Assessment of ecosystem services and environmental impacts of agricultural systems: going further than an indicator list

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Poster

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Abstract

Integration of ecosystem services (ES) in the redesign of agricultural systems is a major avenue for progress towards sustainability. Such agroecological transition requires the integration of ES in sustainability assessment methods. A review of literature showed that few methods assessing environmental impacts (EI) have addressed ES until now. Furthermore, on the conceptual level, the border between the classical concept of EI and the concept of ES remains blurred. Yet, a clear separation is absolutely needed to avoid any attempt of greenwashing.
Here a new conceptual indicator framework is developed to integrate both EI and ES, starting from the definition of ES linked to ecosystem processes while EI are due to human activities. The indicator framework consists in sustainability themes which address negative impacts (hereafter impacts) and positive ones (hereafter benefits) caused by agricultural systems. Overall 22 themes including 7 benefits and 15 impacts were defined. The themes may be aggregated in a hierarchical way at several levels. Each of those impacts and benefits are determined by the interactions of effect linked to human activity (e.g. greenhouse gas emission), ES (e.g. carbon storage) and environmental characteristics (e.g. soil texture). For each theme, a joint assessment method of impact and ES was developed to identify favourable (low impact, high service), unfavourable (high impact, low service) and mitigated (low impact and low ES or conversely) situations regarding sustainability.
The framework was implemented for a sample of 33 arable intensive and organic farms around Arcis-Sur-Aube in chalky Champagne, members of the SCARA cooperative. Some economic (e.g. gross margin) and social (e.g. working time) indicators, were selected to complete the assessment with the other dimensions of sustainability. Synergies and trade-offs between indicators were studied. The joint assessment of EI and ES, followed by a PCA and a hierarchical ascendant classification analysis highlighted the interest of the method. It was possible to distinguish more groups of farms than only the expected and binary opposition of intensive vs. organic. The group of farms with high level of ES and EI should be noticed. Those farmers do not use the potential ES linked to diversified crop rotation.