

# Grassland areas should be chosen wisely

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When farmland is converted from grain production to grasslands, the greatest environmental benefits are obtained by choosing land that is close to existing natural areas or has high nutritional loads to aquatic environments, a new study indicates.

Conversion from cereals to grasslands is good for the environment—but where in the landscape is the best place to carry it out? According to researchers from the Department of Agroecology at Aarhus University, it depends on whether you prioritise improvement of nature and the aquatic environment, how much biomass you can produce, or how much land is needed to do so—or a combination. The researchers developed a method that enabled them to optimise selection of the best areas, where multiple benefits were taken into consideration.

Almost two thirds (63 per cent) of Denmark's land area is taken up with intensive agriculture. Farming challenges the environment, climate, and water. The impact of agriculture can be reduced if some of the [agricultural land](#) is converted from cultivation of cereals to cultivation of grass for green biorefining.

## **Grasslands are good in many ways**

Grassland production leads to reduced [nitrogen](#) leaching to the aquatic environment and reduced greenhouse gas emissions. In addition, grass can be refined to green protein through a biorefinery and thereby replace some of the soy protein that Denmark imports from abroad. This can benefit the environment in the soy-producing countries.

However, choosing which areas to convert from cereal to grass should be done wisely if you, for example, wish to avoid destroying existing, well-functioning ecosystems. So how can you identify the most suitable agricultural land for [conversion](#)? The researchers from the Department of Agroecology have investigated this.

## **Three scenarios for conversion to grasslands investigated**

The researchers analysed three different scenarios with varying levels of fertilisation to investigate the most suitable agricultural areas to convert from cereal to [grassland](#) while gaining multiple environmental benefits.

The three biomass scenarios in the study were:

- Achievement of three million tonnes dry matter from organic, non-fertilised grass-clover mixtures
- Achievement of five million tonnes dry matter from grass fertilised with 300 kg N/ha
- Achievement of five million tonnes dry matter from grass fertilised with 450 kg N/ha

The areas in Denmark selected for conversion were chosen based on coastal nitrogen loads and an index that expressed the value of the surrounding nature. The selection was done stepwise until the goals for biomass were reached.

## **60 per cent of the nitrogen targets can be attained with targeted conversion**

The areas selected for conversion were located close to existing nature and had a high coastal nitrogen load in all three scenarios.

In order to achieve the biomass goal in [scenario 3](#), i.e. production of five millions tonnes dry matter with 450 g N/ha, the researchers found that it was necessary to use 23 per cent of Denmark's current agricultural land. Correspondingly, it would require 28 per cent of the current agricultural land to produce five million tonnes dry matter with only 300 kg N/ha (scenario 2), and 24 per cent of the current farmland to produce a mere three million tonnes dry matter but without fertilisation (scenario 1).

Even though less area would need to be converted in scenario 3, not all is perfect, because there is a higher coastal nitrogen load compared to scenario 2. With scenario 2 it is possible to achieve 50-60 per cent of the national target of reducing nitrogen by 13,000 tonnes compared to 21-28 per cent with scenario 3.

The maps that the researchers compiled show that conversion from cereals to grasslands on 24-28 per cent of Denmark's farmland would go a long way towards fulfilling the national targets regarding reduction of nitrogen leaching to the fjords—up to 8,536 tonnes nitrogen per year—improve the local nature, and produce grass that can replace imported protein.

"Actual management plans cannot be initiated based solely on this study, but the areas that show high potential for achieving multiple benefits can be used as a starting point for suitable field work to further investigate possibilities for targeted implementation," says Postdoc Mette V. Odgaard from the Department of Agroecology and one of the researchers behind the study.

**More information:** Mette V. Odgaard et al, Targeted grassland production – A Danish case study on multiple benefits from converting cereal to grasslands for green biorefinery, *Journal of Cleaner Production* (2019). [DOI: 10.1016/j.jclepro.2019.03.072](https://doi.org/10.1016/j.jclepro.2019.03.072)

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