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Towards a Climate-neutral Land Sector by 2050

Scenarios Quantifying Land-Use & Emissions Transitions Towards Equilibrium with Removals (SeQUEsTER)

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Identifying pressures

Ireland's agriculture, forestry and other land use sector accounts for over 40% of national greenhouse gas emissions. The Climate Action and Low Carbon Development (Amendment) Act 2021 commits Ireland to reaching a legally binding target of net-zero emissions no later than 2050. While there are clear techno-economic pathways towards net-zero emissions within the energy and industrial sectors, there are no such pathways for the agriculture sector, where technical abatement options for emissions of nitrous oxide and methane are limited. Globally, it is assumed that land management will provide a net carbon sink to offset residual emissions from agriculture and other sectors. However, Ireland's land sector is a large net emitter of carbon dioxide (CO_2) owing to large areas of drained organic soils and a low afforestation rate relative to the forest harvest rate. There is an urgent need to identify potential agriculture and land use configurations compatible with net zero. The SeQUEsTER project provides new insight into what those future land use mixes could look like.

Informing policy

SeQUEsTER provides new evidence to underpin strategic policymaking across agriculture, the environment and land use. The conclusions are relevant to policymakers, farmers, foresters, agri-food businesses and wider stakeholders in land management and food production. Key policy messages arising from the research include the following:

- Ongoing efforts to deploy ambitious emissions abatement across the agriculture sector are vital; however, the need to curtail milk and beef output cannot be avoided if climate neutrality is to be achieved.
- Delivery of ongoing bog restoration and plans for organic soil rewetting (water table management) will be critical to reducing very large (albeit uncertain) emissions from organic soils.
- The afforestation rate needs to be ramped up to at least 10 times the current rate, and 2.5 times the official policy target, in order to support large-scale milk and beef production within net-zero constraints in 2050.
- There is a need for coordinated policy across sectors to support both supply and demand of bio-based feedstocks for the bioeconomy, in a manner that incentivises positive land use change and diversification.

Developing solutions

SeQUEsTER uniquely applied a backcasting approach to identify what "solutions" to net zero could look like for the agriculture and land sector. This was necessary owing to the scale of the challenge and differs from approaches that extrapolate past trajectories forwards (and inevitably fail to identify net-zero compatible futures). The scale of systems transformations invoked in this modelling work indicate reversals or very steep accelerations in trends in land use and cattle numbers. Addressing this challenge is imperative to ensure the future viability of farms and agri-food exports. Strategic, long-term and cross-sectoral policymaking could realise multifaceted opportunities, linking farm diversification to downstream sectors, including timber engineering, construction, bioenergy and alternative proteins to support a climate-neutral, circular bioeconomy. Above all, this research highlights the need for a mindset shift to explore alternative, sustainable and resilient futures for the food and land sectors. Constructive dialogue across diverse stakeholders and stronger government guidance on the precise definition of "climate neutrality" and "net zero" with regard to non-CO_2 emissions will be essential.

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