Bundling the ecosystem services supplied by agro-ecosystems as part of the French Evaluation of Ecosystems and Ecosystem Services (EFESE).

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Abstract

In line with the European program "Mapping and Assessment of Ecosystem and their Services", the French Ministry for the Environment implemented its National Ecosystem assessment (i.e. French Evaluation of Ecosystems and Ecosystem Services, EFESE) in 2012. Here, we present the analysis of the associations among ecosystem services (ES) supplied by agro-ecosystems and quantitatively estimated by a group of experts coordinated by the French National Institute for Agricultural Research.
Ten ES were represented by fourteen indicators, which were quantified at the Small Agricultural Region (SAR) level. We first identified associations among ES using a correlation network. Our results highlighted three broad nodes of ES: a first node combines ES related to water and nitrogen cycles, a second node combines ES sensitive to semi-natural habitats or intensity of agricultural practices and, a third node combines ES related to carbon fluxes and stocks.

In a second step, we differentiated ES bundles corresponding to two beneficiary groups: society and farmers. For each beneficiary-oriented bundle, we identified spatial clusters of SARs based on their similarity in ES supply using self-organizing maps and the Silhouette index. We then explored the spatial congruence of the clusters of SARs between the two beneficiary-oriented bundles. The analysis of congruence between the different types of ES

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bundles to society and farmers allowed characterising SARs according to their multifunctional character.

Finally, we investigated the relationships between bundles of ES and several management parameters related to measures for the degree of intensification (the relative area of croplands, expenses in phytosanitary products and agricultural inputs).
Although a higher diversity and supply of multiple ES were expected for SARs with low phytosanitary inputs and a lower proportion of croplands, we did not find such a clear relationship between agricultural inputs and multi-ES supply.