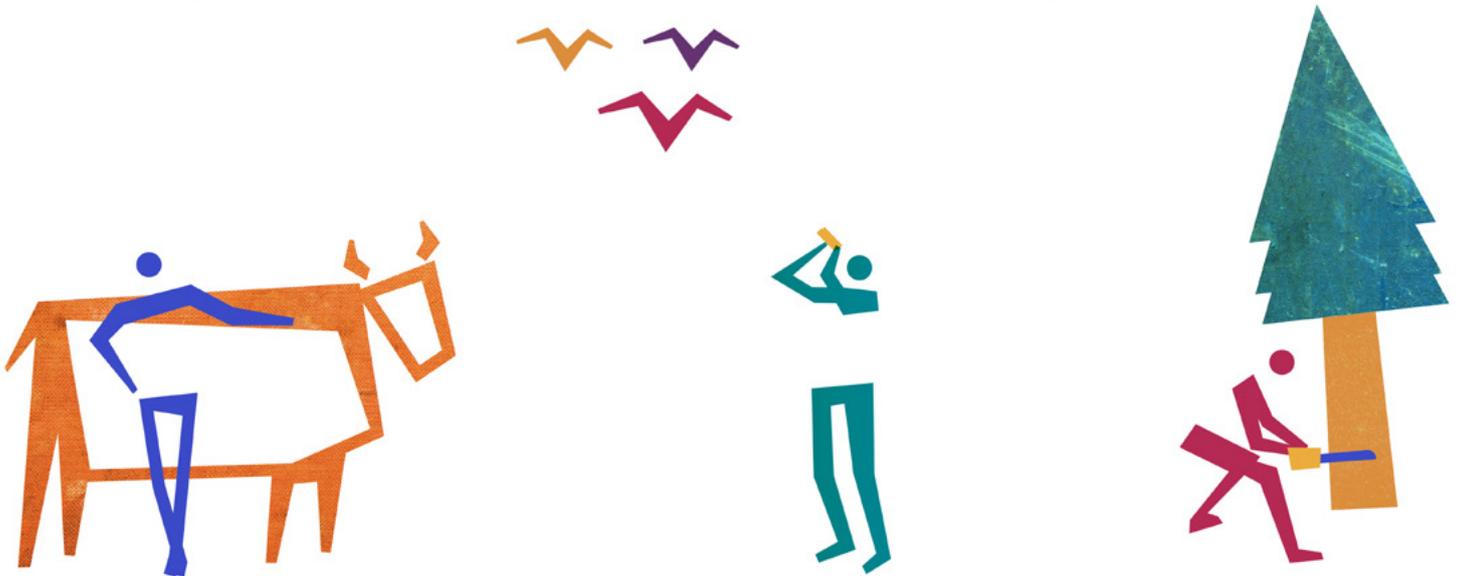


# How do you take into account trade-offs between ecosystem services in land management and decision-making?



## Summary

**Navigating trade-offs is an essential part of decision-making.**

It is particularly important in natural resource management, where decisions that are made today may have implications for other ecosystems and future generations. To operationalise the concept of ecosystem services (ES) and to manage natural capital wisely, decision-makers need to have a full understanding of the trade-offs associated with their decisions, particularly regarding ecosystem services. If the increase of one ecosystem service happens directly or indirectly at the cost of another, maximising the provision of that service might lead to sub-optimal results. To support decisions, explicit information about trade-offs between ecosystem services is required. The OPERAs project made a number of contributions to improve our understanding of ecosystem services trade-offs and developed methods that can assist in navigating them.

## Key messages

- ▶ Land use decisions inevitably come with trade-offs
- ▶ Understanding how land use and ecosystem services synergise or trade-off can help land managers find solutions that minimise negative outcomes
- ▶ Certain groups of ecosystem services are more likely to lead to trade-offs rather than synergies; other groups of ecosystem services can be synergistic if well managed
- ▶ Trade-offs can occur over space, over time, or among stakeholders
- ▶ Whether management options and the trade-offs they incur are acceptable depends strongly on the values and preferences that stakeholders hold
- ▶ Multifunctional landscapes are not always win-win – some trade-offs cannot be avoided
- ▶ A wide range of tools are available to help decision-makers navigate trade-offs effectively

# Knowledge

## OPERAs researchers conducted a literature review on the subject of ES trade-offs.

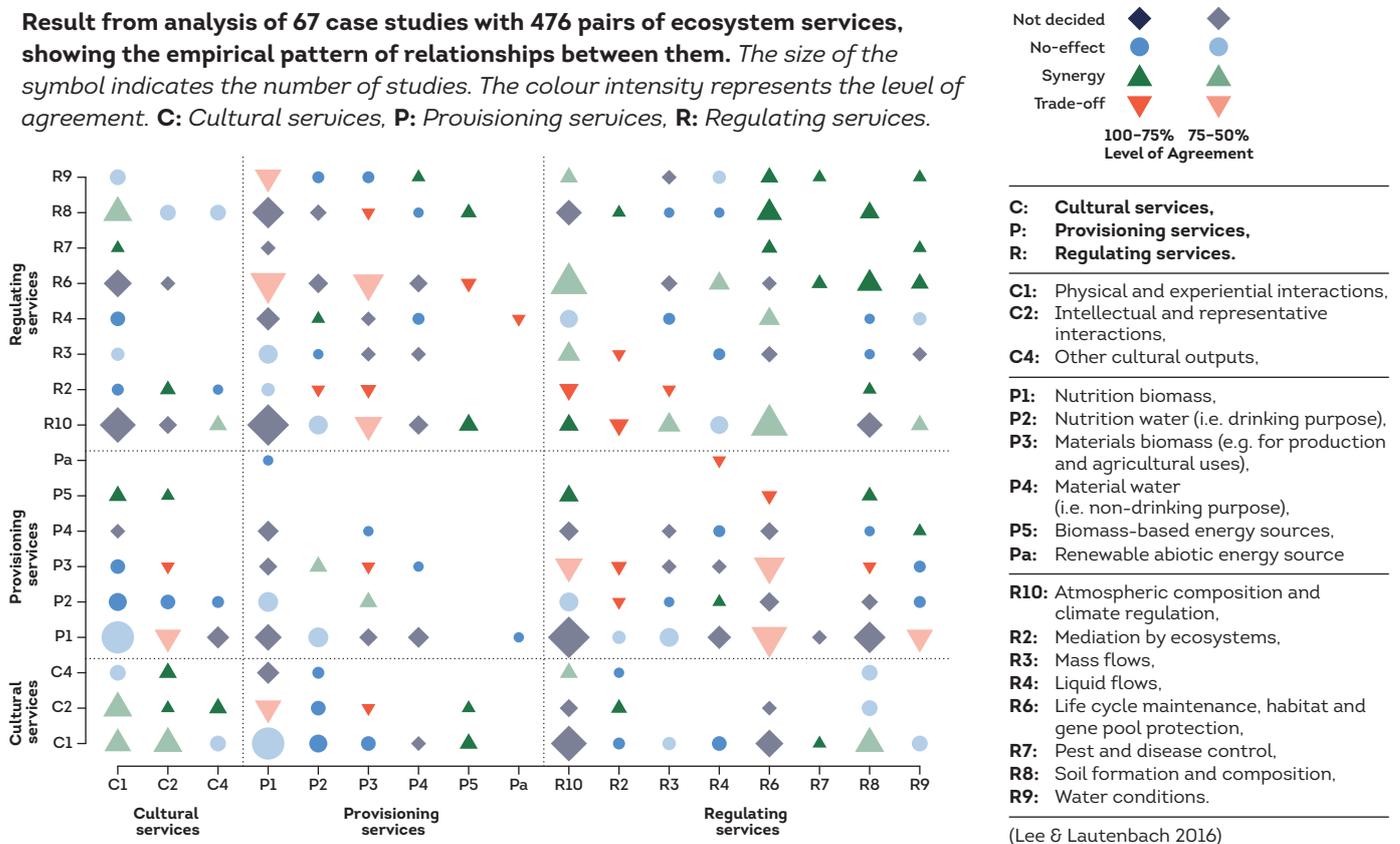
The research identified different relationships between different categories of ES. Regulating and cultural ES were more likely to have a synergistic relationship, while trade-offs were more common between regulating and provisioning services. Cultural and provisioning services had a 'no effect' relationship.

In order to optimise ecosystem service provision, objectives need to be set. Setting such objectives

is often complicated, as the relationships between how much of a service is provided and the value it has for society tend to be non-linear (e.g. minimum levels needed before a benefit is provided), location-dependent (e.g. pollination near crops, air purification near urban areas) and context-dependent.

OPERAs studies demonstrated that improvements are often possible to both the current level of ecosystem service provision and future 'business as usual' scenarios. For example: tools such as pareto-optimization can assist in identifying the best possible land management options for a given set of objectives; whilst tools such as Zonation can identify which areas are of most (or least) importance in meeting a region's ecosystem service objectives, thereby providing guidance to spatial planning to minimize impacts of land use change.

**Result from analysis of 67 case studies with 476 pairs of ecosystem services, showing the empirical pattern of relationships between them. The size of the symbol indicates the number of studies. The colour intensity represents the level of agreement. C: Cultural services, P: Provisioning services, R: Regulating services.**



# Instruments

**Environmental management often involves use of decision support tools to inform choices between different land use options and weigh up the trade-offs involved.**

OPERAs developed a number of decision-support tools in a variety of landscapes. Some of these tools deal with trade-offs explicitly by working with preferences (e.g. CBA, MCA, MCDA, mDSS), while others do so implicitly by quantifying the impacts of different decisions and comparing them against each other (e.g. TESSA, ToSIA, WeLCA).

Policy-making can often involve trade-offs when choosing which activities to encourage or favour and where to allocate funding. The Environmental Harmful Subsidy (EHS) tools were developed to help policymakers identify the impacts of policies and navigate the potential trade-offs associated with them.

## Practice

### Many of the OPERAs exemplars looked at multi-functional landscapes where there is potential to explore the many facets of trade-offs and synergies in ecosystem services.

Research in the French Alps and in Costa Rica looked at whether services align spatially to form a 'bundle' (synergy), or not (trade-off). Spatial relationships are typically linked to the land cover or land management that services are associated with. For example, in Costa Rica biodiversity hotspots were found to have the highest co-benefits for other services, while carbon hotspots have the lowest.

Temporal synergies and trade-offs describe how ecosystem services respond to factors such as changes in policy decisions, hydrological regimes, or climate. This was explored in the French Alps using scenarios to look at the impacts on ecosystem services.

Supply and demand trade-offs, studied in Barcelona, the Swiss Alps and the Lower Danube, refer to the societal demand for ecosystem services and whether this is met through the capacity of the ecosystem to provide services.

Trade-offs among beneficiaries looks at the degree to which the ecosystem services objectives of different stakeholders are affected by changing boundary conditions or planning decisions. This was the focus of work in Peru, where it was found that the ecosystem service approach could contribute to territorial management by creating networks and strengthening relationships between actors.

## The French Alps Exemplar

In the French Alps exemplar, trade-offs were studied in a number of different ways.

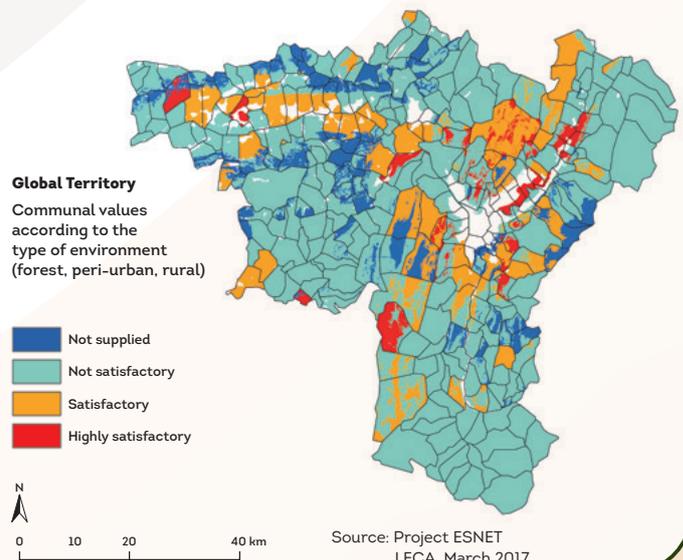
- Biophysical or spatial trade-offs
- Temporal trade-offs – the effect of future scenarios on bundles of ecosystem services
- Value-use trade-offs – using scenarios that reflect different values (e.g. pro environment or pro-business) and assessing the success of scenarios depending on values used

It was useful for stakeholders to see how conservation objectives trade-off with other dimensions of sustainability. They found that, although current management strategies

consider themselves to be pro-environment, they actually reflect a 'business as usual' scenario. The work on values showed that although multifunctionality is an ideal, there are certain trade-offs that cannot be avoided.

For example, a group of stakeholders, representing different economic sectors, were asked to develop a 'multifunctionality rule' that would determine the supply of 12 ecosystem services in the Grenoble region. The predominant blue colours on the map show that under this rule, ecosystem services are generally not considered to be delivered at satisfactory levels.

### Assessment of ES bundles following 'ideal' multifunctionality rule



## BackES

**BackES is a tool for exploring possible solutions to current and future problems based on socio-economic, political and environmental information, criteria and goals.** It can be used to determine potential land use strategies that will lead to a desirable combination of ecosystem benefits. Unlike forecasting methods, which often predict a range of future plausible scenarios based on current information, the starting point when using a backcasting approach is an ideal future scenario. From here, one works backwards to determine how that can be achieved. Follow up strategies and pathways leading to that desired future are then defined.



Copyright © 2017 Ut4M Ultra Tour des 4 Massifs'

## The Future

### The OPERAs project researched trade-offs and synergies in ecosystem services in a variety of socio-ecological systems, covering many aspects of the issue.

An essential part of managing trade-offs is to identify the relevant ecosystem services, measure them and identify preferences and targets. This process encourages a complete understanding of the benefits provided by the system.

The knowledge and instruments developed by OPERAs will help environmental managers and policy-makers to better identify and navigate the trade-offs that arise in environmental management.

“A merit of the ecosystem service approach is that it makes visible some things that are usually invisible [to decision makers]”

Grenoble stakeholder

“Taking ecosystem services into land planning should become the rule!”

Grenoble stakeholder

“Scientific arguments have a definite weight in land planning decisions.”

Grenoble stakeholder

“The fact that not the best scenario is not the same everywhere highlights the need to play on complementarities at regional scale.”

Grenoble stakeholder



Find further details about this theme on Oppla:  
[oppla.eu/operas/trade-offs](http://oppla.eu/operas/trade-offs)

[www.operas-project.eu](http://www.operas-project.eu)  
[info@operas-project.eu](mailto:info@operas-project.eu)

   OPERAsProject

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement number 308393.

