

From crop diversity to ecosystem services: using indicators to evaluate crop diversification benefits

Problem

Diversified crop rotations can help to support the agroecological transition of cropping systems. However, most crop diversity indicators currently available only consider crop rotation length. Evaluating the ecosystem services provided by diversified rotations requires the consideration of additional criteria, e.g. crop species and sequence.

Solution

We have developed a global crop diversity indicator addressing both temporal and spatial diversity. The temporal diversity consists of an assessment of taxonomic diversity (assessed by an inverted Simpson index) and of the functional diversity through an indicator linked to 12 ecosystem services (ES). The spatial diversity depends only on strip width.

Benefits

Farmers and advisors can gain insights into the agroecological performance of a rotation through single indicators providing information on ecosystem services, while the aggregated indicator estimates the overall impact of the rotation.

Practical recommendation

- In order to test the potential benefits of different crop diversification scenarios, farmers and advisors can make use of this indicator tool by inputting the different crops and catch crops of the rotation into the Excel calculator.
- The following conditions apply when using the tool:
 - Rotation lengths should not exceed 10 years;
 - There are a maximum of 3 consecutive crops within a cropping season for multiple cropping schemes or 2 crops in intercropping schemes;
 - The multi-service cover crop after the cash crop has a maximum of 6 species.

Applicability box

Theme

Assessment, rotation, ecosystem services

Agronomic conditions

The current version of the tool is suitable for any rotation with crops within a list of 46 species.

Required time

A few minutes to test a rotation and a few minutes to analyse the result

Equipment

A computer with Excel software

Best in

Rotations with arable crops and mixed farming rotations with leys, forages and alfalfa crops

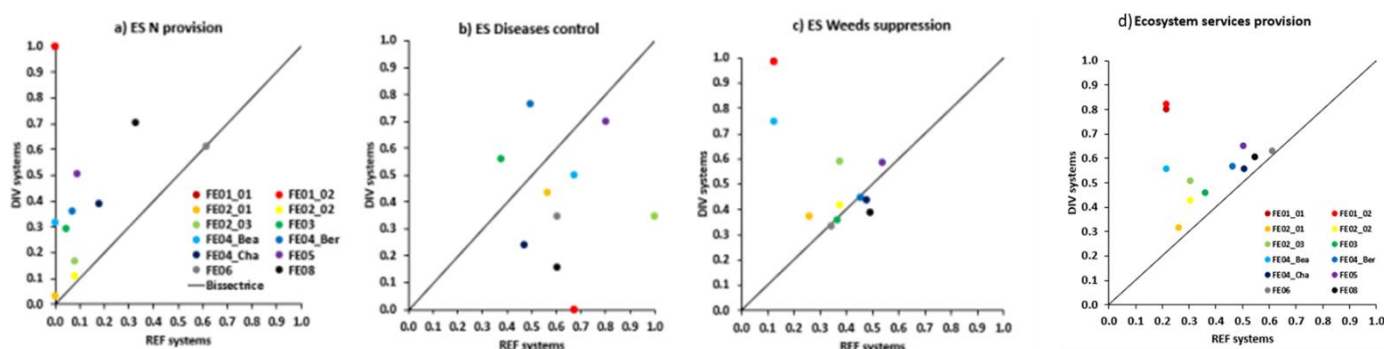


Figure 1: Comparison of 12 pairs of rotations (between the reference rotation and the diversified rotation) for different ecosystem services (a) Nitrogen provision (b) regulation of diseases (c) regulation of weeds (d) all the 12 ES. Rotations are taken from DiverIMPACTS field experiments (See website below for details).

- For spatial diversity, the width of crop strips is the only data used. This indicator does not vary a lot for widths of more than 100 m.
- Ecosystem services covered by the indicator are: the regulation of diseases, weeds and pests, pollination, nitrogen supply, soil structuration, carbon storage, soil erosion, nitrogen leaching, water storage, habitat for wildlife, and aesthetic of the landscape.
- Farmers and advisors gain insights into the effect of crop diversification on ecosystem services, and some of the trade-offs between different ecosystem services arising from the diversification strategies selected, for example:
 - Nitrogen provision vs the regulation of diseases when the number of legumes crop is too high (figure 1);
 - Nitrogen leaching vs water storage when multi-service cover crops are introduced in the rotation.

Further information

Further reading

- Un indicateur évaluant la diversité globale des rotations : de la diversité des cultures aux services écosystémiques. Olivier Keichinger, Loïc Viguier, Guénaëlle Corre-Hellou, Antoine Messéan, Frédérique Angevin et Christian Bockstaller, Agriculture, environnement et société, <https://agronomie.asso.fr/aes-11-1>, 18.

Weblinks

<https://www.diverimpacts.net/field-experiments.html>

About this practice abstract and DiverIMPACTS

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This practice abstract was elaborated in the DiverIMPACTS project, based on the EIP AGRI practice abstract format. It was tested in more than 50 rotations, implemented and tested in France and on field experiments of DiverIMPACTS partners between 2017 and 2020.

DiverIMPACTS: The project is running from June 2017 to May 2022. The overall goal of DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability - is to achieve the full potential of diversification of cropping systems for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains.

Project website: www.diverimpacts.net

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