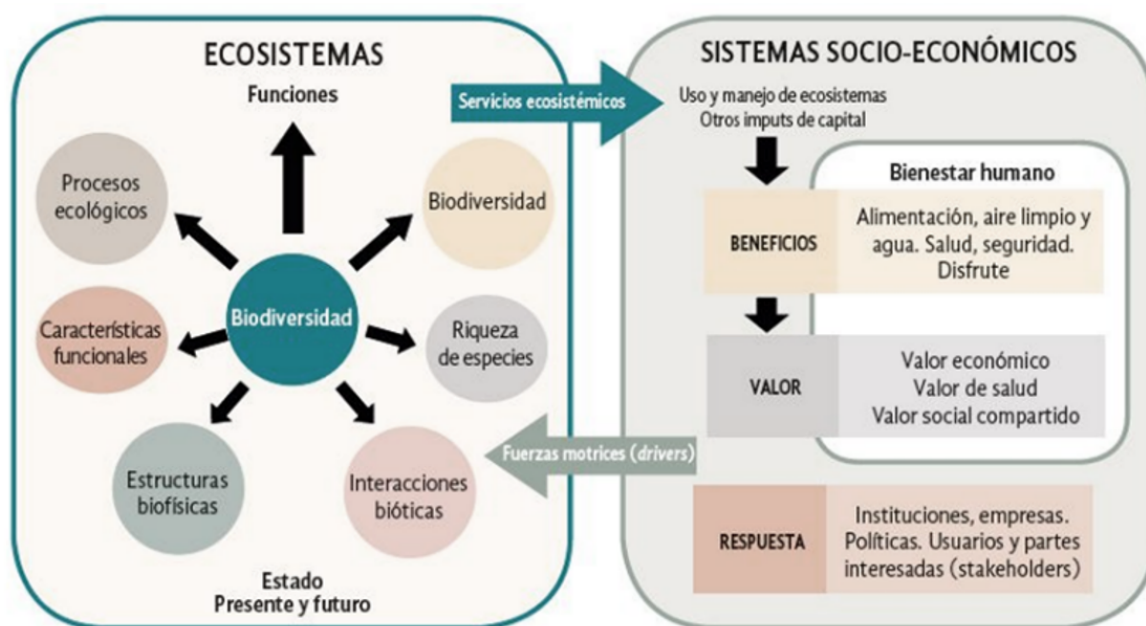


ECOSYSTEM SERVICES: MAKING THE INVISIBLE VISIBLE

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'What is not named does not exist.' In other words, anything without a name, value or clear measure is simply excluded from decisions. This is precisely what happens with ecosystem services. The benefits that nature provides to society, such as climate regulation, water purification and carbon capture, are essential to human life and well-being. However, their value continues to be ignored in traditional economic models. Without figures to quantify them, these services remain invisible in urban planning, investment and public policy.

To break this cycle of invisibility, it is crucial to quantify the value of these services. This is not just a technical matter, but a transformative tool: what is measured is managed, and what is valued is protected. Not only does measuring these services better justify investments in green infrastructure, it also allows them to be integrated into the cost-benefit analysis of projects, making them a fundamental part of sustainable development strategies.



The MAES model was proposed by the EU for assessing ecosystem services. **Source:** European Commission, 2018.

Measuring their value allows us to recognise their importance and gauge the negative impact that certain policies, development models or economic decisions have on them. Without clear valuations, the degradation of these services goes unnoticed, leaving no one accountable and no effective compensation mechanisms in place. Quantification forces us to recognise that destroying a wetland, polluting a river or fragmenting a forest are not minor externalities, but concrete losses that incur real environmental and economic costs. Sooner or later, this cost will have to be met through restoration measures, ecological compensation or investments to recover damaged ecosystem services. Therefore, quantification is not only a protection tool, but also a means of demanding accountability and ensuring that environmental damage is recognised and repaired.

However, quantifying these services is complex, as their value depends on local, meteorological, social and cultural factors. In recent years, significant efforts have been made to develop methodologies and tools that facilitate and standardise this process while still allowing for the particularisation and contextualisation of each ecosystem service according to its environment.

One of the most widely used tools is **InVEST (Integrated Valuation of Ecosystem Services and Trade-offs)**, which enables the modelling of the impact of various land uses on the provision of ecosystem services, such as water quality and carbon sequestration. Its main advantages are its

flexibility and its ability to adapt to different scales and types of ecosystems, which facilitates its integration into planning processes. However, it has limitations in that it requires high-quality input data, and using it optimally may require specialised training. Similarly, **ARIES (Artificial Intelligence for Ecosystem Services)** uses artificial intelligence and probabilistic models to evaluate the supply, demand and circulation of ecosystem services in various scenarios. Its greatest strength lies in its ability to generate dynamic analyses based on contextual data, enabling the simulation of future scenarios. However, its dependence on external databases and variability in information availability can affect the accuracy of its results in certain territories.

For smaller scales, **TESSA (Toolkit for Ecosystem Service Site-based Assessment)** enables the comparison of conservation and degradation scenarios, offering decision-makers an accessible tool that does not require advanced technical knowledge. A disadvantage is that it does not offer automated modelling; rather, it relies on manual data collection and qualitative analysis, which may limit its application in large-scale studies.

Conversely, **SoIVES (Social Values for Ecosystem Services)** enables the mapping of social perceptions of the benefits provided by ecosystems, thereby integrating subjective values into the assessment. Its ability to capture the social dimension is one of its strengths, but reliance on surveys and self-reported data can introduce bias and make replication in different contexts difficult.

Additionally, the use of satellite data and remote sensing through tools such as **Google Earth Engine** and **Global Forest Watch** has transformed our ability to monitor and quantify these services, enabling us to analyse the evolution of natural capital dynamically. While these technologies are accurate and scalable, they are limited in their ability to interpret data, which requires validation with field information to avoid errors in the classification of land cover and changes in land use.

In urban areas, **i-Tree** is one of the most important tools. Developed by the US Forest Service, it is a set of models that allows the impact of urban trees and forests on air quality, the heat island effect, carbon capture and energy savings to be assessed. Its key strengths are its empirical, data-driven approach and its ability to integrate with geographic information systems (GIS), enabling the generation of detailed reports for urban planning. However, its application may be limited in regions outside the US, as local climate and ecological data may not be accurately represented in the default models.

The development and application of such tools is a significant step forward in the integration of ecosystem services into planning and decision-making processes. Increasingly accurate models and data make it possible to generate concrete evidence of the benefits of nature and the impact of its deterioration. This ensures that natural capital is recognised and effectively protected and managed. Nevertheless, there is still a challenge to harmonise these methodologies with political and economic decision-making processes to ensure that the information generated is effectively used to promote sustainable development.

