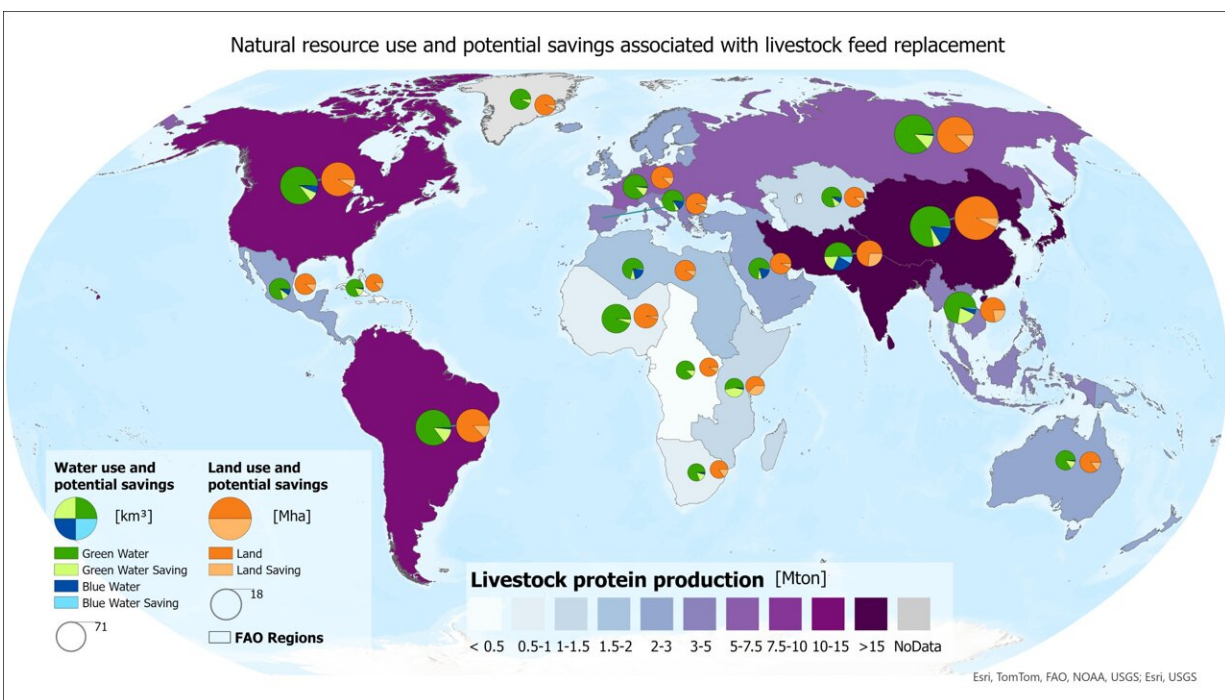


Agriculture: Changing animal feed reduces consumption of natural resources such as soil and water

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Global distribution of protein production, including meat and dairy products, adapted from FAO, combined with results on region-specific land and water use for energy-rich livestock feed production and the potential savings achievable by replacing feed with agricultural by-products. Credit: Politecnico di Milano

A study [published](#) in *Nature Food*, the result of a collaboration between

Politecnico di Milano and the University of Milan, highlights how the increased use of by-products in the feed sector in a circular perspective can lead to significant savings in the use of land and water resources and thus to more sustainable agri-food systems.

Underlying the work led by Camilla Govoni and Maria Cristina Rulli (Politecnico di Milano), Paolo D'Odorico (University of California at Berkeley), and Luciano Pinotti (University of Milan), there is a thorough analysis of the competition for natural resources between animal and human [food](#) production and a search for strategies to reduce both this competition and the unsustainable use of natural resources that can result from it.

The study shows that an 11-16% substitution of energy-intensive crops currently used as [animal feed](#) (e.g., cereals) with agricultural by-products would save approximately between 15.4 and 27.8 million hectares of soil, between 3 and 19.6 km³ and between 74.2 and 137.8 km³ of irrigation and rainwater.

This saving of natural resources is an appropriate strategy for reducing the unsustainable use of natural resources both locally and globally, i.e., through virtual trade in land and water.

Agricultural by-products are defined as secondary products derived from processing primary crops such as cereals and sugar. The study includes cereal bran, sugar beet pulp, molasses, distillery residues, and citrus pulp.

Food of animal origin is an important source of protein in [human diets](#) and contributes, on average, 16% of global food requirements, while using 1/3 of the resources used in agriculture and up to 3/4 of all agricultural land for their production.

Animal production can, therefore, compete directly or indirectly with

plant food production.

"Not only does the use of agricultural by-products in animal diets decrease competition between sectors and pressure on resources, but it would also increase the availability of calories that can be directly earmarked for the human diet (e.g., cereals); if the saved resources are used for other purposes, including the production of plant foods lacking in current diets, it would improve food security in several countries, with healthier as well as more sustainable food choices," says Camilla Govoni, researcher at Politecnico di Milano.

"The use of alternative ingredients in animal diets would lead to increased sustainability and reduced [environmental impact](#) not only locally, where the company raises and produces meat and animal products, but also over large distances."

"Indeed, a decrease in demand for feed could lead to less importation of feed with both economic and socio-environmental benefits. The production of certain feed products actually corresponds to over-pressure on [water resources](#) and deforestation, with consequent effects on the concentration of greenhouse gases in the atmosphere, loss of biodiversity, and so on," explains Maria Cristina Rulli, Professor of Hydrology and Coordinator of the Glob3ScienCE Lab.

"The inter-sectoral decrease in the demand for cereals is of particular relevance at a time when the supply of these crops is facing serious shortages due to the combination of the ongoing war between Russia and Ukraine, the residual effects on the food supply of the COVID-19 pandemic, and a drop in harvests caused by increasingly frequent extreme events such as floods, droughts and heat waves induced by climate change."

"By converting fodder and agricultural by-products into high value-

added products and services, animal production makes a fundamental contribution to the modern bio-economy. Alongside this, [livestock farming](#) is often held responsible for a significant global environmental impact, which is why it is essential to rethink [animal nutrition](#) in particular, as it is one of the main reasons for competition for resources," concludes Luciano Pinotti, Professor of Nutrition and Food at the University of Milan.

"The approach must be to develop 'smart animal nutrition,' where research must come up with solutions to increase animal protein production without increasing the environmental footprint of animal protein. Hence the importance of studying animal nutrition not only in terms of competition but also in terms of synergies and complementarity with human nutrition so as to optimize the utilization of nutrients in the food chain. The main challenge is thus to explore innovative feeds that may work as an alternative to conventional ones, possibly do not compete with human nutrition, are part of a circular economy, and are intended with a view to 'one nutrition'."

More information: Camilla Govoni et al, Preserving global land and water resources through the replacement of livestock feed crops with agricultural by-products, *Nature Food* (2023). [DOI: 10.1038/s43016-023-00884-w](#)

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