

Science for Environment Policy

Integrating animal and crop production can reduce nutrient leaching from agricultural fields

Nutrient leaching, the movement of plant nutrients from soil to water, can have negative effects on aquatic ecosystems due to eutrophication, which reduces the oxygen available in water, causing species and habitat loss. Ecological Recycling Agriculture (ERA), which is based on ecological principles and integrates crop production and animal husbandry, may limit this effect. This study investigated the impact of ERA on agricultural fields in Finland, showing that the practice can reduce nitrogen leaching and may help to achieve agricultural nitrogen-reduction targets.

When water enters soil, it dissolves the nutrients within and transfers them to the water supply. When [water](#) percolates through [soil](#), these dissolved nutrients can be transferred into deeper layers. This process, termed nutrient leaching, contaminates groundwater and can have negative effects on aquatic ecosystems. For instance, nitrogen, which is introduced to soil mainly by fertilisers, contributes to the eutrophication of water bodies, with many negative consequences for aquatic life.

This is a significant problem in the Baltic Sea, where the influx of nutrients from catchments (areas of land that are connected to bodies of water) has caused the water to become severely oxygen depleted. Although nutrient loading has been on the decline since the 1980s, the ecological status of the Baltic Sea has not significantly improved, suggesting that more reductions are necessary. Achieving this requires countries bordering the Baltic Sea to apply agricultural practices that optimise nutrient use. One such practice is Ecological Recycling Agriculture, or ERA, which can be defined as a system, such as a farm(s), in which at least 85% of total nitrogen used is produced by the system¹.

More broadly, ERA involves balancing crop and animal production, so that the material used for nitrogen fixation and to improve soil fertility can also be used as fodder, and the plant nutrients in manure are distributed over the entire farm during crop rotation. This type of farming, which also does not use pesticides or chemical fertilisers, can achieve a high level of self-sufficiency. According to the [Baltic Ecological Recycling Agriculture and Society](#), ERA has three key principles: crop rotation, balanced animal stock, and self-sufficiency in resources².

A key element of ERA is placing animal and crop production near to each other. This proximity is important, as nutrient leaching is often due to the fact that livestock and plant production are located in distant areas. Due to higher application rates next to the centres of livestock farming it tends to accumulate in soil locally. In fact, the distance between crop and animal production is thought to be the main reason for the high nitrogen load in the Baltic Sea.

In this study, part funded by the EU's [Baltic Sea Region Programme](#), researchers assessed the environmental impacts of ERA in three agricultural catchments. The catchments were all in Finland (which borders the Baltic Sea): Lepsämäenjoki, where crops are grown; Yläneenjoki, where animals are bred; and Lestijoki, a dairy production line. Nitrogen leaching from the catchments was simulated using a model, which was run based on the existing farming conditions and under hypothetical ERA conditions. As well as agricultural nitrogen losses, the concentration of nitrogen in streams was calculated to give a broader picture of how ERA affects nitrogen leaching.

The simulations showed that ERA can decrease nitrogen losses. The maximum inorganic nitrogen concentrations in streams and the average amount of nitrogen loss from agricultural fields were lower compared to the existing production method, which, unlike ERA, depends on inorganic fertilisers. In two of the catchments (Lepsämäenjoki and Yläneenjoki), the decrease in nitrogen losses would enable them to meet national water protection targets for agricultural production (a 30% decrease in nitrogen loading from fields).

There is a pressing need to reduce nitrogen leaching from agricultural areas to surface waters. This study suggests that ERA could be an effective method to achieve this, as it can reduce excess nitrogen in agricultural soils and nitrogen leaching. The researchers also suggest that ERA could be used to achieve the nitrogen reduction targets for agriculture set by the [Baltic Sea Action Plan](#).



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1. Source:
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2. Source:
<http://www.beras.eu/implementation/index.php/en/2012-02-09-21-53-40/ecological-recycling-agriculture-era>