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MAIA
Mapping and Assessment for
Integrated ecosystem Accounting

The MAIA country fact sheets summarize the state of affairs on natural capital accounting (NCA) in the countries connected to the MAIA project. They serve as an accessible overview and entry point for collaboration. The factsheets describe the needs from policy, society, science and business for the use of NCA, give an overview of the ongoing and published research -including knowledge gaps- in the country, include contact details and an overview of national partners and stakeholders involved in the accounts. Information in this document is based on MAIA Deliverables and exchanges, and the content is reviewed, co-authored and updated by MAIA-liaison persons in the participating country. This version was updated on August 5th 2022.

Country fact sheet: Spain (ES)

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Summary

In Spain the development of Ecosystem accounts is seen as complementary to a broad range of national and international policy needs. They would contribute in particular to the SEEA-EA the proposed EU Regulation No 691/2011 as regards introducing Ecosystem accounts as a new environmental economic accounts module, the European Environmental Economic Accounts (EEA) and the EU and Spanish Biodiversity strategy. Currently the focus of policy is on the Environmental Economic Accounts as they have been recently rolled out in Spain and integrated in their national statistics. There have also been discussions, to connect the accounts to the economic sector.

Ecosystem accounts are being developed on two different levels: at the national level and at the regional level for Andalusia. At the national level, an ecosystem extent and a forest condition account have been developed. They are also working on a range of multiple ecosystem services and biodiversity accounts, and in the near future they will develop ecosystem asset accounts.

At the regional level and in Andalusia the focus has been to develop forest asset accounts in monetary terms that have been published, along with ES accounts, carbon and biodiversity accounts.

The main data gaps are related to evaluation and quantification of some ecosystem services, mainly regulating and some cultural. Otherwise, developing accounts in some specific ecosystem such as marine ecosystems present an additional difficulty. One of the main challenges is to improve the participation of institutions and to promote political and legislative actions.

Spain reports sufficient capacity and scientific information to implement SEEA-EA in the context of MAIA. Nonetheless, there is a need for training for some Spanish government institutions. Moreover, a simple guide of applications of the different accounts would be helpful for the process. Sharing experiences and systematic communication between the different MAIA partners will be very useful.

Country policy priorities for developing natural capital accounts

Based on MAIA D5.1 (Annex 10 section 3)

The development of the Spanish ecosystem accounts will contribute to the EU Regulation No. 691/2011 of 6 July 2011 on European Environmental Economic Accounts. The EU and Spanish Biodiversity Strategy as well as the Habitats Directive require each State to produce a six-year report on the provisions they have adopted for compliance. In Spain, this commitment is also an express mandate of Law 42/2007, of December 13, on Natural Heritage and Biodiversity. Ecosystem accounts will help achieve the goals set out in these strategies and directives. Furthermore, stakeholders also mentioned ecosystem accounts development to enable climate adaptation, monitor and reach the Sustainable Development goals (SDG) and the Convention of Biological Diversity (CBD).

The work under the Spanish National Ecosystem Assessment has already contributed to the accomplishment of some of the EU and Spanish Biodiversity Strategy targets. There have also been discussions, and regional pilots studies (i.e. Andalusia), to connect the accounts to the economic sector.



Pilot accounts under development

Summary table of national accounts

Account		Ecosystem Types / Ecosystem Services	Link to research
Accounts for ecosystem assets	Ecosystem extent account	All ecosystems*	García-Bruzón and Santos-Martín, forthcoming. http://dx.doi.org/10.1016/j.scitotenv.2021.152903 Bruzón et al. 2020
	Ecosystem condition account	Forest* Out of the MAIA scope	García-Bruzón and Santos Martín (in prep)
Accounts for ecosystem services	Ecosystem services supply and use table - physical terms	All ecosystems ES: Crop production, Livestock production, Timber production, Freshwater supply, Water infiltration, Soil fertility, Carbon storage, Nature recreation, Carbon stock and sequestration	González-García et al 2021. https://doi.org/10.1016/j.ecoser.2021.101397 & Santos-Martín, et al. 2018
	Ecosystem services supply and use table - monetary terms	All ecosystems ES: Landscape aesthetics	
		All ecosystems ES: Crop production, Livestock production, Timber production, Freshwater supply, Water infiltration, Soil fertility, Carbon storage, Nature recreation	Santos-Martín, et al. 2016
Thematic accounts		Carbon	García-Bruzón and Santos Martín (in prep)
		Biodiversity	García-Bruzón and Santos Martín (in prep)

State of development
Finished
Ongoing
None ongoing or published
*Highlighted in the fact sheet

Summary overview of highlight national accounting projects

Ecosystem Account for Spain

Scale of the account

National;

Involved and funding partners

Ministry of Ecological Transition (MITECO) and National Institute of Statistics of Spain (INE);

(Policy) Goal of the study

This study constitutes the first attempt at a national scale to integrate statistical data into a framework for organizing biophysical data, measuring ecosystem services, tracking changes in ecosystem assets and linking this information to economic and other human activity. This project will develop all the core accounts from the SEEA-EA framework and a biodiversity thematic account;

Ecosystems under study

All ecosystems but with more detailed information for forest ecosystems;

ES/thematic account under study

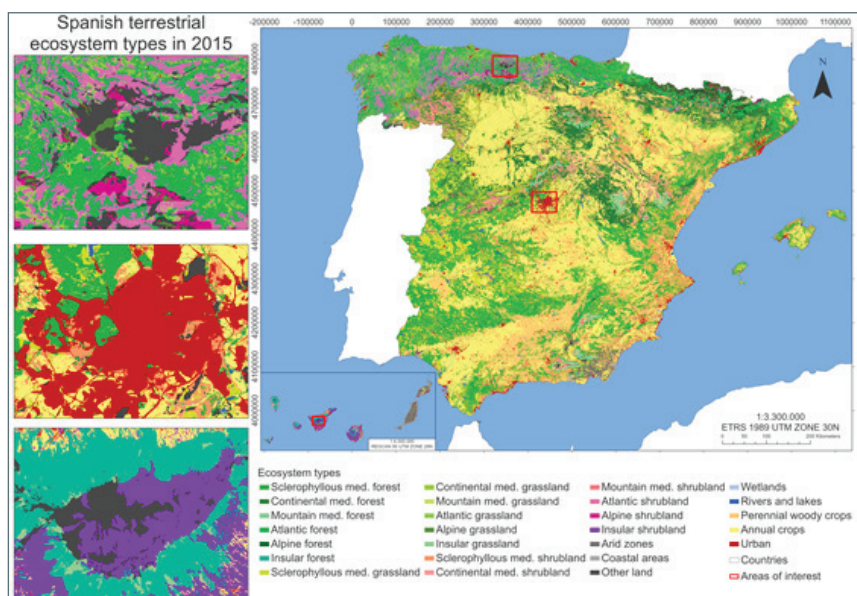
There are multiple ES under study and the thematic account for Biodiversity;

Methods and data used for the study (if relevant indicators used)

- Included new methods and data: National Ecosystem classification for Spanish Evaluation of Millennium Ecosystems
- Statistic approach for significative ecosystem flows
- Full condition SEEA-EA method. Indicators based on European databases and remote sensing
- Validation phase for extent
- Include innovative methods based on machine learning and deep learning

Approximate date of final results

End 2022.



Figure

Spatial representation of Spanish ecosystem types in 2015. Detail areas from top right to bottom: (I) 'Picos de Europa' National Park. (II) The city of Madrid.

(III) 'Teide' National Park.

● *An extent account proposal at the national level*

We present a novel approach to construct ecosystem extent accounts automatically from ecosystem type maps. The method includes a statistical method to measure the flows of spatial changes among ecosystems over time.

We developed the ecosystem extent account at a national level of 26 ecosystems (i.e. forests, grasslands, croplands, and urban, among others) between 1970 and 2015. This extent account is based on national ecosystem classification developed by the Spanish National Ecosystem Assessment and land use, land use change and forestry spatial cartography (LULUCF). Extent accounts were developed at a resolution of 25 meters and provided reliable information on how ecosystem types have changed over time in Spain.

This account has a number of potential applications: the management of natural areas and ecosystems, the integration of ecosystem accounting into national accounts, the fight against climate change and the evaluation of natural capital by the private sector, among others.

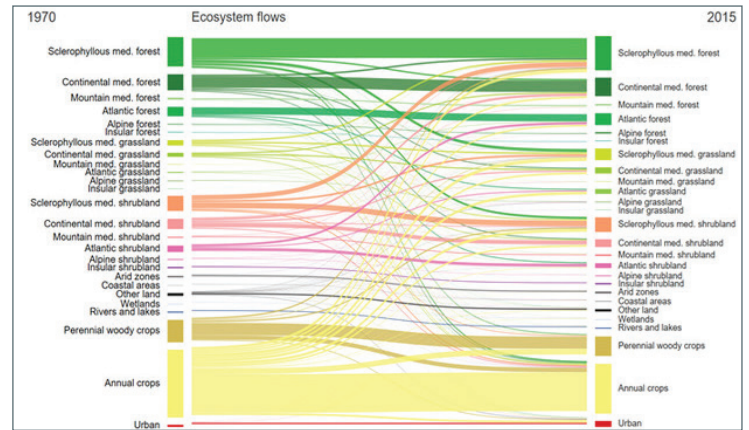


Figure
Representation of ecosystem extent changes and flows between 1970 and 2015 in Spain.

Table 1
Indicators used for measuring the forest condition accounts

ECT groups	ECT classes	Indicator
Abiotic ecosystem characteristics	Physical state	NDWI
		SOC
	Chemical state	AOT40f
Biotic ecosystem characteristics	Compositional state	Species richness Forest birds
		Species richness Forest flora
	Structural state	Tree cover
		NDVI
	Functional state	GPP
Landscape characteristics	Landscape characteristics	Forest Area Density
		Naturalness index

● *Forest condition account proposal at the national level*

We have developed an approach to making ecosystem condition accounts according to the SEEA-EA framework through the selection of indicators following the ecosystem condition typology. This approach has a high potential for scalability and is therefore useful for generating comparable condition accounts at different scales and in different ecosystems.

For this pilot methodological approach we developed the condition account for Spanish forests using forest ecosystems used in the extent account: 2000 and 2015. This approach used the national classification of forests, made for the national forest inventory and map.

To ensure the consistency of different variables describing the same ecosystem type, we used sites with minimum disturbance as a reference. This was based on two criteria: forests within protected areas of IUCN category I, II and of which the forest cover has not changed since 1970. The difference between the weighted indicators in the reference areas and the rest of the forest areas by class and region was evaluated.

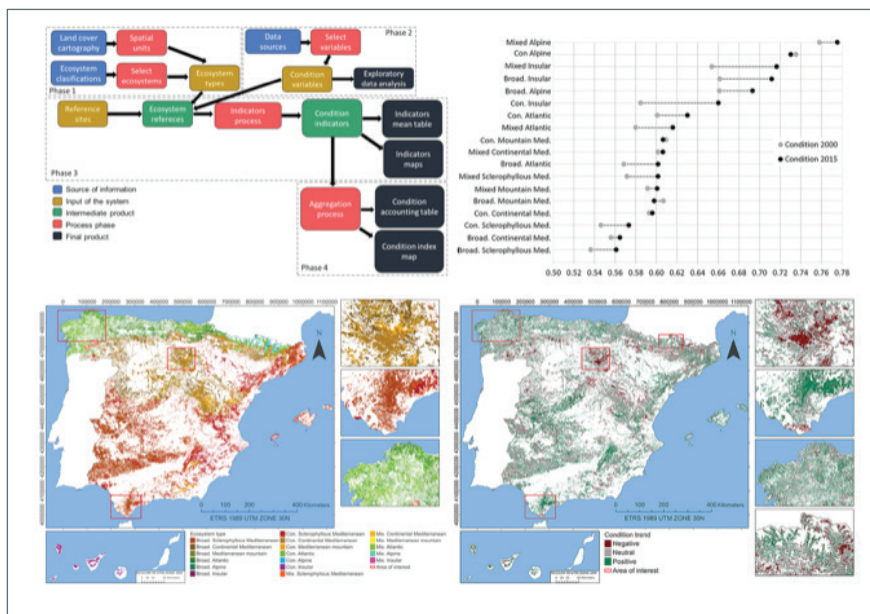
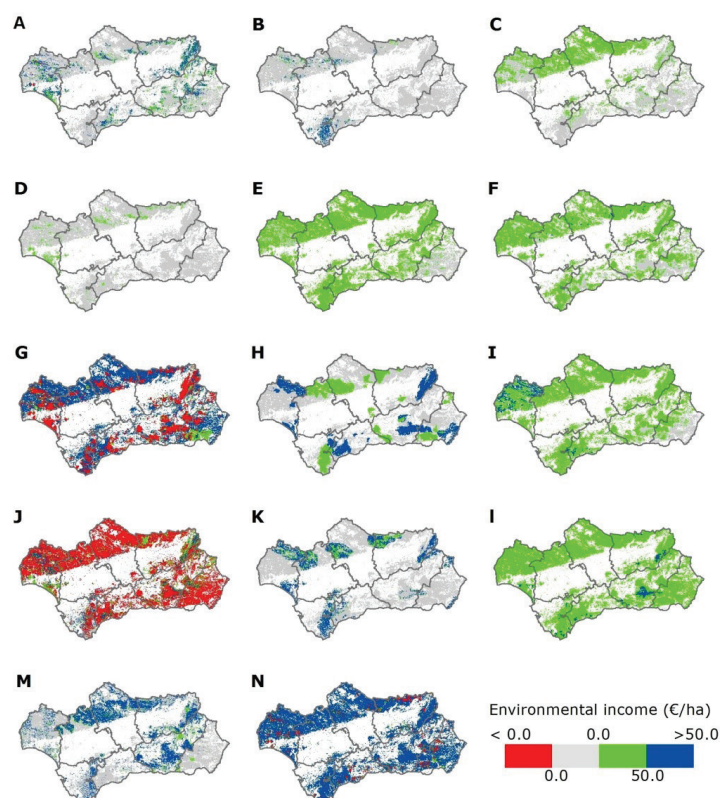


Figure
Spanish forest condition account

Summary table of regional accounts

Account		Ecosystem Types / Ecosystem Services	Link to research
Accounts for ecosystem assets	Ecosystem extent account	Forest	Campos et al., 2019; Caparrós et al., 2017
	Ecosystem condition account	Forest	Campos et al., 2019; Caparrós et al., 2017
		Forest	Campos et al., 2019; Caparrós et al., 2017
Accounts for ecosystem services	Ecosystem services supply and use table - physical terms	Forest ES: forestry, hunting, residential and private amenity, mushroom, carbon, water, recreation, landscape and threatened biodiversity	Campos et al., 2019; Caparrós et al., 2017
	Ecosystem services supply and use table - monetary terms	Forest ES: forestry, hunting, residential and private amenity, mushroom, carbon, water, recreation, landscape and threatened biodiversity	Campos et al., 2019; Caparrós et al., 2017
		Land	Campos et al., 2019 and 2020
Thematic accounts		Carbon	Campos et al., 2019 and 2020
		Biodiversity	Campos et al., 2019



Summary overview of highlight regional accounting projects

RECAMAN, Renta y Capital de los Montes de Andalucía

Scale of the account
 Regional, Andalusia;

Involved and funding partners

Instituto de Políticas y Bienes Públicos del CSIC (IPP-CSIC), Centros de Investigaciones Forestales del INIA (CIFOR-INIA), Escuela Técnica Superior de Ingenieros de Montes (ETSIM-UPM), Universidad de Extremadura (UNEX), Instituto de Recursos Naturales del CSICs (IRN-CSIC), Centro de Servicios Forestales de Castilla y León (CESEFOR), Estación Experimental Aula Dei del CSIC (EEAD-CSIC), Egmasa, Junta de Andalucía;

(Policy) Goal of the study

To provide a large scale application of an ecosystem accounting framework designed to estimate total income, or Hicksian income;

Ecosystems under study

Forests and open woodlands;

ES/thematic account under study

Multiple Environmental Incomes, see below;

Methods and data used for the study (if relevant indicators used)

Agroforestry Accounting System (AAS), Simulated Exchange Values (SEV) and many methods and data sources, see Campos et al. (2019) and Caparrós et al., (2017). A more elaborate explanation is given below for the estimation of the Hicksian income and the Simulated Exchange Values for the Andalusian forests;

Figure

Maps of environmental incomes of Andalusian forests (2010). Abbreviations: A is timber, B is cork, C is firewood, D is nuts, E is grazing, F is hunting, G is private amenity, H is public recreation, I is mushrooms, J is carbon, K is landscape, L is biodiversity, M is water and N all products. Note: the value 0.0 denotes a value below 0.01 €/ha. Source: Campos et al. (2019a).

References of the main research

Campos, P., Álvarez, A., Oviedo, J.L., Ovando, P., Mesa, B., Caparrós, A., 2020. Refined Systems of National Accounts and Experimental Ecosystem Accounting Versus the Simplified Agroforestry Accounting System: Testing in Andalusian Holm Oak Open Woodlands. <https://doi.org/10.3390/f11040393>

Campos, P., Caparrós, A., Oviedo, J.L., Ovando, P., Álvarez-Farizo, B., Díaz-Balteiro, L., Carranza, J., Beguería, S., Díaz, M., Herruzo, A.C., Martínez-Peña, F., Soliño, M., Álvarez, A., Martínez-Jauregui, M., Pasalodos-Tato, M., de Frutos, P., Aldea, J., Almazán, E., Concepción, E.D., Mesa, B., Romero, C., Serrano-Notivoli, R., Fernández, C., Torres-Porrás, J., Montero, G., 2019a. Bridging the Gap Between National and Ecosystem Accounting Application in Andalusian Forests, Spain. *Ecological Economics* 157, 218–236. <https://doi.org/10.1016/j.ecolecon.2018.11.017>

Campos, P., Oviedo, J.L., Álvarez, A., Mesa, B., Caparrós, A., 2019b. The role of non-commercial intermediate services in the valuations of ecosystem services: Application to cork oak farms in Andalusia, Spain. *Ecosystem Services* 39, 100996. <https://doi.org/10.1016/j.ecoser.2019.100996>

Caparrós, A., Oviedo, J.L., Álvarez, A., Campos, P., 2017. Simulated exchange values and ecosystem accounting: Theory and application to free access recreation. *Ecological Economics* 139, 140–149. <https://doi.org/10.1016/j.ecolecon.2017.04.011>

● *Hicksian income or Total income in the forest of Andalusia*

In Andalusia, as part of the RECAMAN project and using the "Agroforestry Accounting System" (AAS), we provided monetary accounts for forests and open woodlands farms for four private activities (forestry, hunting, residential and private amenity) and six public activities (mushroom picking, carbon sequestration, water, recreation, landscape and threatened biodiversity) (Campos et al. 2019a). The AAS is compatible with the SEEA-EEA methodology, although the aim of the AAS is to estimate total income, or Hicksian income (Caparrós et al., 2003; Campos et al. 2019a). In fact, RECAMAN was the first large scale application of an ecosystem accounting framework designed to estimate total income. Current efforts within the MAIA project have allowed to detail the results for 12 private economic activities (timber, cork, firewood, industrial nuts, grazing (grass, acorn, browse, wild fruit), conservation forestry services, hunting recreation services, commercial recreation services, landowner residential services, livestock, agricultural crops and amenity service auto-consumption) and 7 public economic activities (fire services, public recreation services, mushrooms, carbon, landscape conservation services, threatened wild biodiversity preservation services and water supply stored in lowland watershed government reservoir). Current efforts within MAIA are also focused on further developing particular parts of the AAS methodology, e.g. the role of intermediate services (Campos et al., 2019b), and on linking this methodology with SEEA-EEA (Campos et al., 2020);

● *Simulated exchange values (SEV) and free access recreation in the forest of Andalusia*

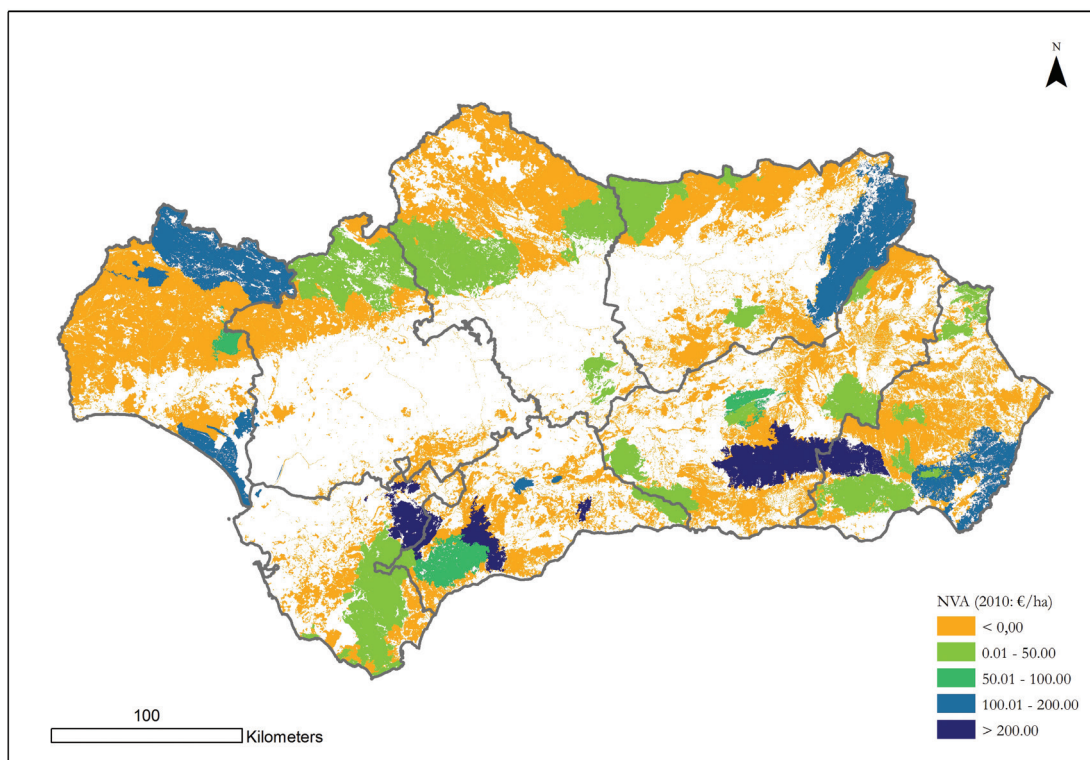
The use of simulated exchange values (SEV) for ecosystem accounting was discussed in Caparrós et al., 2017, extending the methodology initially proposed in Caparrós et al., 2003 (for choice experiments and SEV, see Oviedo et al., 2016). The SEV is a practical method to estimate values for goods and services currently outside of the market in a manner consistent with the market-based figures considered in national ac-



counts. The method proposes to simulate, in a partial equilibrium context, the price that would occur if a good or service outside of the market, such as free access recreation in forests, were internalized. The method takes into account the demand, estimated using non-market valuation techniques, the supply and the market structure. The SEV has been applied, in an ecosystem accounting context and as part of the RECAMAN project, to free access recreation in the forests of Andalusia. The results were compared to those obtained using Hicksian variations (roughly, consumer surplus).

● *Towards biodiversity accounts in monetary terms at national level*

Within the MAIA project, we are estimating Simulated Exchange Values (SEV) for the preservation of threatened biodiversity at national level. The goal is to obtain spatially explicit values and to advance, as much as possible, towards a monetary account for biodiversity at national scale. However, there are no results available yet.



Figure

Map of recreational Net Value Added in Andalusia using the SEV.

Source: Caparrós et al. (2017).

Knowledge gaps and difficulties for developing natural capital accounts

Based on MAIA D3.2 (Annex 10 section 5); D5.1 (Annex 10 section 5e and 6d)

The main data gaps are related to evaluation and quantification of some ecosystem services, mainly regulating and some cultural. Otherwise, developing accounts in some specific ecosystem such as marine ecosystems present an additional difficulty. One of the main challenges is to improve the participation of institutions and to promote political and legislative actions.

A key gap is the lack of specific frameworks for the measurement of the different accounts in a replicable and scalable manner. It is a big challenge to manage the data and implement the novel methods for these experimental accounts.

However, the main limitation is not technical. The institutions that express interest in accounting do not have the working conditions to actually work on this topic. They lack time and resources. Moreover, the implementation of ecosystem accounts into the SNA needs more political and legislative support.

Support needs for developing natural capital accounts

Based on MAIA D3.2 (Annex 10 section 6 and 7); D5.1 (Annex 10 section 6e, 7 and 8)

Spain reports to have sufficient capacity and scientific information to implement NCA in the context of MAIA. Nonetheless, there is a need for training for some Spanish government institutions. Moreover, a simple guide of applications of the different accounts would be helpful for the process. Sharing methods and systematic communication between the different MAIA partners is needed.

The capacity to produce accounts is already available in Spain. Nonetheless, there should be some training for the staff of the Ministry for Ecological Transition of Spain and the Spanish National Statistical Office. Training could be done back to back with annual MAIA workshops throughout the next 2 years.

Based on the results of other scientific projects (i.e. SNEA, RECAMAN) it can be assumed that there is enough scientific information for implementing MAIA in Spain. The Ministry of Ecological Transition supports this and is convinced that MAIA could facilitate the interface between scientific knowledge in different disciplines and decisions.

Spain is missing a simple guide of applications of the different accounts. The sharing of methods by the different teams would help to advance and improve in different areas. Therefore, more systematic communication and information exchange between MAIA partners is needed.

Involved partners and stakeholders

Based on D5.1 (Annex 10 section 2); European NCA stakeholder day

Government	Research	Private sector or NGO
Ministry of Ecological Transition (MITECO)	Universidad Rey Juan Carlos de Madrid (URJC)	Ecoacsa
National Institute of Statistics of Spain (INE)	Spanish National Research Council (CSIC)	
Biodiversity Foundation (FB)		

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