be similar. Unit values must then be adjusted to reflect differences between study sites and policy sites. The strength of this method is its simplicity. However, values from very similar sites are rarely available, and it is unlikely that we can control for all the relevant differences between the "study site" and "policy site".

2. If we have more information on characteristics on the study site, that can be used to statistically control for differences in study site and policy site through a so-called value function transfer. In this method, a production function of the service is created from data in the study site, explaining how characteristics of the site explain the value of the service. This function is then transferred to the policy site by changing the values of the explanatory variables, and thereby generating new values specific to the policy site.

3. When we have results from multiple primary valuations we can control for even more differences between study and policy sites through a so-called meta-analytic function transfer. Relevant factors to control for are difference in population characteristics, area of ecosystem, availability of substitutes. The strength of this method is that it allows controlling for more differences and can be used for consistently valuing many policy sites. The weakness is the data requirement for policy sites, and it can be analytically complex (Brander et al, 2013).

La Notte (2012) provides an interesting example of benefit transfer in the context of habitat services and tourism where parts of the analysis include value transfer from a British study site to a policy site in Italy, and furthermore, where results from a stated preference study which typically provides welfare values is "translated" to value per hectare. La Notte (2012) emphasize that the concern is not to find the right value, but to examine effects of different methods and assumptions. Grammatikopolou et al. (2023) discuss value transfer in the SEEA EA context. They argue that value transfer will be necessary in the SEEA EA because it makes valuation at different scales feasible, however they also argue that it cannot be the only method and there will be a need for a quality control of the estimates.

Work has been done to make databases of standardized values for transfer. NCAVES and MAIA (2022) refer to the Ecosystem Service Valuation Database (ESVD) (De Groot et al, 2020), the Environmental Valuation Reference Inventory (EVRI), COPI (Braat and ten Brink, 2008) and some older initiatives). In addition, the Capitals Coalition (Capitalscoalition.org) will according to their website launch a database of values for transfer at the end of 2025. NCAVES and MAIA reports some of the ESVD values in Table 8, p. 111, including for recreation/tourism by biome in international dollars per hectare (2020 price level), where tourism/recreation values are reported in Table 4.2 below.

*Table 4.2:* Summary of monetary values for each tourism / recreation services by biome (International dollars per hectare per year, 2020 price level) *from the ESVD. Source: Table 8 in NCAVES and MAIA 2022, p. 112*

| **Biome** | **International dollars / hectare 2020 prices** |
|---|---|
| Open sea/Ocean | 2473 |
| Coral Reefs | 14,057 |
| Coastal Systems | 7694 |
| Mangrove | 4366 |
| Inland wetlands | 2 660 |
| Rivers and lakes | 13,633 |
| Tropical Forests | 52,789 |

| | |
|---|---|
| Temperate forests | 281 |
| Wood lands | 124 |
| Grass lands | 92 |
| High Mountain Polar | 167 |
| Cultivated areas | 3101 |
| Urban green-blue | - |

Section 6.1.4 in ENCAVES & MAIA (2022) is a guidance for conducting value transfers.

**Other economic valuation methods**
Here three methods for estimating monetary values relevant to biodiversity and landscape aesthetics are explained, although they fall outside of the preferred methods of NCAVES and MAIA (2022). The methods are Contingent Valuation, Choice Experiments (Choice modelling) and group/participatory valuation. These methods are frequently used to estimate welfare values but could in principle be used also for estimating exchange values. Although, these methods can be used as a basis for Simulated Exchange Values (see above), Barton (2022) highlights the importance of the institutional context in determining spatial variation in exchange values and argues for “caution in assuming any (market) institutional regime for a given ecosystem location”.

Contingent Valuation (CV) ask respondents to state willingness to pay for an ES through surveys. Thus, it is part of the family of stated preference methods. The method has been criticized for the hypothetical nature of the answers given by the respondents, and there is a risk of bias in design and analysis (Brander et al, 2018). A well-done contingent valuation study is expensive. A typical CV example could be a questionnaire involving a hypothetical entrance fee to a recreational area, given certain ecosystem characteristics of the area. The results depend on the scenario being credible to the respondents. Barton et al. (2019 p. 45) state that “the more credible stated preference studies i) identify site specific changes in measurable ecosystem condition indicators, and consequently ii) are not scalable to regional or national accounts across sites without benefit transfer error.” This claim seems to depend partially on an observation that CV-studies frequently include just two or few scenarios to check that willingness to pay is sensitive to scope of improvements (ibid.p.45). A seminal reference on the CV-method (Mitchell and Carson, 1989) discusses aggregation issues in chapter two. An advantage of the CV-method is that it can be used also for non-use values like e.g. assessments of the existence value of biodiversity.

Discrete choice experiments (DCE) try to elicit willingness to pay from respondents by asking them to make trade-offs between ES and other goods. A respondent is asked to choose among multiple combinations of attribute levels, each with a specific payment level. For example, one could choose between three options:

(1) business as usual
(2) an increase in biodiversity, a decrease in tourism infrastructure and a small increase of access fee
(3) a decrease in biodiversity, an increase in tourism infrastructure, and a larger increase of access fee

This allows for valuation of the separate elements that make up the value of the ecosystem service, as well as other elements.

Besides the risk of bias in the design, it is analytically demanding and typically expensive (Barber et al, 2018). Barton et al. (2019 p.45) state that choice experiments “offer more flexibility to estimate multiple points on a demand curve to changing site quality, and potentially transfer demand functions across sites with different qualities.” In line with this, Grilli et al (2020) recommends choice experiments for valuation among other reason for the different geographical scales it can cover. In Norway, contingent valuation or choice experiments are recommended as primary

valuation studies to the EPA in the context of air pollution (Magnussen et al. 2019). Lindhjem et al. (2023) use CV to estimate values of ES in agriculture in Norway. They calculate welfare values and willingness to pay-estimates and estimate that respondents are willing to pay 728 Norwegian kroners (NOK) per year for ten years for esthetical qualities in the agricultural landscape, or 1093 NOK per year for ten years for esthetical values and biodiversity values combined (roughly 62 euros or 93 euros respectively).

Participatory valuation methods consist of asking groups of stakeholders about their willingness to pay for an ES through group discussion. There is a risk of bias introduced from the group dynamics (Brander et al. 2018). Participation of stakeholders in valuation helps to gather information, build trust and achieve procedural justice (IPBES 2022).

## 4.5 Distributional effects

Assessing and mapping values of nature is important. It is also important to assess distributional consequences of changes in ES provision across communities and stakeholders. Distribution of benefits and costs is obviously important for policy making in an ethical sense, (broad values according to IPBES, 2022) but also in a practical sense. Local stakeholders will often have a strong influence on how successful implementation of project or policy will be (Brander et al, 2018). In addition to distribution across groups, impacts will be distributed spatially. Brander et al. (2018, p.52) state that the analysis of spatial impacts “may be a useful approach to identifying different social groups that are impacted by a project. For example, projects that address water management at a river basin level are likely to affect upstream and downstream stakeholders differently-and this should be identified through spatial analysis”. This relates to what we above have referred to as the two-way interaction of ES and development of tourism. Development of tourism in some areas, for some ES, and for some segments of the ROS, may have direct consequences or trade-offs for other areas, other ES and other touristic segments. In addition, impacts may be indirectly mediated through changes in ecosystems with distributional consequences.

An assessment and valuation of NBT should therefore accordingly ideally seek to identify potential trade-offs. A literature review by Aryal et al. (2022) finds that the most frequent trade-off of ES identified is between crop and grains on one side and carbon and climate services on the other. However, the tourism and recreation category is included among the top ten trade-off pairs of trade-offs identified. Some papers that provide examples of this are Drius et al. (2019), costal tourism in the mediterranean, Wang et al. (2022) that analyse the case of Sanya, China and Chen (2020) that looks at tourism in the Wulingyuan Scenic Area in China. Lohaugen et al (2017) combined the travel cost method with stated preference methods for a popular day-trip in southwest Norway (Dalsnuten). They estimated current valuation with the travel cost method. Windpower was planned in the area, therefore Lohaugen et al (2017) used stated preference methods to estimate changes in use (daytrips) with the presence of wind power. The surveys predicted a 13-34% reduction in visits, thus clearly indicating a trade-off.

A third distributional impact identified in Brander et al (2018) is temporal. Brander et al (2018) states that it is often the case that projects involve initial investment costs followed by a stream of benefits received over a period in the future. However, when considering trade-offs with other ES we may also see costs (or reduced incomes) incurred over the period. In cases involving temporal impacts, we encounter discount rates and the concept of net present value (NPV) where current values receive a higher weight than future values. A simple explanation for this is that people prefer to receive money now over receiving the exact same amount of money years into the future. A simple line of reasoning supporting this, is that the risk-free return of the market interest rates is always an alternative to any investment project. If interest rates are 5%, 100 Euros today is equivalent to 105 Euros one year into the future, or more than 127 Euros five years into the future. Thus, the present value of 105 Euros in one year, or approximately 127 Euros in five years are both 100 Euros. Brander et al (2018) states that capital is productive,

therefore an entrepreneur is willing to pay more than one Euro in the future to get one Euro today. Brander et al (2018) also gives a more behavioural reason why discounting is necessary, that people are impatient and prefer to have things now rather than to wait.

The value of the discount rate is therefore extremely important in comparing present values of different investment opportunities. The higher the discount rate, the lower the value attached to future costs (NCAVES & MAIA 2022). A longer time frame means more compounded effects of discount rates, suggesting the need for reducing discount rates over longer periods. Discount rates are discussed in section 5 in NCAVES & MAIA (2022).

# 5 Experiences on ecosystem services related to the tourism sector in Norway

## 5.1 Recreation in the forests around Oslo ("Oslomarka")

It is estimated that approximately 86% of the population in Oslo aged 15 or older use the peri-urban forest around Oslo ("Oslomarka") for recreation over a year. A large majority use it for multiple purposes, like trekking, physical recreation, skiing and experiencing nature. "Recreation, physical and mental health" is defined as part of "experiential and knowledge services" by Oslo municipality, and it has been noted that the importance of Oslomarka for mental and physical health is fundamental and as such, invaluable (Hågvar 2014, cited in Barton et al, 2015).

The suitability of Oslomarka as a recreational area depends on accessibility to the area and quality of the forest. There is a continuing source of contention between environmental interests and private forest owners, and these conflicting interests are regulated in the so-called Marka-act, among other things, provides the legal basis for forest protection based on experiential values, and regulates the use of the forests for sports and location of sport facilities. The Marka-act provides a definition for classifying forest according to subjective experience (forest cultural service values) and it regulates which characteristics should be preserved to provide cultural ecosystem services (Barton et al, 2015).

To valuate these services, Barton et al (2015) did not consider how use could differ across different parts of the forest but estimated the total recreational visits per year to Oslomarka. Based on the knowledge of the share of the population that uses the forest for recreation, its daily, weekly and monthly distribution per season, and on research indicating an average stay of three hours per visit (Gundersen et al. 2015), Barton et al. (2015) estimated the total visitation per year by Oslo residents to be around 70 million hours. This number does not include children or tourists. The information used in the valuation is summarized in table 5.1 below:

*Table 5.1: Time (hours) spent in Marka forest by Oslo dwellers, by season per year.*

| | **Daily** | **Weekly** | **Monthly** | **More Seldom** | **Never** | **Total per season (hours)** |
|---|---|---|---|---|---|---|
| Spring | 7 449 681 | 7 429 271 | 2 694 131 | 204 101 | - | 17 777 184 |
| Summer | 4 966 454 | 5 306 622 | 1 632 807 | 176 887 | - | 12 082 770 |
| Autumn | 7 449 681 | 7 252 383 | 2 939 052 | 190 494 | - | 17 831 611 |
| Winter | 9 932 908 | 9 905 695 | 3 374 467 | 204 101 | - | 23 417 171 |
| Total | 29 798 724 | 29 893 971 | 10 640 458 | 775 583 | - | 71 108 736 |

*Source: Barton et. al, 2015.*

The authors estimate the economic value of the use of Oslomarka by different techniques and provide both willingness to pay (WTP) estimates and consumer surplus estimates. The WTP estimates were done by considering the value of recreation time based on its opportunity cost. The opportunity cost is measured as the disposable income foregone from not spending the same time in paid work.

The literature on valuation of time frequently argues that a fraction of the income should be used as discussed above but as noted in Barton et al. (2015) what fraction to use is unclear. Barton et al. (2015) reports values from comparisons with both 100% and 33% of average wage after tax. The calculations are straight forward from the information in the table above, however the assumption that an hour of recreation could be traded with an hour of work is obviously more open for discussion.

As mentioned above, authors have also used “methods where the price for the ecosystem service is obtained from markets for similar goods and services” in the NCAVES & MAIA (2022) terminology, or substitutes in the economics literature. When estimating the recreation value based on the price per hour of training in a health studio in Oslo, it is assumed that the training effect is the main reason for recreation in Oslomarka, which is at odds with the observation referred to above that most users use the forest for multiple purposes. However, the health effects of outdoor recreation are among the benefits discussed. This is an example of what the authors (Barton et al, 2015) call an illustrative purpose of valuation. They recognize that the numbers are not reliable enough for policy formulation but argue they may be good enough for awareness raising. This inaccuracy is also a reason for using multiple valuation methods.

Finally, Barton et al (2015) also consider a value transfer method based on a previously conducted Choice experiment in Oslomarka (Sælen and Ericson 2013). This Choice Experiment was conducted in Oslomarka, but with a very small sample. Barton et al. (2015) extrapolate from this small sample to the entire population of Oslo, and there are known transfer errors such as not estimating values for children. Barton et al. (2015) thus point out that this should be considered as a value transfer method. This study estimated WTP for recreation in Oslomarka under different conditions: With snow, bare ground or “slush” conditions. Table 5.2 shows results from valuation of recreation time in Oslomarka by the different techniques discussed above.

*Table 5.2: Total monetary value of visits to Oslomarka by Oslo’s adult population*.

| **Valuation recreation time** | **Per month** | **Per hour** | **Per trip** | **Total value of visits to Marka (NOK/year)** |
|---|---|---|---|---|
| Value recreation time 100% wage after tax | | 187 | | 13 297 333 559 |
| 33% wage after tax | | 62,271 | | 4 428 012 075 |
| Cost of training studio | 453 | 37,75* | | 2 684 354 769 |
| **WTP value transfer** | | | | |
| Spring, summer, autumn | | | 124,8 | 1 957 550 484 |
| Winter | | | 209,3 | 1 612 318 420 |
| Whole year | | | | 3 569 868 904 |

*Adapted from Barton et al. (2015), p. 50. * 12 hours of training was assumed by the authors*

Looking at the table we see that the estimated value has a large variation. The lowest yearly estimate is approximately 2.7 billion NOK, and the highest 13.3 billion NOK per year. This is obviously not precise enough to be decisive in policy design for conflicting interests in Oslomarka. However, as Barton et al. (2015) claim, the numbers could serve to raise awareness about the importance of peri-urban natural areas for recreation and other functions related to recreational use by Oslo dwellers.

## 5.2 Recreation/tourism management in areas of protected biodiversity

The Snøheim area is situated near Hjerkinn within the Dovrefjell-Sunndalsfjella National Park, in an area that has been subject to large changes in management during the past decades. From 1923, parts around Hjerkinn (around 165 square kilometres) were used as a military practice field for both Norwegian and allied forces. A new practice field was opened in 2005 and the largest nature restoration project in Norway was started at Hjerkinn, lasting until 2020. According to the Norwegian Defence Estates Agency, a governmental administrative agency under the Ministry of Defence, the restoration project included the safe removal of around 19 000 duds (unexploded mines, artillery shells etc.), the removal of 540 tons of metal waste, planting of 47

000 willow saplings (*Salix* spp.). Five thousand and two hundred acres of roads and other infrastructure were cleared, and 115 acres were planted with seeds of local origin. In 2018, the restored area at Hjerkinn was included in the Dovrefjell-Sunndalsfjella National Park which expanded the National Park area with 130 square kilometres.

Generally, roads from the period with military practice were removed. However, one road, the Snøheim road, has been the topic for much discussion. The Snøheim road is a 14 km long gravel road from the Hjerkinn railway station leading to Snøheim[18], a large tourist cabin belonging to the Norwegian Trekking Association[19], that reopened in 2012 after the period of military ownership. From Snøheim it is possible to ascend the iconic mountain Snøhetta[20] on a daytrip. However, the area between Snøheim and Hjerkinn which the Snøheim road crosses is also an important winter foraging area and migration corridor for the vulnerable wild reindeer population of the area. There are approximately 20 000-25 000 wild reindeer in Norway, or around 90% of the remaining population of wild reindeer in Europe.

Research shows that infrastructure may constrain reindeer migration routes and use of the area. Some well documented reindeer migration routes are no longer in use due to the barrier effect of a railway and road in one direction (eastwards toward Knutshø and Rondane) and the effect of hydro power infrastructure in another direction (towards Torbudalen/Dalsida/Aursjøen). Further migratory constraints are important to avoid. Especially during the last part of the summer and through the autumn the area is popular for hiking and outdoor activity. Thus, there is a need for careful balancing of tourists and the viability of the reindeer population and in the case of the Snøheim road, this has led to a long and careful evaluation process. Until 2011 it was allowed to use private cars on the road. From 2012 as part of a research project a solution with a shuttle bus was tried out. In a 2013 research report, three different scenarios were analysed: First, a removal of the road, and restoration of the area. Second, a solution with restricted use (including the shuttle bus) and third, a scenario where the road was open for all. The recommendation was alternative 2. This was part of a suggested strategy: tourist traffic should be encouraged through established trails and sights to areas less important for the reindeer and led away from the most important areas for reindeer (Gundersen et al. 2016).

The situation for the wild reindeer population became even more difficult and important when in the spring of 2016 chronic wasting disease (CWD) was discovered in wild reindeer for the first time in Norway, in two mountain areas (Norefjell and Hardangervidda).

When in 2018 the restored area at Hjerkinn was included in Dovrefjell-Sunndalsfjella National Park, it was decided that the Snøheim road should remain with restricted access and with a shuttle bus solution, which has been the option implemented until present. In addition, biking is allowed in the period from June 1st to July 15th. In the period after July 15th biking is not allowed. However, the management of reindeer and tourists is an ongoing issue of debate and negotiations. During the writing of this report, a new report led by county governors has recommended even stricter regulations in the future, including the removal of the Snøheim road (e.g. County Governor of Trøndelag 2023). They also propose a large infrastructure project where the railway and the European road 6 (E6), which is the main land transport connection between the largest and third largest cities in Norway, Oslo and Trondheim) should go through a tunnel. They recommend removing some of the tourist cabins in the area, as well as some of the established trails that go over important areas for reindeer. This is yet a recommendation from this administrative level and will work its way to the Ministry of Climate and Environment via the Norwegian Environmental Agency and will probably see some discussion through 2024.

[18] https://www.dnt.no/hytter/betjente/snoheim/english/
[19] https://www.dnt.no/english
[20] https://www.nasjonalparkriket.no/turtips/snohetta-pa-dovrefjell

An important tool that will be used in the discussion is the quality norm for wild reindeer populations that was approved by the government in 2020. Based on indicators it classifies the ten areas with wild reindeer in Norway according to a “traffic light principle” where red means that the situation is bad, yellow means average and green means good condition. Six of the ten areas have been classified as red. The rest is either average or unclassified. Five areas (including the Snøhetta area) are classified as bad due to factors in the environment that restrict reindeer movement. Two are classified as bad due to the occurrence of CWD. Three reindeer areas are classified as in bad condition due to the percentage of adult males in the populations (which is an indicator relevant for management strategies for CWD). Three areas with wild reindeer are classified as bad due to conditions with calves. The indicators are weight of calves corrected for age and sex, and number of calves per female.

## 5.3 Impacts of poor visitor management in the Lofoten islands

The Lofoten islands have become a very popular tourism destination, and the archipielago’s spectacular nature is the main attraction. Along with an increase in the number of visitors there has also been some conflict associated with it. Popular for hikers and climbers, improvised camping may be a local nuisance several places in the Lofoten islands. The media have reported improvised camping for instance in cemeteries. In addition, temporally and spatially concentration of tourists has been reported, for instance in particularly popular beaches or hiking areas during some few intense summer months. An example of visitors congestion is a popular approximately 2 km long beach (Kvalvika) in the Lofotodden National Park, which received approximately 30 000 visitors in the period from May until October in 2022, and where at most 37 tents were counted a summer night with midnight sun (Selvåg, Keller, & Engen, 2022). Perhaps not surprisingly, 25% of visitors reported that they had seen toilet paper or human excrements during their trip. In 2022, high levels of *E. coli,* most likely from human sources, were recorded in streams where visitors often fill water bottles, which could cause health problems (Selvåg, Keller, & Engen, 2022).

In addition, visitor congestion obviously results in the reduction of the quality of the experience for tourists, and it may cause conflicts with the locals. It has been reported that locals avoid areas in Lofotodden National park due to the garbage spread in the area. Ongoing research seeks to gather information about behavior and necessary infrastructure to solve the problem. Surveys among visitors show that more than 60% of respondents say that they would be willing to test bags for human excrements if bags were available at the start of the trip, and ongoing research evaluates the effects of the availability of such bags in the summer of 2023 with disposal bins near the entrance to the national park. In addition, researchers try to evaluate the effect of information placed at strategic points about the problems caused by human waste.

In addition, the Norwegian coalition government from 2021 has also opened for the introduction of a tourist tax with the Lofoten islands as one of a few possible pilot cases, tentatively from 2024. The initiative is politically debated with some fearing that it will make already expensive destinations, even more expensive, while others point out that the tax could help make nature-based tourism more sustainable and help finance maintenance. Similar tourist taxes have been used in Croatia, Portugal and Switzerland and are being considered in other European countries to handle over-tourism for highly attractive destinations (i.e. Venice, Seville).

Numbers from 2018 show that visitors to the general Lofoten area (also including the municipalities in Vesterålen) spent approximately 1 400 million NOK, roughly 145,7 million euros using 2018 average exchange rate of NOK to Euro of 0,1041. The Lofoten and Vesterålen area is sparsely populated, so these numbers indicate approximately 25 000 NOK per inhabitant, or (again assuming average 2018 exchange rate) approximately 2 600 Euros. A report from 2019 (Menon Economics, 2019) also states that secondary economic effects from the tourism sector in Lofoten and Vesterålen area, (demand to subcontractors) is of about the same magnitude as the direct contribution from tourists, i.e., approximately 145,7 million euros. Combined, according to Menon Economics (2019), the tourism sector employed 1 600 people in Lofoten and Vesterålen, and subcontracts for goods and services for the industry corresponds to almost 600 people

employed nationally. The Menon Economics report (2019) also highlights some challenges and possibilities related to business activities in Lofoten. They discuss challenges related to the strong seasonality of the tourism activity and the possibility of generating more winter tourism, with attractions such as skiing, winter climbing and northern lights sighting.

## 5.4 Impact assessment of tourism on vulnerable arctic areas

### Guidelines for impact assessment on species and habitats

Located approximately in between the middle of mainland Norway and the North Pole at 78º North, the Svalbard islands main attractions are arctic nature and wildlife, as well as some cultural heritage places like burial sites, and remains of cabins and/or settlements from early periods when whaling and hunting were important economic activities. The webpage visitsvalbard.com advertises “landscape dominated by tundra, bare mountains, glaciers, extreme light variations and an exciting animal life that would be hard to match anywhere on earth”[21]. Tourism in Svalbard has become increasingly popular, including being a destination of cruise ships, with disembarkation at popular scenic spots, often including cultural heritage sites. In 1996 there were approximately 29 600 disembarkations at more than 200 different sites. In 2019 the number was 108 000. The potential impact of increasing number of visitors on the environment was early recognized. The Svalbard Environmental Protection Fund was established in 2007 and the very first research grant from the fund financed a literature review on environmental impacts from tourism in the arctic with a focus on Svalbard (Vistad et al. 2008).

From 2008 to 2011, the fund financed the research project “Environmental Impact from Human use”, with a report published in 2012 (Hagen et al. 2012). This project looked at impacts on both environment and cultural heritage sites and considered the role of guides of tourist groups as potential “nature managers”. The project developed a protocol for assessing vulnerability of the nature in Svalbard to the impact of tourism (three classes: robust, average vulnerability and vulnerable). The protocol has been used by the governor at Svalbard when preparing for the establishment of large protected areas in East-Svalbard (2010) and West-Svalbard (2012). In addition, the Association of Arctic Expedition Cruise Operators (AECO) has used the protocol to produce site-specific guidelines for disembarkation sites. To assure common methods and understanding of the protocol, a manual for practical use in the field has been developed (Hagen et al. 2014).

The guidelines consider the level of vulnerability of plants and wildlife species, including those in the Norwegian Red lists. Some features that characterize wildlife vulnerability include nesting sites where human traffic could possibly be disturbing, for instance, freshwater lake systems, bird cliffs, ponds of brackish water, grounds where walrus lie with their offspring, dens for arctic fox and more. As in the case of vegetation, red list status is given high weight in the assessment. However, with animals the score for red list status is combined with a score for probability for reduced reproduction.

### Measures to control the introduction of alien species

Despite that the number of non-native species established on the high Arctic archipelago of Svalbard and their impact is considered relatively low, and that exotic species have mainly established around settlements and areas of human influence, the considerable increase in tourism activities in the Svalbard archipelago, has led to both the assessment of risks of introductions (Ware et al. no date), and to implement measures to reduce these risks. The assessment of the risk of introduction was based on collecting samples from visitors’ shoes, together with questionnaires. The sample of visitors that arrived to Svalbard’s international airport had their shoes cleaned of mud, dirt and biological material, and any seeds of vascular plants present in the samples were collected and identified. The Analysis revealed at least 41 plant species belonging to 18 plant families were transported on shoes to Svalbard. Even species were obtained being introduced earlier posing an elevated risk for non-native plant expansion (Ware et al. no date).

[21] https://en.visitsvalbard.com/

Seed introduction–management at airports is not unique to Svalbard, e.g. shoe cleaning is mandatory at airports in Australia, New Zealand and when flying to Antarctica, and awareness and information campaigns have proved to be very successful in reducing the introduction of seeds (Ware et al. no date).

An information campaign that raises awareness on the risk of introduction of alien species (https://youtu.be/oghk2GRI5i8) encouraging visitors to clean shoes and clothing has been developed for Svalbard (https://en.visitsvalbard.com/visitor-information/travel-information/alien-species).

## 5.5 Concluding remarks

Nature-based tourism is a business sector that both directly and indirectly relies on nature and its qualities. As other instances where nature and society, including the economy, interact, ecosystem services models and assessments can provide a structured knowledge base that enables to assess both the contribution of nature to various dimensions of well-being associated with cultural spaces and practices (Fish et al. 2017), but also to quantify the impacts of use on nature, a measure that can support sustainable use. Ecosystem services assessments can also help identify conflicts between the land use or area take by other sectors which can affect the quality of the nature-based tourism offer. Examples of these include large infrastructure development projects, such as for renewable energy (wind-parks and hydropower), transport, or even accommodation facilities and other service infrastructure for the tourism sector. Other land-uses or interventions can lead to the decline of species which directly underpin tourism activities such as recreational fishing, wildlife safaris (including marine species), photographing, bird watching and hunting.

However, there is currently no common framework to assess the potential contribution of nature to nature-based tourism activities, or how these values can conflict with other land-use allocations. Ecosystem services assessments can contribute to inform this kind of decision-making processes by capturing a broader range of values, which can be made explicit, quantified, and weighted against each other. Despite this potential, the application of ecosystem services assessments to support planning and investment decisions is at its infancy both generally and for the tourism sector. Following the ecosystem services ‘logic chain’, ecosystem services assessments provide a consistent framework that requires explicit quantitative definitions of: (i) the service providing units (typically ecosystem components or areas), (ii) indicators of the ecological condition of these units, (iii) a model (of service supply and use) that defines a metrics of ecosystem service flows, (iv) the definition of the beneficiaries, as well as (v) various indicators of spheres of human well-being. The momentum triggered by the SEEA EA process, as well as the commitments under the Global Biodiversity Framework (GBF) of the Convention on Biological Diversity (e.g. targets 5 and 9 on the sustainable use of wild species, and target 11 on restoring, maintaining and enhancing nature contributions to people), has the potential to foster the further development of ecosystem services assessment methodologies, and the uptake of ecosystem services information, for planning, development and evaluation of actions including the tourism sector.

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*The Norwegian Institute for Nature Research, NINA,* *is as an independent foundation focusing on environmental research, emphasizing the interaction between human society, natural resources and biodiversity.*

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*NINA's activities include research, environmental impact assessments, environmental monitoring, counselling and evaluation. NINA's scientists come from a wide range of disciplinary backgrounds that include biologists, geographers, geneticists, social scientists, sociologists and more. We have a broad-based expertise on the genetic, population, species, ecosystem and landscape level, in terrestrial, freshwater and coastal marine ecosystems.*

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