

## ***Summary***

This paper explores qualitative perceptions of ecosystem services and the connections between those services and human wellbeing through an inductive process, using the case of an agricultural system under transformation through irrigation in Navarra, northern Spain. We identify which livelihood variables and production models influence perceptions of ecosystem services among different stakeholders including landowners and farmers and we analyse if agricultural intensification translates into significantly different perspectives on ecosystem services, and their related benefits. We finally discuss the relationship between the qualitative valuation of ecosystem services, farmers' livelihoods and wellbeing and draw implications for agricultural and rural development policies.

## ***Abstract***

The intensification of land management practices in agricultural systems have focused on meeting the growing global demand for food leading to a decrease of soil-related ecosystem services (Martín-López et al., 2011).

This paper explores the degree to which land management intensification translates into different perspectives on ecosystem services and their related benefits and costs. It investigates how agrarian ecosystem services are perceived and how they relate to different dimensions of human well-being, as well as highlights which livelihood variables and production models influence those perceptions.

The paper sheds light regarding the connection of agrarian ecosystem services to human well-being and their valuations. It is also intended to contribute to improving the formulation of agrarian policies and measures by delivering the understandings and stated preferences of directly affected stakeholders. Enhancing certain ecosystem services may deny the enjoyment of other types of ecosystem services by different stakeholders. Uncovering such trade-offs imply understanding the way and the extent to which services are valued by different stakeholders. A broad awareness of perceptions and the non-economic motives behind valuations for different stakeholders will contribute to better design policy measures which are deemed effective, legitimate and fair.

Socio-cultural valuation methods are used to address preferences towards ecosystem services. To our knowledge, the literature on ecosystem services valuation addressing agrarian soil services is surprisingly scant. We contribute to this literature by means of an empirical case study that focuses on multiple agrarian ecosystem services.

The case of the irrigation Canal de Navarre (in its phase 1) is used as the case study. This area is transitioning to a system of more intensive land management through irrigation. 23500 hectares have already been transformed into irrigated systems and 15.000 hectares more have just been approved for change. This transformation affects 22.5% of Navarre population and 4.5% of the employed people in the primary sector. The region encompasses heterogenic climate and water access infrastructure. Although the agrarian sector is still important, full time farmers make up just half of the survey participants, with the other half being part time farmers and retired farmers. Therefore, their livelihood strategies are diverse and local acceptance of the irrigation project differs depending on the type of livelihoods, ecosystem services valuations and identities.

Participants have shown that, contrary to what was expected, regulating services, rather than provisioning services, are highlighted with regard to farmers' responsibility in this kind of services production. This was relevant mainly for biological control, depuration of water (due to use of fertilizers and pesticides), erosion prevention (type of rotations and tilling) and

supporting services (fertility). The promotion of land management that improves fertility, water quantity regulation and erosion might be welcome by the stakeholders. However, biological controls, pollutant regulation and climate regulation can lead to conflicting visions if adopting measures to enhance those kinds of regulating services. Further, as Smith and Sullivan (2014) point out, the regulatory services that transcend property boundaries require specific policy attention since it is well established that the spatial distribution of beneficiaries and providers may be unbalanced.

One of the main findings of the study is that there is a clear trade-off between provisioning services and the other services provided by agrarian land. Although these types of services are generally the highest valued overall, they are also found to be more important for full-time farmers which are mostly productivity-focused instead for those pursuing other types of livelihoods, such as part time farming, who value cultural services more highly. In the latter case, agrarian ecosystems support non-commercial personal use of land such other informal economic activities that may constitute not only an economic income and an important food provisioning source but also their “way of life” (Poe et al., 2013).

The lack of recognition given in policy and science to cultural services may be influencing the generally low valuations towards those kind of services. The fact that some groups value cultural services more highly also sheds light on the mismatch between mainstream formal institutions promoting certain agrarian development strategy and some local stakeholders’ preferences. Neglecting the importance of cultural services may affect subjective happiness, social relations, freedom of choice and also on security, with their omission potentially contributing to the breakdown of social networks (MEA, 2005b; Poe et al., 2013). Moreover, abandoning cultural services may create conflict, reduce trust and hinder collaborative management, therefore reducing the well-being of the community.

Well-being is not unidimensional. It is necessary to understand how it is conditioned by what people value. That is, if provisioning services (income, food and raw materials) are enhanced, significant biophysical processes as well as socio-cultural structures can potentially be impacted. The management to obtain higher yields implies intensive fertilization and water consumption that, in consequence, can lead to soil degradation including loss of organic matter, erosion, salinization, as well as the disappearance of less intensive livelihoods.

Management choices often lead to trade-offs between private financial gains and social losses (Zhang et al., 2007). Those co-lateral (cost-shifting) effects, when tangible, may influence people to decide to change their land management practices based on a desire for long-term livelihood sustainability. However, in the meanwhile it may also imply neglecting alternative options that existed in the past but were not protected. This also connects ecosystem services valuation and human well-being with vulnerability (MEA 2005).

An explicit understanding of farmers' values and perceptions of ecosystem services increases the likelihood of engaging their participation in behavioural change. This is essential to encourage the adoption of ecosystem-oriented management practises as well as implementing effective natural resource policies (Smith and Sullivan, 2014).

## ***Bibliography***

Carpenter, S.R., Mooney, H.A., Agard, J., Capistrano, D., DeFries, R.S., Díaz, S., Dietz, T., Duraiappah, A.K., Oteng-Yeboah, A., Pereira, H.M., 2009. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proc. Natl. Acad. Sci.* 106, 1305.

Costanza, R., Fisher, B., Mulder, K., Liu, S., Christopher, T., 2007. Biodiversity and ecosystem services: A multi-scale empirical study of the relationship between species richness and net primary production. *Ecol. Econ.* 61, 478–491.

- Gómez-Baggethun, E., De Groot, R., Lomas, P.L., Montes, C., 2010. The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecol. Econ.* 69, 1209–1218.
- Martín-López, B., García-Llorente, M., Palomo, I., Montes, C., 2011. The conservation against development paradigm in protected areas: Valuation of ecosystem services in the Doñana social–ecological system (southwestern Spain). *Ecol. Econ.* 70, 1481–1491. doi:10.1016/j.ecolecon.2011.03.009
- MEA, 2005a. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC. Accessed online at [www.millenniumassessment.org](http://www.millenniumassessment.org).
- MEA, 2005b. *Ecosystems and human well-being*. Island Press Washington, DC.
- Poe, M.R., Norman, K.C., Levin, P.S., 2013. Cultural dimensions of socioecological systems: key connections and guiding principles for conservation in coastal environments. *Conserv. Lett.*
- Smith, H.F., Sullivan, C.A., 2014. Ecosystem services within agricultural landscapes—Farmers’ perceptions. *Ecol. Econ.* 98, 72–80. doi:10.1016/j.ecolecon.2013.12.008
- Sukhdev, P., Kumar, P., 2008. The economics of ecosystems and biodiversity (TEEB). *Wesseling Ger. Eur. Communities*.
- Zhang, W., Ricketts, T.H., Kremen, C., Carney, K., Swinton, S.M., 2007. Ecosystem services and dis-services to agriculture. *Ecol. Econ.* 64, 253–260.