

Diversified agriculture enhances ecosystem services and maintain yields

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Increasing diversity in crop production systems benefits ecosystem services and biodiversity without compromising crop yields. An international research group found this by analyzing nearly 42,000

comparisons between diversified and simplified agricultural practices. Diversification can occur both above and below ground in a cropped field, and is accomplished with management practices that include growing multiple crops in a rotation, planting flower strips within fields, reducing tillage, adding organic amendments that enrich soil life, and establishing or restoring species-rich habitat in the landscape surrounding crop fields.

Diversification—adding more variety to cropping systems and the agricultural landscape—has been suggested as a path to make agriculture more sustainable. It has the potential to reduce negative impacts from agriculture on climate and the environment. Increasing biodiversity is assumed to enhance yields and ecosystem services such as pollination, pest regulation by natural enemies, nutrient turnover, water quality and climate mitigation through carbon sequestration. Although much research has been invested to explore this, the results of [diversification](#) studies have not been synthesized. Further, the focus has mainly been diversification of crops and vegetation. Diversification of soil organisms has seldom been recognized.

"My colleagues and I wanted to test if diversification is beneficial for both agricultural production and ecosystem services. The current trend is that we simplify major cropping systems worldwide. We grow monocultures on enlarged fields in homogenized landscapes. The results of our study indicate that diversification can reverse the negative impacts that we observe in simplified forms of cropping on the environment and on production itself," says lead author Dr. Giovanni Tamburini at the Swedish University of Agricultural Sciences and University of Bari.

Based on 5,188 studies with 41,946 comparisons between diversified and simplified [agricultural practices](#), an international team of researchers show in a recent article in Science Advances that overall, diversification

measures enhanced ecosystem services. Diversification practices generally maintained at the same level or even increased [crop yields](#). The enhanced biodiversity created by diversification practices improved pollination and pest regulation by natural enemies. It also improved water regulation and enhanced soil fertility. Diversification practices had variable effects on climate regulation. In some cases, diversification increased greenhouse gas emissions.

"An important next step is to identify which specific practices and conditions that result in positive or negative climate mitigation, and to avoid practices that give [negative impacts](#)," says Sara Hallin at the Swedish University of Agricultural Sciences and a co-author of the study.

Studies where yield had been examined together with one or more other ecosystem services were few but still numerous enough to analyze the occurrence of win-win, trade-off and lose-lose situations. Win-win outcomes between yield and another service dominated with 63 per cent of the cases, but all other possible outcomes were also represented.

"There was a clear majority of win-win situations. But there were also less desirable outcomes that we need to avoid when diversifying cropping systems. Agricultural researchers, specialists and farmers need to get together and identify, develop and implement winning combinations of diversification practices," says Riccardo Bommarco at the Swedish University of Agricultural Sciences and a co-author of the study.

Many of the tested diversification practices are already in use, but could be more widely adopted and used in combinations both on and around [crop fields](#).

How can we diversify our farming systems?

There are many ways to increase diversity both on and around crop fields. We can add crop species and cover crops to crop rotations or grow crops together in the same field with intercropping. Flowering [crops](#) provide pollen and nectar for pollinating and predatory insects. Flower strips and vegetation around crop fields enhance biodiversity that can benefit the cropping system. We can also support belowground biodiversity by retaining crop residues on the soil surface, adding manure and minimizing soil disturbance, e.g. by reducing tillage. We can also add beneficial fungi and bacteria.

More information: Giovanni Tamburini et al. Agricultural diversification promotes multiple ecosystem services without compromising yield, *Science Advances* (2020). [DOI: 10.1126/sciadv.aba1715](#)

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