Accounting for Nature: *Developing ecosystem accounts when "the respondent" cannot speak*

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Abstract

This paper demonstrates how ecosystem accounts relate to other statistical accounts and how they complement each other. It also discusses opportunities and challenges in implementing ecosystem accounts in national statistical offices (NSOs). A core principle of ecosystem accounting is that it should be spatially explicit. The use of maps for statistical purposes is under rapid development, and data sources like satellite data are becoming increasingly relevant. This development creates opportunities to integrate more geospatial data as well as a potential to present part of the result as maps, complementing the tables.

In the compilation of ecosystem accounts, spatial and statistical data for the EU is facilitated by Eurostat. However, due to the uniqueness of the Nordic countries, with distinct geographic, climactic, and administrative characteristics, further adaptation is necessary. Data and statistics on ecosystems needed for the compilation of ecosystem accounts are often situated outside NSOs. Using Norway and Finland as examples, this paper highlights the importance of interdisciplinary and cross-sectorial cooperation, an essential part of the development of data and the compilation of ecosystem accounts. In Norway, the NSO work closely with the Norwegian Environment Agency and research organisations. In Finland, the Finnish Environment Institute and Natural Resource Institute are key partners for the NSO.

Implementing ecosystem accounts in the EU, based on the new statistical framework System of Environmental Economic Accounting - Ecosystem Accounting, demands new approaches to data collection and the incorporation of new types of data. In comparison to other related accounts, such as air emission accounts and national accounts, there is no common unit that applies to the entire accounting framework. This illustrates the complexity and the methodological challenges on how to measure ecosystems and nature in a comparable and harmonised way. The new statistical framework offers solutions to address this issue.

Keywords: Ecosystem accounting, Nature, Geospatial data, Cooperation, New data.

1. Introduction

The System of Environmental-Economic Accounting – Ecosystem Accounting, establishes ecosystem accounts as part of official statistics, and assigns National Statistical Offices (NSOs) a coordinating role (United Nations [UN] et al., 2024). Unlike most other statistics, SEEA EA is spatially based, linking data to geographical locations. This has implications for data structures, methods, and presentation of statistics.

Official statistics traditionally rely on data reported by identifiable units such as households, firms, or public institutions. Ecosystem accounting challenges this model, as ecosystems cannot self-report (United Nations Statistics Division [UNSD], 2025). This creates challenges for data collection, measurement, and institutional responsibilities.

These challenges are especially visible in the Nordic countries, characterized by large areas, diverse ecosystems, and low population density, which require adaptation of EU-level data sources, classifications, and methods. Much of the data needed for ecosystem accounting is held outside NSOs, typically by environmental agencies and research institutions with different mandates and production logics than official statistics. This makes close collaboration with environmental management authorities, relevant data suppliers, and research institutions essential due to its spatial and cross-cutting nature.

This paper examines how ecosystem accounting relates to and complement other statistical accounts. Using Norway and Finland as examples, it analyses how cross-sectoral and interdisciplinary cooperation has been organized in practice, and discusses the use of geospatial data, maps, and new data sources to complement traditional tabular outputs.

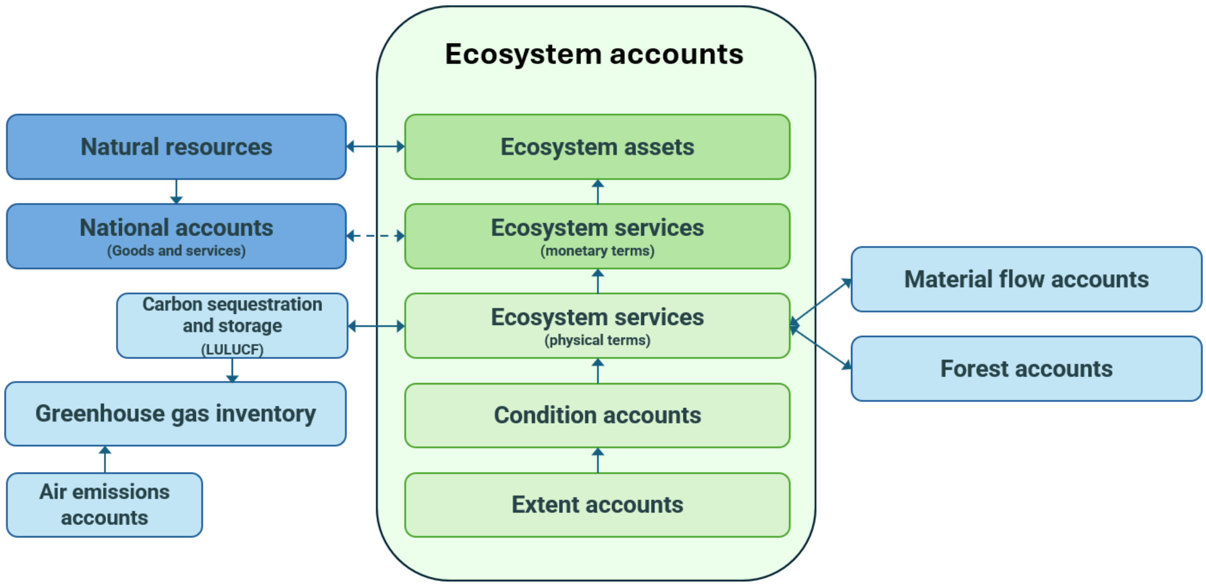
2. The SEEA Ecosystem Accounting framework

The SEEA EA was developed and implemented through a collaboration between the UN Statistical Division, NSOs and other international bodies, and adopted in 2021. The framework establishes NSOs as central role to the management and development of national ecosystem accounts (UN et al., 2024, para.1.51), ensuring the use of recognised statistical methods and principles to assure the reliability, credibility and independence of the ecosystem accounts, in line with code of practice, while also enabling linkages and coordination with other statistics such as environmental and economic accounts.

SEEA EA is a spatially based, integrated statistical framework for structuring information on ecosystems, their extent, condition, and the services they provide society (UN et al., 2024). It complements the SEEA Central Framework (SEEA CF) (UN et al., 2014) and applies the accounting principles of the System of National Accounts (SNA) 2008 (UN et al., 2009). The ecosystem accounts are built up by five core accounts: extent accounts, which classify ecosystem types within an accounting area (ex. a country or region) and track change over time; condition accounts, which measure ecosystem condition through a set of indicators; ecosystem services accounts, which record the supply and use of ecosystem services; ecosystem services in monetary terms; and the monetary stock (capital) of the services. Unlike related accounts such as air emission accounts and national accounts, there is no single common unit of measurement across the framework. Instead, different units of measurements apply depending on which part of the accounts is in focus, with ecosystem types serving as the common denominator tying the five accounts together.

Figure 1 illustrates the five accounts and their links to other accounts, including national accounts (via ecosystem services in monetary terms) and material flow accounts, forest accounts, and the greenhouse gas inventory, where common units apply (via ecosystem services in physical terms).

Figure 1. Ecosystem accounts and the connection to other accounts



3. Compiling ecosystem accounts: New Data Sources, Measurement, and the Nordic Context

At the EU level, Eurostat provides a common spatial and statistical infrastructure that supports ecosystem accounting across member states. For the Nordic countries, this offers a baseline, but geographic and climactic characteristics of Norway and Finland require national adaptation of EU-level data. The SEEA EA framework cuts across disciplines, affecting how data are compiled, integrated and presented. The spatial dimension ranges from detailed spatial approaches to more aggregated overviews, with the chosen level of resolution depending on data availability, policy priorities, and resources. This resolution is expected to improve over time as data sources, methods and technologies develop (UN et al., 2024, para. 1.57-58; 3.1-2).

Spatial input and output data

The compilation of ecosystem accounts typically starts with ecosystem extent accounts, which provides a statistical and spatial frame for the subsequent condition and ecosystem service accounts (UN et al., 2024, paras. 1.59; 4.5). These rely on geospatial data, including land cover and land use maps, and satellite data. While global data sets, or EU-level data, can serve as an initial input for this step, national ecosystem accounting requires adaptations to national definitions, classifications, and data needs (UN et al., 2024, paras. 3.65;3.75-76). A practical illustration is provided by recent Eurostat grant projects on the crop pollination ecosystem service, in respectively Sweden, Finland and Denmark, which combined land cover maps with species distribution models to estimate the spatial supply of crop pollination. The experience reveals shared challenges and solutions in data harmonization and model selection[1].

Ecosystem accounts also draw upon data that feed other environmental accounts, such as air emissions, land use, water, and energy accounts, as well as Eurostat reporting streams such as LULUCF and Material Flow Accounts (UN et al., 2024, Chapter 5.1). This creates opportunities for consistency and efficiency but also risks double-counting and misalignment across classification systems and reference periods that must be carefully managed. Outputs from ecosystem accounting can be presented as both maps and tables, where maps can

[1] Will be presented in the same session at the Nordic Statistical Meeting 2026

communicate a spatial heterogeneity, such as patterns of changing ecosystem fragmentation, which are not evident in tabular form (UN et al., 2024, para. 4.32). This expands the policy relevance of such accounts and requires NSOs to develop GIS infrastructure and dissemination capacities that go beyond traditional statistical practices.

Methodological Complexity and Measurement Issues

Beyond the spatial dimension, ecosystem accounting faces a fundamental measurement challenge: extent, condition and ecosystem service accounts are expressed in distinct units (area, biophysical indicators, and service measures respectively), with no single unit capable of aggregating across them. This contrasts with related accounts such as Material Flow, energy, and air emission accounts, which all rely on an established common unit (e.g. tonnes, petajoules, CO2-equivalents).

The absence of a common unit in ecosystem accounting reflects the heterogeneity of what is being measured, which creates comparability challenges. Within a single account, it is difficult to assess whether improvements in one dimension of condition set off deterioration in another, or whether gains in one ecosystem service come at the expense of others, since condition indicators or ecosystem services cannot simply be added up. Between countries, comparability also depends on consistent indicator choices and modelling approaches. Reporting under Regulation (EU) 2024/3024, due from 2026, addresses this by specifying common ecosystem typologies, indicator sets and accounting boundaries, while SEEA EA addresses the issue through principled design, where extent, condition and service accounts can be compiled and interpreted separately.

More fundamentally, these constraints reflect a broader critique: applying strict accounting rules to highly complex systems may lead to errors or a misleading picture of how nature really functions. Transparency about the uncertainties is therefore essential to using and interpreting them responsibly.

The Nordic Context

Nordic adaptations of ecosystem datasets are necessary because the region’s ecological, climatic, and socio-economic characteristics differ markedly from other parts of the world. Forests are highly dominant compared to other regions, affecting the structure and functioning of ecosystems, meaning that datasets must accurately reflect forest-heavy landscapes to capture key processes such as biomass accumulation and biodiversity patterns. Peatlands play an especially important role in Finland due to their carbon sequestration and storage capacity, while in Norway, delineation of mountains is central to condition accounts. Cooler temperatures and shorter growing seasons further shape ecosystem services such as pollination. Generic datasets risk underestimating or misrepresent these functions if they are not specifically calibrated to Nordic conditions.

Societal and land-use factors add further complexity. Preferences related to nature and its use, such as outdoor recreation and nature-based tourism, can vary regionally and influence how ecosystem services are valued and utilized. Without incorporating these factors, datasets may not fully represent the human–nature interactions that are important in the Nordic context. Forest management practices and agricultural systems, central to Nordic land use, influence outputs such as wood provision and crop provision in distinct ways.

Nordic-specific adaptations thus ensure that ecosystem datasets are ecologically realistic and relevant for decision-making, improving their usefulness in policy, management, and sustainability assessments, though at some cost to comparability with countries outside of the Nordic context.

4. Organisational Models and Cooperation

Traditionally, NSOs have produced official statistics largely independently, by collecting data through surveys, administrative sources, or other sources such as commercial and geospatial data (UNSD, 2025). New technologies and data sources have increasingly pushed NSOs towards a role as service providers and data stewards, facilitating collaboration across different communities.

According to the SEEA EA, there is arguably no statistical domain that demonstrates the potential of NSOs to serve as data stewards more than with ecosystem accounting (UN et al., 2024, para. 1.51). This collaborative approach has been adopted in Norway and Finland, with the production of ecosystem accounts relying on close and well-coordinated collaboration between multiple public authorities, with environmental agencies playing a particularly critical role. These agencies are essential because they hold much of the primary environmental data and the subject-matter expertise needed to interpret it. However, the data required for ecosystem accounting is fragmented across institutions, lacking a complete overview, and was often not originally produced for statistical purposes, but as individual studies, surveys, and thematic assessments. Transforming these materials into consistent, high-quality statistical outputs suitable for ecosystem accounting requires close cooperation between the NSOs and their respective data-producing agencies.

To support this work, a broader collaboration network has been established for environmental accounting in Finland, and for ecosystem accounting in Norway. These networks bring together both data producers, such as the statistical office and environmental authorities, and data users, including ministries, researchers, and actors from the public and private sectors. This ensures that ecosystem accounts are not only technically sound but also relevant for policymaking, research, and practical applications.

At the same time, this collaborative approach involves challenges. National information needs and the differing objectives of participating organisations regarding ecosystems and ecosystem accounts do not always align with the requirements set by statistical regulations, requiring careful balancing of priorities and allocating of resources. Ecosystem accounting in Finland and Norway is built on a complex but essential system of inter-agency cooperation, enabling the integration of diverse data sources into a coherent statistical framework.

5. Concluding Remarks

This paper has demonstrated how ecosystem accounting departs from traditional official statistics: ecosystems cannot self-report, no single common unit applies, and the framework is spatially explicit. These features shift NSOs toward roles as coordinators and data stewards, integrating data from environmental agencies and research institutions into consistent statistical systems. The Norwegian and Finnish experiences show this is feasible, provided strong collaboration networks are in place to support data integration, quality assurance, and consistency across accounts. The Nordic context further highlights the need to adapt EU-level data and methods to specific ecological and societal conditions, with implications for international comparability. Returning to the title question, the Nordic experience suggests that institutionalized cooperation allows environmental and statistical expertise to substitute for the missing voice of the respondent, while NSOs safeguard statistical quality and coherence.

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