

Land-use to solve climate change: a focus on livestock

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The land sector can strongly contribute to climate change mitigation if sustainable land-use options are applied. A study led by the CMCC Foundation highlights that land-based mitigation options at a small-scale landscape level can lead towards carbon neutral livestock systems while

providing an additional wide range of ecological, environmental and socio-economic co-benefits at local level. Greenhouse gas (GHG) emissions from agriculture, forestry and other land uses (AFOLU sector) cover 24% of global emissions, representing the second hot spot in the contribution to climate change after the energy sector.

The main drivers are CO₂ emissions from deforestation, methane (CH₄) emissions produced by ruminant [livestock](#) and by anaerobic fermentation of organic matter, mainly from rice crops, and nitrous oxide (N₂O) emissions from fertilizer use. Thus, the land sector plays a crucial role in the contribution to [climate change](#).

A new study lead by the CMCC Foundation explores to which extent sustainable land management options applied at small-scale rural landscape level can be a valuable solution for increasing the [mitigation](#) potential of the land sector. In particular, possible land-based mitigation options are identified to reduce and offset GHG emissions from the livestock sector that represents one of the main sources of GHG emissions of the whole agricultural sector. Although GHG emissions from the livestock sector decreased since 1990, with -20% in Europe in 2018, they still contribute to more than 60% to the total agricultural emissions at European level.

"The land sector," explains Maria Vincenza Chiriaco, CMCC researcher and lead author of the study, "has the unique characteristic to be at the same time both a contributor to climate change and part of its solution, thanks to the carbon sink function in soils and biomass that can be enhanced by an appropriate and sustainable land management. Our proposed land-based approach consists of two consecutive steps: we assess first the GHG emissions from the livestock activities, that is carbon footprint, in a small-scale rural area, then we evaluate the mitigation potential of a set of land-use options against livestock emissions assessed in the previous step. Our aim is to understand the

extent to which land-based mitigation options at small-scale landscape level can lead to carbon neutral livestock systems."

CMCC scientists developed a land-based approach by combining different methodologies, including geographic information system (GIS) elaboration, life cycle assessment (LCA) and methodologies from the Intergovernmental Panel on Climate Change (IPCC), to investigate how and how much GHG emissions from livestock activities can be decreased and compensated through carbon removals in the same area. They tested the approach on a pilot area in central Italy corresponding to a portion of the Municipality of Viterbo (Lazio region) characterized by a strong agricultural vocation, aiming at estimating the livestock GHG emissions and the mitigation potential of sustainable land-use options applied in the same small-scale rural landscape, in the immediate proximity of the livestock emissions source.

"The results," Prof. Riccardo Valentini (CMCC Foundation and University of Tuscia) says, "show the potential for a total offsetting of the livestock GHG emissions in the pilot area, indicating possible pathways for the carbon neutral livestock systems. Besides, depending on the type and intensity of the land-based mitigation options, results undermine also the possibility to even turn the system into a net carbon sink, producing negative emissions in the land sector that can significantly contribute to the global climate change mitigation targets."

"It's important to highlight," Maria Vincenza Chiriaco adds, "the idea of proximity of our land-based approach. There are already many existing mechanisms of carbon offsetting but they work on a logic of carbon compensation on a global scale, where the carbon removals usually take place in areas that are geographically far from those in which the emissions to be compensated are generated. In our study, instead, mitigation is achieved through the implementation of land-based mitigation options that reduce emissions or increase carbon sink in the

immediate proximity of the livestock GHG emissions source. This, besides contributing to the global climate change mitigation targets, entails a wide-ranging improvement of the entire agro-ecosystem at local scale, providing co-benefits that involve the local rural communities as well as the local institutions and the citizens that can gain in terms of environmental co-benefits, quality of life and territorial image."

The proposed land-based approach has been recently developed in a web tool. Designed and developed by the CMCC and Istituto di Servizi per il Mercato Agricolo Alimentare (ISMEA), with the financial support of the program "Rete Rurale Nazionale 2014-2020," the tool is freely available online. The web tool is based on rigorous scientific information (IPCC methodology), but it's designed to be easy to use for everyone.

The platform allows Italian livestock farmers to assess the [carbon footprint](#) of their farms by compiling a simple online questionnaire that considers the main characteristics of their livestock systems. Then, they can also assess the potential of sustainable land-based options needed to reduce and compensate their livestock emissions. Therefore, the web tool will help farmers, policy makers, and other relevant stakeholders in recognizing the best options to be applied for sustainable land management in particular at small-scale rural landscape level.

CMCC researchers aim to develop in collaboration with ISMEA and the program "Rete Rurale Nazionale 2014-2020" a traceability system for sustainable land-use leveraging on the developed land-based approach, through a voluntary mechanism of [carbon](#) farming practices at local level, aiming at reducing and offsetting GHG emissions from the livestock activities in Italy.

Hence, this mechanism has the potential to reduce and compensate the impacts caused by livestock products, making farmers and rural systems an important target for climate change mitigation.

More information: Maria Vincenza Chiriaco et al, A land-based approach for climate change mitigation in the livestock sector, *Journal of Cleaner Production* (2020). [DOI: 10.1016/j.jclepro.2020.124622](https://doi.org/10.1016/j.jclepro.2020.124622)

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