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6 HOW CAN WE INTEGRATE A MULTISCALAR APPROACH INTO NATIONAL ECOSYSTEM ASSESSMENTS?

From national to local and vice versa

KEY FINDINGS

- One of the main challenges addressed by the Spanish National Ecosystem Assessment was the integration of results obtained at different spatial scales using the same conceptual approach, but with different assessment methodologies.
- The five case studies analyzed show different trends in terms of the evolution of both the services and drivers of change and are consistent with the general pattern of trends observed at the national level. This may be due to the application of different analytical methods and to different geographical, ecological and socioeconomic characteristics.
- The cultural services demanded by urban people tend to increase in all of the studied cases. There is also a general trend of an increase or maintenance of technified provisioning services, while traditional provisioning services and regulating services are declining in four of the five cases.

While the ecosystem service analysis of the 14 ecosystem types at a the national scale was mainly based on the identification of indicators from available databases and through the use of expert judgment, the regional/local case studies attempt to address trade-offs in ecosystem services at a finer level of detail using different methodologies, such as participatory assessment techniques based on the social perception of local actors, modeling of future scenarios, and biophysical evaluations of services and trends through local-scale indicators. The specific approach and methodology applied in each of the five regional/local case studies are presented in Table 6.1.

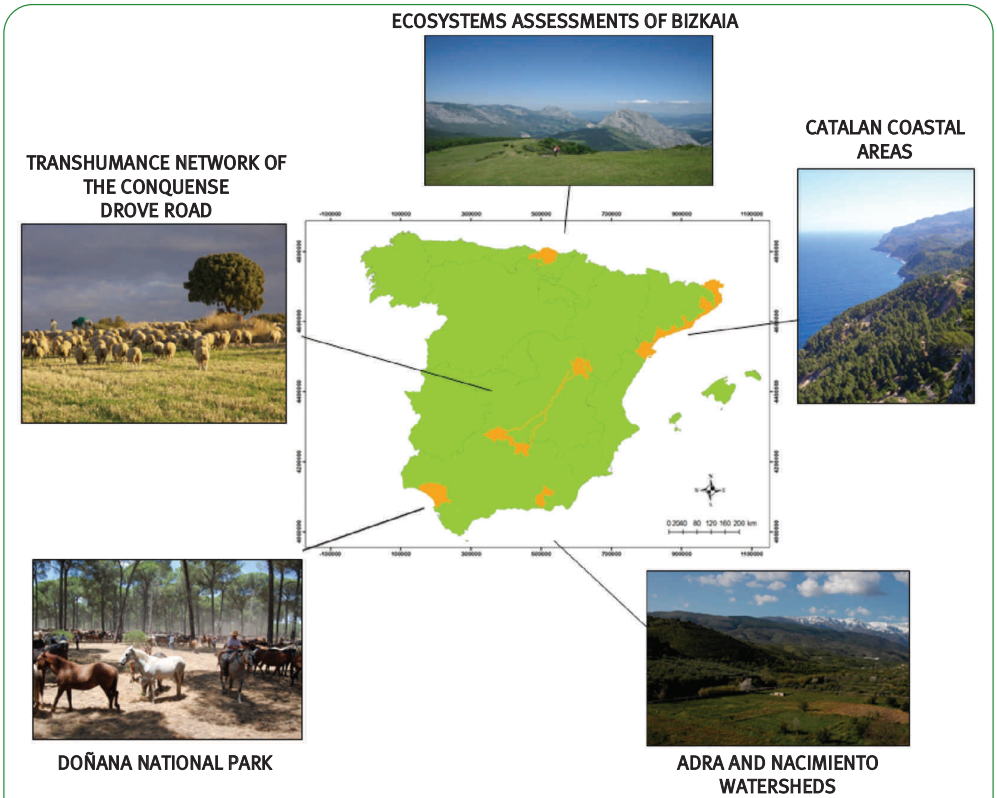

Figure 6.1 Geographic location of the five case studies selected to investigate different possible socio-ecological processes at regional and local scales and to explore different methodologies for evaluating ecosystem services at different spatial scales.

One of the main challenges addressed by the Millennium Ecosystem Assessment in Spain was the integration of results obtained at different spatial scales using the same conceptual approach, but assessment methodologies that are not directly

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comparable. Thus, the SNEA developed five assessments of ecosystem services at local/regional scales. The specific methodologies used in each case study were adapted to the biophysical reality of the socio-ecological system assessed and the interests of local stakeholders. At the regional level, the case studies included the Millennium Ecosystem Assessment of Bizkaia, the coastal ecosystems of Catalunya, and the transhumance network of the Conquense Drove Road. At the local scale, the case studies included two watersheds in Almeria and the Doñana National Park and its surroundings (Figure 6.1).

Table 6.1 General description of the five case studied assessed in SNEA

	Doñana National Park	Adra and Nacimiento Watersheds	Transhumance network of the Conquense Drove Road	Bizkaia	Catalunya Coastal ecosystems
Spatial scale	Local: National park and sorrounding	Local: Watersheds	Local: Drove Roads	Provincial: with four local studies	Regional: Coastal areas
Area (km²)	3.115	1.341 (744 Adra and 597 Nacimiento)	2.400	2.217	6.930
Population (inhabitants)	213.000	66.400 (54.000 Adra and 12.400 Nacimiento)	44.700	1.151.113	682.718
Location (province and municapalities)	Provinces: Huelva, Sevilla y Cádiz (16 municipalities)	Provinces: Granada and Almería (24 municipalities)	Provinces: Teruel, Cuenca, Guadalajara and Jaén (28 municipalites)	Province: Bizkaia (112 municipalities)	Province: Girona, Barcelona and Tarragona (39 municipalities)
Socio-economic characterization	Intensive agriculture and international tourism	Extensive agriculture and local tourism	LIvestock, extensive agriculture, hunting and forestry	Industry and international tourism	International tourism, intensive agricultura and fhising
Ecosystems	Wetlands and coastal	Arid zones, agroecosistems, rivers and mediterranean mountains.	Continental forest and mediterranean sclerophyllous srub and forest and agroecosystems	Atlantic forest, agroecosystems and urban areas	Wetlands and coastal
Protected areas	National Park and (1969), Sourrondin Natural Park (1989) UNESCO Biophere Reserve (1980), Ramsar (1982)	National and Natural Park (1999) UNESCO Biosphere Reserve (1985), Natura 2000 (1992)	Natural Park and UNESCO Biosphere Reserve	Natural Park and UNESCO Biosphere Reserve	Natural Park, Ramsar, ZEPA
Land management	Protected areas vs. Intensive agriculture	Protected areas vs. Intensive agriculture	Public land use vs. Private large land holders	Industrial areas vs. Periurban natural areas	Protected vs. Costal urbanization
Asssessment methodology	Social preferences, future scenarios, biophysical indicators	Social preferences and, water flows (green and blue) modeling	Social preferences and perceptions, future scenarios, biophysical indicators	Social preferences and perceptions, future scenarios, biophysical indicators, expert opinion	Spatial analysis and Social preferences

GENERAL PATTERNS

Despite the significant differences among the five analyzed case studies, a number of general trends were observed in both the services and drivers that are consistent with the general pattern of trends observed at the national level (Table 6.2). For example, the results of grouping services into the five major categories used in the SNEA to analyze trends show how the cultural services demanded by urban people tend to increase in all of the regional/local cases studied. There is also a general trend of an increase or maintenance of technified provisioning

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Table 6.2 Results of the ecosystem services assessment for each case study included in the SNEA

Type of service	Service	Drove Roads	Semiarid watersheds	Doñana	Bizkaia	Catalan coastal
Provisioning	Food	↓	↔	↑	↓	↓
	Water		↓	↓	↑	↓
	Biotic material	↓	↓		↑	
	Geotic material		↓		↓	
	Energy		↑			
	Gene pool	↓		↔	↓	
Regulating	Climatic regulation	↓	↔		↑	↑
	Air quality	↓	↔		↑	↑
	Water depuration	↓	↔	↓	↑	↔
	Erosion control	↓	↓	↓	↓	↓
	Soil fertility	↓	↓	↓	↓	↓
	Disturbance control	↔		↓	↓	↓
	Biological control	↓	↓	↓	↓	
	Pollinization	↓	↓	↓		
Cultural	Scientific knowledge	↑	↑	↑	↑	↑
	Recreation activities	↑	↑	↓	↑	↑
	Aesthetic landscape	↔	↓		↓	↔
	Spiritual value	↓	↔	↔	↓	↑
	Local ecological knowledte	↔	↓	↓	↓	
	Cultural identity	↔	↔			↔
	Environmental education	↔	↔	↑	↑	↑

(↑: increase; ↔: no clear trend; ↓: decrease; blank cells indicate that the service has not been evaluated).

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services, while traditional provisioning services and regulating services are declining in most cases (four of the five cases analyzed).

Regarding the direct drivers of change underlying the current observed trends, the five case studies clearly show that changes in land use are the main drivers in terms of importance, showing a clear tendency to increase rapidly in four of the five cases. The relative importance of the other drivers varies among cases, with over-exploitation, pollution or invasive species being the second most important driver. Overall, direct drivers of change showed a clear tendency to increase in the five case studies (70% of the drivers analyzed).

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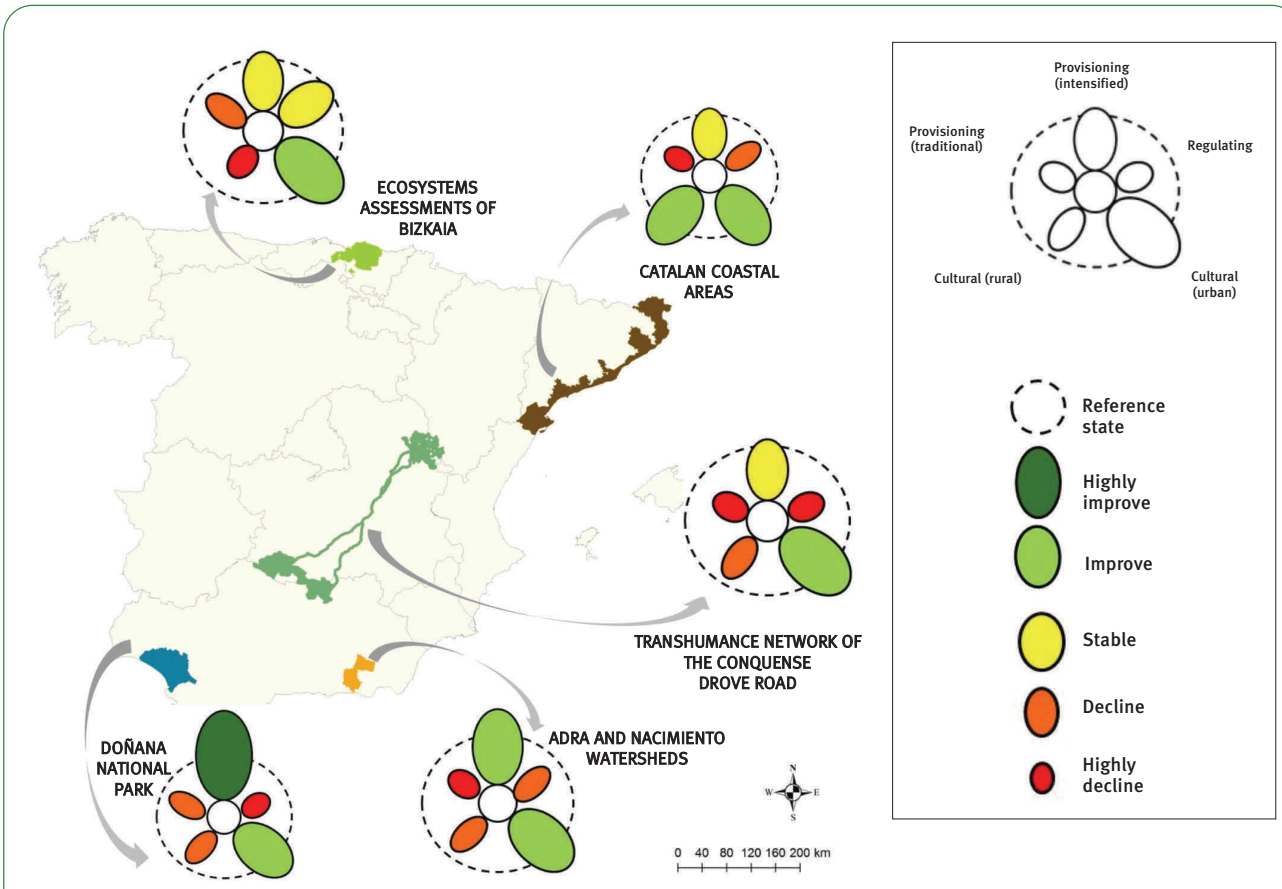

Figure 6.2 Synthetic evaluation of the status and trends of ecosystem services in the five case studies included in the SNEA.

In the transhumance network of the Conquense Drove Road, all of the regulating and provisioning services showed a declining trend, with the only exception being disturbance control, which mostly referred to the prevention of forest fires due to the removal of biomass by transhumant livestock. Regarding cultural services, all such services remained stable or improve, except spiritual value, which was affected by rural abandonment and the loss of traditional practices. It is interesting to highlight the deterioration of services related to traditional food production, caused by rural abandonment and the perceived loss of quality of agricultural products.

In the Adra and Nacimiento watersheds, a decrease in provisioning services was observed, including that of water, fibers and other biotic materials. Food provisioning is maintained because while traditional agricultural activities have decreased significantly, intensive farming systems (e.g.,

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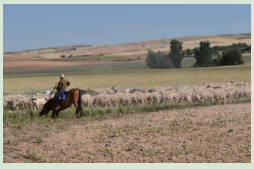
Box 6.1 Evaluating ecosystem services in transhumance cultural landscapes[a]

An interdisciplinary and participatory methodological framework for ecosystem services assessment was applied between 2009 and 2011 to the landscapes associated with transhumance in the Conquense Drove Road[b] (CDR), one of the major livestock drove roads still in use in Spain. A total of 33 ecosystem services (10 provisioning, 11 regulating, and 12 cultural services) were identified and evaluated using biophysical, socio-cultural and/or economic valuation methods. Three examples are provided below.

Type of evaluation / ecosystem service evaluated	Methodological approach	Main results
Biophysical evaluation: Structural and functional connectivity provided by the presence of the drove road 	A GIS polygon file was built with current land cover in the CDR network. Structural connectivity was evaluated through polygon counts under three different scenarios (absence of drove road, drove road with its actual width and a hypothetical drove road with the legal 75-m width). Functional connectivity was evaluated using the travel cost index (a GIS tool based on resistance). Three types of matrices (forest, drove road and agrarian) and three theoretical matrix resistance values for different wildlife species (low, medium and high) were explored.	The current drove road physically connects seven forest patches comprising 9,350 ha, while a drove road with its legal width would connect 25 forest patches totaling 77,180 ha. Regarding functional connectivity, the presence of the drove road reduces resistance to wildlife movement by 0.2-1 percent on the whole trip between summering and wintering areas (up to ten percent in the case of the drove road with legal width). However, this effect is particularly important in those stretches that cross a highly transformed agrarian matrix, where the resistance reduction effect can reach 62 percent.
Socio-cultural evaluation: Aesthetic value of the drove road and livestock presence as perceived by different stakeholders 	Questionnaires (n=286) were applied to local inhabitants and non-residents, asking them to express their aesthetic preferences when comparing 30 photographic pairs. Pictures in every pair were very similar except for the presence/absence of a drove road, or the presence/absence of livestock. Differences were analyzed using Kruskal-Wallis tests and multivariate analyses.	Overall, no significant effect was observed regarding the presence of the drove road in the landscape, but differences were found among certain groups of stakeholders. The presence of livestock in the landscape was positively selected by all consulted stakeholders. Livestock herders (either transhumant or not) and neo-rural people were the stakeholders with a higher preference for the presence of the drove road and livestock in all the landscapes.
Economic evaluation: Soil fertility provided by sheep manure in stubble fields of the summering area 	Total manure production of sheep was estimated by multiplying the number of transhumant sheep heads by the average daily rate of manure deposition and the number of days sheep spent feeding in stubble fields in the summering area. The equivalent monetary value of fertilization using sheep manure as fertilizer was calculated at current market prices.	Over 1,000 tons of manure are produced every year by transhumant sheep in the summering area, and distributed over 19,000 ha of stubble fields (ca. 54 kg/ha). The monetary investment needed to replace this fertilization service would reach over 35,500 Euro at market price (not including the labor necessary to distribute manure, another service also provided by sheep).

a Modified from Oteros-Rozas et al. (2012).
b The drove road consists of a 75-m-wide (in most parts) corridor that crosses the agricultural lands in the central Iberian plateau for approximately 410 km, connecting summering and wintering pasturelands.

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Marina García Llorente

greenhouses) have increased in terms of both area and production. Regulating services have also been negatively affected in these watersheds, particularly erosion control, soil fertility, biological control and pollination. This decline is driven by an abandonment of rural mountain areas and a degradation of terraced crops as well as subsistence farming. Finally, cultural services linked to scientific and recreational activities (e.g., nature tourism) have improved, while others linked to the maintenance of local ecological knowledge and aesthetic values have declined.

In the Doñana National Park case study, the only services that showed an increasing trend were those related to food provision (e.g., fruit crops) and certain forms of formal knowledge (the cultural services of scientific and environmental education). In general, regulating services were degraded, particularly those associated with water quality and agricultural intensification (e.g., loss of soil fertility, increased erosion, decreased shock damping).

In the Bizkaia case study, there was an overall decrease in agricultural practices related to traditional knowledge and an increase in the forest area, mainly due to the proliferation of intensive pine forest plantations in recent decades. This increase, together with the reduction of industrial pollution over the past two decades, explains why certain regulating services have improved, including air and water quality, local and regional climate regulation and carbon storage. However, due to heavy anthropogenic pressures, there was a loss of many other services. Regarding cultural services, an increase was observed in scientific knowledge and environmental education as well as in recreational activities associated with the development of tourism and recreation, while traditional ecological knowledge declined.

Finally, on the Catalan coast, there was a general tendency to decrease provisioning services as well as most regulating services (except for the climate control and air). Cultural services associated with recreation activities, education and scientific knowledge have increased significantly.