Beyond 2030 - Pathway to net zero

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Summary

- There is an urgent need for rapid adoption of existing mitigation measures to meet 2030 targets
- Further development of emerging and new mitigation measure is required
- Continue research in improving understanding of factors influence soil carbon storage
- Need for increased afforestation rates and advisory on how forestry can be integrated with other agricultural systems
- Wider discussion on how we treat different GHG emissions and the global/regional food system is needed

Introduction

THE UNFCCC have acknowledge that human activities are causing an increase in average global temperature through the increase in atmospheric concentration of greenhouse gases (GHG). This is affecting climate patterns that can have devastating consequences on lives and the economies. The Green Deal is the EU's growth policy to create a cleaner, healthier and climate neutral Europe by transitioning the way we produce and consume. The EU Green Deal is Europe's contribution to the COP 21 Paris Agreement 2016 that brings all nations into a common cause to strengthen the global response to combatting climate change by keeping a global temperature rise to well below 2 degrees Celsius and to pursue efforts to limit the temperature to 1.5 degrees Celsius above preindustrial level. To achieve this goal the EU Green Deal has committed to reducing EU wide GHG emissions by at least 55% for 2030, with an ultimate goal of becoming the first climate neutral area in the world by 2050. Climate neutrality means the transition to a green economy where GHG emissions from anthropogenic (human) activities are balanced, or exceeded, by the removal of GHGs from the atmosphere, achieving net zero GHG emissions. The EU acknowledges that the transition to a climate neutral economy has challenges and highlights the need for a fair and just transition to include and support people most affected. This paper discusses Ireland's climate commitments up to to 2050, and focuses on its agricultural sector, what progress has been made, the roadmaps available, and what is needed to become a climate neutral economy.

Ireland's climate commitments

Ireland is supporting the EU Green Deal through implementing the Climate Action and Low Carbon Development Act 2021. The Climate Act supports Ireland's commitment to reducing national GHG emissions by 51% by 2030 (relative to 2018 levels), and to achieve a climate neutral economy by 2050. As part of the Climate Act, Ireland are committed to publishing an annual Climate Action Plan for the country. The purpose of the Climate action Plan is to establish roadmap to guide the Irish economy towards to ultimate goal of climate neutrality and will be published annually with the addition of new research and mitigation measures. For the intermediate 2030 climate targets the Irish government has set a 25% GHG reduction target (relative to 2018) for the agricultural sector. Agriculture's target is notably lower that the Electricity (-75%), and Transport (-50%) sectoral GHG reduction targets. This is from the Irish government acknowledging the difficulty in mitigation agricultural GHG emissions in comparison to fossil fuel dominated sectors. For the 2050 climate targets. This is important as it highlights that carbon neutrality is an economy wide target, requiring all economic sectors to work together.

Marginal Abatement Cost Curve 2021-2030

In 2023 the Irish agricultural sector emitted 20.8MT CO2eq, 2.9% lower than the baseline of 2018 (21.4 MT CO2eq), and a 4.6% reduction in comparison to the preceding 2022 production year (EPA, 2024). In fact, Agricultural GHG emissions have been reducing for the past three reporting years with further reduction expected for 2024. In contrast the EPA(2024) have projected LULUCF sector GHG emissions to increase come 2030. Teagasc published a new marginal abatement cost curve (MACC) (Lanigan et al. 2023) for the Agricultural and Land Use, Land Use Change, and Forestry (LULUCF) sectors. The purpose of the MACC is to summarise the science, and evaluate the cost-effectiveness of current technical measures that are available to farmers/landowners to reduce GHG emissions, and increase carbon sequestration and storage. The Teagasc MACC reports that while it is going to be challenging to achieve the Agriculture sectors 2030 target, it was not impossible with projected reduction potentials of 4.9 and 4.1 MT CO2eq for the Agricultural and LULUCF sectors, respectively. These projections are achieved through the rapid and ambitious adoption of measure occurring across the sector.

Towards 2050

The scope of the Teagasc MACC is up to 2030. Post 2030, Irish farmers will need new and improved GHG emission reduction and carbon removal measures to those in the most recent MACC to contribute to the economy wide target of climate neutrality. Promising measures requiring further research include the development of methane (CH4) reducing feed additives for ruminants, and slurry additive. Trials have been conduct on both with promising result to date. Going forward focus needs to be on the practicality of feeding/using additives in Irish systems, the safety of handling and using (i.e. residues) these products, how to bring these products to level, consumer perception, and lastly who is going to pay for the use of these products.

There are also opportunities to further develop well-established measure, breeding being a prime example. Significant resources have been invested into the measurement of enteric fermentation from Irish ruminants. This research will improve our understanding of factors influencing enteric CH4 production, including breeding with future opportunity to select and breed of low emitting ruminants.

Further research is required to improve our understanding of the factors influencing carbon fluxes from agricultural soils. Murphy et al. (2024) and Saunders et al. (2024) have previously highlighted the considerable research effort across Teagasc and the Universities to reduce uncertainties through the refinement of GHG emission factors and carbon sequestration rates for mineral and organic soils. This research will provide soil type specific land-use, land management, and climate emission factors that can be coupled with high-resolution soil maps. Current Irish soil maps are not at a scale that is appropriate for it to be used at field nor farm level. New soil maps are required, utilising more recent soil sampling and geophysical surveys of Irish soils. This information needs to be made available to farmers and advisors, providing field and farm specific soil maps.

The collection of more granular activity data is needed to measure and verify management change at farm level on its journey to climate neutrality. Data integration will be central in this process, compiling existing datasets residing in different locations rather than having to ask farmers again. AgNav, a digital sustainability platform, will provide farmers with information to support decision making on farm to help meet agriculture's climate targets. Over time, new data sources will be included to improve the quality and scope of the assessment and to reduce administrative burden on farmers. Advisory tools/resources such as AgNav should be connected to another to improve the efficiency of advisory service and to ensure there is consistent communication to farmers. Data governance will be key to this process as farmer data is being used.

Historically change has been incremental and not uniform across agricultural systems. Research is needed in determining what drives change around adoption across different cohorts of farms as a one size fits all policy approach is not likely to produce the desired level of adoption of mitigation measures. This research will identify barriers and enable policymakers to tailor a mix of instruments (e.g. incentives, regulation, education & extension) to enhance the uptake of mitigation measures. Take afforestation and water table management measures as examples, both measures are critical if Ireland is to become a climate neutral economy. There is a need for research and confidence building among landowners of the benefits (i.e. carbon capture, biodiversity) of such land uses/managements as a viable option to alternative agricultural systems.

How we treat GHG emissions

The IPCC's 100-year variant of the global warming potential (GWP100) metric has been formally adopted in international climate policy and widely used in standardised Life Cycle Assessment (LCA). The purpose of the GWP100 is to bring all GHGs to a common units, carbon dioxide (CO2) equivalent. When emitted CO2 persists in atmosphere for long period, therefore continued emission will result in the increase of CO2 concentration in the atmosphere. In contrast, when CH4 is emitted form a natural source, natural atmospheric removals limit the increase in atmospheric concentration when emission rate is constant. The GWP100 metric does not distinguish the above behaviour difference of short (CH4) and long-lived (CO2) greenhouse gases in the atmosphere. (Lynch et al, 2020). This is a significant shortcoming of the GWP100, particularly for the livestock sector as CH4 is the dominant greenhouse gas. In response, researchers have been developing alternative methodologies that accounts for the behaviour differences of short and long lives greenhouse gases (Lynch et al. 2020; Shine et al. 2007). Other researchers have called for countries to adopt a split gas approach when setting national targets to achieve climate neutrality by 2050. This approach sets a net zero target for CO2 and nitrous oxide emissions for 2050 and a separate reduction target for CH4 emissions. In preparation for post 2030, discussions at both a national and EU level on how we treat GHG emissions are needed.

Feed/Food competition

An increasingly popular topic is the use of human edible food for animal feed and its impact on food security and resource use. Current livestock systems are engaged in feed-food competition, however this needs to be minimised to meet future food demand, minimise associated environmental impact, and prevent further increase in resource use (i.e. deforestation for agricultural land). Several metrics have been developed to measure the net contribution of livestock to the supply of human digestible protein, such as the edible protein conversion ratio (EPCR) and the land-use ratio (LUR). The EPCR compares the amount of human digestible protein in animal feed over the amount of human digestible protein produced. The LUR goes a step further where it also account for the potential human digestible protein from a crop grown on the land used to produce the livestock feed. In an analysis of the Irish food system Hennessy et al. (2021) calculated that all ruminants provide a positive contribution to global food production when operating on land unsuitable for crop production, however when the crop opportunity cost of land used is accounted for only dairy and sheep have a positive contribution. This raises the question on how and where food should be produced. From a food security and resource use perspective, this would indicate that global ruminant production should occur in regions/countries where land use competition with human edible crop production is minimal. In theory this optimised regional/global food systems approach makes sense, however the economic and social implications of such structural change must be addressed. Furthermore, this regional/global food system approach is at odds at national level climate policy.

Conclusion

There is an urgent need for rapid adoption of existing mitigation measures to ensure the Ireland's Agriculture sectors achieves the intermediate 2030 targets set out in the National Climate Action. To achieve the ultimate climate objective of becoming a climate neutral economy, the sector needs further development of current and new emerging technologies, the integration of afforestation into agricultural systems, improving understanding of factors impact soil carbon, and research in determining drives adoption. Wider discussion is needed around how we treat different GHG emissions and how we produce food.

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