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Chapter 17

Analyzing ecosystem services to manage territories

Bruno Locatelli, Améline Vallet, Giacomo Fedele and Bruno Rapidel

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Territorial management can be based on analyses of ecosystem services (Opdam, 2016), i.e., on the analysis of the benefits human beings receive from ecosystems in the form of provisioning, regulating and cultural services (Figure 17.1). Management approaches based on ecosystem services are defined here as those that recognize the diversity of the services provided by ecological processes in a territory, as well as the diversity of values ascribed to these services by different actors. These approaches thus allow, among other objectives, the comparison of different management options or the design of policy instruments. They recognize numerous instrumental and relational values that include, for example, the consumption of goods and the existence of spiritual relationships with nature (Díaz *et al.*, 2015). It should be noted that these approaches transcend economic assessments and payment mechanisms, which often form the focus, speciously so, of analyses based on ecosystem services.

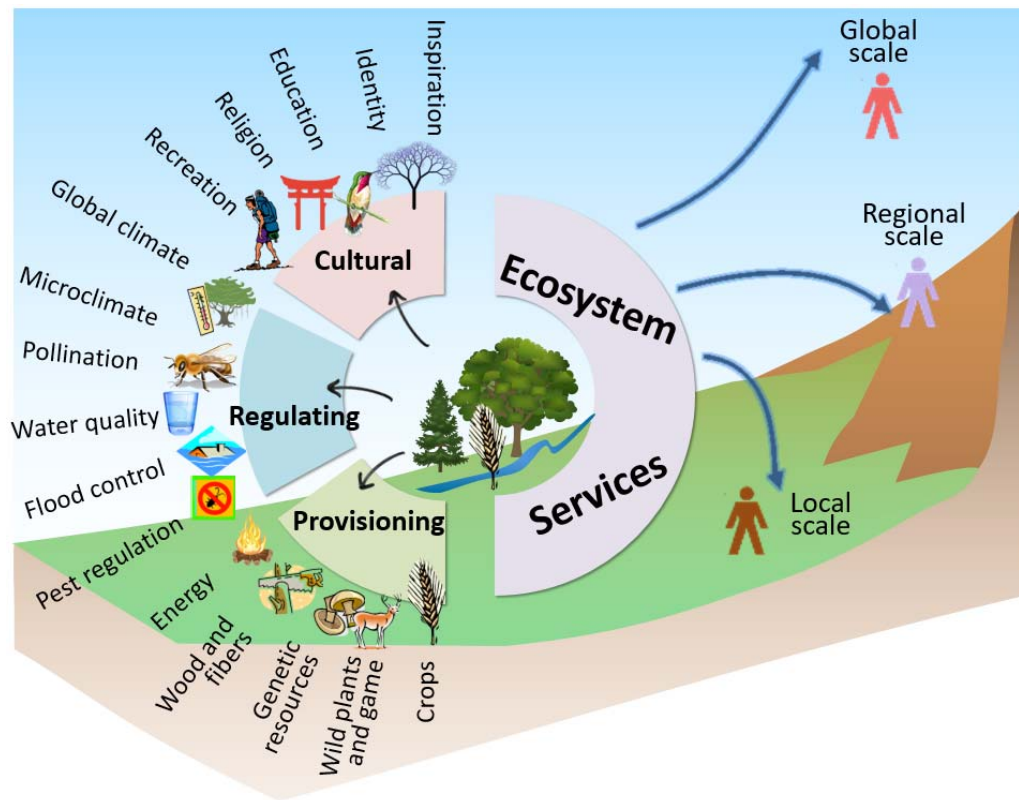


Figure 17.1. Examples of provisioning, regulating and cultural services provided by a territory to beneficiaries at different scales. Source: authors.

TERRITORIES AND ECOSYSTEM SERVICES AT DIFFERENT SCALES

Decisions concerning a territory impact its ecosystems, but the services provided by these ecosystems can be supplied beyond the borders of this territory, referred to by geographers as ‘disjunction of levels’ and by economists as ‘externality’. For example, hydrological services can reduce flooding in a distant downstream city, and carbon sequestration is an ecosystem service that regulates the global climate for the benefit of all of humanity (Opdam, 2016). For this reason, analyses of ecosystem services often take into account, in a spatially explicit way, the supply of services by ecosystems, societal demands and linkages between ecosystems and human beings (Locatelli *et al.*, 2014). This aspect is crucial for stakeholders who are interested in the implications of management decisions on ecosystem services (Fürst *et al.*, 2014). Their spatial analysis can even lead to the demarcation of new territories.

For these analyses to be useful for territorial management, it is necessary to understand how management practices influence the supply of ecosystem services. Since a service exists only as a link between an ecosystem and beneficiaries, its analysis requires moving from a particular management scale, such as that of the plot, where the farmer’s practices reign, to the scale of the territory where these ecosystem services are provided, or to the scale – regional and/or global – where services may have an effect. This change in scale is straightforward for some services (e.g., the service of climate change mitigation provided by ecosystems at a global scale is the result of the local contributions, regardless of their location), but is more complex for others. For example, in Costa Rica, the presence of shade trees in coffee systems reduces erosion in the plot but, at the level of the watershed pertaining to this ecosystem service, erosion is dictated by threshold effects and can increase or decrease depending on processes involved at larger scales, e.g., retention or release of sediments in the basin (Villatoro-Sánchez *et al.*, 2015).

WHY APPROACH THE TERRITORY THROUGH ECOSYSTEM SERVICES AND ECOSYSTEM SERVICES THROUGH THE TERRITORY?

An important aspect of ecosystem services approaches is that they make it possible to take into consideration various contributions of ecosystems to human well-being, for example, understanding the effects of the evolution of a territory on landscape beauty, food production, carbon sequestration or water regulation (Vallet *et al.*, 2016b). By bringing these services together, analysts and managers are able to consider the trade-offs between different options for addressing challenges such as climate change (Locatelli *et al.*, 2015). Since it is not possible to optimize all ecosystem services at the same time, it becomes necessary to recognize trade-offs: if one service is improved at the expense of another, which uses and which actors stand to win or lose (Fürster *et al.*, 2015)?

Since ecosystem services approaches seek to incorporate the diverse values that human beings attribute to their territory, they can prevent the management of multi-functional territories for a sole purpose, such as food production. For this reason, these approaches are linked to the multi-functionality of landscapes or agriculture (Caron *et al.*, 2008). If stakeholders have the opportunity to formulate their perceptions of and expectations from the territory in similar terms, it could help them and researchers understand the divergence of values and the search for a compromise concerning the multi-functionality of human activities (Fürst *et al.*, 2014).

In Indonesia, for example, the evolution of a territory reflects trade-offs between

sometimes conflicting demands for services. In villages in central Java, the authorities decided to replace mixed forests with pine plantations for timber. According to farmers, rice harvests have been reduced by such plantations and droughts. To mitigate economic risks, farmers planted teak in soybean fields (agroforestry) and reforested the slopes considered the least productive (assisted natural regeneration). In doing so, they have strengthened, at the same time, provisioning (wood) and regulating services (soil stability and fertility) to complement agricultural provisioning services (Fedele *et al.*, 2016).

The identification of benefits human beings receive from ecosystems and, consequently, the definition of these services remain subjective, making the concept abstract. However, the concept, with its broad definition and its consideration of multiple values through multidisciplinary analyses (beyond economic or monetary values alone), can be useful for decision-making concerning territories. Ecosystem services can help stakeholders discuss territorial management at the appropriate spatial level, think long-term as well as short-term, and assimilate multidisciplinary knowledge (Fürst *et al.*, 2014).

Ecosystem services approaches can contribute to the organization of the territory by creating networks and strengthening relationships between actors, especially between those managing ecosystems (e.g., farmers) and those benefiting from these services (e.g., downstream users of water). Discussions of their benefits have not only already led to partnerships between farmers, water managers and actors involved in the protection of cultural values and biodiversity, but has also helped consensus decision-making concerning the territory (Fürst *et al.*, 2014).

The concept of ecosystem services makes it possible to think of ecosystems not as objects threatened by the territory's economic development, but as elements to be considered in the planning of this development (Opdam, 2016). It has been shown, for example, that ecosystem services approaches make it possible to think of opportunities instead of problems (Baker *et al.*, 2013). By highlighting the multiple benefits provided by ecosystems, the concept makes it possible to involve actors in the management of the ecosystems on which they depend without often recognizing it, for example hydroelectric companies with upstream forests (Locatelli *et al.*, 2011).

CHALLENGES OF ECOSYSTEM SERVICES APPROACHES FOR TERRITORIES

Despite their potential, these approaches have not yet been widely used in territorial management (Cowell and Lennon, 2014). Some of the reasons can be found in the diversity of scales at which ecosystem services are supplied, and the divergences between these scales and those of territorial management, and the divergences between actors. Driven by strategy or by the desire for power, actors responsible for the management of territories can decide to ignore certain services or promote others, even if the scientific analyses or the beneficiaries' perceptions suggest other priorities.

A participatory approach to ecosystem services can co-opt different visions of all the actors within a territory, but its success depends on governance systems, the socio-cultural context, and interactions between actors. Deliberations on ecosystem services and their management highlight different values, which depend on the interactions of actors with their services and their vision of the world (Fürst *et al.*, 2014). It is thus important to establish participatory activities in which all actors contribute with their own mental models of nature, for example, by using, if

necessary, other terms for service if this latter could possibly be misinterpreted (Baker *et al.*, 2013).

Different perceptions of ecosystem services often reflect power relationships between actors. Recognizing the trade-offs between services leads one to question the power relationships between those who exert the most influence on the evolution of the territory and those who suffer from changes in the production of these services (Berbés-Blázquez *et al.*, 2016), e.g., between urban and rural populations in the case of watershed management. These questions of power come to the fore during decision-making concerning the territory.

For example, in a Peruvian Andes watershed, an analysis was undertaken of an actors' network linked to provisioning (food and medicinal plants), regulating (water, soil, climate) and cultural services (beauty of the landscape). The study highlighted that beneficiaries of ecosystem services and ecosystem managers have few opportunities to interact with each other. The beneficiaries of the services have little involvement in the management of these services (legislation, monitoring, etc.), and are also less in contact with other actors apart from the managers, placing them in a peripheral position in the actors' network. The power asymmetries observed call into question the capacities of public management institutions to legitimately represent actors linked to ecosystem services (Vallet *et al.*, 2016a).

CONCLUSION

Approaching the territories through ecosystem services makes it possible to identify and analyze the multiple interactions between ecosystems and societies or between actors linked to these services at various scales. The current challenges concern the application of this analysis to decision-making concerning the territories. Various methods are needed to arrive in a participatory manner at a shared understanding of ecosystem services and to foster collective territorial management. These methods should make it possible to adapt the concept to different socio-cultural contexts, encourage their appropriation by the actors concerned, and encompass the multiple values, different knowledge and divergent visions of the world.

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