Overview of the MAIA innovation tasks' outcomes (WP4)

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WP4. Test innovative approaches for natural capital accounting in the European context

- **Deliverable D4.6:Final report on progress made with innovations in MAIA, and contributions to the implementation and development of a global standard for SEEA EEA**

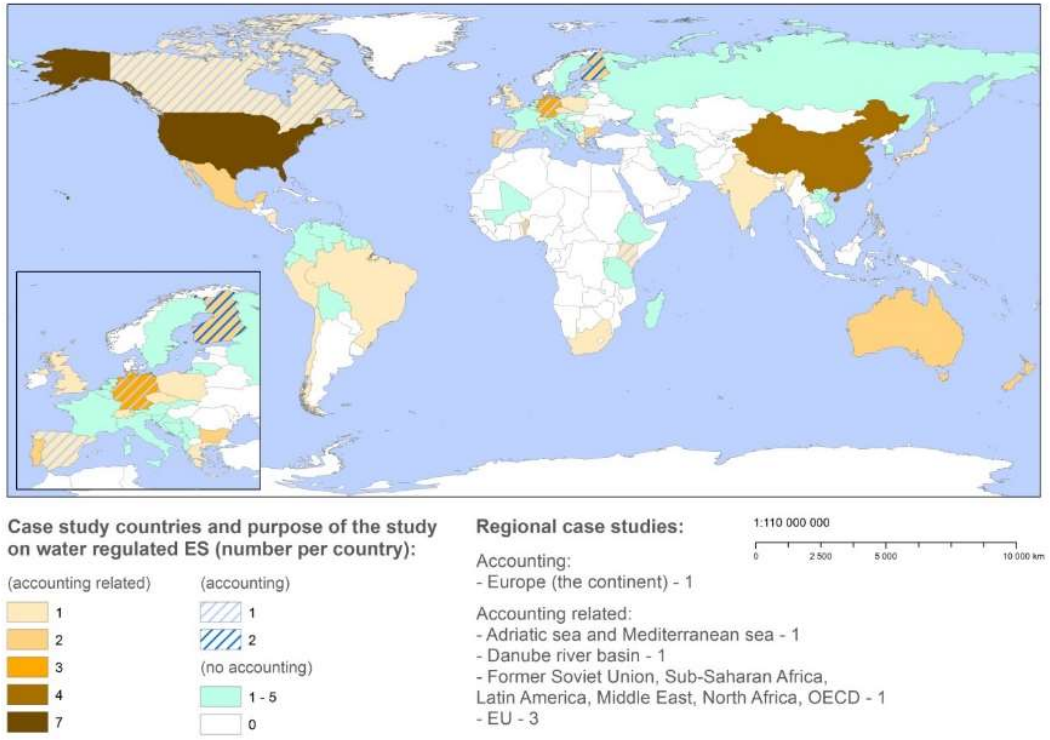
WP4. Test innovative approaches for natural capital accounting in the European context

- **Task 4.1 Modelling water regulation services in support of ecosystem accounting** (lead partner: NIGGG-BAS, contributing partners: LUH, URJC, UPAT, CzechGlobe).
- **Task 4.2 Exploring big data sources for quantifying cultural services** (lead partner: CBS + WU, contributing partners URJC + SarVision)
- **Task 4.3 Valuing Ecosystem Services and Ecosystem Assets (**lead partner: CSIC, participating: AgroParisTech, VITO, CBS, EV-INBO, NINA, WU, BfN)
- **Task 4.4 Biodiversity accounting** (lead partner: WCMC, partners SYKE, VITO, NINA, EVINBO, UPAT, CBS, BfN)
- **Task 4.5 Piloting Marine accounts** (lead partner: SYKE, contributors AgroParisTech, CBS)

Task 4.1 Modelling water regulation services in support of ecosystem accounting

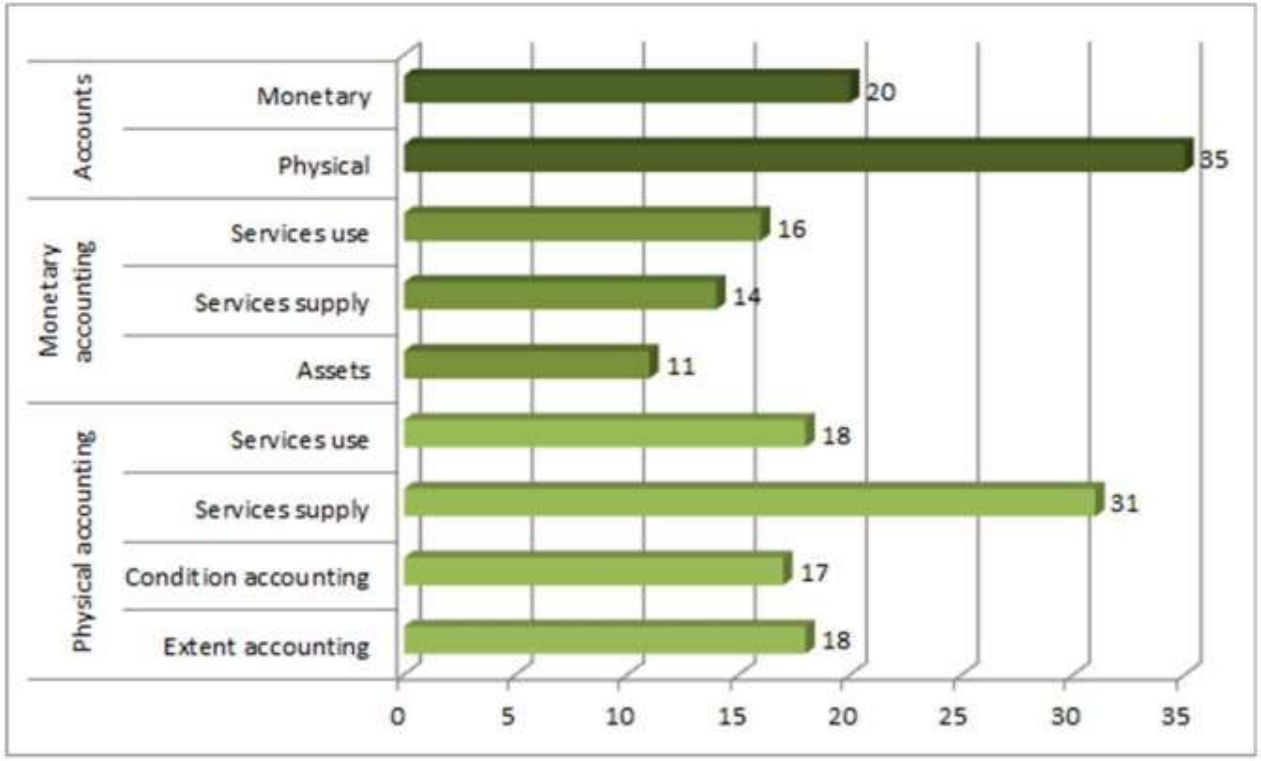
- Water regulation is considered as one of the main regulating ecosystem services by SEEA-A. It includes water retention, storm and high water protection (including flood control) and it is also closely related to erosion and sedimentation control, as well as water purification
- Review of the existing modelling approaches for water regulation. Sistematic review of different sources to:
  - identify models for water regulation;
  - identify water regulation services which can be assessed by modelling;
  - define the main characteristics of the models in relation to ecosystem accounting.
- The predominant number of papers was related to physical accounting while monetary accounting was less studied.

Task 4.1 Modelling water regulation services in support of ecosystem accounting



Spatial distribution of the case studies by countries .

Task 4.1 Modelling water regulation services in support of ecosystem accounting



Task 4.2 Exploring big data sources for quantifying cultural services

- Big data applications in ecosystem accounting include the use of remote sensing data for extent and condition accounts, as well as various social media platforms that can provide data on people's physical location, activities, and preferences.
- Big data from social media platforms provides an opportunity to produce new spatially explicit statistics on cultural ecosystem services (CES).
- A novel conceptualisation of cultural ecosystem services in the context of big data and the SEEA EA was developed, following a review of existing conceptualisations and big data sources.
  - Several models using this conceptualisation were developed in the Netherlands.

Task 4.2 Exploring big data sources for quantifying cultural services

- Big data by itself is difficult to interpret, mostly due to its volume and velocity. Capturing CES using big data therefore requires the development of methods which can process these large quantities of data. To respond to these challenges, the working group has turned to artificial intelligence, or ‘AI’,

- Social media and AI-based models of aesthetic landscape quality were developed, and their accuracy were tested using a crowdsourced survey in Great Britain.

- This novel modelling approach was found to generate a high level of accuracy, independence of the scale of measurement and a direct measure of individuals’ aesthetic enjoyment, an important methodological feature in the context of ES modelling.

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

- The use of simulated exchange values in ecosystem accounting has been discussed, illustrating the discussion with a regional application in Andalusia (Spain), a local application in Oslo (Norway) and an ongoing national application in Spain.
- The SEV is basically an extension of the approach proposed in §3.123 in the SNA of using prices from simulated markets where none presently exist.
  - The applications developed within the MAIA project show that the method can be applied at large scale (Campos et al., 2019a, 2021). Relationships to alternative approaches and a more solid foundation of the method have also been analysed and developed (Caparros, 2022, Caparros and Oviedo, 2022).

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

- Intermediate product and own intermediate consumption in monetary ecosystem services, and the role of enhancement/degradation and different assumptions in asset accounts are also discussed, using a regional application to Andalusia (Spain) as an example (Campos et al., 2019b).

- The role of enhancement/degradations in asset accounts are analysed using the same application as an example (Campos et al., 2020).

- Relationships between the accounting methodology developed by CSIC's team and the SEEA EA can be found in Campos et al. (2020 and 2022).

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

- Alternatives for the valuation of stormwater retention services for urban ecosystem accounts are also presented and applied.
  - Physical ES and monetary accounts for changes in Oslo's built zone over the period 2015-2019 are computed.
  - An institutional design simulating a stormwater retention fee is proposed, where the stormwater run-off fee level depends on the rights allocation assumption that properties are responsible for run-off from their property.
  - A combination of monetary valuation methods are used to simulate fees that would cover the full municipal costs of stormwater run-off: (i) collection and treatment costs of combined stormwater overflow (CSO), (ii) future costs of expanding CSO costs to meet run-off with climate change and (iii) water pollution costs of unmitigated CSOs.

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

- In a further study from Oslo, MAIA explored tools for value generalization from a few study locations to a whole accounting area.
  - A Bayesian network model is used to generalize the value of regulating services from municipally managed trees to all tree canopy in Oslo (Norway).
  - The Bayesian network is used to summarizes the non-parametric correlation patterns between tree canopy extent-condition, regulating services as computed by iTree Eco for selected sites, and the monetary asset value per tree and per canopy unit area.

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

- The use of restoration and maintenance cost approaches as an alternative indicator to SEEA EA recommendations for computing exchange values is discussed conceptually, and applied to marine ecosystems in France.
- Cost-based approaches aim to assess the costs required to protect ecosystems, but also the cost of in-kind restoration of the degradation of natural capital, to maintain a constant level of natural capital at a relevant scale.

Task 4.3 Valuing Ecosystem Services and Ecosystem Assets

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  - Cost-based approaches aim to assess the costs required to protect ecosystems, but also the cost of in-kind restoration of the degradation of natural capital, to maintain a constant level of natural capital at a relevant scale.
  - The goal has been to experiment with the implementation of ecosystem accounts on a national and regional scale, using the unpaid restoration costs method and the good ecological status defined by the Marine Strategy Framework Directive.
  - The net present value of the projected difference between the restoration costs needed to bring ecosystem condition to good ecological status, and the current ecosystem maintenance costs, is defined as “ecological debt”.

Task 4.4 Biodiversity accounting

- The SEEA EA describes thematic accounting for biodiversity as one of four themes in Chapter 13. Integrating national biodiversity monitoring data in the SEEA EA via thematic 'Accounting for Biodiversity' can support more coherent environmental-economic policy responses to addressing biodiversity loss.
- However, there are limited real world applications that demonstrate this in practice.

Task 4.4 Biodiversity accounting

- How can existing national biodiversity monitoring processes (e.g., Norwegian Nature Index) be adapted for informing Accounting for Biodiversity and Ecosystem Condition Accounting?
  - established processes for reporting on the EU Nature Directives and National Biodiversity Indexes can support ecosystem accounting;
  - National IUCN Red List type assessments can be used to compile thematic 'Species Accounts';
  - species abundance and richness accounts developed from national biodiversity monitoring data can inform ecosystem condition and cultural services accounts;
  - where spatial referencing for national biodiversity data is limited, information on species can be assigned to different broad ecosystem types based on habitat preferences
  - structured frameworks such as Elite Index (Finland) and IBECA index (Norway) can be adapted to inform SEEA EA Ecosystem Condition Typology.

Task 4.4 Biodiversity accounting

- What specific biodiversity data items could be included in SEEA EA accounts (including Species) for better guiding decisions on biodiversity?
  - integrating red list assessment data can help inform a more integrated planning for achieving conservation objectives; (
  - compositional state indicators need to be included in Ecosystem Condition Accounts as other condition characteristics do not adequately reflect trends in species assemblages;
  - extended analyses by France and Germany allow for a “biodiversity debt”, underinvestment, and budgetary investments to be determined,
  - integration of thematic ‘Protected Area Accounts’ into SEEA EA will be helpful for decision-makers evaluating land use and sustainable development options,
  - biodiversity trends presented in ecosystem accounts need reference thresholds so decision-makers realise what is in good or poor condition
  - science based policy targets provide reference levels to track progress towards national biodiversity objectives, and allow to define the biodiversity debt.

Task 4.4 Biodiversity accounting

- There is a need for further experimentation and development of extended applications of the SEEA EA for mainstreaming biodiversity into planning processes.
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- Where links can be made to policy targets and thresholds indicative of good condition for biodiversity, this will be particularly useful for guiding decision-makers. Collectively, this can foster the potential of the SEEA EA to inform on developments that delivers better outcomes for biodiversity and people.

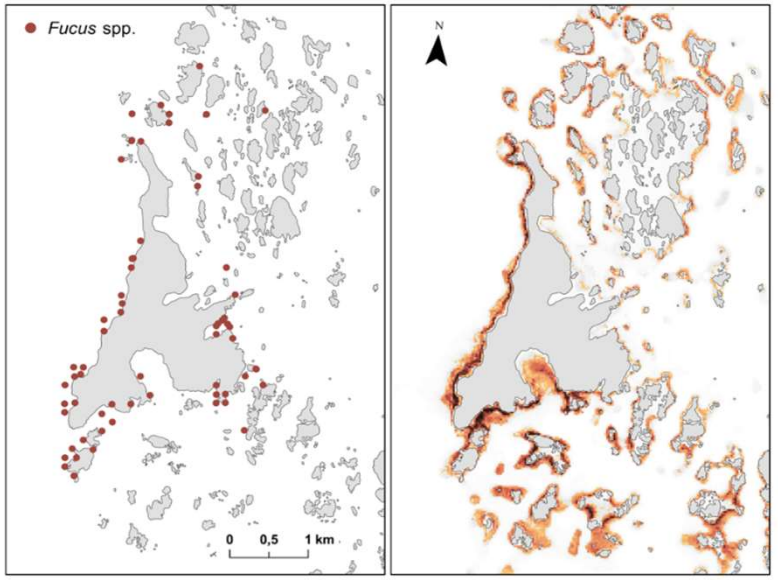
Task 4.5 Piloting Marine accounts

- The capacity of an ecosystem to provide services for humans depends on the area covered (i.e. extent) and its quality (i.e. condition).
  - Determining the present condition requires defining a reference condition against which the present state is compared. Good Environmental Status (GES) of the EU's Marine Strategy Framework Directive can be used as an example of existing indicators for reference conditions.
- MAIA researchers have developed two different approaches to develop biophysical marine ecosystem accounts. The first has been applied in Finland and the second in France.

Task 4.5 Piloting Marine accounts

The Finnish case study

- The marine ecosystem extent was assessed using an extensive underwater inventory data, collected by the Finnish Inventory Program for the Underwater Marine Diversity (VELMU) with ca. 170,000 sites visited.
- Approximately 200 species distribution models (SDMs) were developed for vascular plants, algae and invertebrates.



Task 4.5 Piloting Marine accounts

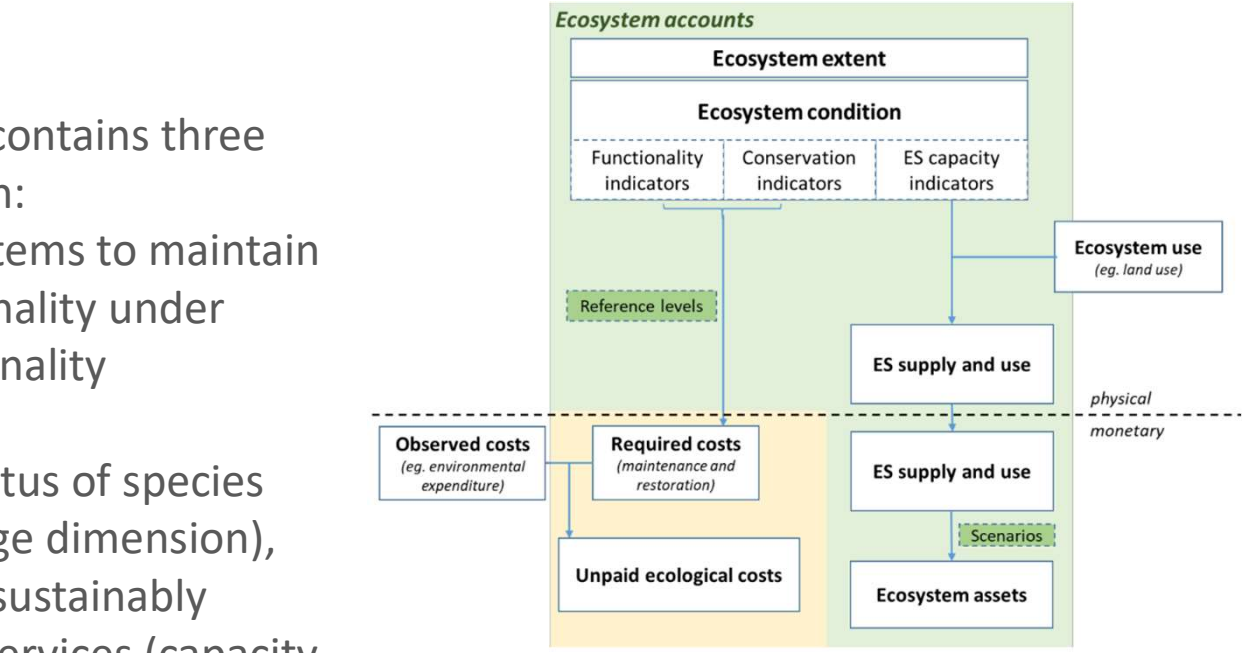
The Finnish case study

- By using SDMs, the geographical distribution (in km^2) of key species producing ecosystem services was assessed.
- The potential effects of human activities, such as costal construction, dredging, dumping, shipping lanes, anchoring areas, and artificial shorelines, were assessed based on expert estimates on the magnitude and intensity of pressures. The condition is reported for human activities which lead to direct habitat loss per grid cell.
  - For instance, small jetties which are on average 20 m^2, were identified from 58 850 grids. In this case, habitats lost (under the jetties) totals to 1,77 km^2.

Task 4.5 Piloting Marine accounts

The French case study

- The system of accounts contains three categories of information:
  - the ability of ecosystems to maintain their overall functionality under disturbance (functionality dimension),
  - the conservation status of species and habitats (heritage dimension),
  - and the capacity to sustainably provide goods and services (capacity dimension).



Task 4.5 Piloting Marine accounts

The French case study

- Physical damage caused by human activities was assessed based on a map of cumulative physical pressures that impact the marine environment (e.g. dredging, concrete building of the coastline, trawling).
- The ultimate aim is to assess costs required for the maintenance and restoration of the ecosystem extent and condition by comparing current observed costs and required maintenance costs (for reaching the ecological reference levels). This provides a measure of unpaid ecological costs.

Conclusion

- MAIA uses the System of Environmental Economic Accounting – Ecosystem Accounting (SEEA-EA) as the conceptual and methodological basis for NCA.

- In 2021 the SEEA-EA became a global standard for biophysical accounts.
  - MAIA researchers have contributed actively to the process that culminated with the publication of this landmark document
  - .
- However, the part on valuation of SEEA-EA 2021 was not adopted as a standard. This implies that research efforts in this direction are particularly valuable.
  - MAIA has contributed to further recommendations for monetary accounts in a separate report (NCAVES and MAIA, 2022), in collaboration with the UNSD NCAVES project.

- The SEEA-EA 2021 has established a research agenda for the next years which is completely in line with the different concepts and issues discussed above. The innovations presented here can be seen as a first step towards the implementation of this research agenda.

MAIA
Mapping and Assessment for Integrated ecosystem Accounting

Mapping & Assessment for Integrated ecosystem Accounting
Road Name, City Name, Post Code, Country
http://maiaportal.eu/

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