EESTI
STATISTIKA

Challenges related to the communication of the ecosystem accounts

UN London Group of Environmental Accounting, 2023

Kaia Oras, Kätlin Aun, Grete Luukas, Statistics Estonia

Üllas Ehrlich, Tallinn University of Technology

Contents

Introduction and background

With the approval of the ecosystem accounting as a statistical concept (and partly also as a standard), a need for a new stream of statistical literacy has appeared. The communication is important as the concept of ecosystem accounting is new and the knowledge on methods and how to use the information is not yet widespread. Communication of the ecosystem accounts via routine publication procedures has started. The best practices how the communication on the monetary valuation of ecosystem services could be done and what should be explained is under the question in this article as well.

New features are related to the typology of the values, multiplicity of values, linkages between the ecosystem services, presenting and interpreting spatial information, questions of the aggregation of the service monetary values and possible new future metrics. Some of these aspects are discussed in the current paper and proposals are outlined in the section “Discussion, conclusions and areas of further development”. First, current communication channels are described. Secondly, the issues which need additional communication when presenting ecosystem accounts are described: aggregation of ecosystem service monetary values, development of new indicators, challenges regarding communication of the economic value of ecosystem services. Thirdly, supply and use tables are studied from the viewpoint of being a structured way to present and analyze the monetary values of ecosystem services. Also the scope of the values included in supply and use tables is discussed. The interpretation of the trends in supply of ecosystem services is discussed as well.

The last chapter outlines the issues which need further exploration.

The study is based on the work done in the frame of Eurostat grants "Development of the land account and valuation of ecosystem services regarding grassland ecosystem" (831254-2018-EE-ECOSYSTEMS) and "Development of the ecosystem accounts" (881542-2019-ENVECO and 101022852-2020-EE-ENVACC). The selection of the valuation methods for ecosystem services was based on the suggestions outlined in UN SEEA EA.

Communication channels for the statistics of ecosystem accounts

Communication of the statistics on ecosystem accounts involves dissemination activities in a form of tables and graphs, georeferenced information on maps accompanied by the agreed classifications and standards. In a complex topic like ecosystem accounting, statistics has to be accompanied by explanations, therefore communication semantics are essential.

Statistics Estonia has produced and published the results of ecosystem accounting online. The results have been analyzed with the main users, among others Ministry of Environment and Ministry of Finance. Discussing and developing ecosystem accounts has been seen as one step of communication.

Marketing and Dissemination Department in Statistics Estonia has suggested using routine procedures as the best solution for the communication and visualization regarding the impartiality and objectivity of statistics and the future mainstreaming of this area of statistics. In addition, a visualization of spatial data was tested by creating a prototype of an interactive map as one of the dissemination channels.

Dedicated section for ecosystem accounting was initiated in Statistics Estonia's thematic website "Environment - Biodiversity protection and land use" (https://www.stat.ee/en/find-statistics/statistics-theme/environment/biodiversity-protection-and-land-use). Methodological reports are available for downloading from the website. Also the links to the recordings of the methodological seminars where methodologies and main results were discussed can be found on the website.

Experimental dissemination and visualization using web database and infographics

Ecosystem extent by ownership types and the supply and use tables of ecosystem services are made available on thematic webpage of Statistics Estonia "Environment – Biodiversity protection and land use" (https://www.stat.ee/en/find-statistics/statistics-theme/environment/biodiversity-protection-and-land-use) with references to metadata descriptions and to the datasets[1].

For the visualization of the statistics Statistical Office uses standardized web-based visualization tools. The main distribution channel is the website and Statistical Database, where all statistics is made available online. The website is in Estonian and in English and is developed according to WCAG 2.0 AA accessibility standards. Data are first made available in the database in order to automatically visualize the data later. The database allows users to create preset visualization, self-tabulation, but also new products and visualisations as it is API readable. Statistical outputs (e.g. press releases, ready-made tables, charts, maps connected to statistics, infographics, videos) and metadata could be disseminated using tools and formats that facilitate re-dissemination by the media or any other users. In future, these infographics can be linked in press releases and news.

Consultants in Customer Service answer requests and explain statistical outputs and direct to the applications where data is available. Help for users is provided mostly by phone or by e-mail. There is

[1] Tables on ecosystem accounts published in Statistics Estonia database:

KK090: ECOSYSTEM EXTENT BY OWNERSHIP CATEGORY AND ECOSYSTEM TYPE

KK091: SUPPLY OF ECOSYSTEM SERVICES (MARKET PRICE, COSTS-BASED AND REVEALED PREFERENCES BASED METHODS

KK092: USE OF ECOSYSTEM SERVICES (MARKET PRICE, COSTS-BASED AND REVEALED PREFERENCES BASED METHODS)

also a chat bot called ITI available on the website which helps users to find and answer most common questions or directs users to customer service.

Dissemination and visualization using ArcGIS Online

Interactive maps have become powerful tools to visualize data and technological advances allow to present the data in well readable format, while including analytic tools and/or aggregated information, which provides the options to compare, analyse and conclude, depending on the needs and interests of the users.

Illustrative maps were produced for ecosystem extent and ecosystem services, where monetary values were spatially allocated. Interactive dashboards in ArcGIS Online were created to illustrate spatial data, which allows the user to see how ecosystem accounts, both extent and services are situated in Estonia.

Three spatial levels were used – counties, municipalities and 500x500m square grid. First two levels were included to give an overview within administrative divisions, while 500x500m square grid gives a more detailed distribution of ecosystem types or ecosystem services either within a single county or municipality. The use of counties and municipalities should have a vital role in the future, since local governments want and need to know, which ecosystems are present within their territory and which services are supplied. Users can view the data (ecosystem extent and services) based on the selection of administrative units. They can also select a service and further refine the selection by ecosystem types or administrative units. These dashboards are a part of a single application (ArcGIS Experience), which is available here. The interactive dashboard in ArcGIS on Estonian ecosystem account is the first prototype and still under development. As the interface is aimed mainly for experts from national audience, the user language is Estonian. In the future the application can be developed further by adding additional features. However the descriptions and metainformation supporting the interface needs to be first progressed further and integrated in the application. Further development is foreseen and depends on the agreed definitions and concepts.

Indicators: detailed and aggregated information on ecosystem service values

Indicators can describe detailed and aggregated information on ecosystem service values. How well can we communicate these indicators, are their meaning clearly understandable? Every change in the values of the flows of ecosystem services per area or population could be regarded as an indicator dependent on its relevance to users.

Aggregated monetary value estimates are important as they are easy to use and can give a quick and good overview. However using aggregated indicators could have several restrictions due to the loss of information. The users have also shown interest in using aggregated indicators[2]. The concept of the aggregated ecosystem services index has been analysed previously and contributing paper "Aggregation of the ecosystem service values in urban ecosystem account, application of the principles of gross ecosystem product (GEP)" was discussed in London Group on Environmental Accounting Meeting in 2021. According to the latest knowledge GEP is not a definite candidate for headline indicators but nevertheless the meaning and semantics of the aggregation of the monetary values of the supply of ecosystem services needs further work if the aggregated metrics would be used.

Views on the use of indicators as well as aggregated monetary values are still being established. The main processes of relevance are the agreeing on The Kunming-Montreal Global Biodiversity Conservation Framework and respective monitoring framework on global level and agreeing on the proposal for the nature restoration law in Europe as regards the development of EU biodiversity policy. These new processes require a response from statistical organizations and respective statistical activities were started in Estonia as well. Possible indicators based on ecosystem accounting in connection with CBD (Convention on Biological Diversity, https://www.cbd.int/) reporting have been

[2] CBD (Convention on Biological Diversity) had selected gross ecosystem product (GEP) as a candidate for one of the lead indicators and it has been listed in "Proposed headline indicators of the monitoring framework for the post-2020 global biodiversity framework" (goal B, page 5) in 2020.

defined in Estonia and discussed with users. In addition, the monitoring framework related to the EU Biodiversity Policy was analysed.

Output indicators

The Kunming-Montreal Global Biodiversity Conservation Framework (GBF) consists of measurable indicators which will be used to assess the meeting of the targets of the goals of GBF and several of these indicators (mandatory main indicators and voluntary additional indicators) could be produced based on ecosystem accounts. For many of these indicators, methodology for monitoring is still being developed and is not yet agreed upon. Actual production of these indicators will depend on the methodological development in respective task teams. National reporting is already foreseen in year 2026. Statistical system is foremost involved in regards with SEEA EA and SEEA CF related outputs (Figure 1). SEEA CF and SEEA EA provide basic statistics for calculating indicators, basis for the analyses and scenario modelling for monitoring of the goals of the biodiversity goals.

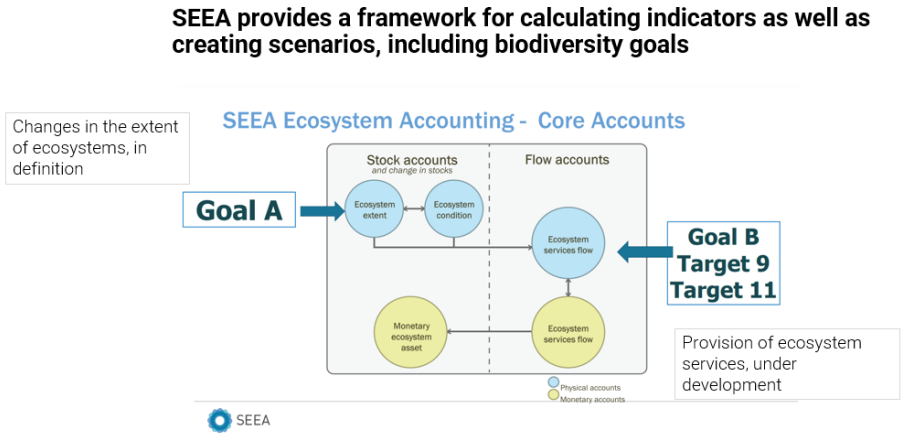

Figure 1. SEEA EA provides basic statistics for calculating indicators, bases for the analyses and scenario modelling for monitoring of the goals of the biodiversity

Main indicators of GBF that are related to ecosystem accounting:

- Extent of natural ecosystems (quite straight forward and already mainly agreed);
- Services provided by ecosystems (in development);
- Proportion of agricultural area under productive and sustainable agriculture (definitions still need to be agreed);
- Average share of the built-up area of cities that is green/blue space for public use for all (definitions still need to be agreed).

It is emphasized that the links to other environmental accounts are important. Statistical data are relevant in the monitoring of the measures on biodiversity conservation regarding global biodiversity framework targets. CF together with SEEA EA could provide basic statistics for calculating indicators and scenario modelling for monitoring of the GBF long-term goals (until 2050) (Figure 2). The long-term goals focus on protection of ecosystems, species and genetic diversity; valuing, maintaining, restoration of natural resources and contributions; equal distribution of revenues from the use of genetic resources; adequate resources for nature conservation. Short term-goals (until 2030) can be summarized to reducing impacts on biodiversity, sustainable use of natural resources and fair allocation of its revenue, developing means and solutions for meeting the goals and mainstreaming biodiversity.

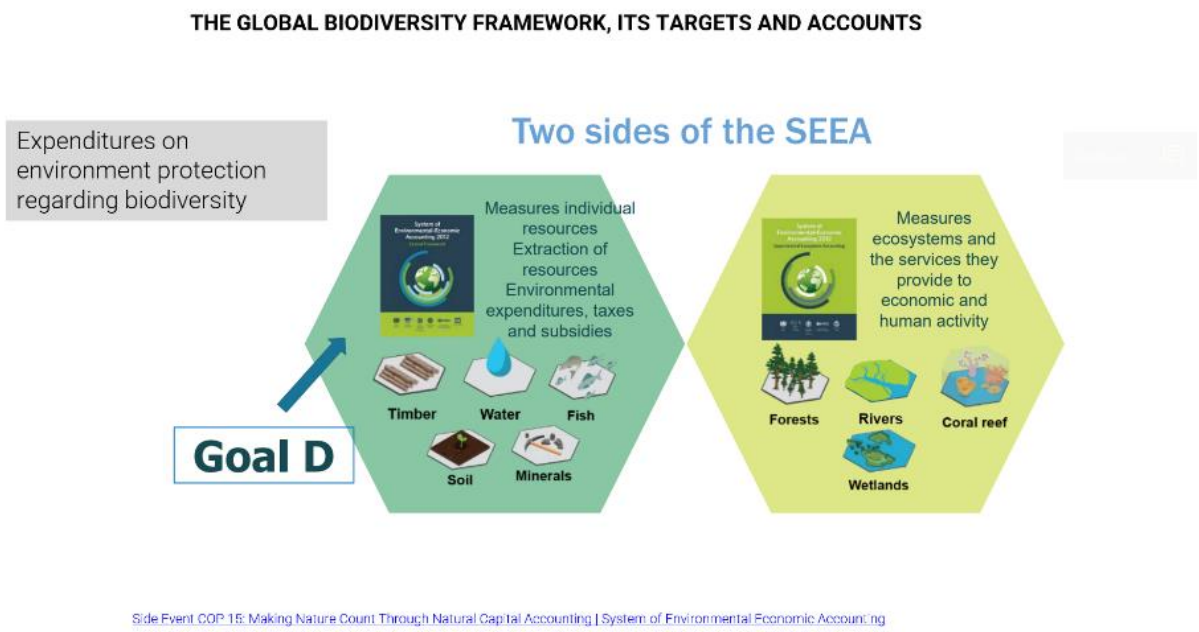

Figure 2. SEEA CF together with SEEA EA provide basic statistics for calculating indicators and scenario modelling for monitoring of the goals of the biodiversity

In Europe the proposed Nature Restoration Law (22.06.2022, currently in negotiating phase in the EU) provides monitoring framework for ecosystem condition. In principle, several of the proposed indicators for monitoring the extent and condition of habitats could be associated with ecosystem accounts[3]. Statistics Estonia has produced the first round of statistics for the last available year for the condition account that is proposed by the amendment of the regulation on environmental economic accounts 691/2011. Indicators relevant from the viewpoint of Nature Restoration Law are acknowledged in addition to the indicators included in the proposal of the ecosystem accounts module of regulation EU 691/2011.

Further work on the output indicators of ecosystem accounts is waiting for the outcomes of the CBD task teams and Nature Restoration Law. The results of both workstreams on indicators is important as headline indicators would serve as an important component in the communication of biodiversity protection in the future.

[3] Currently following indicators, such as the area of urban green space and the coverage of tree canopies in cities, abundance and diversity of pollinator species, grassland butterfly index, organic carbon stock of mineral soils of agricultural lands, share of agricultural land with diverse landscape elements, farmland bird index, dead wood, age structure of forests, coherence of forests, forest bird index. The reporting has to be harmonized and developed in coming years as currently reporting has been scheduled for 2031. These indicators and methods will be discussed in more detail during the following years in the work on ecosystem accounts.

Challenges regarding communication for the values of ecosystem services

Different units are used for indicators of ecosystem service values in physical form, therefore aggregating these values is not possible unless all the values are converted to the same base and units. Service values in monetary units can be technically easily summarized but it can bring dubious results when semantics and meaning of economic values of ecosystem services are unclear and confusing.

The last assessment by IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) about the values of nature indicated that a too shortsighted view on nature's contributions to people is a general threat and that a broader range of economic values has to be accounted[4]. It is hence relevant to clearly communicate the scope and semantics of the ecosystem services covered in SEEA EA, this communication should present, reflect and help to understand how the contributions of nature to society function.

The UNSC, at its 52nd session in March 2021 also requested the [UNCEEA] Committee to promptly resolve outstanding methodological aspects in chapters 8 to 11 of SEEA EA pertaining to monetary valuation in ecosystem accounting.

Methodological work for resolving the "outstanding methodological aspects" of the SEEA EA in statistical system has started. Work in Estonia on the monetary valuation of ecosystem services is experimental and common understanding and language regarding the applied metrics has not been reached yet.

There is a recently published analyses and proposal "Beyond valuation. Monetary aggregates for the SEEA-EA. The Italian proposal" [5] that points to the need for empirical research on how monetary aggregates - and those resulting from valuation, in particular - are currently used in policy-making, as well as for further theoretical research on how to best use the multiplicity of available monetary aggregates, based on the specific information of each of them.

Supply and use tables as a structured way to present and analyze ecosystem services supply

There are two aspects that should be discussed. First the concepts of valuation and secondly the aggregation of the values of the supply of ecosystem services in monetary terms.

In one hand the aggregation of the ecosystem service monetary values by ecosystem types can be justified because ideally the value of the land should encompass the value of the services provided. In practical calculations and deals this has not yet been reached.

When determining the value of the land, in addition to the value derived from the location, creditworthiness, etc. that are currently taken into account, the value of the services provided by the ecosystems located on the land being valued should also be taken into account. For example, if a landowner plans an activity that damages the ability of ecosystems on that land to provide services, such as a change in land use, the landowner should be taxed in proportion to the value of ecosystem services lost as a result of the planned activity. However, when taxing land, it should be taken into account that the tax rate favors the continuation of ecosystem services. Considering that the ecosystem provides a service not only to the owner, but to the whole society, the land tax could be reduced. In general and according to the opinions of the authors of the paper it is important that the land taxation system should be aimed at preserving and maximizing the value of ecosystem services. Undoubtedly, this is not an easy task in practice, and the creation of a specific system would require a political decision and detailed development.

In general supply and use tables of ecosystem accounts allow to present the values of ecosystem services in a structural and contextual manner which should satisfy the needs of those who use the information. The structure of the supply and use tables in ecosystem accounts is similar to the tables

---

[4] https://www.ipbes.net/global-assessment

[5] Beyond valuation. Monetary aggregates for the SEEA-EA. The Italian proposal https://oneecosystem.pensoft.net/article/84689/

used in National Accounts and therefore values could be linked. The supply and use tables record the actual flows of ecosystem services supplied by ecosystem assets and used by economic units during the accounting period. The same structure can be used for both physical and monetary terms (SEEA TR 2.27).

Concerning the presentation and communication of supply and use tables of ecosystem services, there are two levels of complexity: detailed information of single services and secondly aggregated form for policy purposes. Both should meet the scientific standards.

Experimental physical and monetary supply and use tables of ecosystem services for Estonia were complied. In monetary supply and use table the ecosystem services have the same units and were therefore mathematically additive. The total supply by ecosystem types was calculated but the semantics behind the total monetary values is not easily and compactly explained because included services may or may not have positive or negative combination effects and are valued by different methods which scope and principles can vary. When both direct and indirect valuation methods are used, then one option is to distinguish between the class of valuation methods and for example describe the monetary values of ecosystem services as the "relative values of given ecosystem services estimated by indirect methods". The total should be then named as "the total relative value of given ecosystem services". However, the composition of the monetary aggregated indicators comprising several ecosystem services has not been defined yet. Also the links between detailed and aggregated levels and weights for single indicators have not been defined.

Semantics and communication depend significantly on the ecosystem service itself. For example, the communication of the supply service of agricultural ecosystems and the recreational service of the forest ecosystem should be somewhat different. However, there are several common aspects that apply to and can be used in communicating the information of services of practically all ecosystems.

Semantics and communication on the supply of the ecosystem services in monetary terms should comprise the following:

1. While valuing ecosystem services in monetary terms the context of imperfect market should always be noted. The market-based valuation cannot provide adequate information about the monetary equivalent of all ecosystem services. Most ecosystem services are non-market.
2. Our knowledge of the monetary equivalent of the value of ecosystem services is limited and does not reflect the total value provided by the ecosystem.
3. It must be considered that for all ecosystem services, the existence of the ecosystem is a prerequisite for the service provision. No matter what monetary equivalent assigned to the service, without the ecosystem the service would not exist. Thus, the existence of an ecosystem is an indispensable condition for service provision.
4. Regardless of the method by which the monetary equivalent of an ecosystem service is found, it must not be interpreted as a price for which the ecosystem can be destroyed.
5. It should be indicated that in case of resource rent method the derived ecosystem monetary values may only be residual values.

There may be other relevant aspects not mentioned above. It has been argued by Estonian experts that estimated economic values could be currently used to show how far we are from the valuation of the ecosystems' contribution to human society. As the service values in monetary terms are rather low (depending of course on the valuation approach taken) these figures allow to show that most of the ecosystem services can be used free of charge. We have come to an understanding now that the values of the ecosystem services are not related to the sustainable levels of use of these ecosystem services.

Monetary equivalents of the ecosystem services values are currently relatively low for various reasons. In the case of ecosystem services participating in the market (for example, the provisioning service of agricultural production), Estonian experts have a hypothesis that the ecosystem service is not included in the market price of the product or is incompletely included in it. If a (small) part of the market price is taken as the monetary value of the ecosystem service, there is a risk that the ecosystem service and therefore the contributions provided by the ecosystem will be underestimated. There is also a risk of underestimation in the monetary evaluation of non-market regulating and recreative services. If only a

part of the value is attributed to the service (for example, the profit of the carrier in the case of the travel cost method), then the ecosystem service is likely undervalued.

In the case of welfare values, finding the monetary value of the service requires a direct measurement of changes in the welfare of individuals using the service (for example, by using the contingent valuation method). Such an approach is hindered by the conceptual difficulties of how to use financial data in statistics that are not based on actual financial turnover. Such an approach may require a change in current statistical paradigms.

Scope of the values related to ecosystem services reflected in supply and use tables

In order for the management decisions and changes for sustainable ecosystem management be effective both public adaptation and government lead measures need to be supported by data. Could the adequately identified monetary values of ecosystem services play a role in the decision-making processes? Would this lead to the decisions which bring the desired changes in ecosystems and their ability to provide services? The threat is that underestimation could lead to harmful decisions regarding ecosystems. For example, when a change in land use is planned, such as an industrial complex is to be built on forest land, the loss of forest ecosystem services should be taken into account as costs in the cost-benefit analysis. Another example would be the construction of a hydroelectric powerplant, which dries up a picturesque waterfall or rapids. The cost-benefit analysis of the planned hydroelectric plant should take into account the loss of habitat services of the river ecosystem and the reduction of recreational services. Such studies have been conducted for environmental impact assessment in Estonia and already used as arguments in decision-making processes.

There is still a lot of information on ecosystem services, condition and capacity of ecosystems which is out of scope of the statistical system when compiling ecosystem accounts. If incomplete values of the supply of ecosystem services are used, for example for management decisions, the missing components in the service values may send wrong signals and give rise to the wrong conclusions. Reasons for the incomplete information in ecosystem accounts are:

1. Information for single ecosystem services is still in development.
2. The preconditions for ecosystems to provide ecosystem services (ecosystem condition) are important and obvious but the currently the load of information probably exceeds the ability of the statistical system to record all possible statistics.
3. It is not considered that ecosystems are very complex and services are interlinked.

Secondly, the assessment of the monetary value of ecosystem services is complicated as many services are non-market in nature, this means that they do not have a price in the buying and selling process, and thus such services are not objects of classical economic accounting. This makes it quite unattainable to integrate the values of these services into statistics, considering current standards. Non-market ecosystem services include most of the regulating services and cultural services.

Regulating services (for example, water and air purification, carbon sequestration) can cause a change in the environment that can be measured by natural scientific (mainly physical and chemical) methods, thus providing an objective quantitative basis for expressing and measuring their value. Cultural services, however increase the welfare of individuals. The increase in welfare, which is one of the most important criteria of the quality of life from an individual's point of view, is not expressed neither in the physical and chemical changes of the environment nor in the turnover that can be described in accounting. Therefore, quantifying the value of cultural services is a very complicated case for statistics, which would require a direct measurement of the increase in welfare caused by ecosystem services. There is no agreed set of rules for taking into account the increase in welfare caused by the cultural services and integrating it into the statistics. But ignoring the welfare services and values can lead to considerable welfare losses. One option to avoid this is to consider the financial equivalent of the change in welfare provided by ecosystems in values of ecosystem services.

The valuation of ecosystem services and respective semantics is currently an area of major development needs. The input of the London Group to the question of the plural values and the scope of the reporting of ecosystem accounts is desired.

The interpretation of the trends in supply of ecosystem services

How to interpret the trends in the supply of ecosystem services? Is more better by default or is there a need to define the directions of the trends? Preferably trends for each trend should be considered separately. Use of the criteria "more is better" for the ecosystem services should be considered carefully because of the absolute nature of the statement.

For ecosystem services which are traded on market, both physical and monetary values are easily available. These statistics cover mainly provisioning services. If the trend of the supply of these services show mainly growth this indicates that nature is providing more materials to the society.

The opposite is true for the regulating ecosystem services. Regulative services often become visible only when the supplying limits have been reached. In contrary to provisioning services a lot of the regulating ecosystem services/functions are deteriorating rapidly even considering Planetary Boundaries[6]. For example, stabilizing the climate or natural purification of the water. The statistics for regulating services are more difficult to compile and interpretate. Monetary data need to be identified and estimated using indirect methods.

The interpretation of the trends differs in case of the valuation of the ecosystem services in monetary or physical terms. When evaluating the economic value of regulating and especially recreational and cultural services of ecosystems, it must be taken into account that these are not constant quantities that depend on ecosystems alone. For example, the values of regulatory services depend on how many pollution units there are in the environment, which the assessed service renders harmless (neutralizes). For pollutant units such as CO2 that have a unit price, the monetary equivalent of the ecosystem service of sequestration of CO2 also depends on the unit price of CO2.

In the case of recreational and cultural services, the value of the service depends on the number of its consumers. If the value of an ecosystem service is found by measuring changes in the welfare of consumers of the service (contingent valuation method), then the value of the service depends on the number of individuals whose welfare is enhanced by the service. Thus, the monetary equivalent of the recreation service value of similar ecosystems (for example, a recreational forest) can differ more than ten times between Estonia and the Netherlands. Thus, the monetary equivalent of the value of ecosystem services depends very strongly on the time and place, i.e. on the specific conditions where the observed ecosystem provides the service. Therefore, the value of ecosystem services must be approached on a case-by-case basis, and special care must be taken when applying the value transfer method in the assessment of ecosystem services.

In conclusion, the interpretation of the trends should be clarified for each service (or service type) separately and the links between the trends of the values of ecosystem services and ecosystem condition and assets should be clarified as well.

How to reflect the multitude of indicators involved in the creation of ecosystem services

The ability of ecosystems to provide services depends on the interaction of closely related elements both within an ecosystem and between ecosystems. Statistics cannot reflect all the complexity and multi-layered relationships between elements related to ecosystem services because of the limitation of both data and financial resources. Therefore, it is important to find a compromise between the multitude of indicators involved in the creation of ecosystem services and the practical possibilities of statistics. For the sake of truthfulness (correspondence to reality) of ecosystem services statistics, it would be extremely useful to define and map such ecosystem condition indicators which are currently

[6] https://en.wikipedia.org/wiki/Planetary_boundaries

outside official statistics but are of great importance in ensuring the quality and quantity of ecosystem services.

An example can be given here of a forest ecosystem, where a whole spectrum of ecosystem services is supplied. The quality and diversity of forest ecosystem services depends on many factors, two of the most important can be expressed by the canopy coverage (which is the main criterion of a forest) and the age and height diversity of the trees that make up the forest. The ecosystem accounting currently considers canopy coverage but not forest stand layers/structure. As a result, a tree plantation and a multi-storied natural forest can have a similar status in statistics. At the same time, the spectrum of ecosystem services provided by natural forest with several layers is much greater but it is not reflected in the statistics. Thus, it can be argued that the diverse structure of forest is a critical factor in the provision of ecosystem services and the failure of including it does not allow for a correct value assessment of forest ecosystem services.

A short, agreed list of the condition indicators is planned to be included for regular reporting in the EU (in the proposal of the ecosystem accounts module of regulation EU 691/2011) and Statistics Estonia has by now produced the first round of these condition indicators for the last available year. Additional potentially relevant indicators were analysed together with main partners and experts in the field in Estonia. The additional indicators could improve the coverage of the important parameters of ecosystems. In principal, several of the proposed indicators for monitoring the extent and condition of habitats could be associated with ecosystem accounts, such as the area of urban green space and the coverage of tree canopies in cities, abundance and diversity of pollinator species, grassland butterfly index, organic carbon stock of mineral soils of agricultural lands, share of agricultural land with diverse landscape elements, farmland bird index, dead wood, age structure of forests, coherence of forests, forest bird index. The reporting has to be harmonized and developed in coming years as currently reporting has been scheduled for 2031. These indicators and methods will be discussed in more detail during the following years in the work on ecosystem accounts.

Statistics Estonia would be responsible for the production of the statistics for ecosystem accounts, but other institutions in Estonia have their role in providing input data depending on the specific role and the needs of the proposed amendment of the regulation on environmental economic accounting ecosystem accounts module. Condition account which was developed in Statistics Estonia in 2023 was largely based on the data from Estonian Environment Agency, but also on data from Estonian Environmental Research Centre regarding spatial data for the concentration of PM2,5 and State Forest Management Centre regarding the tree cover density. Experts from national institutions provided both useful knowledge and data for the compilation and modelling of the condition indicators and service values.

It has been considered essential that the most detailed data and statistics need to be assembled and stored in order to allow further analyses to be carried out and published. Therefore the most detailed data are always needed from the partners and subsequent analysis or aggregation to more general level can be done in Statistics Estonia without the least loss of information. In future after the full content of the reporting has come into the force, the goal would be that a uniform system for regular compilation of ecosystem accounts would be established, and agreements made concerning the format and transmission of input data from partners.

The relation between the condition of the ecosystem and the ability to provide the services is important to highlight because services depend on condition and ecosystem good status is precondition for supplying services.

Alternative approaches to be considered: role of the models, visualization and storytelling

Role of the models, visualization and storytelling in providing the context is increasingly important in dissemination of statistics. Processes in ecosystems are interconnected and quite often the complexity cannot be generalized. As valuation methods give different numerical results there is a need to put the ambivalent information in perspective. Scientific knowledge could help to create the context and semantics around these ambivalent results.

The partnership with scientific community is important as the field is advancing quickly. Estonian scientists have started to propose valuation methods on ecosystem services and give their opinions on applied valuation methods. Scientists have highlighted that it is, as a rule, difficult to capture the economic value of regulative services which are important for maintaining our living environment. For example, to understand carbon cycle and the interconnected global climate regulation services, different asset types, long-term assets, short-lived assets and circulating carbon, have to be included in the model. All of these need simultaneous consideration but quite often are valued by different valuation methods; however different valuation approaches give different results.

For example when looking at the carbon market to find the carbon retention service value, it can be seen that, the EU ETS carbon price has varied quite a lot from 5 – 100 EUR CO2/t over the years. This price (now around 85 EUR CO2/t) gives the value of around 300 billion euros for accumulated carbon in protected areas and 900 billion euros in other assets in Estonia. Value of the ecosystem service based on social cost of carbon (which summarizes the costs related to climate changes) gives higher values as the price is higher: the average price is 185 USD CO2-SC/ton ($44 – $413 t CO2: 5%-95% strict, 2020 USD)[7]. When applying avoided damage method and using the price, which according to the IPCC is necessary in order to keep climate warming below 1.5 °C, then the price is up to 5500 USD/t CO2 till 2030 and up to 13,000 USD/t CO2 till 2050.[8][9]

The previous example highlights well how complicated and multiple the valuations might become. In order to communicate complicated issues also the narratives and storytelling could be used as an option for wider public. There is an old Estonian saying that when you tease a field once, the field teases you back nine times harder. This illustrates how bad management practices can ruin the balance easily and lead to the deterioration of the ecosystem. Following the meaning, one of the scientists has suggested a unit “teasing” or “cheating” in case of the violation of the ecosystem management practices leading to erosion, eutrophication, decrease of recreation values. One time of violation of the ecosystem management practices could lead to the multiple simultaneous drawbacks regarding several ecosystem services.

Discussion, conclusions and areas of further development

From the perspective of the communication on ecosystem accounts, the quality and semantics are important as described and stated in the paper. As the field is still in development the concepts are not yet fixed. Also the concepts of this statistics are not familiar to the users, like experts in environment management and planning, users in relevant ministries and also for wider public. The dissemination and introduction of the ecosystem accounts via the routine publication procedures however has started and the accompanying metainformation is needed to support and interpret the data.

The development of the headline indicators depends mostly on those who define the policy in the area related to ecosystem and habitat monitoring. The results of the CBD taskteams on indicators would be important as headline indicators will serve as a significant component in the communication in the area of biodiversity protection in future. However, both detailed or aggregated values of ecosystem services dynamics per area or population could also be regarded as indicators depending on its relevance to users. Hence the development of the semantics for all components of accounts is important.

More advanced sections of ecosystem accounts have no major conceptual issues regarding the communication and of the presentation of ecosystem extent account. In the case when there are several ecosystem maps produced nationally, the technical differences between the results and maps should be explained. It is important that the information in administrative and statistical institutions is in

---

[7] Rennert et al., 2022: https://doi.org/10.1038/s41586-022-05224-9.

[8] ELME seminar: https://www.facebook.com/Keskkonnaagentuur/videos/177915928453601, 4:00:00

[9] Helm, A., Kull, A., Veromann, E., Remm, L., Villoslada, M., Kikas, T., Aosaar, J., Tullus, T., Prangel, E., Linder, M., Otsus, M., Külm, S., Sepp, K., 2021. Metsa-, soo-, niidu- ja põllumajanduslike ökosüsteemide seisundi ning ökosüsteemiteenuste baastasemete üleriigilise hindamise ja kaardistamise lõpparuanne. ELME projekt. Tellija: Keskkonnaagentuur (riigihange nr 198846). http://loodusveeb.ee/en/countrywide-MAES-EE-condition-and-services-terrestrial

compliance when spatial data are used in decision making regarding the management of the ecosystems and the use of ecosystems.

Less advanced areas of ecosystem accounts (like ecosystem services accounts) have major issues regarding the communication. Suggestions for solving some of the issues are outlined below.

In general,

1. There is a need to accompany the figures on ecosystem service values with the notions on what they capture and what they do not capture. Figures on ecosystem services values without the explanations are considered a risk: the meaning could be ambivalent on current stage of the knowledge.

2. The direction of the trends of the supply of ecosystem services should be indicated from the perspective of sustainability as suggested in IPBES report. This report suggests prioritizing the maintenance of the ecological features and biodiversity from the viewpoint of future values.

Regarding the scope of ecosystem services,

3. The broad scope of the ecosystem and services is important to consider: for example, pollination is not just important for agricultural crops. Currently probably the lowest pollination service values are accounted because only the pollination of agricultural crops is included in the accounts. In case of the monetary valuation of pollination ecosystem service using market price methods, the scope is narrowed down to the crops for which market exists. For several ecosystem services there is no market and these non-market values are missing from traditional accounting. The contribution of ecosystem services to the economy needs clarification as there is not yet clear distinction where the ecosystem contribution begins. A considerable input is expected from the scientists in this field. There is a threat that underestimating the natures contribution could send wrong signals to those who make the management and resource use decisions.

4. If ecosystem services have different nature, this needs to be explained, for example describing provisioning services as the ones related to the use values created by ecosystems and other services related more to the common goods "regulative services" as ecological economics considers it.

5.Typology should be linked to the scientifically agreed categories of the values such as use values and non-use values[10] Instrumental and intrinsic values is another dimension to consider.

Regarding interpretation of messages,

6. Interpretation of messages is important not only for decision makers in policy but also for broader audience. How to interpret the trends in supply of ecosystem services? As was described, the decrease in trends in the supply of provisioning services may reflect lower pressure on the use of resources (this can, for example, also be a monitoring target, e.g the reduction of the felling's or crop production), while the decrease in the supply of regulative services describes the lower ability of the ecosystem to provide regulation (usually not a target). Short- and long-term trends (wished targets) may also have conflicting nature.

7. Aggregated indicators are important, but the oversimplification is a threat as well.

8. The interpretation of the trends differs in case of the valuation of the ecosystem services in monetary or physical terms. When evaluating the economic value of regulating and especially recreational and cultural services of ecosystems, it must be taken into account that these are not constant quantities that depend on ecosystems alone. Influence of the prices on the value of ecosystem services and the relation to ecosystems needs explanation.

[10] e.g Turner, R.K. 1999. The place of economic values in environmental valuation. In I.J. Bateman and K.G Willis, eds, valuing Environmental Preferences. Oxford University Press, Oxford.

Regarding monetary valuation,

9. The concepts and semantics of the monetary valuation of ecosystem services need to be agreed upon. The controversial area of monetary valuation needs concepts that are as clear as possible. Monetary valuation methods need to be described and agreed upon as much as possible and when the results are published, these should be presented alongside with the descriptions of used methods.

Methodological work for resolving the “outstanding methodological aspects” of the SEEA EA in statistical system has started but needs to be taken further.

The recently published analyses “Beyond valuation. Monetary aggregates for the SEEA-EA. The Italian proposal” outlines some options for further development of this area which could be addressed in next year London Group work.

10. If the broader range of the values is important to consider, the inclusion of the wider scope of the welfare values should also be regarded.