Date of meeting:	23rd November 2023
Agenda item:	4
Title of paper:	4.1 Thematic Paper on Agriculture and Land Use
Purpose:	This paper, prepared by the Secretariat, provides background information and analysis for a CBWG Discussion on various aspects of Agriculture and Land Use.
Length:	63 pages

1. Introduction

The paper will consider in turn:

- The status and trends within Agriculture in Ireland. The council requested a summary of key statistics describing the agriculture sector, to include social, environmental and economic indicators and analysis.
- Provide insight into the priority mitigation options identified in the Teagasc MACC.
- Background to the topical issue of changes to the Nitrate Action Programme.
- Current status of national systems to support reporting of emissions and removals associated with Land Use, Land Use Change and Forestry, LULUCF.
- Insights from the Land Use Review Phase 1
- Key features of EU regulations and accounting rules governing LULUCF in the period to 2030, and the outlook for further development in EU policy on LULUCF in light of proposals under the Green Deal. However, this paper does not consider other EU legislative initiatives, such as the Nature Restoration Law, which would likely further refine national land use policies.

Climate & Temperature Neutrality

The United Nations Framework Convention on Climate Change explicitly acknowledges the risk of adverse impacts on food production in the context of climate change itself and the potential risk of mitigation actions themselves to reduce production capacity. The basic objective underpinning long term climate policy is the need to stabilise human influence on the global climate system at a level which avoids adverse impacts as much as is possible, including impact on food production.

Nevertheless, as cited in the IPCC 6th Assessment Report, the Special Report on Climate Change and Land observed that the land is simultaneously a source and sink of CO_2, due to both anthropogenic and natural drivers. It estimated with *medium confidence* that agriculture, forestry and other land use (AFOLU) activities accounted for around 13% of CO_2, 44% of CH_4, and 82% of N_2O emissions from human activities during 2007–2016, representing 23% (12.0 ± 3.0 $GtCO_2$ equivalent yr^{-1}) of the total net anthropogenic emissions of greenhouse gases.[1] In Ireland, AFOLU accounts for approximately 45% of reported emissions.

The Climate Action and Low Carbon Development Act (as amended 2021) defines a 'climate neutral economy' as a sustainable economy and society where greenhouse gas emissions are balanced or exceeded by the removal of greenhouse gases. Section 3(1) sets out the national climate objective; *'The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy'.*

The European Climate Law, Regulation (EU) 2021/1119 adopted by the European Union on 30 June 2021, sets a legally binding objective for Europe to become climate neutral by 2050 in pursuit of the long-term temperature goal set out in point (a) of Article 2(1) of the Paris

[1] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2391 pp. doi:10.1017/9781009157896.

Agreement, by achieving net zero greenhouse gas emissions for EU countries as a whole[2]. The EU has also articulated the ambition to achieve pan-EU net zero emissions across the AFOLU sector by 2035.

The recent 2050 Vision paper presented to Council presented a detailed discussion of climate neutrality. Given Ireland's emissions profile Agriculture and Land Use sectors are seen as critical to the achievement of climate neutrality. Climate neutrality involves human activities having no additional net effect on our climate system with a balance of all greenhouse gas emissions with removals. Carbon neutrality or net zero CO_2 emissions involves anthropogenic CO_2 emissions being balanced by anthropogenic CO_2 removals over a specified period but does not encompass all greenhouse gases.

The first challenge is to balance AFOLU emissions and their contribution to climate change, and, thereafter, to consider the potential for net negative removals from the sector to balance residual GHG emission from other sectors. The EU is considering approaches to "carbon farming" in this context.

Some intensification of stocking rates has been observed in specific regions, associated with dairy, pig and poultry systems. There is also clear evidence of on-going consolidation of tillage into specific regions with associated changes in environmental pressures. Understanding the drivers for these changes in farming activity is critical to the development of effective policies to address potential adverse outcomes at an early stage.

[2] This is expressed in the legislation as *'emissions and removals of greenhouse gases regulated in Union law shall be balanced at the latest by 2050, thus reducing emissions to net-zero by that date'*

2. Basic Agriculture Facts and Figures

General overview

The Annual Review and Outlook for Agriculture, Food and the Marine, published by Department of Agriculture, Food and the Marine provides a very useful overview of sectoral activities. The most recent publication was in Nov 2022.[3] In 2021, Ireland had 135,037 farms, 808,848 hectares of forestry and nearly 1,900 fishing vessels. The sector employed 170,400 people, or 7.1%, of the total workforce on the island. Average Family Farm Income increased for the third successive year, by 26% during 2021. Irish farmers received close to €1.9 billion in direct and capital payments under EU and nationally funded schemes. The value of agri-food exports for 2021 is a record €15.4 billion, which is up 51% on 2012. We exported our in-demand produce to over 180 countries, with our largest export being dairy, which exceeded €5 billion for the third year in a row. Agri-food exports accounted for 9.5% of total merchandising exports from Ireland.

In Ireland, agri-food is an integral part of the economy and society, and especially so for our rural and coastal communities. Beyond direct employment, the sector plays a key role in the wider rural and local economy, with estimates for output multipliers ranging from around 2.5 for beef, 2.0 for dairy and food processing and 1.75 for seafood. This compares with an average output multiplier of 1.4 for the rest of the economy and 1.2 for foreign owned firms. The Food & Drink sector accounted for 38% of all exports of Irish-owned firms in 2020.

Emissions overview

Much of Ireland's food production is exported, which limits the extent to which domestic action on consumption can influence emissions within the sector. Therefore, primary production in agriculture is largely driven by international market forces, including input costs and output prices. In addition, farm enterprises also avail themselves of farm support and environmental schemes implemented under the EU Common Agricultural Policy (CAP).

Emissions from the agricultural sector are dominated by sources of methane and nitrous oxide, with livestock farming and the use of nitrogen fertiliser to grow fodder for animals the dominant activities driving emissions. The profile and size of the cattle herd is important, as dairy cows have a higher emissions profile than non-dairy animals.

In 2021, greenhouse gas emissions associated with agriculture reached an all-time high of 23.6 Mt CO_2 eq, but fell back slightly to 23.3 Mt CO_2 eq in 2022. This follows a steady upwards trend since the lowest emissions were reported in 2011 (see Figure 1).

Provisional estimates indicate that there was a 1.2% decrease in emissions from agriculture in 2022, largely due to reduced fertiliser use and an accelerated uptake of protected urea fertilisers.

[3] https://www.gov.ie/en/publication/91e7e-annual-review-and-outlook-for-agriculture-food-and-the-marine-2020/

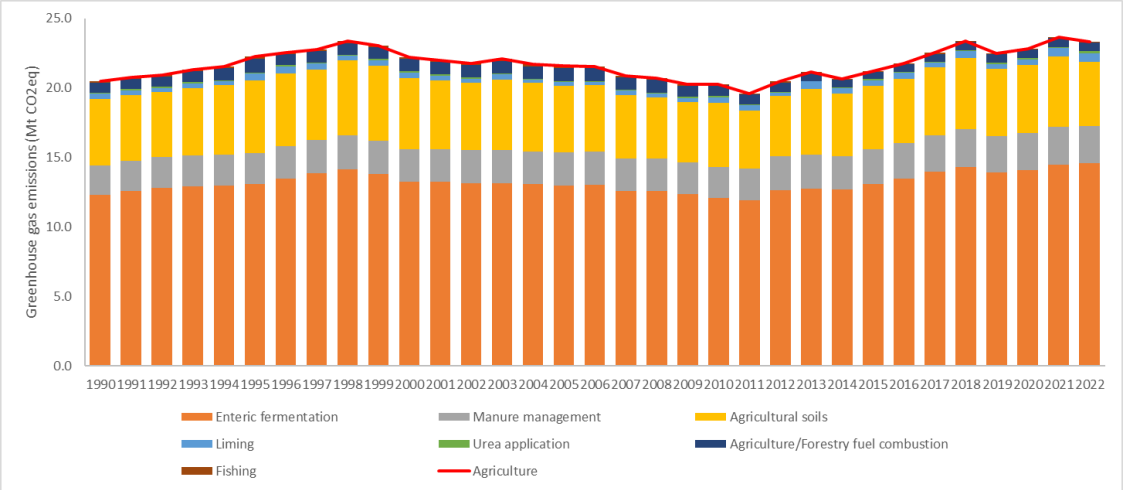

Figure 1 Greenhouse gas emissions and removals from Agriculture sector 1990-2022 [Source EPA Provisional Emissions Estimates 2023]

The most recent EPA WEM and WAM scenario projections of emissions from agriculture are shown in Figure 2.

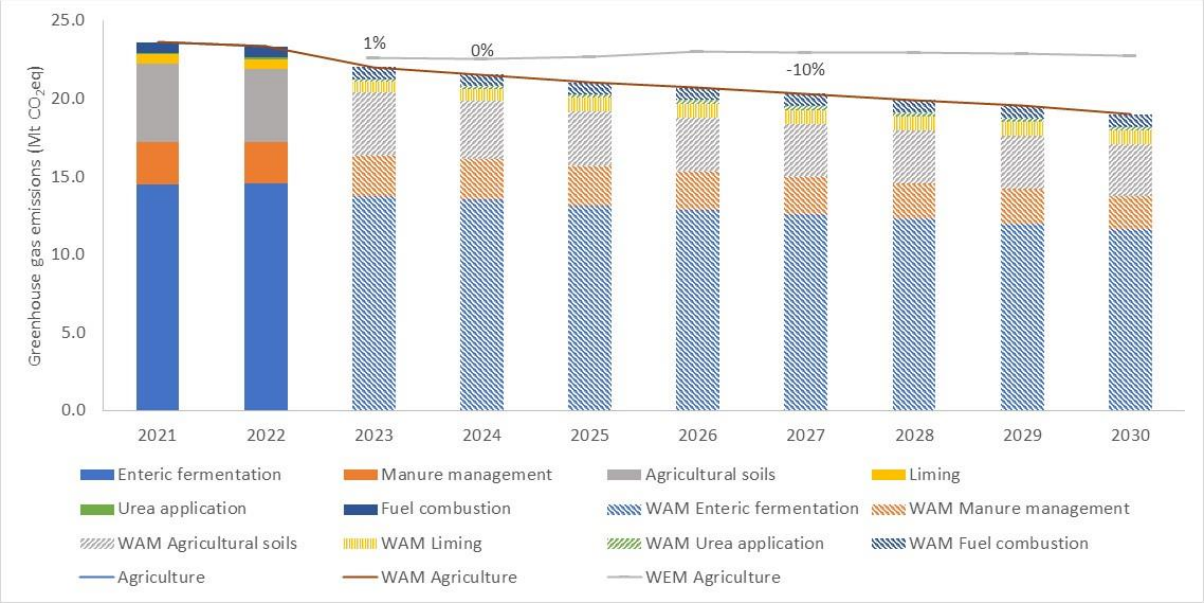

Figure 2 Most recent EPA 'with existing measures' and 'with additional measures' projections of emissions from agriculture. Sources: EPA emission and projections 2023].

Table 1 provides an assessment of the agricultural sector's progress in remaining within its sectoral emission ceilings based on the EPA's reported provisional emissions for 2021 and the projected WEM and WAM scenarios. There is a high risk that the agricultural sector will overshoot its sectoral emission ceilings in 2025 and 2030.

Table 1 Projected progress of the agricultural sector towards achieving sectoral emission ceilings for the periods 2021–2025 and 2026–2039. Based on the EPA 'with additional measures' scenario and EPA reported emissions in 2022 (Mt CO_2 eq). Sources: [Annual Review, 2023]

Carbon budget period	Sectoral emission ceiling	Reported emissions 2021–2022	Projected emissions for	Cumulative emissions during	Projected exceedance of sectoral

			remaining budget period	budget period	emission ceiling
2021–2025	106	47 (44%)	65	112	6
2026–2030	96		100	100	4
2021–2030	202	47	165	212	10

Drivers of emissions

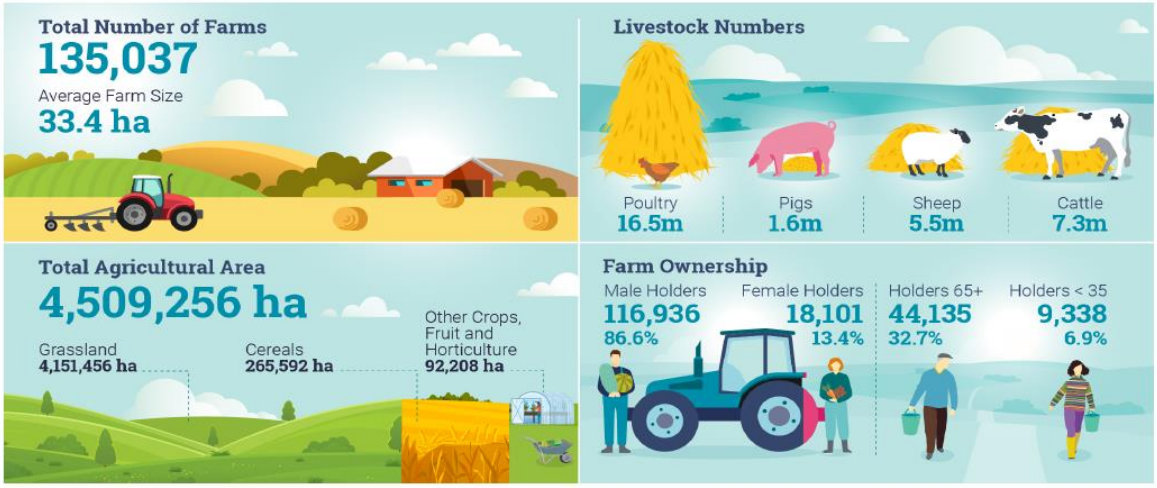

Figure 3 Infographic of key farm statistics for 2021[Source DAFM Fact Sheet on Irish Agriculture, Feb 2023]

Table 2 and 3 show the trend in number of farm holdings in Ireland since the 1850s and the evidence of a shift and increase in farm size. Unfortunately, as evident from to a major revision and upgrade in methodology, it is not possible to make direct comparison between pre 1980 farm numbers and post 1991 values which are basis analysis of the agriculture census data. It is likely that the pre-1980 approach over counted small farm holdings.

The number of farm holdings is decreasing, while the average area per farm is increasing. This is evidence for consolidation, and perhaps the concentration of agricultural land into a decreasing number of farm families. The average farm size has increase steady over recent decades.

Table 2 Total number of farm holdings from 1855 to 1980, and proportion each size categories [CSO Farming Since the Famine data archive]

Year	1-5 Acres	5-15 Acres	15-30 Acres	30-50 Acres	50-100 Acres	100-200 Acres	200+ Acres	Total Number of Farm Holdings
1855	14.72%	30.32%	24.20%	13.25%	10.71%	4.61%	2.19%	419,535
1860	14.81%	30.28%	24.17%	13.24%	10.72%	4.61%	2.17%	428,861
1865	14.65%	30.14%	23.96%	13.34%	10.99%	4.73%	2.19%	419,374
1870	13.84%	30.03%	24.49%	13.52%	11.22%	4.74%	2.17%	415,369
1875	13.06%	29.94%	24.76%	13.85%	11.36%	4.84%	2.19%	410,045
1880	12.40%	29.55%	25.12%	14.01%	11.63%	5.01%	2.27%	402,943
1885	11.98%	29.18%	25.33%	14.30%	11.79%	5.14%	2.29%	396,854
1890	11.70%	29.15%	25.33%	14.36%	11.90%	5.23%	2.32%	395,782

1895	12.00%	29.14%	25.13%	14.34%	11.91%	5.20%	2.27%	397,787
1900	11.98%	29.09%	25.16%	14.34%	11.99%	5.19%	2.26%	398,276
1905	11.98%	29.06%	25.29%	14.40%	11.93%	5.14%	2.19%	399,940
1910	11.95%	28.68%	25.63%	14.54%	12.01%	5.07%	2.13%	404,043
1915	10.37%	26.57%	26.25%	15.46%	13.00%	5.70%	2.65%	359,654
1930	9.17%	22.02%	26.97%	18.48%	14.78%	6.24%	2.34%	337,982
1940	8.37%	20.65%	27.80%	19.15%	15.33%	6.45%	2.25%	326,697
1945	8.35%	19.96%	27.58%	19.47%	15.74%	6.66%	2.25%	321,834
1950	8.24%	19.50%	27.24%	19.69%	16.19%	6.86%	2.28%	317,850
1955	8.26%	18.85%	26.78%	20.13%	16.68%	7.00%	2.28%	313,287
1960	8.03%	16.35%	25.25%	21.38%	18.67%	7.88%	2.44%	290,308
1965	8.14%	15.84%	24.26%	21.60%	19.48%	8.23%	2.46%	283,468
1970	8.26%	15.75%	23.54%	21.55%	20.12%	8.36%	2.41%	279,450
1975	8.24%	15.29%	22.78%	21.55%	21.04%	8.68%	2.42%	269,827
1980	8.53%	14.97%	21.96%	21.32%	21.87%	8.90%	2.45%	263,558

Table 3 Total number of farm holdings from 1991 to 2020, and proportion each size categories [CSO Agriculture Census 2022]

Year	Less than 10 ha	10 ha- 20 ha	20 ha- 30 ha	30 ha - 50 ha	50 ha - 100 ha	100 ha or more		Total Number of Farm Holdings
1991	25%	28%	18%	17%	9%	2%		170,578
2000	20%	24%	18%	21%	14%	3%		141,527
2010	18%	24%	18%	22%	15%	3%		139,860
2020	21%	23%	17%	20%	15%	4%		135,037

Agricultural Production

The key determinant of the size of the ruminant herd in Ireland is the number of breeding animals. Figure 4 shows the time series of the three dominant ruminant types farmed in Ireland from 1975 to 2022. During the 1990s, perverse incentives to the sheep sector (headage payments) lead to an unsustainable surge in sheep numbers. The current population of breeding animals maintains overall ruminant numbers well in excess of historic levels. The capacity to farm at this scale and intensity has been enabled by the rapid modernisation of farming in Ireland starting in the during the 1960s.

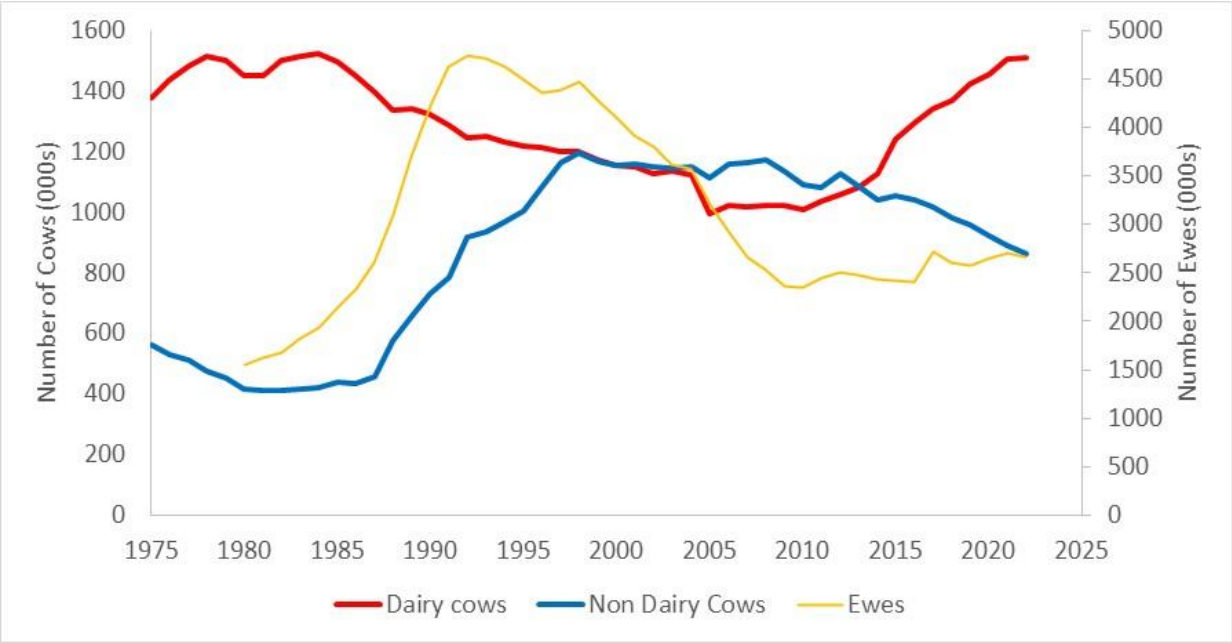

Figure 4 Number of breeding animals from 1975-2022 [CSO]

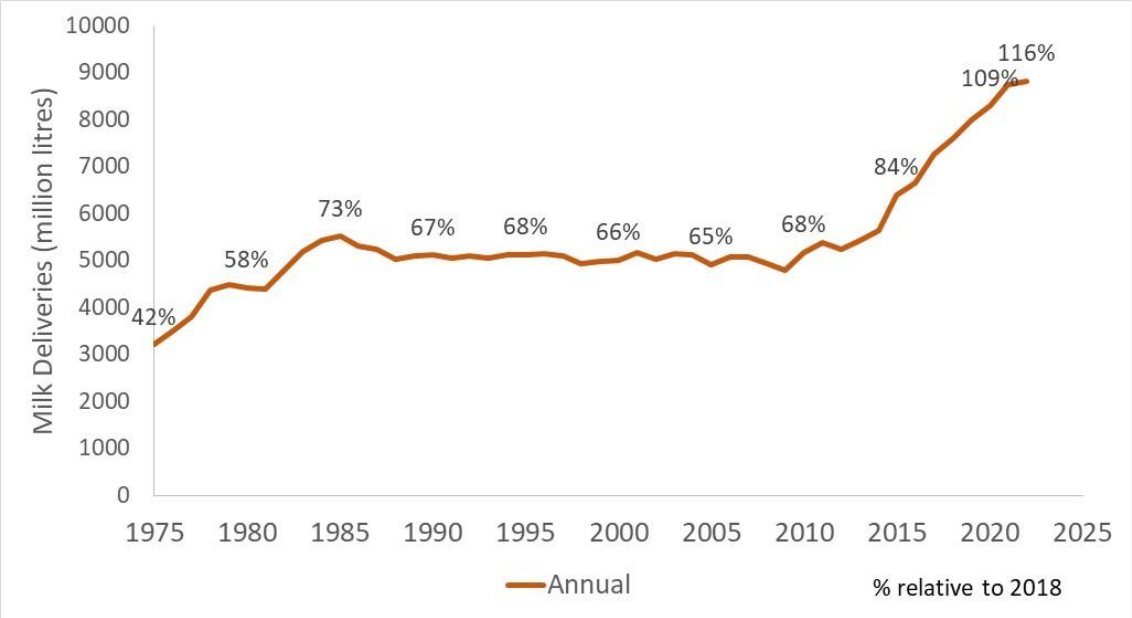

Figure 5 Milk deliveries to processors from domestic suppliers [Source CSO Table AKM01, 1975-2023]

The growth in milk production Ireland's has been remarkable. Significant growth in production occurred in the period immediately following the joining the EU until the mid-1980s, with the modernisation of dairy systems in Ireland. Over the following two decades, output was relatively stable, due to the imposition of the quota system under the Common Agriculture Policy. Production has grown dramatically again during the period from 2011. Notable over the entire time series is a steady improvement in productivity, estimated based on milk

deliveries and the number of dairy cows. The delivery of milk to the processors in 2022 was double that delivered in 1980 from a dairy herd just 3% larger.

Ireland has demonstrated the validity of policies and actions to modernise and improved dairy farming practice to achieved higher production efficiency. Unfortunately, this focus on production efficiency has led to increased environment pressures, as recently emerged in the derogation debate. The Teagasc MACC analysis identifies a number of actions and measures which can improve the greenhouse gas emissions profile whilst maintaining production levels comparable with current levels.

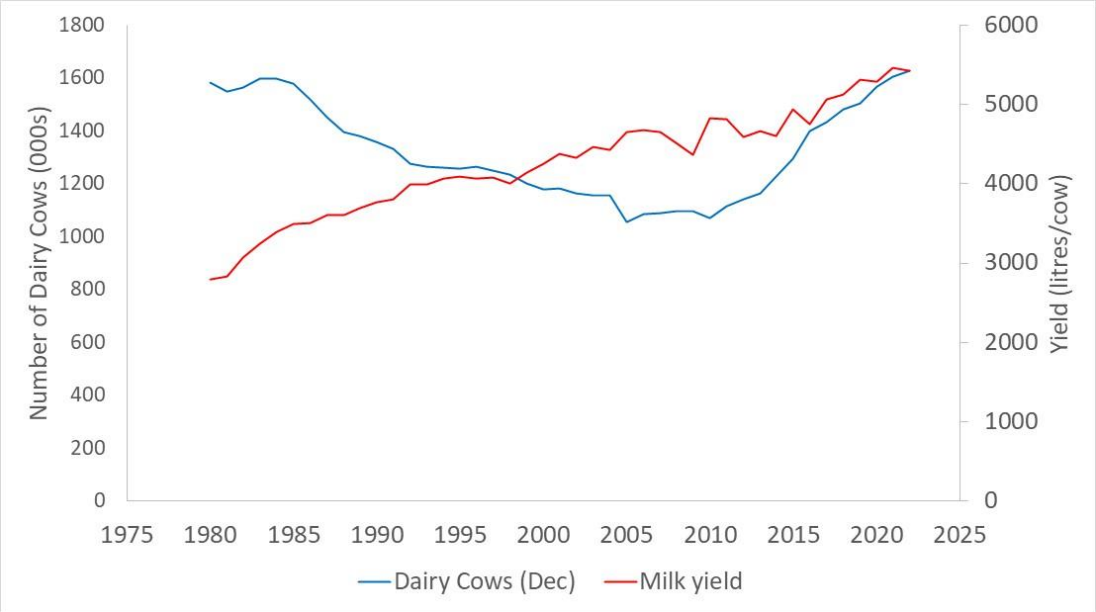

Figure 6 Trends in the number of Dairy Cows and implied Milk Yield per animal (based on annual milk deliveries) [Sources CSO Milk Deliveries and Animals Numbers]

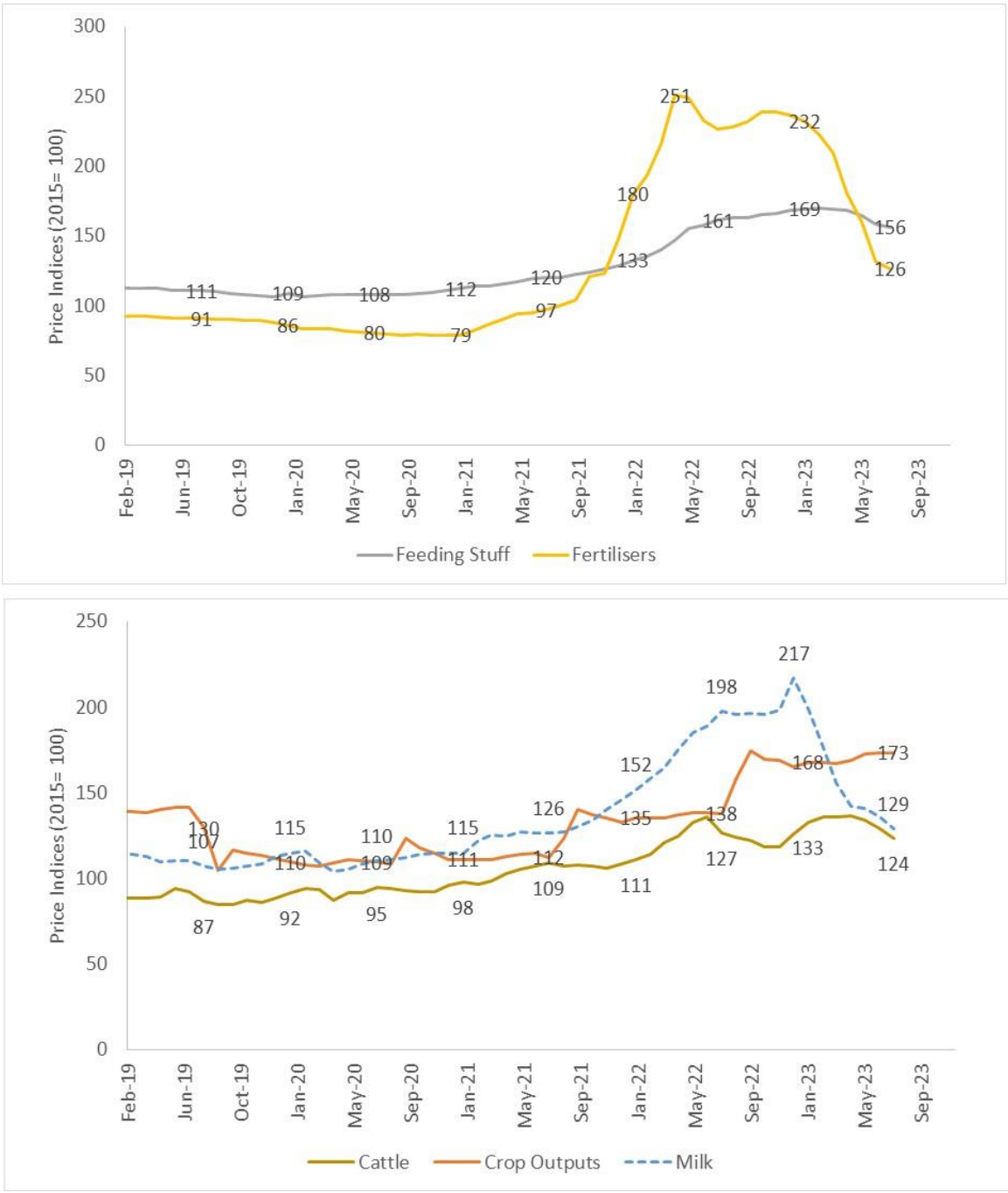

Figure 7 Selected Monthly Input prices (upper panel) and Outputs Price (lower panel) indices 2015=100 (Feb 2018-Jul 2023) [Source CSO]

The Teagasc National Farm Survey assesses the economic viability of the farm business, including allowance for the role of income earned outside of the farm in determining the sustainability of farm households. The NFS also provides a viability profile of its farms broken into three categories viable, sustainable and vulnerable.

Sustainable: If the farm business is not viable, the household is still considered sustainable if the farmer or spouse has an off-farm income.

Viable: A farm is defined as economically viable if the farm income can remunerate family labour at the minimum wage (taken as €20,129 in 2021) and provide a 5% return on the capital invested in non-land assets.

Vulnerable: A farm is considered to be economically vulnerable if the farm business is not viable and if neither the farmer nor spouse works off the farm.

The viability of Irish farms varies significantly across systems. In 2021, 85% of dairy farms were found to be viable, up from 80% in 2020. Tillage has also seen an increase in the proportion of viable farms in 2021 to 72%, up from 67% in 2020. Cattle other and sheep farms had the same FFI per hectare and likewise the proportion of viable farms on both systems is almost the same at 32% for cattle other and 33% for sheep farms. Cattle rearing farms however have just 16% of the farms in the viable category although it is an improvement on 2020, when just 11% of them were viable. There are 34,800 viable farms nationwide in 2021.

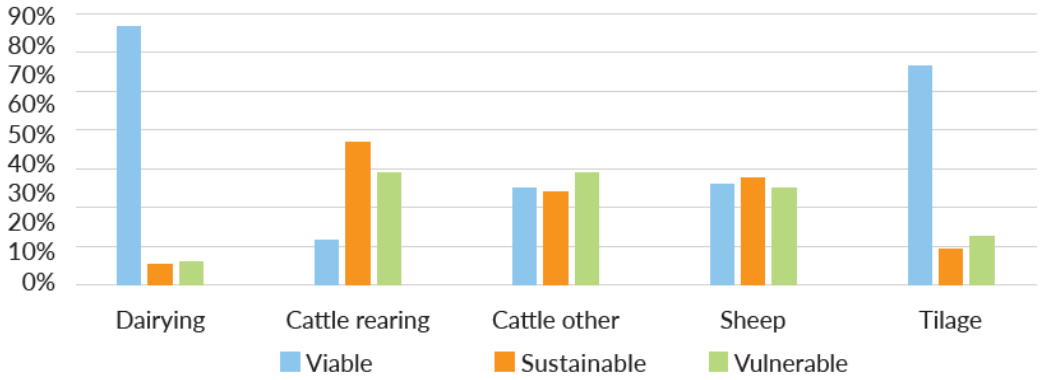

Figure 8 Viability of Farm by farming systems, 2021. [Source Teagasc Farming Survey preliminary results, 2022]

This assessment of economic viability can vary significantly over time, with external events, including input and output prices, off farm employment opportunities, weather and climate conditions, influence farm viability. The consistently high proportion of farms which are vulnerable, or which rely on off-farm employment to remain sustainable is of concern. In both category the human or finance resources to engage in additional climate mitigation and adaptation actions is limited. Significant supports and incentives are likely required to enable engagement, even with respect to mitigation measures that are low cost or cost negative from a technical perspective.

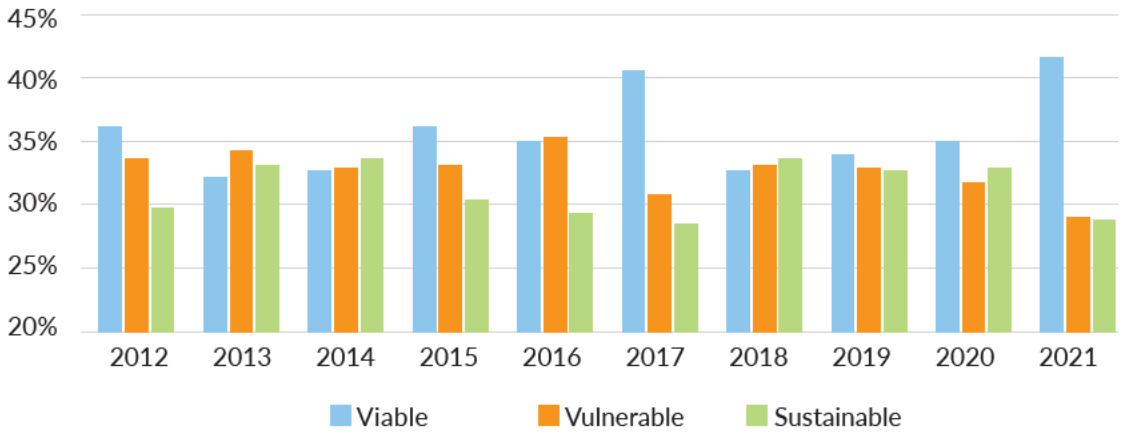

Figure 9 Farm viability 2012-2021 [Source Teagasc Farm Survey-preliminary results, 2021]

Land Prices, Sale and Rent trends

The price of each parcel of agricultural land that comes to the market for sale varies significantly across the country and is influenced by location, soil quality, typography, development potential). However, clear patterns are evident, see Figure 10.

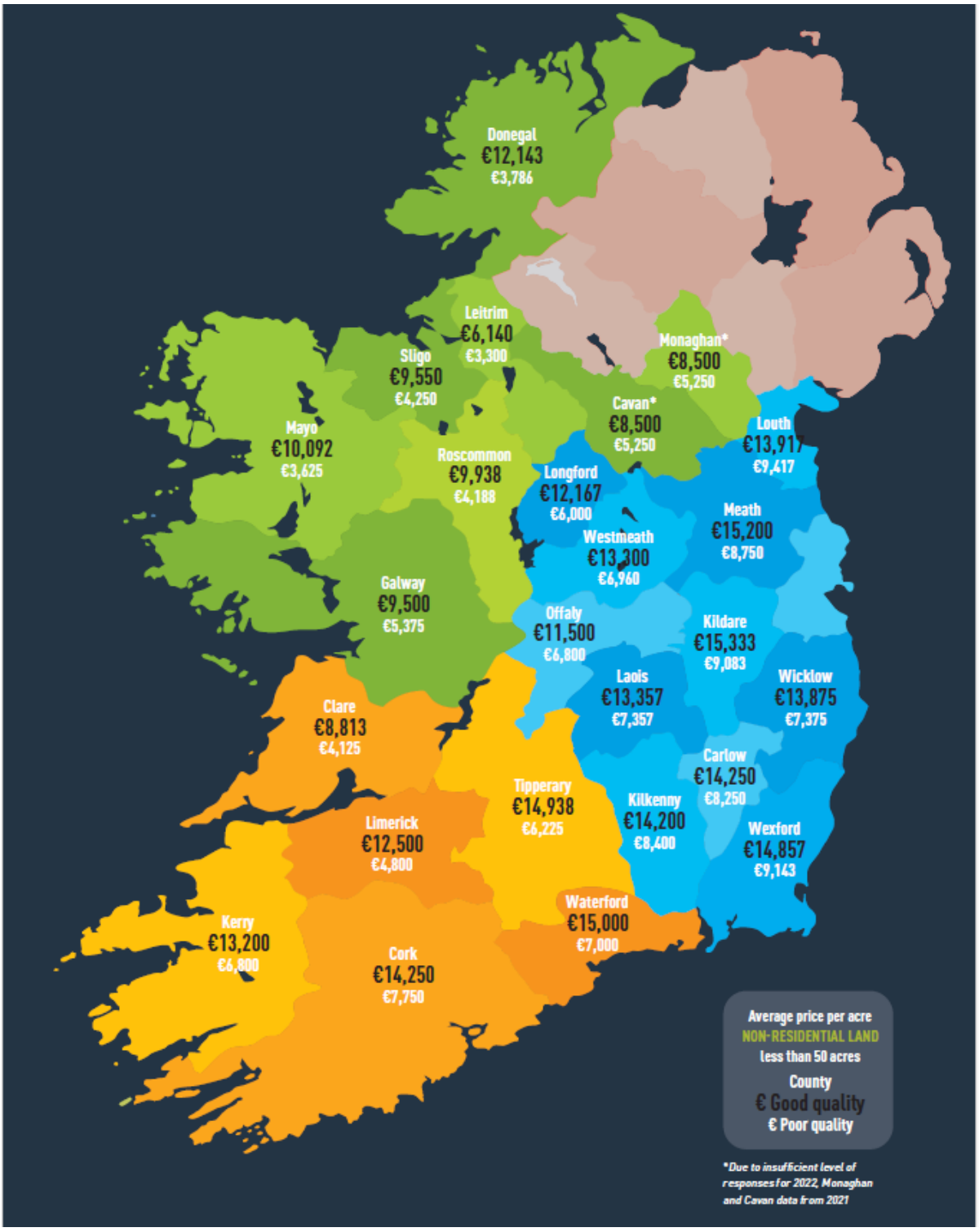

Figure 10 Map of average price per acre. Source: SCSI

The national average differential between good and poor-quality land is €5,608 on a per-acre basis (Figure 10). As a national average, this highlights that buyers can often pay multiples per acre for good quality land compared to what is paid for poorer quality land. There are several significant reasons why values may differ, such as good quality land possessing better soil fertility, soil structure and percolation abilities. Therefore, the land itself is easier to farm and more advantageous for more farming practices. Typically, residential farms of less than 50 acres brought to the market are on average between 14% and 19% more expensive than non-residential farms of a similar size. For mid-sized residential farms (i.e., between 50 and 100 acres) the percentage premium can be between 11% and 17%, and for plot sizes over 100 acres with a residence, the average premium compared with a non-residential farm of a similar size is between 9% and 14%.

On average, good quality land in Leinster (excluding Dublin) is valued between €11,000 per acre (same as in 2021) and €15,333 per acre (€15,350 in 2021), dependent on plot size and location. Poor quality land is valued between €5,333 (up from €4,667 in 2021) and €9,417 (up from €9,125 in 2021). Demand for farmland remains high in this province. The good arable land or land close to any sizeable dairy farming enterprises tends to attract strong interest and competitive bidding. On the contrary, land agents report that changes to the Nitrates Directive, as mentioned in this report, will reduce animal stocking rates and but may also impact land values. In Munster, on average, good quality land in 2022 ranged from €7,750 per acre (over 100 acres – €8,250 in 2021) to €17,400 (€15,071 in 2021) For poor quality land, prices ranged from €2,667 to €7,750 (€2,375 to €7,688 in 2021). One of the main drivers of the agricultural land market in 2022 was: “A heightened interest from individuals with their own funds to invest in land and guard against the effects of general inflation”. On average, good quality land in the Connacht/Ulster region ranged from €3,563 (€3,375 in 2021) to €12,143 per acre (€13,375 in 2021). For poor quality land, prices ranged from €2,040 to €5,375 per acre (€2,375 to €7,688 in 2021). Taking poor and good quality land across all the three plot sizes, the land market remains very active and strong over the past 12 months, as evidenced in the land value data, with good quality land in highest of demand. Table 4 shows available data on agricultural land sales from 2017 to 2020.

Table 4 Agricultural Land Sales 2017-2020

Agricultural Land Sales 2017 to 2020 (Source CSO)				
All Land Types	**2017**	**2018**	**2019**	**2020**
Value of Land Sold	€396,775,812	€355,949,924	€388,559,159	€176,091,601
Number of Transactions	3,354	3,050	3,289	1,602
Volume of Land Sold - Acres	70,735	55,145	61,997	29,031
Average land price per acre	€5,609	€6,455	€6,267	€6,066

Executor/probate sales are the most active type of farmland sales (Figure 11). A ‘farmer who is no longer interested, willing or who has retired from farming’ was the second most active seller type in 2022, this is up from 6% in 2021. Investors, financial institutions and developers continue to be least active seller types in 2022.

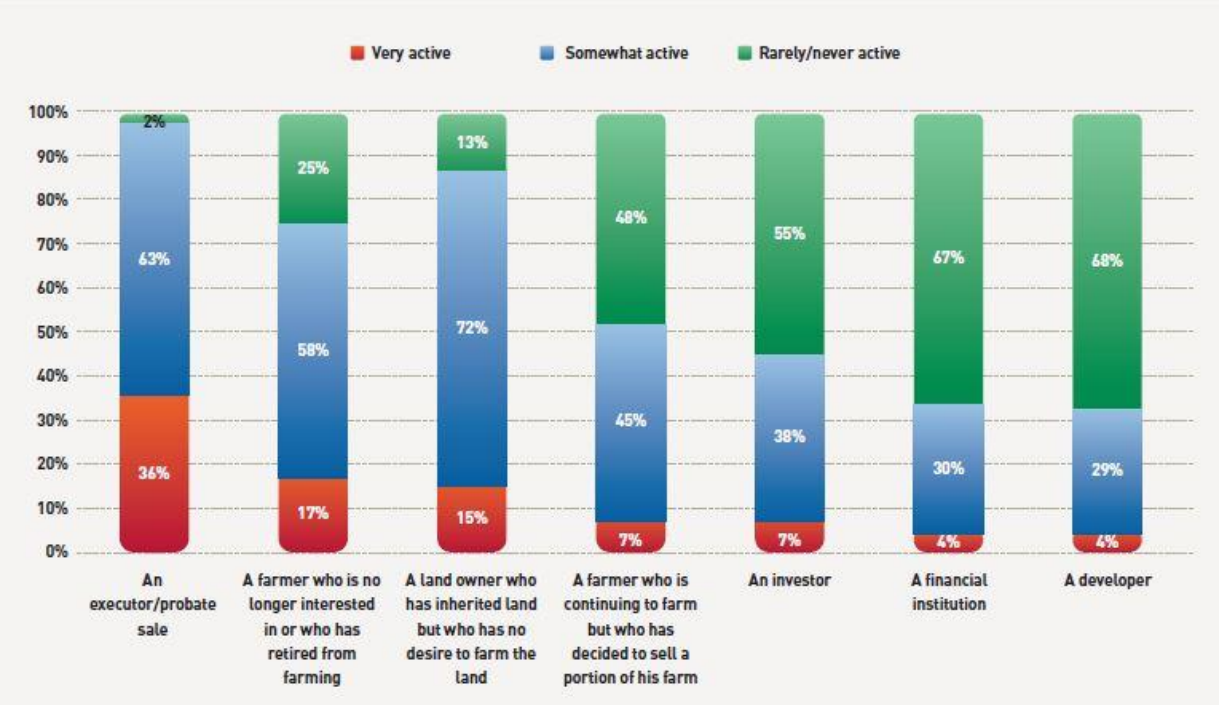

Figure 11 Activity levels in 2022 for selling agricultural farmland by seller type. Source: SCSI research

Land rental overview

There has been an uplift in demand over recent years for long-term leases, with income tax relief expanded by the Department of Finance in 2015. This has encouraged a greater degree of land leasing with longer leasing durations. Leinster rental values saw an average increase across all farming uses except potato growing (Table 5). Overall, rental rates across all farming/land use types increased by 9% on average compared to 2021. In Munster, land suitable for potato crops and other crops such as sugar beet, maize and beans increased by 15% for each category, while rental land suitable for cereal crops increased by an average of 14%. Across all farming uses, average rental values increased by 13%. Land suitable for grazing, meadowing and silage, and land suitable for grazing only both saw increases in rental values in Connacht/Ulster in 2022. Rental values increased by just 1% for land suitable for grazing, and by 5% for land suitable for grazing, meadowing and silage (Table 5).

Land made available for leasing is reportedly driven largely by both farmers who are no longer interested or who have retired from farming (93% of agents report this cohort as being somewhat or very active), and landowners who have inherited land but have no desire to farm it themselves (90% of agents reported this cohort as being somewhat active or very active in 2022.

As with land sales values, agents also expect to see an increase in land rental values in 2023. The expected national increase is 14% (Table 5). Provincially, rental values are expected to increase the most in Munster, where values are expected to rise by 17%. Rental values are anticipated to increase by 15% in Leinster, and by 10% in the Connacht/Ulster region. The anticipated increase in values is reflective of the constrained supply of rental land generally, with higher demand anticipated in 2023, particularly from the dairy sector.

Table 5 Land rental values in Leinster, Munster, and Connacht/Ulster – 2022 compared to 2021 (€/per acre). Source: SCSI

	Leinster			Munster			Connacht/Ulster		
Rental Use	**2021**	**2022**	**Percentage Change**	**2021**	**2022**	**Percentage Change**	**2021**	**2022**	**Percentage Change**
Grazing/meadowing/silage	€245	€266	9	€231	€261	12	€168	€176	5
Grazing only	€215	€248	15	€221	€241	8	€161	€162	1
Cereal crops (e.g., wheat, barley, oats)	€259	€290	12	€244	€283	14	No data	No data	No data
Potato crops	€463	€439	-5	€326	€383	15	No data	No data	No data
Other crops such as sugar beet, maize and beans	€323	€370	15	€256	€300	15	No data	No data	No data

Farm types and production by region

In 2020, farms classed as specialist beef production accounted for the largest number of farms in every region, with the proportion highest in the Midlands (67%) and lowest in the South-East region (47%). The regional importance of dairy and tillage farming varies substantially (Figure 12). In the South-West (Cork and Kerry) over 23% of all farms are specialist dairy farms, which contrasts with the West (Galway, Mayo and Roscommon), where less than 3% of farms are specialist dairy farms. Specialist tillage farms account for a little over 3% of farms nationally, but in the South-East Region (Carlow, Kilkenny, South Tipperary, Waterford, Wexford), over 11% of farms are specialist tillage farms. Specialist tillage farms represented

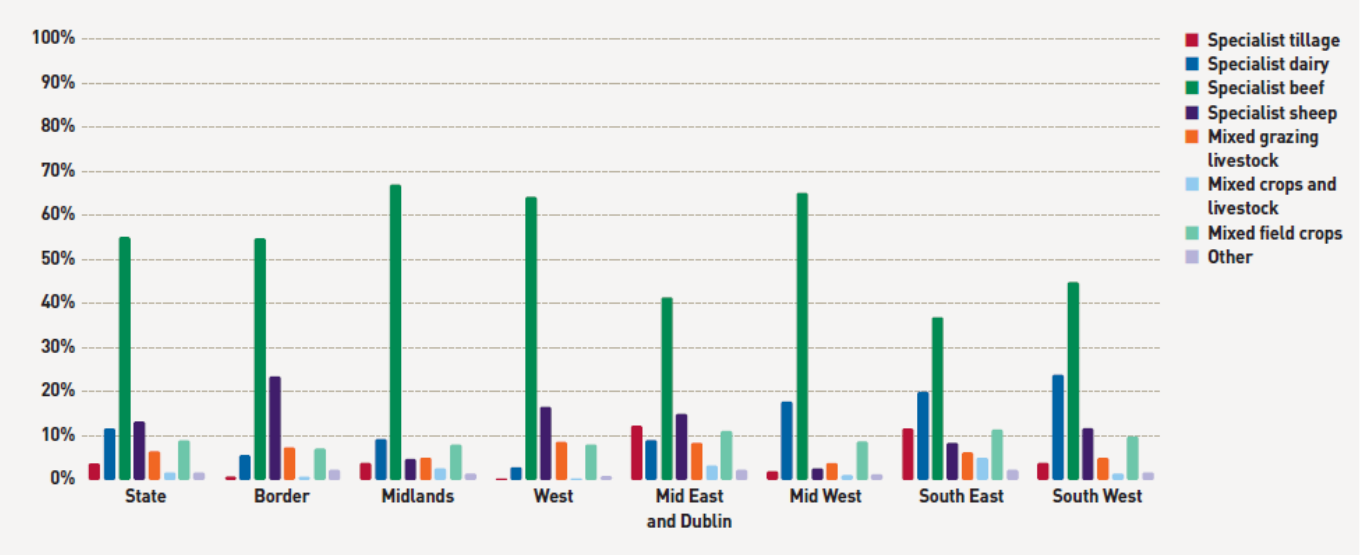

Figure 12 Prevalence of farm type by NUTS III region in 2020. Source: CSO Agricultural Census.

12% of farms in the Mid East (Kildare, Meath and Wicklow) and Dublin region. Relatively few tillage farms are found outside of these two regions.

The importance of different farm types by region is reflected in the varying composition of the agricultural output produced across the regions of Ireland in 2021, as illustrated in Figure 13. Agricultural output is the value of what is sold by farmers. The prominence of cattle output can be observed across all regions, with the cattle output share varying from 23% in the Mid East and Dublin region, South-West region and South-East region, to 55% in the West region. However, the importance of milk and cereal and root crop output varies widely across the NUTS III regions. The prevalence of milk is highest in the South-West, at 59%, Mid-West, at 49% and South-East, at 44%. The continuing growth in milk production of recent years has pushed milk production (40%) into first place in terms of the share of output delivered within

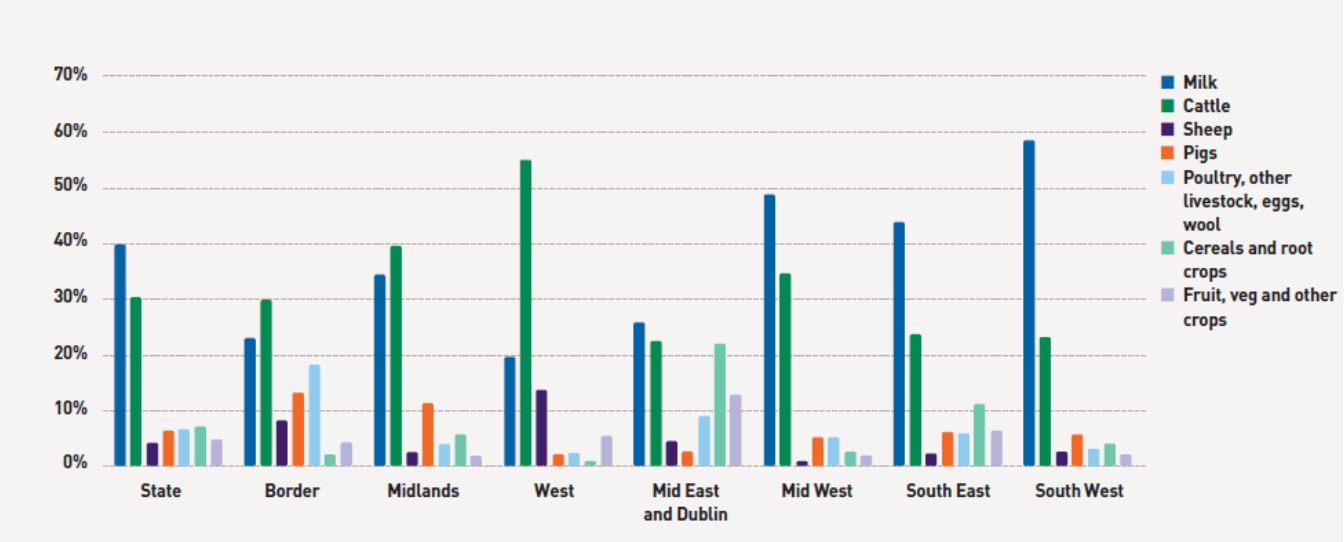

Figure 13 Agricultural output (excluding forage) 2021: shares for each system by NUTS III Region. Source: CSO Regional Account for Agriculture 2021

primary agriculture at a national level. This trend can also be observed in the dairy heartlands of the South-West, Mid-West and South-East, where milk production is by some distance the largest sector in output value terms in 2021. Milk production was also the largest sector in output value terms in the Mid East and Dublin region in 2021.

3. Current state of play

A brief summary of important indicators as of April 2023

Dairy

Milk prices began to decline in early 2023 from the record levels seen in 2022. The average net margin per litre of milk is expected to fall from 23.9 cent per litre in 2022 to 14.3 cent per litre in 2023. High input costs may contribute to reducing milk yields on some farms, although a small overall increase in milk production is forecast. The recent changes to environmental policy aimed at protecting water quality as part of the Nitrates Directive will limit the extent of growth in overall milk production in 2023.

Cattle

Prices for finished cattle are currently ahead of 2022 levels. In April 2023, the average price for an R3 steer is approximately €5.55 per kg, which is approximately 10% above the annual average for 2022. The annual average beef price in 2023 is forecast to be 4% higher relative to 2022. The costs of production for beef are forecast to be slightly higher in 2023, mainly due to an increase in feed expenditure. In 2023, the increase in output prices may exceed the effect of rising input prices. With the introduction of the Suckler Carbon Efficiency Programme (SCEP), the expansion in funding for the Agri-Climate Rural Environment Scheme (ACRES), and higher young cattle prices, it is expected that margins and incomes on cattle-rearing farms will be significantly higher in 2023 relative to 2022.

Sheep

After a few relatively good years economically, sheep farmers are experiencing significant difficulties in terms of margins and production costs. Due to the elevated costs of production and weaker lamb and sheep prices, the margins on sheep farms are forecast to decline in 2023. Trade patterns are influencing the weaker performance of lamb prices in 2023. In April 2023, average heavy lamb prices are lower relative to April 2022. EU imports of lamb increased by 22% in 2022 (January to November) relative to 2021. This included a 27% increase in EU imports from New Zealand. It is forecast that EU imports will increase by an additional 4% for 2023. These additional imports place some downward pressure on EU lamb prices.

Cereals

Cereals producers in Ireland faced substantially higher production costs in 2022 due to the sharp increase in the price of inputs. However, the family farm income (FFI) increased on most tillage farms in 2022 due to the substantially higher output prices. The outlook for 2023 appears less promising, with futures markets indicating significant declines in output prices at harvest time. This reflects optimism for the global harvest and an increase in crop exports from Ukraine (USDA 2023b). Reduced pressures on energy prices are also relevant. There is real uncertainty about these factors and therefore significant uncertainty about output prices at harvest time. Based on current futures markets, the expectation is that cereal-based net margins will be negative on approximately 50% of specialist tillage farms in 2023.

Farm incomes, labour force, Proportion on-farm/off farm income

The income opportunity from different farm types have been well documented. Table 6 provides a detailed breakdown, highlighting that specialist beef farming, at 55% of all farms is the most common farm type. The income on specialist beef farms is fairly evenly spread across the economic scales up to the €25k-50k level. Specialist beef is poorly represented in the higher two income brackets. A similar pattern emerges for specialist sheep farming, representing 13% of all farm, incomes are skewed even further to lower income brackets. Dairying farming stands out as remarkably high income, representing 11% of all farms, 80% of dairy farms are in the highest income bracket, and 96% in the top two income brackets. Specialist tillage farms represent just 3% of all farms, with an income profiles nearly the inverse of specialist beef, with a higher proportion of farms in the middle to higher income brackets.

This lowest income bracket is not routinely surveyed on an annual basis, and it is difficult to assess the exact nature of the farming practices involved, yet it accounts for 22% of all farms. The mixed field crop farm type is also worth mentioning in this regard, representing 9% of all farm types, 97% of which are in the lowest income bracket. However, specialist dairy and sheep also have a large proportion of farms in this lowest income bracket.

Table 6 Breakdown of the economic size and farm type [CSO Agriculture Census 2020]

Farm Type	Less than €4k	€4k - €8k	€8k - €15k	€15k-€25k	€25k-€50k	€50k-€100k	Over €100k		All economic sizes
Specialist beef production	16%	19%	23%	19%	16%	6%	1%		55%
Specialist sheep	27%	24%	22%	13%	10%	3%	0%		13%
Specialist dairying	0%	0%	0%	0%	4%	16%	80%		11%
Mixed field crops	97%	1%	0%	0%	0%	0%	1%		9%
Mixed grazing livestock	4%	8%	16%	18%	25%	18%	12%		6%
Specialist tillage	3%	5%	11%	13%	22%	22%	25%		3%
Other	40%	3%	3%	2%	3%	5%	44%		1%
Mixed crops and livestock	1%	2%	6%	13%	28%	27%	23%		1%
All farms	22%	14%	17%	14%	13%	8%	12%		

It is interesting that a relatively high proportion of farms operating at lowest economic size bracket is observed across all counties, with highest proportion in Donegal (31%) and the lowest in Offaly (16%), see Table 7. This seems to indicate very low activity, small farms are ubiquitous across the country, and may represent a specific cohort of farm holding which can be targeted for low intensity land management options to enhance carbon sequestration and the provision of ecosystem services.

A more familiar pattern of emerges when considering the farm economic size across the country, As is well documented, farms of low to medium economic size tend to be dominant in

the north and west of the country, while high economic farms are dominant in the south and east.

Table 7 Distribution economic size by County [CSO Agriculture Census 2020]

County	Less than €4k	€4k - €8k	€8k - €15k	€15k- €25k	€25k- €50k	€50k- €100k	Over €100k
Leitrim	29%	24%	25%	13%	7%	2%	1%
Sligo	25%	20%	24%	15%	10%	3%	2%
Mayo	26%	22%	24%	15%	9%	3%	2%
Roscommon	21%	18%	22%	17%	15%	4%	2%
Clare	19%	17%	22%	17%	13%	6%	6%
Longford	19%	16%	22%	17%	15%	6%	5%
Donegal	30%	23%	21%	12%	9%	3%	3%
Cavan	19%	16%	20%	17%	13%	6%	9%
Galway	26%	16%	19%	16%	14%	5%	3%
Monaghan	19%	15%	19%	15%	12%	7%	14%
Kerry	22%	16%	17%	13%	12%	7%	12%
Westmeath	18%	11%	15%	16%	19%	10%	11%
Limerick	19%	11%	14%	13%	13%	9%	21%
Meath	20%	10%	14%	12%	15%	12%	18%
Offaly	16%	11%	13%	14%	19%	13%	14%
Dublin	25%	9%	13%	10%	11%	10%	21%
Louth	20%	11%	13%	13%	16%	11%	17%
Wicklow	20%	11%	13%	13%	19%	11%	14%
Kildare	23%	8%	12%	12%	15%	13%	16%
Cork	20%	9%	12%	11%	12%	10%	26%
Laois	16%	9%	12%	13%	18%	14%	18%
Carlow	16%	7%	12%	13%	20%	15%	17%
Tipperary	17%	8%	11%	12%	16%	12%	23%
Waterford	20%	7%	10%	9%	13%	10%	31%
Wexford	17%	7%	10%	11%	16%	15%	24%
Kilkenny	18%	6%	9%	11%	15%	14%	28%
State	22%	14%	17%	14%	13%	8%	12%

The South-West region has the highest level of income per hectare at over €1,150 and the Midlands has the lowest at just over €420 per hectare (Figure 14). The differential in income per hectare across the regions reflects the type of agricultural activities that dominate and the intensity of agricultural production in each area. Regions where dairy and tillage are prevalent tend to be farmed more intensively and produce a higher level of income than regions where more extensive beef and sheep production dominates. Regions with a greater share of their agricultural activity in farming that is profitable tend to have the lowest share of subsidies in their farm income. A clear divide is evident between southern/eastern regions on the one hand and midlands/western/border regions.

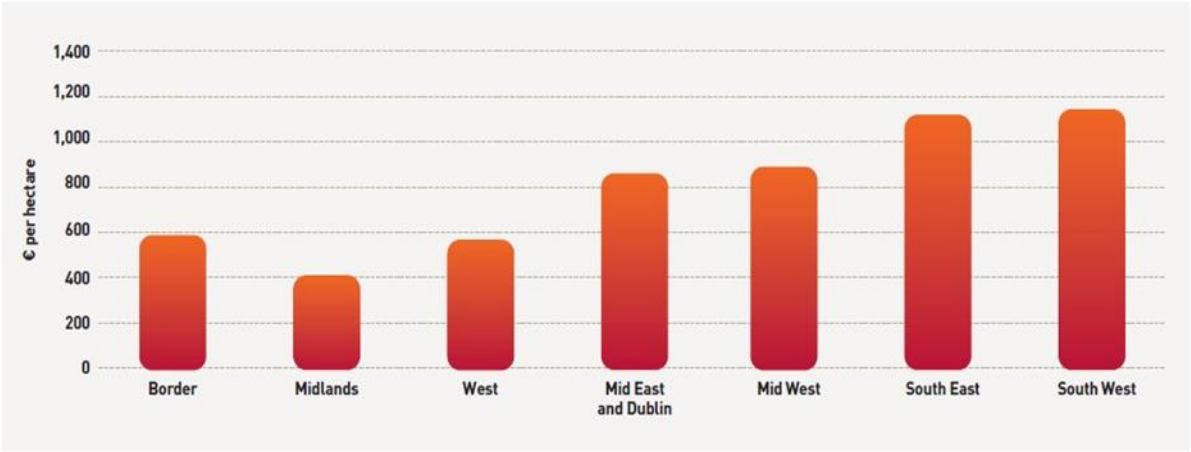

Figure 14 Agricultural income per hectare by NUTS III Region 2021. Source: adapted from data in the CSO Regional Account for Agriculture 2021.

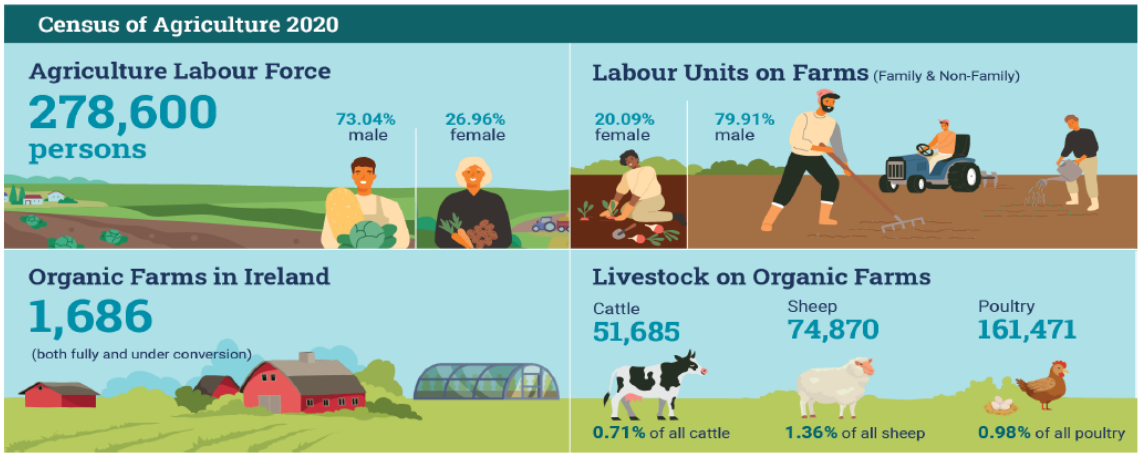

Figure 15 Agriculture Labour Force Statistics

Table 8 shows the proportion of family and non-family labour employed on farm in each farm size category. Unsurprisingly, family workers do most of the work on farms. However, the proportion of work done by non-family workers increases with increasing farm size. From the published data, it is not possible to determine the level of other family and non-family support available to farm holders within different age groups. This is important, as will be seen in the section discussing age trends in demographics.

Table 8 Proportion of Family and non-Family labour employed on farms in each size category [CSO Agriculture Census 2020, Table AVA51]

Farm Area	Holder	Other family workers	Regular non-family workers	Total family workers
Less than 10 ha	60.8%	33.9%	5.3%	94.7%
10 ha or more but less than 20 ha	57.7%	36.0%	6.3%	93.8%
20 ha or more but less than 30 ha	53.0%	39.4%	7.6%	92.4%
30 ha or more but less than 50 ha	50.7%	39.0%	10.0%	89.9%

50 ha or more but less than 100 ha	44.9%	37.5%	17.5%	82.3%
100 ha or more	34.9%	27.0%	38.4%	61.9%
All farms	51.7%	36.6%	11.6%	88.4%

4. Demographic trends

A common observation across the EU in recent decades has been the continued gradual decline in the number of family farms and an increase in the proportion of farm holders in older age groups. There are likely multiple drivers to these trends, for example on-going "flight from the land" as younger generations are drawn to careers in other sectors, and barriers to new entrants into farming from non-farming backgrounds.

These trends raise a number of concerns with respect to the potential for implementation of climate action at farm level. In general, it is likely that older farmers have reduced capacity for labour, reduced access to long term finance for investment on farm, reduced motivation to initiate change in land use management which have long lead times for economic return. Older farmers also give high regard to legacy and succession, and have expressed strong preferences to work past the conventional retirement ages, look to hand over the farm in such condition as allows the next generation the maximum opportunity to make their own decisions regarding the future of the farm. [4] [5]

Table 9 shows the average age of farm holder across each farm type. Of the major farm type, specialist beef farmers, the largest cohort of farm holders, are also the oldest. While dairy specialist, the most profitable cohort, are also the youngest.

Table 9 Average Age of Farm holder by farm type [CSO Agriculture Census, 2020]

Farm Type	Average Age (Years)
Mixed field crops	59.8
Specialist beef production	58.3
Specialist tillage	56.6
Mixed crops and livestock	56.3
Other	56.3
Mixed grazing livestock	56.2
Specialist sheep	56.2
Specialist dairying	52.0
All farms	57.2

Table 10 and Figure 16 illustrate the patterns of few younger, and more older farm holders in recent decades. In Ireland the significant drop in proportion of young farmers between 2000 and 2010, was perhaps a response to the increase in competitive career opportunities in other sectors of the economy, especially during the economic boom.

[4] Peter Howley, et al, Explaining the economic 'irrationality' of farmers' land use behaviour: The role of productivist attitudes and non-pecuniary benefits, Ecological Economics, Volume 109, 2015, Pages 186-193, https://doi.org/10.1016/j.ecolecon.2014.11.015

[5] Stefanie Duesberg, Pat Bogue, Alan Renwick, Retirement farming or sustainable growth – land transfer choices for farmers without a successor, Land Use Policy, Volume 61, 2017, Pages 526-535, https://doi.org/10.1016/j.landusepol.2016.12.007

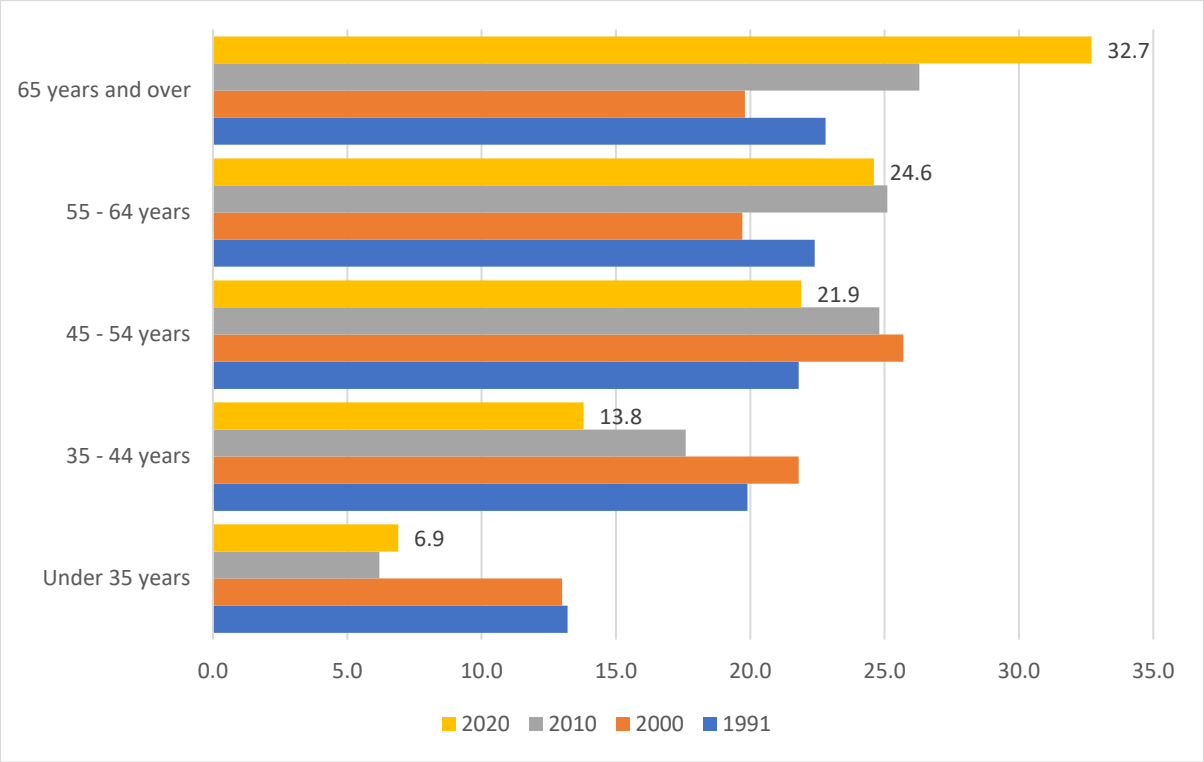

Figure 16 Age profile of Farm Holders from Agriculture Census 1991, 2000, 2010, 2020. [Source CSO]

Table 10 Trends in age profile of farm holders [Source CSO, Agriculture Census, 2020]

Age group	1991	2000	2010	2020	Change since 1990
Under 35 years	13.2	13.0	6.2	6.9	-6.3
35 - 44 years	19.9	21.8	17.6	13.8	-6.1
45 - 54 years	21.8	25.7	24.8	21.9	0.1
55 - 64 years	22.4	19.7	25.1	24.6	2.2
65 years and over	22.8	19.8	26.3	32.7	9.9

The steady increase in proportion of over 65s from 2000 onwards is notable, standing at 33% of all farms in 2020. There have been numerous initiatives to enable and encourage earlier retirement and smooth succession of family farms, however there would appear to be additional barriers which need to be addressed.

5. Teagasc Marginal Abatement Cost Curve (MACC)

The Teagasc MACC analysis sets out a robust evidence base for mitigation actions within agriculture and agricultural land management. The emissions reductions achievable following the insight from the analysis are founded on two basic sets of assumptions: a) how production in Ireland responds to external markets and b) the impact of different levels of deployment of the effective mitigation measures identified through extensive research.

The third iteration of the Teagasc Marginal Abatement Cost Curve (MACC) published in July 2023, outlines pathways for significant change in emissions. The 2023 MACC identifies, in the form of a single visual representation, the most cost-effective pathway to reduce greenhouse gas emissions and enhance carbon sequestration in the Agricultural, Land-Use, Land-Use Change and Forestry sectors plus (Bio) energy. Each potential measure for emissions reduction is assessed in terms of cost and total potential mitigation.

Building on the last MACC (published in 2019), the 2023 document reflects new developments in technology, research, and global market conditions. It will serve as a key tool for policymakers in identifying further options to reduce emissions in the agriculture sector. There are a number of key differences to the previous MACC. These include:

- Updated animal number projections based on the latest modelling.
- A separation of measures that increase greenhouse gas efficiency of production against those that reduce emissions in absolute terms.
- New measures have been added, including age at finishing, feed additives, and diversification etc. The contribution of some existing measures have been adjusted based on the latest science.
- Two adoption pathway rates for GHG mitigation measures have been established along with three possible scenarios for how animal numbers might evolve.

Box 1: Outline of Scenarios and Mitigation Pathways published with the MACC analysis.

SCENARIO 1 (S1): Most likely base case scenario predicts growth (8% relative to 2022) in dairy cow numbers and reductions (-29%) in suckler cow numbers over the period to 2030. The 2030 GHG emissions are estimated to be 21.9 MtCO2 eq. This forms the central "Business-as-Usual" scenario and MACC mitigation figures within the report have been calculated using this scenario.

SCENARIO 2 (S2): Assumes lower growth in dairy cow numbers than Scenario S1 (4% relative to 2022) and a higher reduction (-43%) in suckler cow numbers. The 2030 GHG emissions are estimated to be 21.1 MtCO2 eq.

SCENARIO 3 (S3): Assumes a stronger growth in the dairy sector than in Scenario S1 (12% relative to 2022) and weaker reductions (-16%) in suckler cow numbers. The 2030 GHG emissions are estimated to be 22.8 MtCO2 eq.

Table 11 shows key elements of the scenarios.

PATHWAY 1 (P1): Assumes adoption rates similar to the previous MACC.

PATHWAY 2 (P2): Assumes more ambitious adoption rates of measures. It represents the maximum technically feasible adoption rate.

How to read a MACC

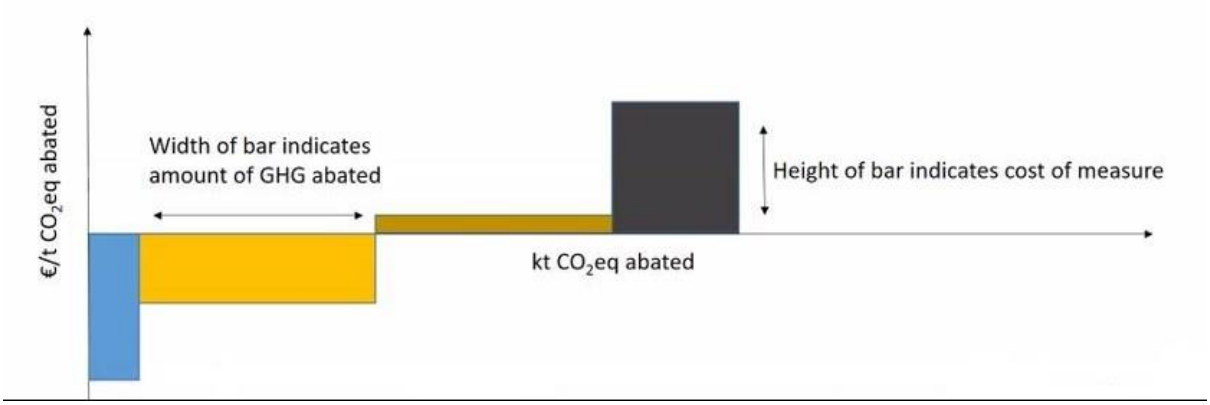

Figure 17 Illustrative schematic on how to "read" the information represented in a Margin Abatement Cost Curve [Source Teagasc MACC 2023]

Figures 18 and 19 illustrate the measures related to direct emission and removals set out in the 2023 MACC following engagement with all stakeholders which need to be integrated into an updated Ag Climatise roadmap through 2024/2025 and in turn for them to be turned into actions in the Climate Action Plan.

Teagasc FAPRI-Ireland economic model was used to model the total activity data associated with Irish agriculture (dairy and other cattle, sheep, pig and poultry populations, tillage production and fertiliser use) in MACC. Three potential agricultural activity scenarios have been examined and two potential adoption pathways. One potential critique of the MACC

analysis is the lack of scenarios which envisage a drop in market prices. It has been argued that a shift to greater consumption of plant-based foods, and other non-animal protein (synthetic meat) may reduce overall demand for animal based foods. For example, Kozicka *et al*, estimate a 14% decrease in price for animal-based foods if there were a global 50% substitution with plant based alternatives.[6]

Table 11 Projected activity data & emissions for 2030

2030 Projected activity data and emissions

	2022 '000 head	Scenario 1 '000 head	Scenario 2 '000 head	Scenario 3 '000 head
Total cattle	7,132	6,785	6,541	7,015
Dairy cows	1,568	1,692	1,627	1,756
Suckler cows	887	632	504	748
Total sheep	5,223	4,656	4,664	4,649
Total pigs	1,676	1,629	1,629	1,630
Total poultry	19,765	20,911	20,912	20910
Total mineral N fertiliser tonnes	343,200	399,156	369,806	420,989
Total GHG emissions Mt CO_2eq		21.9	21.1	22.8

Animal inventories align with the activity level used in the EPA Agriculture GHG inventory. See Ireland's Informative Inventory Report 2023 (EPA, 2023)

[6] Kozicka, M., Havlík, P., Valin, H. *et al.* Feeding climate and biodiversity goals with novel plant-based meat and milk alternatives. *Nat Commun* **14**, 5316 (2023). https://doi.org/10.1038/s41467-023-40899-2

Agriculture MACC (S1) – Pathway 1 = 2820 kt CO_2eq/yr

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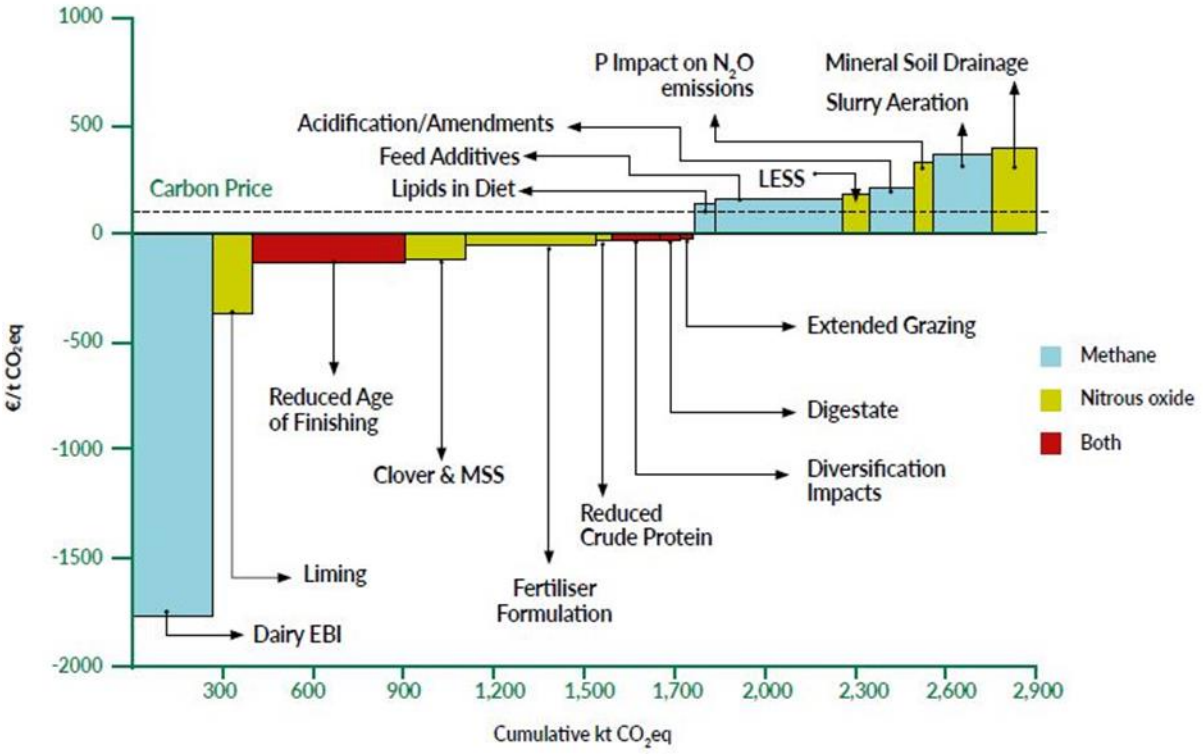

Figure 18 Agricultural MACC for the expected animal numbers (Scenario 1) with a similar level of measure adoption to that previously used (Pathway 1) for methane, nitrous oxide and both gases. The dashed line indicates a Carbon Price of €100 per tonne CO_2eq.

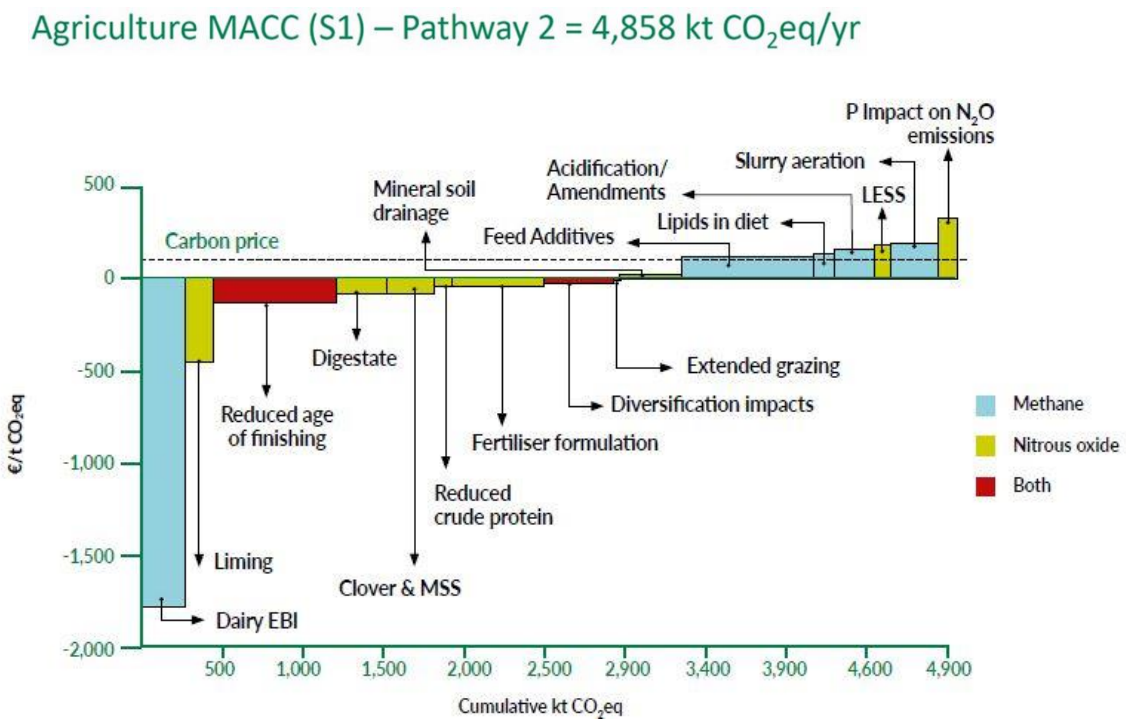

Figure 19 Agricultural MACC for the expected animal numbers (Scenario 1) with a high level of measure adoption (Pathway 2) for methane, nitrous oxide and both gases. The dashed line indicates a Carbon Price of €100 per tonne CO_2eq.

Key measures:

Nitrous oxide mitigation

- Management of and reductions in use of nitrogen fertiliser was identified as the main focus. This can be achieved through a combination of reduced N fertiliser application and altered fertiliser formulation (either protected urea or ammonium based compound fertilisers) (Figures 18 and 19).
- Key technologies for achieving a reduction in nitrogen fertiliser use include the greater use of white and red clover, achieving optimum soil pH and soil P/K status in combination with enhanced use of legumes and multi-species swards and the use of Low Emissions Slurry Spreading (LESS). These can reduce fertiliser use to between 322,590 tonnes N (P1) and 285,727 tonnes N (P2) by 2030.
- Altering fertiliser formulation (switching from CAN to protected urea or an ammonium-based compound) will reduce emissions in 2030 by between 418 $ktCO_2eq\ yr^{-1}$

(Pathway 1) and 553 $ktCO_2eq\ yr^{-1}$ (Pathway 2). Reduced crude protein in animal feed concentrates will also contribute to reduced nitrogen loading in soils.

- The cumulative abatement over the period 2021 to 2030 for nitrogen fertiliser is between 6.8 million and 11.1 million tonnes CO_2eq.

Methane mitigation

- Reduced age at finish could reduce emissions in 2030 by 470 and 732 $ktCO_2eq\ yr^{-1}$ for Pathways 1 and 2, respectively. This is equivalent to a reduction of average finishing age by 2 and 3 months, respectively (Figures 18 and 19).
- Improved Economic Breeding Index, (EBI), could reduce absolute levels of methane by 255 $ktCO_2eq\ yr^{-1}$ by 2030 under both Pathway 1 and 2.
- Feed additives that inhibit methane production in the rumen, could reduce methane emissions in 2030 by between 396 $ktCO_2eq\ yr^{-1}$ (P1) and 788 $ktCO_2eq\ yr^{-1}$ (P2). These still require a lot of research for development and deployment.
- Diversification into organic farming, forestry or particularly feedstock (grass) production for biomethane production could reduce emissions in 2030 by between 150 $ktCO_2eq\ yr^{-1}$ and 417 $ktCO_2eq\ yr^{-1}$.
- Manure management, in terms of slurry additives and aeration but also biomethane and extended grazing could reduce manure methane emissions by between 423 $ktCO_2eq\ yr^{-1}$ and 879 $ktCO_2eq\ yr^{-1}$ by 2030.

Rate of adoption

The MACC analysis requires specific assumptions regarding the rate at which mitigation options can be deployment in the real world. Variable speeds of adoption across the individual MACC measures have based on expert opinion have been included to reflect differing levels of technology readiness.

It should be stated that the very high abatement levels required in Pathway 2 to meet the climate target will be extremely challenging to achieve over the next seven years. Many of the uptake rates demanded in Pathway 2 (e.g., 95% replacement of CAN and 100% replacement of straight urea, Table 12), would almost certainly require policy intervention in tandem with incentivisation schemes.

Agricultural abatement seems cheap and indeed is cost-negative. However, the bulk of the cost savings are associated with two measures: Dairy EBI and reduced age of finishing. If these two measures are excluded from the total, cumulative costs would range from €256M to €730M over the budgetary period with maximum annual costs in 2030 ranging from €93M to €199M.

MACC analysis assumed a continuation of current genetic trends in Pathway 1 with a national increase in the TI (Terminal Index: Agricultural efficiency measure) of €2.30 per year. This is projected to yield total cumulative cost benefits of €23 million by 2030 when compared to 2021. For Pathway 2, the increase in TI value per year is increased to €5 and consequently GHG emissions savings are increased and cumulative cost benefits increase to €38 million. It should be noted that decreased production costs and/or increased production efficiency in terms of liveweight gain could result in increased absolute emissions if total herd numbers expand.

There is resistance to early finishing from a cohort of farmers, particularly those operating extensive finishing systems with later maturing breed types. Finishing with lighter animals

while also demonstrating the gain in the margin will be key to measuring success. Again, the improvement of beef genetics cut emissions across a range of breeds and crossbreeds. As a result, understanding and guiding the impact of genetic merit is more difficult compared to breeding in the dairy industry. In addition, a large cohort of livestock farmers are part-time and have much lower margins compared to their dairy counterparts (Buckley et al. 2022).

Table 12 Mitigation Measures

Uptake Rates of Measures – 80% of Total Mitigation

Measure	Pathway 1	Pathway 2	Description of mitigation measure
N-reducing measures (liming, legumes, LESS)	20% (322,590 tonnes N by 2030)	30% (285,757 tonnes N by 2030)	Reduction in total N
Fertiliser Formulation (Protected Urea, low-N compounds)	100% 65% 50%	100% 95% 65%	Straight urea to protected urea CAN to protected urea Nitrate-based to ammonium-based compounds
Reduced Age of Finishing	2 months	3 months	Reduction in average age at finish of prime beef cattle
Feed Additives	40% 45%	50% 65%	Feed additive to dairy cows during grazing Feed additive to cattle during housing
Diversification Impacts (Destocking & Use of Digestate)	54,849 LU 520,000 m^3	137,963 LU 3,500,000 m^3	Displacement of animal numbers Volume of digestate
Manure Management	25% dairy 15% other	40% dairy 20% other	Slurry aeration or acidification

The MACC proposes just three scenarios for consideration, with all three forecasting an increase in the dairy herd, while relying on a decrease in the suckler herd to meet the carbon budget (Table 11). Moreover, its strong reliance on new science and the very high adoption rates of mitigation measures assumed are very challenging asks. There is a need for contingency if the sector fails to meet such high rates of adoption of measures and in the case of new science on measures like manure amendments and feed additives delays.

Which Scenario/pathway helps Agriculture to meet its target?

Table 13 Emission scenarios

Scenario/Pathway	2021-2030 Projected Emissions	% relative to 2018 Emissions Reduction Target
SEC	202	25%
S1P1	206.8	13.1%
S2P1	203.6	12.7%
S3P1	210.2	13.5%
S1P2	198.9	21.1%
S2P2	196.1	20.3%
S3P2	202.2	21.7%

No scenario/pathway combination achieves the proposed emissions reduction target of 25% by 2030. However, two of the scenario/pathways identified plausibly result in cumulative emissions in the period 2021-2030 which are with the combined sectoral emissions ceilings for the first two carbon budgets, while a third (S3P2) overshoots the cumulative ceiling slightly (Table 13).

Can Agriculture meet the 2030 reduction and carbon budget targets?

- As set out in the Climate Act the agriculture sector has been set a target to reduce GHG emissions by 25% (5.75 Mt CO_2eq) by 2030 or 17.25 Mt CO_2eq relative to 2018 levels.
- To achieve the emission reduction targets, the agriculture sector requires a combination of high levels of measure adoption (80%), limiting animal number increases and development of new science.
- For the most likely animal numbers scenario in 2030 (Scenario 1) a very ambitious rate of measure adoption (Pathway 2) achieves the 2030 emission reduction and comes in under the carbon budget.
- The lower animal numbers scenario (Scenario 2) combined with the higher adoption rates (Pathway 2) would come in under target by 850 ktCO_2eq yr^1 by 2030.
- Scenario 3 does not meet the 2030 25% reduction target or the carbon budget targets for either pathway.
- The quicker measures are taken up, the more cumulative mitigation can occur over the entire 2021 to 2030 commitment period. However, because adoption is back-loaded, cumulative mitigation over the 2021-2030 period is only marginally higher at 985 ktCO_2eq.
- The two pathways representing the upper and lower limits of GHG abatement and uptake rates of individual measures are not mutually exclusive to a given adoption pathway. In other words, adoption rates from both Pathways can be ‘mixed and matched’ in any combination that will achieve the targets.

6. Changes in the new Nitrates Action Programme

The management and control of nitrogen in agriculture can have a direct and indirect impact on the rate of N_2O emissions. Multiple complex processes are involved, and therefore additional analysis is required to establish how changes in the Nitrate Action Programme will impact on emissions. An important feature of the NAP in Ireland has been the option for derogation at the farm level. Ireland is one of only three member states where farmers can avail of a derogation that permits them to farm at a higher rate of nitrogen per hectare than what is permitted elsewhere in Europe. The number of farms availing of derogation in Ireland in recent years is shown in Figure 20, and Table 14.

In relation to the impact of agriculture on water quality, the Nitrates Action Programme – the means by which the European Union's Nitrates Directive is delivered in Ireland – has undergone a number of changes, with stronger measures introduced for the protection of water quality. The Action Programme seeks to manage nitrates in the environment derived from animal waste and fertilisers. The fifth Nitrates Action Programme has been given effect by the Good Agricultural Practice Regulations under S.I. No. 113 of 2022, effective from 11 March 2022. Amendments to these regulations principally relate to animal waste generated and chemical fertiliser allowance. The major changes related to the revised methodology used to calculate the amount of nitrates at farm level and the new methodology is being implemented in 2023 in order to produce a more accurate nitrates figure for individual farms. The application of the new methodology will result in an increase in the amount of nitrates associated with some farms, relative to the approach previously used and this will have implications for some farms, particularly grassland farms with a high livestock intensity.

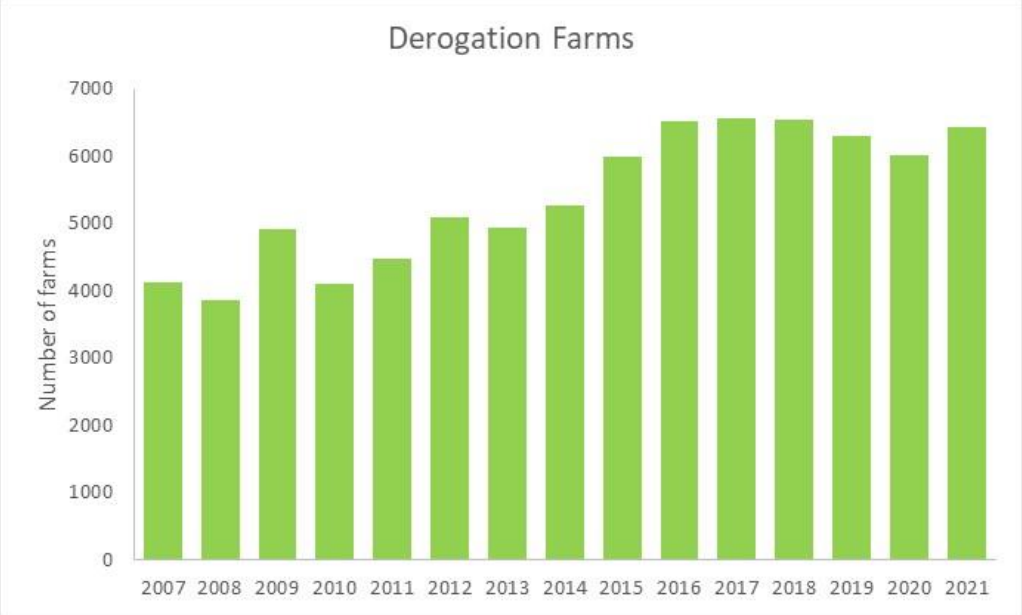

Figure 20 Number of derogation farms {DAFM derogation Report 2021]

Table 14 Profile of derogation applications [DAFM Derogation Report 2022]

Year	2019	2020	2021	2022*
Number of derogation applicants	6,684	6,505	6,814	6,812
Total land area under derogation (ha)	448,900	449,435	479,196	500,913
Average farm size (ha) for derogation farms	67	69	71	73
Average Number of LU's[2] per derogation farm	156	134	163	Not yet available

Up to 2023, a uniform nitrogen excretion rate was applied for all dairy cows in the country, i.e., 89kg of N per cow per year. With the introduction of so called “banding” in 2023, there are now three new specific N coefficients that are to be applied to cows depending on the level of their milk yield. The implications of these banding regulations are particularly important for the subset of dairy farms in the highest band, i.e., where the average milk yield per cow exceeds 6,500kg. On these farms, the coefficient for organic N increases from 89kg per cow to 106kg per cow (an increase of 19%). Many of these farms have derogation status. Recent Teagasc analysis indicates that about one-fifth of specialist dairy farms in 2021 have milk yields above 6,500kg per cow (Teagasc 2023). In order to maintain current levels of milk production, many of these farms will need to either increase their land area or reduce milk production in the short term.

The measure has particular importance for dairy farms given that livestock intensity per hectare tends to be higher on these farms relative to dry stock farms. For the purposes of the Nitrates Directive regulations, the livestock intensity is measured according to the livestock excretion rates for organic nitrogen (organic N) and organic phosphorous (organic P). Ordinarily, farms can operate up to a limit of 170kg of organic N per hectare under the regulations. However, farms can apply for a derogation from the regulation that allows them to operate with a livestock intensity up to a limit of 250kg organic N per hectare, i.e., 47% higher. Ireland is one of only three EU member states that is granted a derogation to enable some farmers to work to a higher nitrate limit than is applied in the rest of the block. Farms with a derogation status form a minority of farms in Ireland, with approximately 6,400 farm holdings operating under this status and most of these being dairy farms (Figure 21). Irelands Nitrate derogation limits have been cut from 250 kg of organic nitrogen per hectare (N/ha) to 220 kg N/ha and will be applicable from 1 January 2024.

In addition to the banding policy, there are five other key changes to the nitrates regulations for 2023. This includes the extension of the closed periods for slurry spreading and soiled water storage, and the mandatory use of soil sampling on arable farms and farms with a livestock intensity above 130kg organic N per hectare. There are also some increased regulations in relation to buffer strips on tillage land. Low-emission slurry spreading (LESS – trailing shoe, trailing hose or injection methods) increases N retained in slurry and reduces the need for chemical fertiliser, and reduces N losses to the environment. Data from the Teagasc National Farm Survey indicate that 67% of slurry applied on dairy farms in 2021 was via LESS methods (Buckley and Donnellan 2022). The compulsory use of LESS has been introduced in 2023 for farms with a grassland stocking rate in excess of 150kg organic N per hectare.

This is a phased measure. This practice becomes compulsory for farms above 130kg organic N per hectare in 2024 and above 100kg organic N per hectare in 2025.

The implications of change in derogation and the Nitrates Action Programme on the land market

The impact of change in derogation and new banding policy on the agricultural land rental market could be highly dependent on the farming structures in a locality and the willingness of landowners to let out additional land. Figure 21 shows the locations of derogation herds across Ireland in 2022. Prior to the policy change, many dairy farmers already had a latent demand to access more land. The available statistics point to the growth in the land area farmed by dairy farmers in recent years. Approximately one-fifth of all dairy farms operate in the highest banding category, where milk yields exceed 6,500kg per cow. Economic theory suggests that localities with a high density of these farms will experience a larger increase in rental prices than other regions. This is particularly the case in localities where few landowners are willing to rent out additional land. The largest bids for rented land will emerge from dairy farms operating in the highest banding category. Some farmers will be outbid in the local land market, including tillage and drystock farms. In those situations, the challenge for tillage and drystock farmers may be to hold on to their existing access to rented land. Many medium- and long-term land lease contracts are fixed in price until the contract comes to an end. However, the banding policy could eventually impact the price of these previously arranged land leases. The analysis shows that the policy impact could be much more benign in localities where a significant number of landowners are interested in letting out land. The banding policy is also likely to have an impact on the land sales markets as well. Parcel sizes are an important consideration in both the land sales and land rental markets. Relatively small additional parcels can help dairy farmers to limit the impact of the policy change on production levels. However, the challenge is particularly acute for those dairy farmers operating in the highest banding category. In addition, young and new entrant farmers may face even higher land prices in places where there is a high concentration of these dairy farms.

The locations of derogation herds strongly corelate with areas where the EPA have identified the needs for targeted mitigation action to address water quality issues associated with nitrates, as see in Figure 22. Derogation herd location also correlates with areas of relatively lower nature value, as can be seen in Figure 23. Actions to deliver improved water quality, through less intensive exposure to nitrates can co-delivery on improved biodiversity. The management and control of nitrogen in agriculture can have a direct and indirect impact on the rate of greenhouse gas emissions, especially where actions reduce fertiliser use, or reduce animal numbers. However, multiple complex processes are involved, and therefore additional analysis is required to establish how changes in the Nitrate Action Programme will impact on emissions.

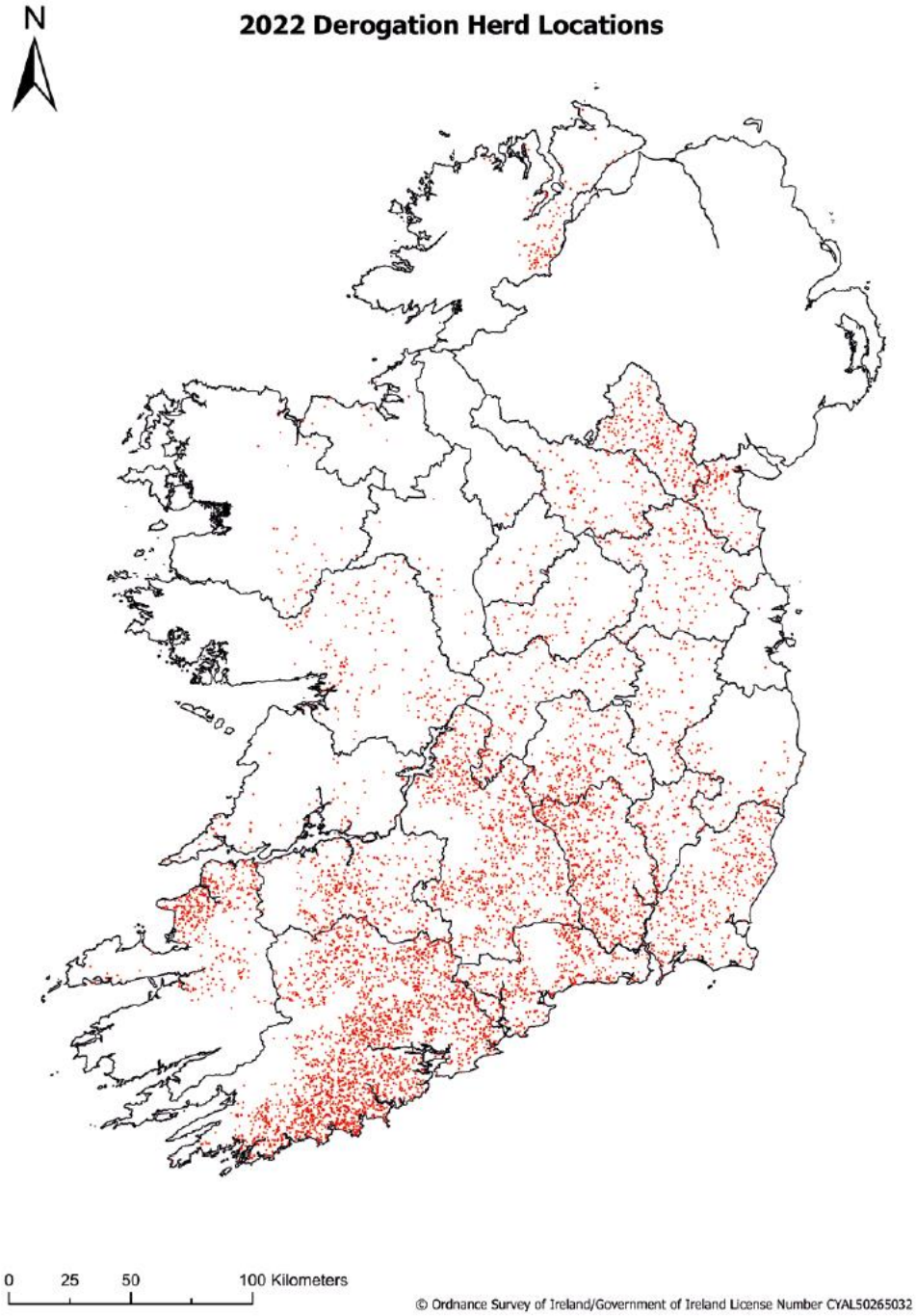

Figure 21 Locations of Derogation Herds in 2022 (EPA, WATER QUALITY MONITORING REPORT ON NITROGEN AND PHOSPHORUS CONCENTRATIONS IN IRISH WATERS 2022, Jul 2023, https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/water-quality-monitoring-report-on-nitrogen-and-phosphorous-concentrations-in-irish-waters-2022.php]

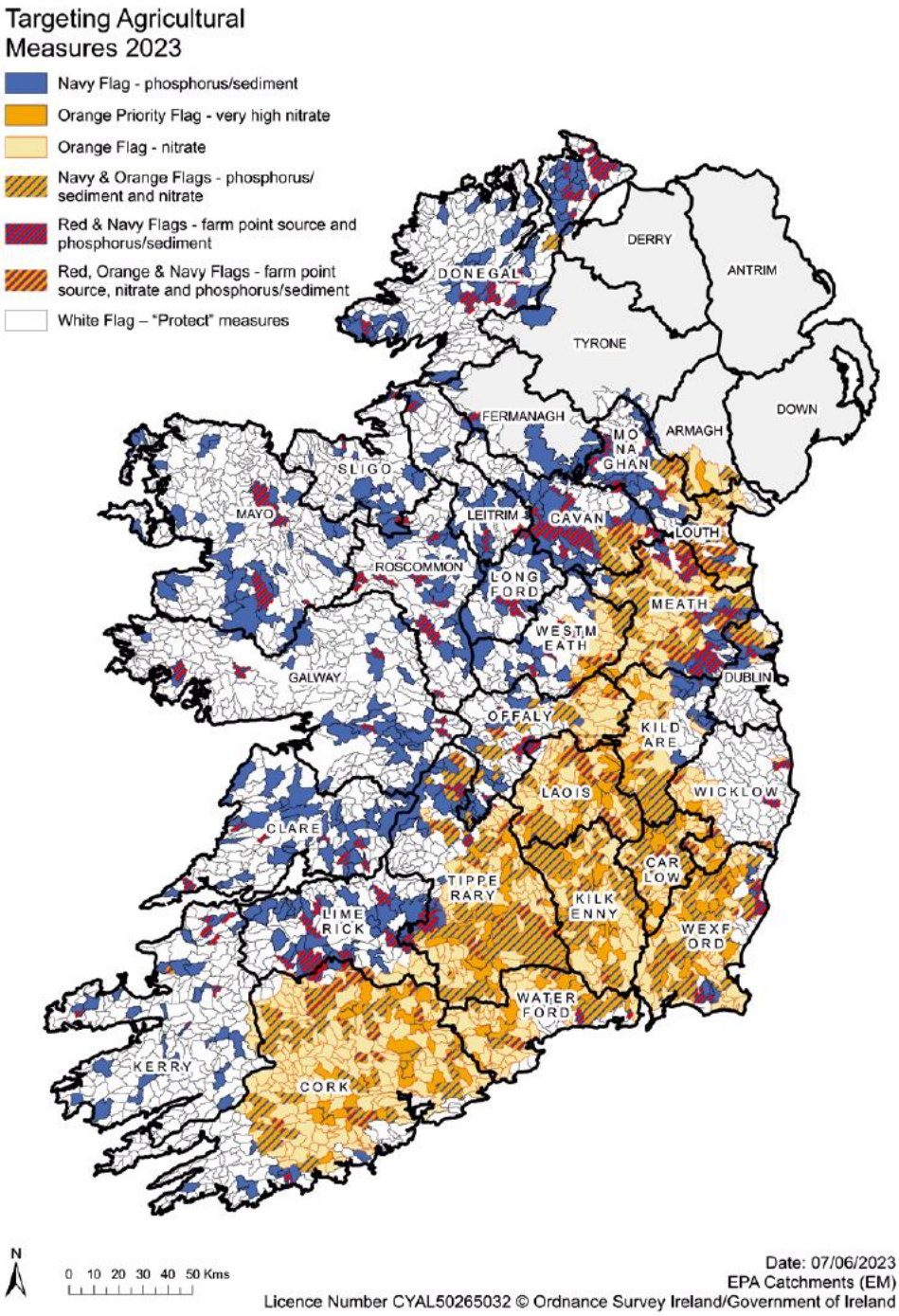

Figure 22 Area requiring targets mitigation to address water quality concerns 2022 (EPA, WATER QUALITY MONITORING REPORT ON NITROGEN AND PHOSPHORUS CONCENTRATIONS IN IRISH WATERS 2022, Jul 2023, https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/water-quality-monitoring-report-on-nitrogen-and-phosphorous-concentrations-in-irish-waters-2022.php]

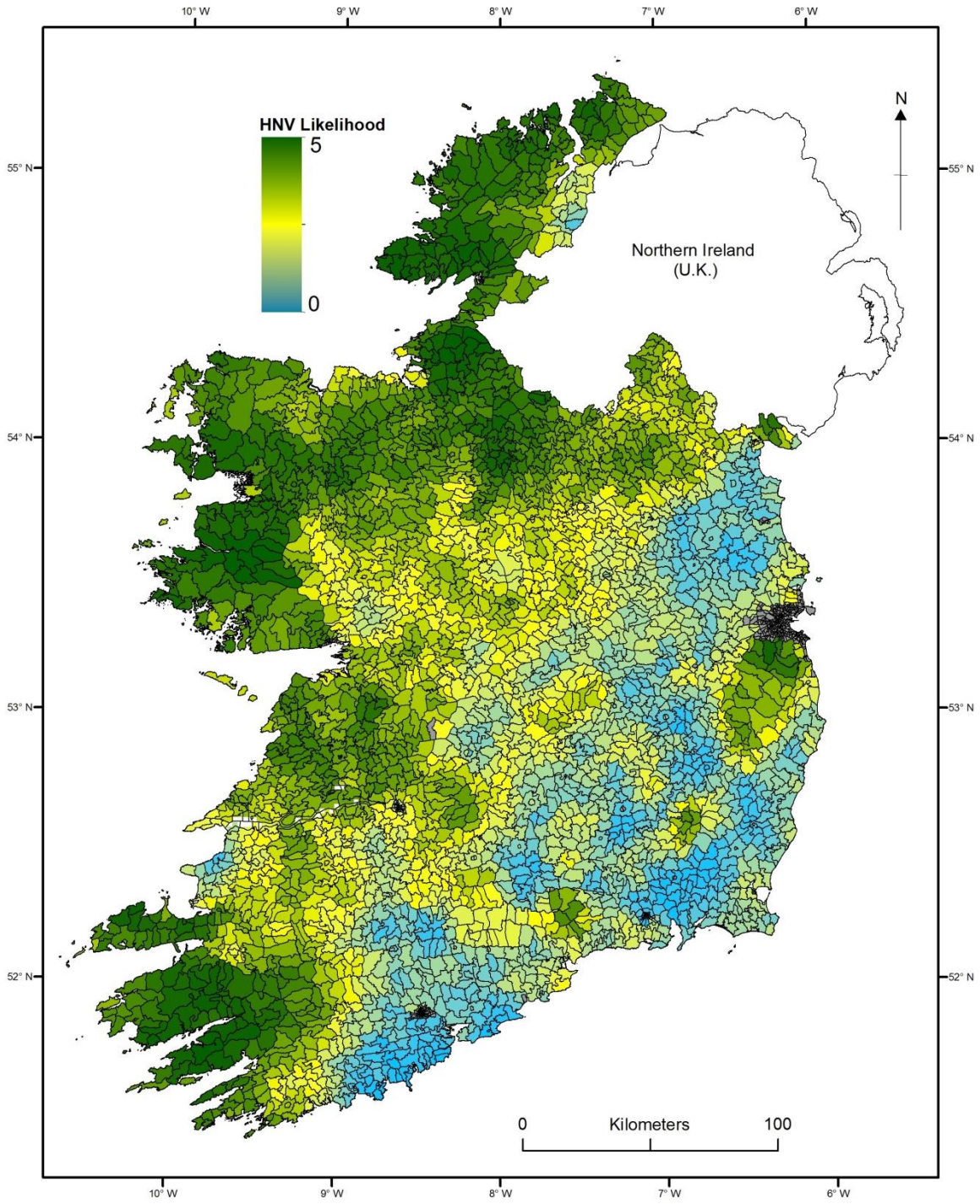

Figure 23 Mapping of High Nature Value (HNV) farming across Ireland [Source: https://www.catchments.ie/high-nature-value-farmland-co-delivery-farmland-biodiversity-water-quality/]

7. Land Use Land Use Change and Forestry

Council has repeatedly called for the development of a national land use strategy and a policy focus on enhancing land based carbon removals (see Appendix 2).

The 2015 Paris Agreement established the long-term goal of *'holding the increase in global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels*' and of achieving '*a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century'*. As set out in the CCAC's Technical Report on Carbon Budgets, the stabilisation of greenhouse gas concentrations in the atmosphere and the establishment of a climate neutral economy requires achieving significant carbon removals with LULUCF.

Appendix 1 presents a briefing note from the Department of Agriculture, Food and the Marine which outlines the reporting and accounting rules agreed to supported EU climate objectives for the LULUCF sector.

Key feature of EU climate objectives for LULUCF include:

- Aggregate net removals across all EU member states to increase to -310MtCO_2eq per year by 2030 from a baseline of -268 MtCO_2eq in 2018. These levels of net removals have been achieved in the past, however, the EU objective is to significantly reverse a trend of decreasing removals in recent years, where removals were-230 MtCO_2eq in 2021.
- Ireland's agreed contribution to this target is to reduce net emissions from LULUCF by -0.626Mt CO_2eq per year.
- Aggregate combined net emissions and removals across the Agriculture and LULUCF sectors are to achieve net zero emissions by 2035. Net zero will be evaluated on the based on the conventional global warming potential metric. Given recent trends across Europe, this is likely a challenging target. Details of specific member state targets and flexibilities have not been agreed. Total EU agriculture emissions in 2021 stood at 378 MtCO_2eq.
- As noted in the Annual Review 2023, there is significant uncertainty in inventory and projections of emissions and removals for LULUCF sector. The EPA and other bodies, are currently engaged in a major research and development programme to address these uncertainties and improve our understanding of the underlying processes and upgrade the inventory methodology to Tier 2 status over the next few years. This timeline is consistent with EU requirement, under the LULUCF Regulation, for implementation of reliable and robust data to inform assessment of baseline emissions/removals, effectiveness of mitigation actions to be incorporated in the 2025 inventory estimates to be submitted in 2027.
- Reporting and accounting under EU regulations for the period 2021-2025 is complex, a legacy of the rules of the Kyoto Protocol. While important in terms of compliance with

EU obligations, there is little in terms of additional motivation to timely action within LULUCF not already required to achieve Ireland's 2030 target.

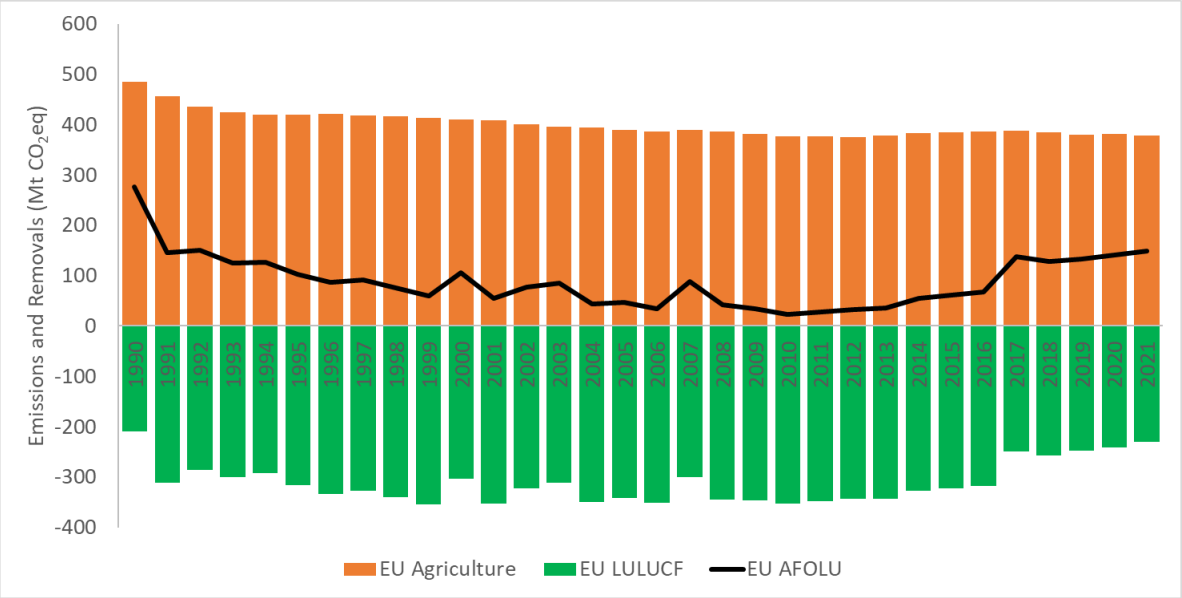

Figure 24 EU emissions and removals for Agriculture and LULUCF sectors and combined AFLOU sector. {Source EU inventory submission 2023]

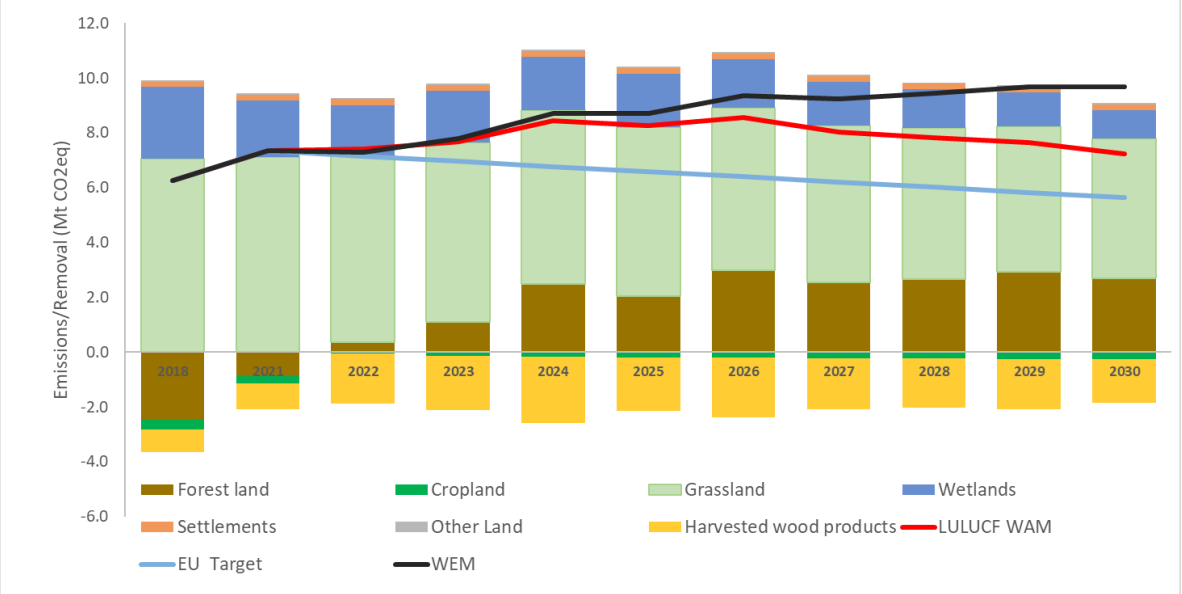

Figure 25 Ireland's estimated inventory and projections for emissions and removals for the LULUCF sector or. {Source Ireland inventory submission 2023, EPA projections 2023]

The dominant land use change in Ireland over the period from 1990 to 2021 has been afforestation. This involved the conversion of ~300kha of grasslands and wetlands to forestry. Much of this afforestation occurred in the 1990s. Unfortunately, much of this occurred on organic soils, leading to continual loss of carbon from the soil. During the initial cycle of forest growth and harvesting, the sequestration of carbon to biomass exceeded the cumulative loss

of carbon form the soil. However, eventually, during a subsequent forest management cycle cumulative losses will exceed sequestration and the forest will emerge as a net sources of emissions.

Plantation on marginal land and organic soils was a feature of afforestation since the foundation of State and prevailed through to the 2000s. This afforestation pattern is clearly seen in Figure 28, where high density of forest cover can be seen in area of poor agricultural lands and upland areas. Although still not completely banned, afforestation on these inappropriate soil types has largely discontinued under most recent forest schemes. Nevertheless, there is a major issue of legacy afforestation on these soils which has given rise to the situation that the national forest estate will transition to a net source of emissions under a business as usual scenario of forest management.

It is interesting to note that, historically, Ireland had been effectively deforested for agriculture in the period prior to the 1850's, by which time Ireland forest cover had declined from an estimated 19% cover in the 1400s to just 1% -2% by 1850, see Table 15 and Table 16. Systematic afforestation did not commence until the intervention of the State with significant commitment of resources yielding results from the 1960's onwards. Current government policy is to achieve 18% forest cover by mid-century.

Table 15 Percent of forest cover on usable agriculture land over time from Kaplan et al. (2009)[7]

Year	1000 BCE	500 BCE	1 CE	500 CE	1000 CE	1350 CE	1400 CE	1850 CE
Forest cover	64.5%	68.4%	69.7%	50.6%	38.0%	13.0%	19.0%	0.9%

Table 16 Forest Cover area and % cover of all land area 1656-2022, [Source Forest Service, DAFM, Forest Statistics 2023, https://www.gov.ie/en/collection/15b56-forest-statistics-and-mapping/#annual-forest-sector-statistics]

Year	**Area (ha)**	**% of Total Land Area**
1656	170,000	2.5
1841	140,000	2.0
1908	125,200	1.8
1918	100,717	1.4
1928	89,000	1.2
1942	89,403	1.3
1950	98,073	1.4
1965	254,350	3.7
1973	323,654	4.6
1985	411,529	5.9
2006	697,730	10.1
2012	731,650	10.5
2017	770,020	11.0
2022	808,848	11.6

[7] Kaplan, J. O., Krumhardt, K. M. & Zimmermann, N. (2009). The prehistoric and preindustrial deforestation of Europe. Quat. Sci. Rev. 28, 3016–3034

Another well documented historical pattern of land use change in Ireland, which has implications for carbon storage in the Irish landscape has been the conversion of cropland to grassland which has occurred since the 1850s. The area of under crops in the 1850s was approximately 1.4 million hectares, declining to 0.4 million hectares in the 1990s, with notable peaks during the first world war (1914-1918) and second world war (1939-1945). Given the gradual growth of the cattle and sheep herds over the same period, it is reasonable to assume the vast majority of these croplands were converted to permanent grassland. As such, they have embarked on the steady process of sequestering carbon to the soil.

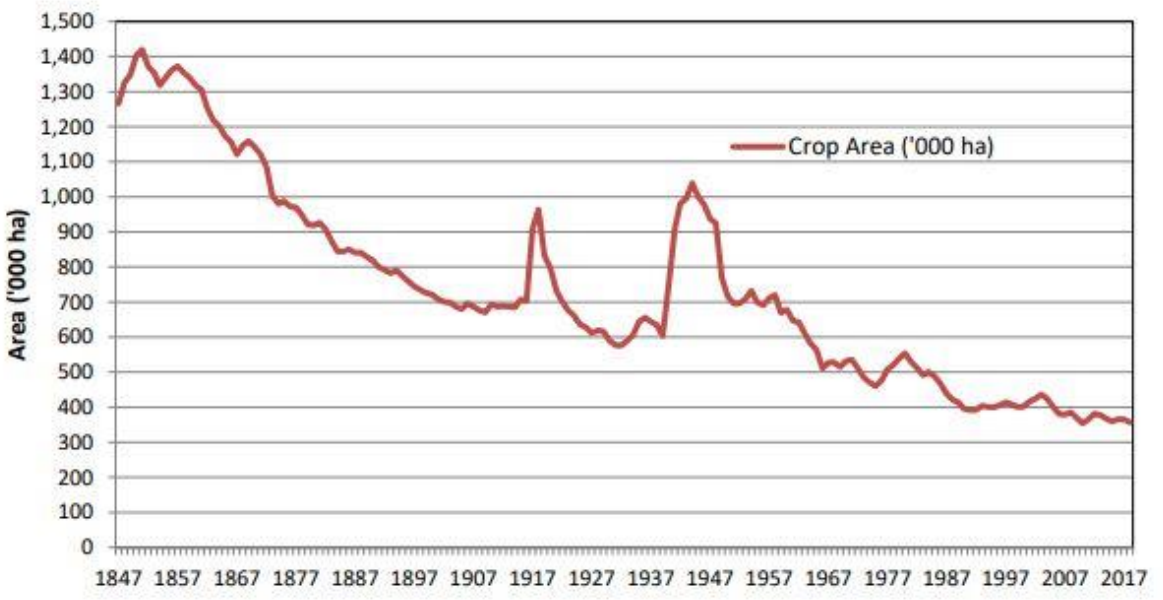

Figure 26 Long term time series of areas under crops in Ireland since 1847

Consistent with this long-term trend in reduced cropland farming, there has been an evident consolidation of tillage farming onto suitable soils in the regions in the east, and south.

A less well documented, more recent significant land use change and land management intervention has been the programme of peatland "drainage and reclamation" for agriculture, mainly grassland. Previous work had estimated the area of lands effectively drained organic soils under grasslands to be of the order of 300kha. However, recent research from Teagasc suggests an area of 120kha had been drained. In additional, significant uncertainty exists as to the historic and current condition of the drainage systems installed at farm scale. [8] [9]

However, similar levels of uncertainty exist as to the extent and condition of peatlands drained and managed for peat extraction for fuel, especially for private use. [10]

[8] https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/NIR-2023-Final_v3.pdf

[9] https://www.teagasc.ie/media/website/environment/climate-change/signpost-programme/Study-shows-area-of-drained-grassland-peat-soils-is-grossly-overestimated.pdf

[10] https://www.epa.ie/publications/research/climate-change/research-401-peatland-properties-influencing-greenhouse-gas-emissions-and-removal.php

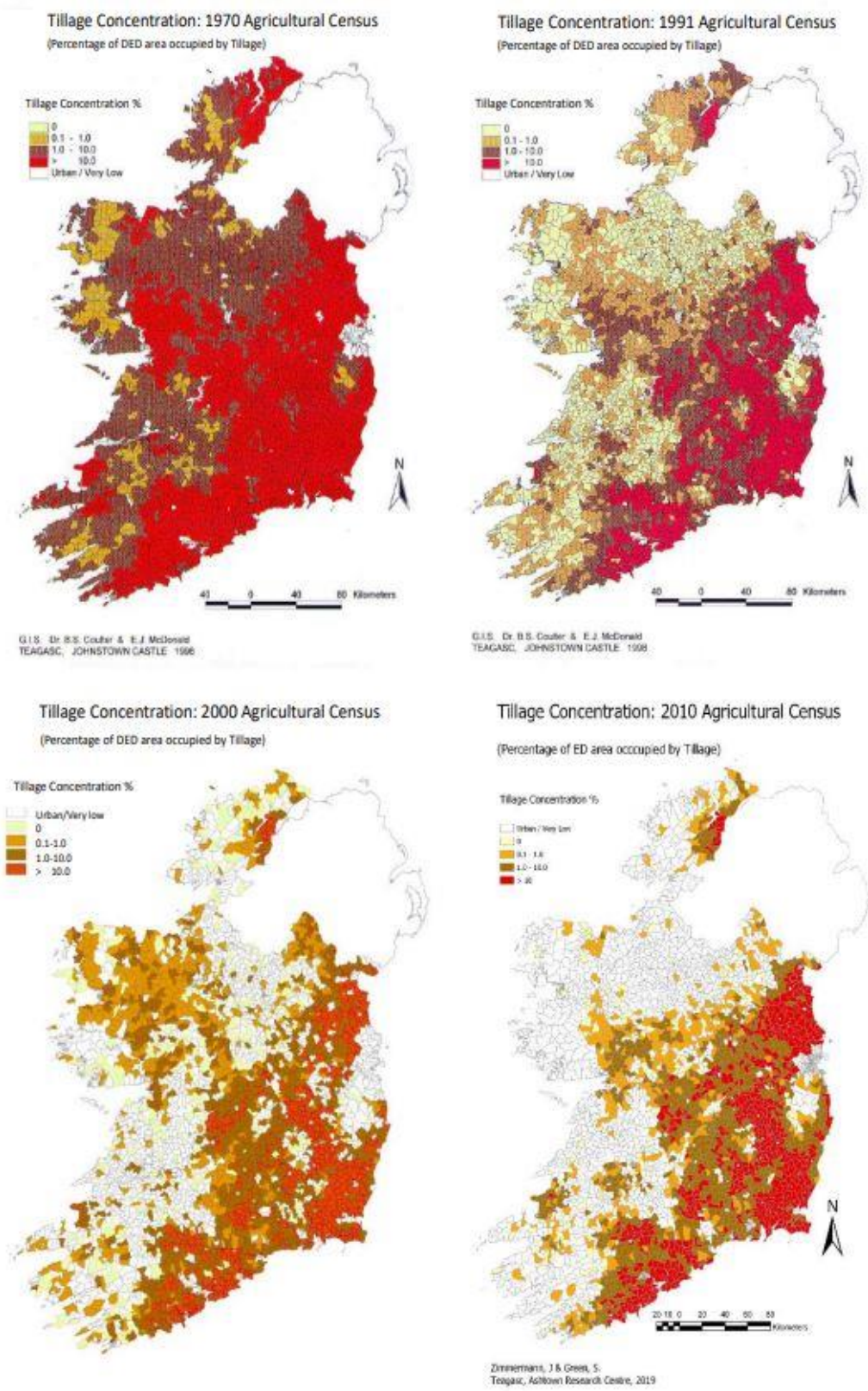

Figure 27 Trends in the change in the spatial pattern of tillage from 1970-2010

Perhaps, equally challenging to the establishing the current status of carbon emissions and removals across all major land use categories and land management types, is identifying the

appropriate land management change which can be implemented on field scale to reduce emissions and enhance removals. For example on organic soils, water table management, rewetting, rehabilitation and restoration are potential options to be considered, but specific action at a site cannot be generalised. Landowners and managers will require robust and committed advisory systems and investment supports to implement improved management across all land use cases, while maintaining and enhancing ecosystem services, including biodiversity, flood and water quality management etc.

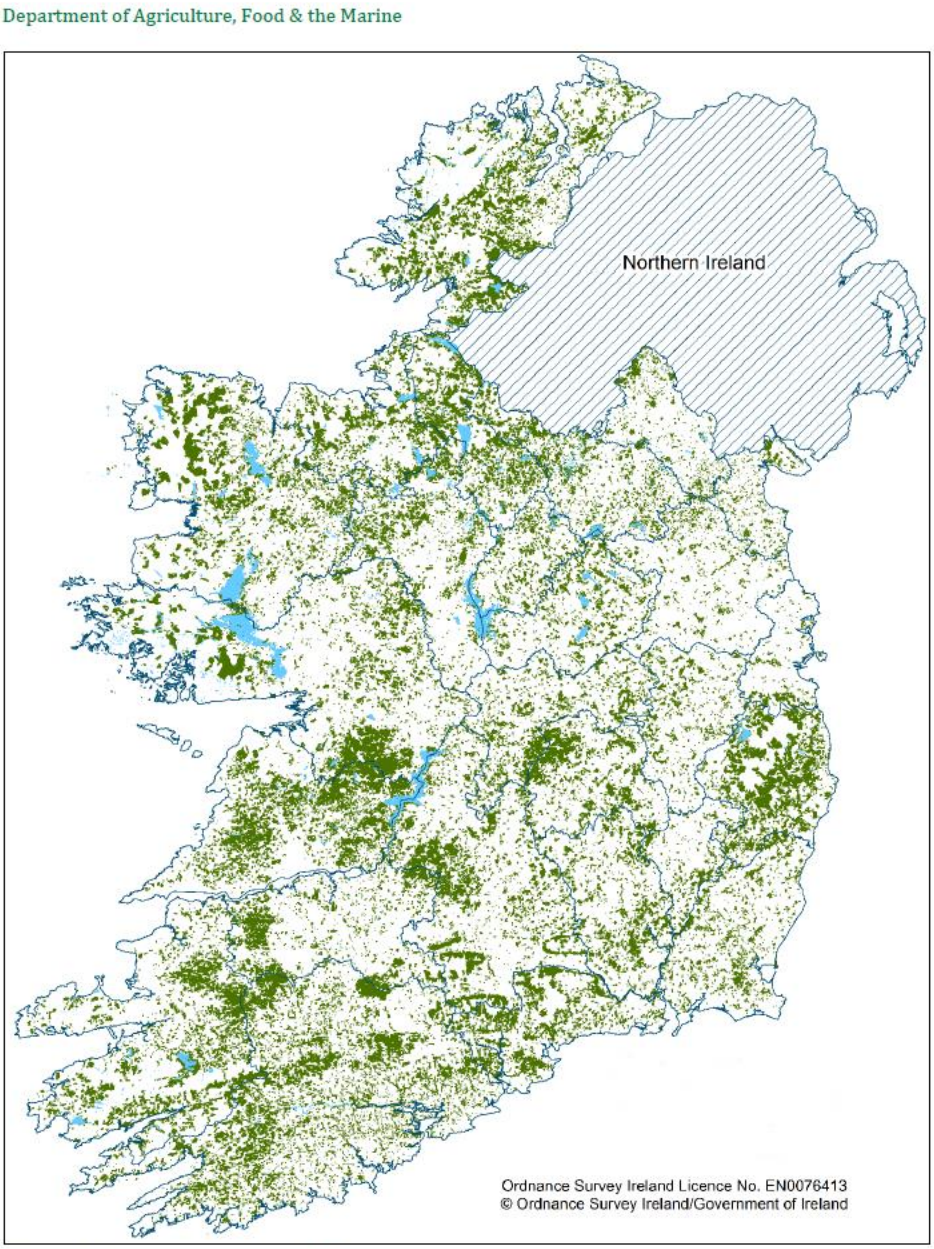

Figure 28 Ireland's Forest Cover[Source Forest Service, DAFM, Forest Statistics 2023, https://www.gov.ie/en/collection/15b56-forest-statistics-and-mapping/#annual-forest-sector-statistics]

Modelling of land use change in response to market demand and policy interventions is challenging. Not least because the decisions to change land use, or to adopt changes in land management practices are taken at the level of the land owner, where behaviour, attitudes and knowledge can have a profound influence. In general, outputs from models such as Global Biosphere Management Model (GLOBIOM) and GOBLIN should be viewed as offering insight

into the maximum technical impact of markets and policies, which assume optimum levels of land utilisation, perfect knowledge of alternative land uses and few if any additional barriers to land use change. For example, at an aggregate scale, a reduction in the total number of cattle may invite the idea of land sparing, that is where under utilised land can made available for other purposes. However, at farm scale, a reduction in the number of animals may simply mean less intensive use of the land, without any consideration by the farmer, of new activities.

Teagasc MACC analysis of LULUCF mitigation options

The LULUCF sector faces a range of challenges. Under Business as Usual, LULUCF emissions are projected to increase substantially to circa. 10.5 million tonnes CO2eq yr1 by 2030. This projected increase in land-use emissions is due to a) the age profile of Irish forestry, b) the relatively low afforestation rate over the last decade and c) emissions from peat soils (both peat grassland and managed peatland). It should be noted that there are considerable uncertainties in the LULUCF inventory in relation to the extent of some of the land use categories and the emissions factors associated with them. Research is underway to increase the accuracy of both land use data and the associated emissions, thereby reducing the uncertainty in this inventory, which may help the sector to meet its targets.

How much mitigation can be achieved?

By 2030, the maximum annual rate of mitigation will range from 2,267 $ktCO_2eq\ yr^{-1}$ under Pathway 1 to 4,110 $ktCO_2eq\ yr^{-1}$ under Pathway 2 (Figure 29 and 30). Much of this mitigation will simply offset the projected increase in emissions over the 2021-2030 period. The cumulative mitigation between 2021 and 2030 is projected to be between 12.8 million tonnes CO_2eq (Pathway 1) and 21.6 million tonnes CO_2eq (Pathway 2). Under the very ambitious Pathway 2, it is possible to achieve the EU LULUCF reduction target of 13.1%. Higher levels of emissions reduction from the sector will be difficult to achieve unless mitigation measures (such as grassland/cropland management) can be incorporated into the LULUCF inventories. A considerable body of scientific work is underway to both refine the land-use and land management factors in the inventory and to collate the activity data required to measure, verify and report emissions reduction or increased carbon sequestration.

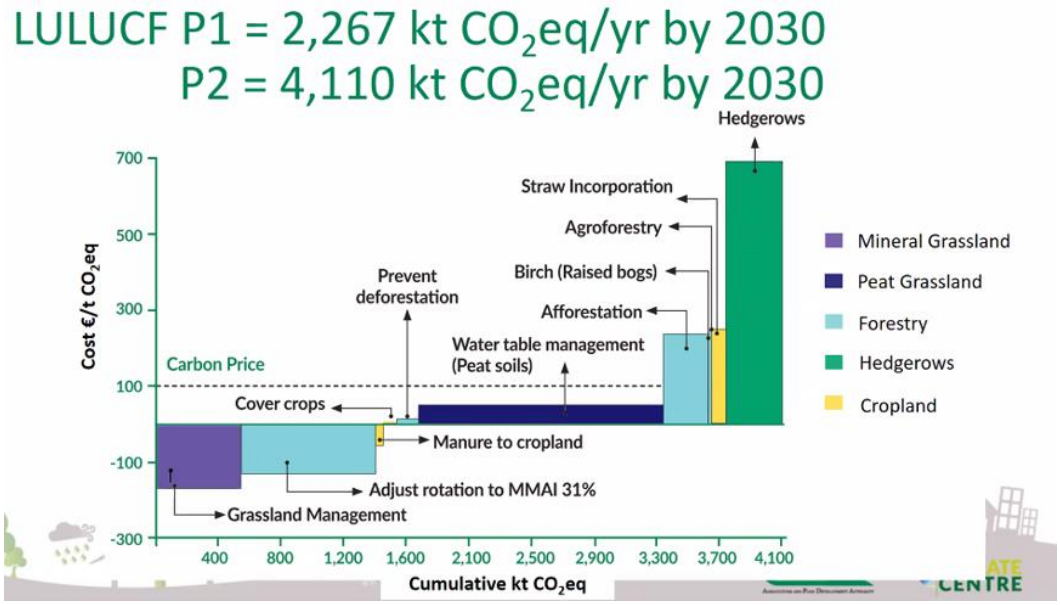

Figure 29 MACC for LULUCF in 2030 (carbon abatement and sequestration associated with forestry,land management and land-use change). Values are based on linear uptake of measures between 2021-2030. Dashed line indicates Carbon cost of €100 per tonne CO_2.

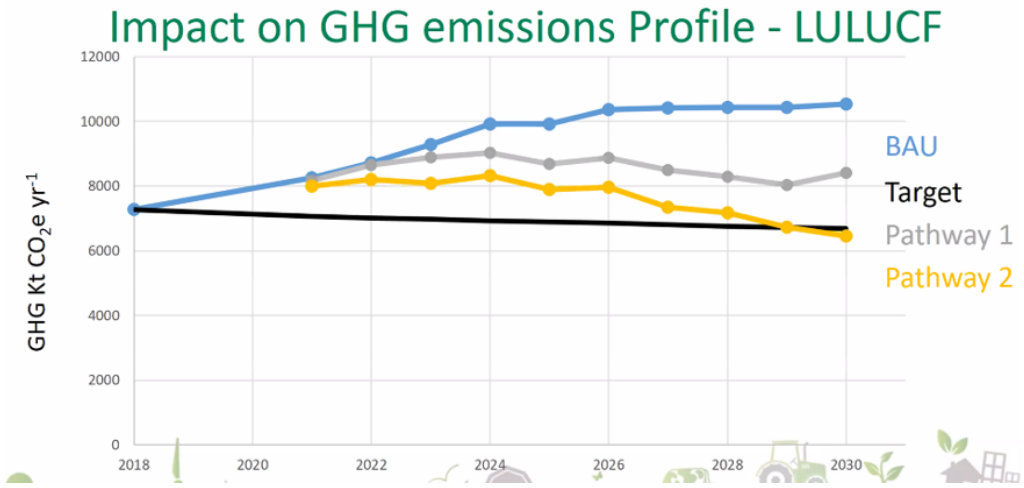

Figure 30 MACC comparison of pathways 1 and 2

8. Land Use Review

Action LU 23 of the NCAP2023 outlines government proposal to undertake a comprehensive Land Use Review to inform development of the sectoral emission ceiling, inform mitigation policy and diversification of land use. The scope of the Land Use Review addresses issues beyond agriculture and the LULUCF sectors, including spatial planning and transport infrastructure. The EPA was tasked with the initial stage of evidence building for the Land Use Review. Phase 1 of the review is complete, and a series of reports collates the evidence basis[11].

Highlights from the Land Use Review, Phase I Evidence Base

The Land Use Review considered the outputs from numerous different approaches to the classification of land which explore and distinguish different aspects and characterises of land and ecosystem function. As such different approaches to classification will lead to seemingly different assessments of the area and condition of in each category. This is further confused by use of different nomenclatures, and different definitions and usage of similar terms. All this to say, mapping of habitats and diversity will be subtly different to mapping of carbon storage although both may be ultimately informed by the same underlying observations.

Primary Production is the dominant land-use class in Ireland: Corine Land Cover data for 2018 shows that together agriculture and forested areas represent 81% of Ireland's land cover. The National Forest Inventory for 2017 states that 11% of Ireland is forest (DAFM, 2021a).

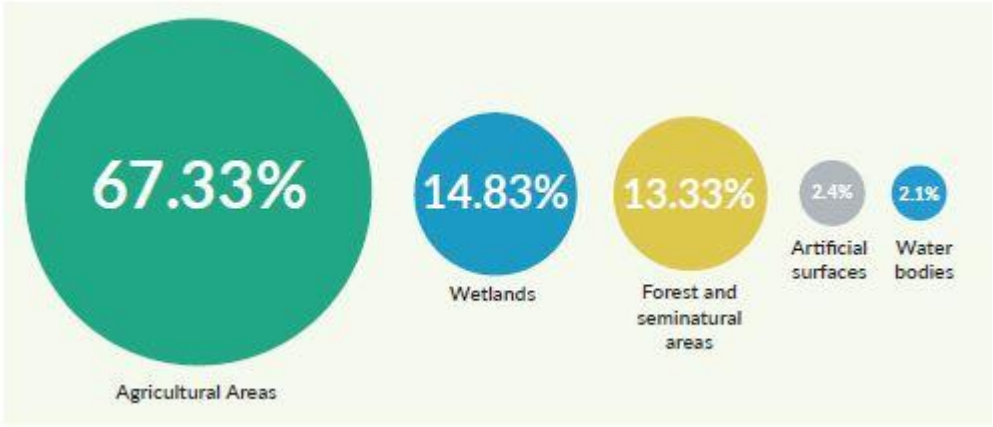

Figure 31 Percentage area of the five main Corine Land Cover classes[Source Land Use Review Phase 1, 2023]

Information on land use at high special and temporal resolution has improved markedly in recent years, with extensive administrative and remote sensing datasets being developed. However, further investment and analysis is required to exploit the full potential of remote sensing tools.

The dominance of agricultural land use and its importance to the national and rural economy and society is clear from the evidence.

The three most notable changes in Ireland's land cover since 1990 (Figure 32) have been:

[11] These can be found at https://www.gov.ie/en/publication/f272c-land-use-review-phase-1/

I. An increase in artificial surfaces: the increase in artificial surfaces occurred at the expense of agricultural land cover.
II. The overall percentage of agricultural land in Ireland has remained relatively constant. Although agriculture land is being lost to artificial surfaces, agricultural land has also been created by other activities including draining of wetlands.
III. There has been a decrease in wetland cover.
IV. An increase in forest and semi-natural area cover.

The increase in forest cover and artificial surface can be broadly attributed to policy and planning decisions.

Socio-Economic Dimensions of Land Use:

A popular approach to the development of policy within land use and agricultural is the model of the three pillars of sustainability, economic, social and environmental. Decision making "on the ground" can also be informed by this approach, however, the needs, aspirations, values, attitudes and behaviours of the individual have more direct influence on action. Farmers and other landowners self-identify as the custodians of the land which they own and manage. They are also strongly motivated by the desire to leave the land is good condition for the next generation. However, an aspect which may be under-appreciated is the social license by which the custodianship is given. Wider society has agreed to give farmers and other landowners decision making pawers as regards the management and use of land, on the assumption that the actions taken are (broadly) beneficial to individual and society and sustainable. In other words, the obligations of custodianship extends beyond the immediately interests of the individual and family to the interests of the whole of society.

The Land Use Review explored how creating positive relationships between social, natural, cultural, and economic capitals should be the foundations of a sustainable land-use strategy in order to maximise the potential of Ireland's land-use. There is also a need to 'move towards a land-use strategy that focuses on wider wellbeing, national and community wealth-building and is aligned with ecological limits'[12] rather than simply extracting profits. Possible options include moving towards a less intensive agricultural model and also developing new land-uses through more mutually beneficial methods such as tourism based on cultural landscapes. A just-transition, effective social learning and political leadership is essential for public support of land-use policies. However, more research is needed 'to understand a wide range of public attitudes and preferences towards land-use and land-use change'[13],because as new land demands emerge, public opinions and values my act as a barrier to change. This highlights the importance of public and stakeholder engagement in decision making to ensure fairness, accountability, trust-building and social learning.

Although progress has been made recently with regards to funding and initiatives to promote national and regional green and blue ways, there has been slow progress made in aspects of the National Landscape Strategy, and the need for landscape character assessment guidelines to be updated is evident. Ecosystem services are increasingly being applied to

[12] Land Use Review, 2023. https://www.gov.ie/pdf/?file=https://assets.gov.ie/246667/53ee6252-322a-4e0b-a40d-0622709a776d.pdf#page=null
[13] Land Use Review, 2023. https://www.gov.ie/pdf/?file=https://assets.gov.ie/246667/53ee6252-322a-4e0b-a40d-0622709a776d.pdf#page=null

policy- and decision-making, for example through the Payment for Ecosystem Services (PES) schemes and the green infrastructure (GI) approach.

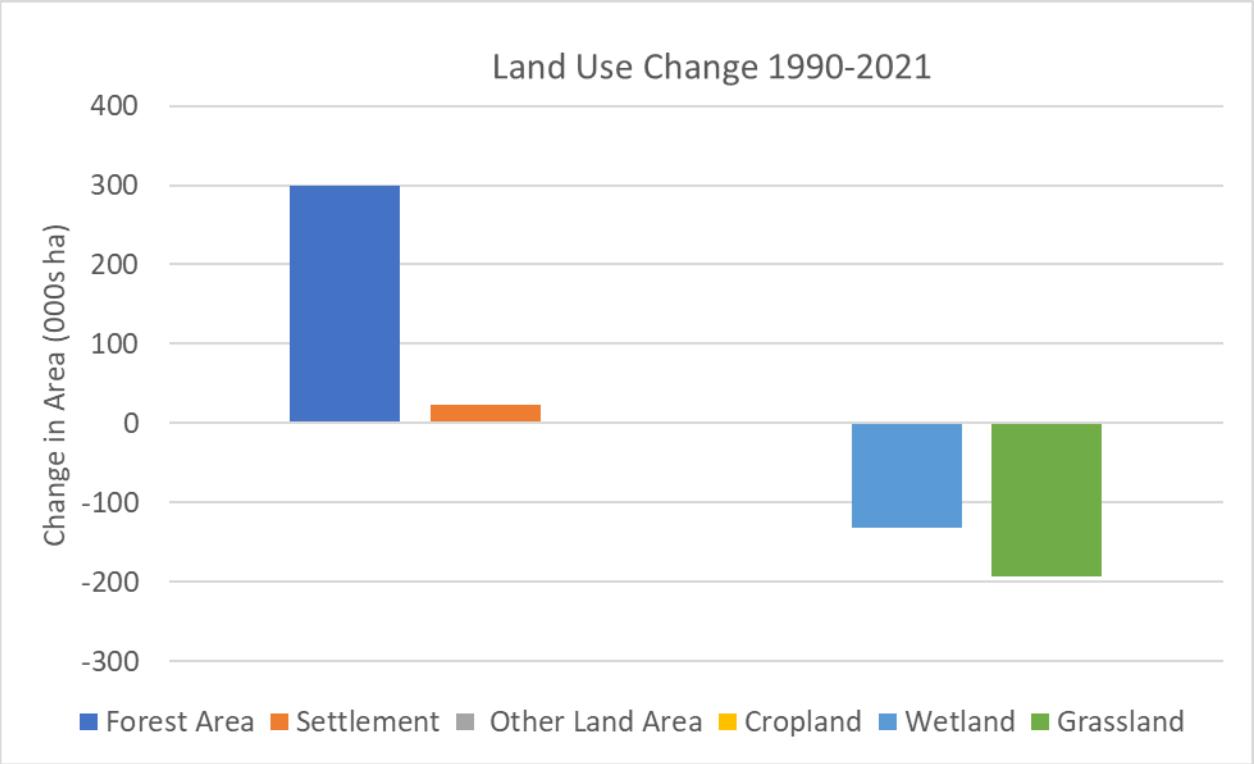

Figure 32 Change in Land Use, from national inventory, 2023.

9. Consumer/retails trends: in export markets (EU, UK)

Export trends:

Ireland is the fourth largest exporter of dairy products in the EU, with 63% of exports going to extra-EU markets, dominated by trade with the UK market. Nevertheless, Ireland also exported dairy products to 147 markets in 2021.[14]

There was an increase in value terms for Irish dairy exports to all markets from €3.9 billion in 2015 to €6.9 billion in 2022, the largest increase across all EU countries. It is important to note that in 2022 there was a significant increase in dairy product prices worldwide. In 2015, the leading exported product by value was infant formula, followed by fat-filled milk powder, while in 2022, the leading product exported from Ireland was butter, followed by cheese and fat-filled milk powder. Exports to the EU increased in 2022, while exports to developing countries have fallen from 37% in 2015 to 32% in 2022. The five top emerging market destinations for Irish dairy exports are China, Nigeria, Mexico, Algeria and Saudi Arabia.

On the other hand, beef exports were worth €3 billion in 2022, with fresh or chilled beef making up the bulk of Irish exports. From 2015 to 2022, the volume of Irish beef exports shows no growth, reflecting a drop in offal exports, stagnation in fresh and chilled beef exports, and an increase in frozen beef exports. In 2015, Ireland accounted for just over 50% of total extra-EU exports and just under 50% in 2022. As with dairy exports, Ireland has a high dependence on the UK market for beef exports. Matthews (2023) identifies that 'Irish beef exports are sold almost exclusively to high-income countries, either in the EU' or other developed countries. Export sales to China are expected to increase in the coming years, following the announcement in January 2023 that Irish beef exports to China could resume.

Plant based products:

Although more plant-based (PB) alternatives are emerging there remains a number of barriers to shifting consumers towards a PB lifestyle, such as their habits, perception of these products, and beliefs about meat consumption. Matthews (2023) states that in order for PB drinks to be a more attractive alternative in low- and middle-income countries they need to become cheaper than dairy products. A study conducted by Kozicka et al. (2023) found that by substituting 50% of animal-based products with PB products, total crop production would increase by 20% from 2020 to 2050, while prices of animal products would decline by 14.1% and by 4.9% for crops.

While a lot of focus is on dairy alternatives, demand for PB meat alternatives is growing. A product audit of plant-based alternatives for meat products focused on Ireland and the UK in 2021 and 2023 found that meat-free chicken, sausages and burgers were the largest product categories in both years, accounting for 50% of products in 2021 and 53% of products in 2023[15]. Even with the increasing trend in consumer awareness of the health, sustainability, and environmental issues caused by meat production and consumption, and the increasing demand for PB alternatives, there has been an 8% decrease from 2021 to 2023 in the number

[14] Matthews, working paper 2023

[15] L. Linberg, J. Woodside, H. Vogan, N. Campbell, S. Mulhal, H. Fitzgerald, J. Walton, and A. Nugent, "A product audit of plant-based meat alternatives available in the UK and Ireland in 2021 and 2023: Changes over time," Proceedings of the Nutrition Society, vol. 82, no. OCE4, p. E273, 2023. https://doi.org/10.1017/S002966512300349X

of PB meat alternatives available in Ireland and UK. There is a need for new meat alternative innovations that tackle consumers concerns regarding health as well as taste.

A survey conducted in Ireland and the UK to gain insights into consumer motivations in Ireland and the UK found varying reasons for consumption of PB alternatives over dairy and meat products[16]. These range from pro-social and moral reasons particularly in relation to concerns for the environment, personal motivations with consumers predominantly citing health reasons, and another motivation was in relation to the taste and price of the PB products. Interestingly, two demographic characteristics, gender and urban/rural living, were seen to significantly predict PB consumption in a recent study focused on consumers in Ireland and the UK. It was found that females, and those living in urban areas were more likely to consume PB products, with one suggested reason for this being that females have a greater awareness of health and nutritional concerns[17]. Although, with that being said, there is still quite a lot of debate surrounding the nutritional value of PB products and whether they can provide the sufficient nutrients to consumers as dairy products would[18], indicating that more research is needed on the topic.

In May 2023, the Climate and Health Alliance published a position paper, 'Fixing Food Together: transitioning Ireland to a healthy and sustainable food system'.[19] The influential health lobby group urges that the farming sector needs to be a key part of the solution.

The position paper warns that a lack of food system policies to shape a healthy food environment has caused ultra-processed foods and excessive red and processed meat to dominate the Irish diet at the expense of fruit, vegetables, plant proteins, wholegrains, and sustainable seafood.

The position paper recommends six key areas where Ireland needs to drive change:

- Ending the junk food cycle
- Promoting transition away from over-consumption of processed foods to a more plant-based diet including beans, peas and lentils
- Harnessing the power of international and national guidelines
- Reducing food waste
- Improving agricultural practices and land use
- Using a policy approach to affect behaviour change.

[16] Beacom, E., Repar, L. & Bogue, J. Consumer motivations and desired product attributes for 2.0 plant-based products: a conceptual model of consumer insight for market-oriented product development and marketing. SN Bus Econ 2, 115 (2022). https://doi.org/10.1007/s43546-022-00278-3

[17] Beacom, E., Repar, L. & Bogue, J. Market-oriented Development of Plant-based Food and Beverage Products: A Usage Segmentation Approach. Journal of Food Products Marketing, Vol 27, issue 4 (2021). https://doi.org/10.1080/10454446.2021.1955799

[18] Matthews, working paper 2023

[19] O'Brien O, Owens S, *et al,* [Climate and Health Alliance sustainable diets working group]. Fixing Food Together: Transitioning Ireland to a healthy and sustainable food system. Climate and Health Alliance. May 2023. https://climateandhealthalliance.wordpress.com/2023/05/16/fixing-food-together-report-launched/

10. Concluding observations

It is very difficult to summarise and tie together the diverse strands of the topics outlined in this thematic paper. There is incomplete understanding of the key aspects of the science, geography, behaviour and attitudes, market dynamics and decision making in complex socio-economic landscape to mention a few of the challenges faced in trying to do so. This does point to areas where further research can be of assistance to the Council and more widely.

Nevertheless, a strong recommendation does emerge on the need to develop and maintain constructive and responsive engagement and dialogue between all stakeholders. This should have the objective of establishing a shared understanding of diverse needs, and identifying an approach to addressing tensions arising between societal and individual landowners needs whilst ensuring successful outcomes in the areas of addressing climate change and ensuring sustainable food and land use systems.

Appendix 1 Revision of the EU LULUCF Regulation

Revision of Regulation (EU) 2018/841 on Greenhouse Gas Emissions and Removals from Land use, Land-use change and Forestry

Briefing note prepared by the Department of Agriculture, Food and the Marine

As part of the EU's "Fit for 55" package, a revision to the LULUCF Regulation has been adopted which changes the way emissions associated with land use will be treated:

- **Moving to an accounting system based on 'absolute' emissions (Gross-net) and**
- **Assigning an EU wide target to generate removals through land use of 310 Mt CO_2eq per year by 2030.Ireland's contribution to this target is to reduce it's emissions by 0.626 Mt CO_2eq to 3.7 Mt CO_2eq by 2030.**

Ireland's land is currently a net source of emissions due to high levels of peat soils (a source of emissions) which is partially offset by afforestation (a net sink). However, due to the age class of our forestry (which is reaching harvest maturity), land-based emissions will rise in the period to 2030.

Contents

Background

Under the European Green Deal, the European Union (EU) has committed to achieve net-zero greenhouse gas (GHG) emissions by 2050 and set a more ambitious climate target of net-55% emissions reductions by 2030 compared to 1990 levels. Both ambitions rely fundamentally on the role of natural sinks from the Land Use, Land-Use Change and Forestry (LULUCF) sector to compensate residual emissions. However, they also come at a time in which the EU's natural sinks are in decline. Over the last two decades, the EU's net-removals have fallen from a peak of -329 Mt CO2eq in 2009 to -243 Mt CO2eq in 2019 (European Union 2021), mainly due to an increase in forest harvesting rates, including for bioenergy. Therefore, achieving the EU's climate goals will thus require reversing this negative trend and securing a strong contribution from the land-use sector towards the EU's climate-objectives.

For this to be achieved, climate change mitigation in the land-use sector needs to reduce risks to environmental integrity. Environmental integrity is achieved by ensuring that aggregated global GHG emissions do not increase because of a mitigation activity or implementation of instruments. Among the most discussed risks to environmental integrity are additionality of mitigation measures, non-permanence (reversals) of emission reductions or removals, uncertainty in monitoring and risk of incomplete reporting, but also the challenge of ensuring other environmental and social safeguards.

The LULUCF Regulation (EU) 2018/841 regulates the EU emissions and removals from the land-use sector for the period 2021 to 2030. On July 14, 2021, the European Commission published its proposal for a revision of the regulation. A trilogue agreement, reached on 11 November 2022, changes the approach from balancing emissions and removals in the LULUCF sector to increasing removals. In 2030, LULUCF carbon removals will need to reach 310 million tonnes of CO2 equivalent. Parliament approved the agreed text on 14 March 2023 and the regulation was published in the Official Journal on 21 April 2023 entering into force on 11 May 2023.

The amended regulation is considered a paradigm shift regarding the treatment of the LULUCF sector in the EU's climate target architecture. The 2020 Kyoto protocol climate targets did not include the LULUCF sector due the large uncertainties in emission calculations and whilst the 2018 LULUCF regulation included a no-debit rule which meant you must not disimprove from a baseline, it also provided substantial flexibilities to generate credits to use against the Effort Sharing Regulation targets. The 2023 amendment represents a major step-up in ambition for the LULUCF sector as it sets an extremely ambitious target for the EU LULUCF sector, with binding national contribution targets and additional limitations on existing flexibilities.

Main Changes and Implications for Ireland

Change of accounting rules

The accounting rules will change to gross-net accounting of all sectoral emissions and removals post 2026. Therefore, the accounting rules will now be different for the two commitment periods of 2021-2025 & 2026-2030. For the first period (2021-2025), the original land accounting categories (e.g., afforested land) and the national "no-debit"[20] rule remain in place.

[20] For land use, the Regulation requires each Member State to ensure that accounted CO_2eq emissions from the LULUCF sector are entirely compensated by an equivalent removal of CO_2eq from the

The adoption of this reporting format means that the accounting rules established through projected baselines (i.e., Forest Reference Level) and different historic reference periods (i.e., Grasslands, Croplands, Wetlands) will no longer be used (Annex 1). These changes are aimed at making the accounting rules more transparent to provide methodological consistency with the Effort Sharing Regulation (Regulation (EU) 2018/842).

The accounting changes particularly impacts the contribution of the forest sector. The establishment of a Forest Reference Level allowed Ireland to exclude emissions associated with those forests older than 30 years. These older forests are projected to be a declining sink and an increasing net emission by 2024. This emission is a result of increased harvesting levels in the older private forests and legacy effects of peatland afforestation from the 1950's - 60's.

As a legacy issue, there are limited interventions open to redress forest peatland emissions in the revised LULUCF regulation.

By changing the accounting rules for 2026-2030, all land emissions must be included in the accounts which will make the distance to the proposed annual targets from 2026-2030 much larger due to increased forest land emissions, which now cannot be factored out.

In addition, due to these changes to reporting-based targets, the greenhouse gas emissions and removals will need to be estimated with a higher level of accuracy. This will require a step-up in research and data collection and refinement to meet this higher level of accuracy in Ireland's National Inventory.

New LULUCF target for Ireland to reduce to 3.7 Mt CO_2eq in 2030 and a 4-year budget from 2026-2029.

A new LULUCF target is proposed to increase removals to -310 Million tonnes of carbon dioxide equivalent within the EU by 2030. This is an increase of around 15%, compared to current annual removals of around -268 Mt CO_2eq. This target has been distributed among Member States as national targets reflecting each Member State's current mitigation performance in the LULUCF sector and their share of the managed land area in the EU. National targets were set using baselines of the average GHG removals and emissions from the years 2016, 2017 and 2018. The Commission has calculated Ireland's target to be a reduction in emissions of 0.626 Mt CO_2eq to 3.7 Mt CO_2eq by 2030 and to meet a 4-year budget period based on linear trajectory from 2026-2029. These binding targets contrast with the current no-debit rule and voluntary LULUCF flexibility which can be utilised to reach the 2030 ESR target.

The target for Ireland allows for a continuation of emissions from the LULUCF sector but requires that they are reduced, based on a relative target, by 0.626 Mt CO_2eq to 3.7 Mt CO_2eq in 2030 (see Annex 2). This will be an extremely challenging target to reach considering Ireland's gross LULUCF emissions, even with the implementation of additional Climate Action Plan 2023 measures, are estimated to rise substantially, mainly due to temporal shifts in the age class structure of the national forest estate resulting in a reduction in removals potential and an increasing net emission from the total forest area from 2024 onwards. These trends

atmosphere through action in the LULUCF sector. This is calculated as the sum of total emissions and total removals in all the land accounting (net-net, forest reference level) categories defined in the LULUCF Regulation. This is referred to as the "no-debit" rule.

are expected to continue up to 2037 followed by a decline in forest emissions as the age class structure normalises.

The 2026-2029, 4-year budget period target will be determined for each MS by a linear trajectory which will start in 2022 (average of 2021/22/23 reported GHGs) and end in 2030 on the target set out for that MS. New emission factors for organic soils as a result of new research[21] meant that the inventory was updated in 2022 and resulted in higher reported emissions. As the inventory is backdated, the revised reference value for Ireland for 2016-2018 is estimated to be 7.27 Mt CO_2eq instead of 4.35 Mt CO_2eq and the projected emissions for 2022 will be higher affecting the start point for the trajectory of emissions between 2026 and 2029. As a result, the technically corrected target is calculated to be 6.64 Mt CO_2eq (7.27-0.626 Mt CO_2eq) instead of 3.7 Mt CO_2eq. Based on revised projections of emissions and removals and a recalculated target for the LULUCF sector, it is estimated that the 2026-2029 budget will be approximately 28.51 Mt CO_2eq. See Table 1.

Even allowing for the full implementation of the very ambitious Climate Action Plan 2023 LULUCF measures, Ireland would expect to still have a shortfall of approximately 9 Mt CO_2eq against this budget. For illustrative purposes only, closing this gap would require the equivalent of rewetting 80k ha of grasslands on drained organic soils by 2026 and increasing year on year to 140k ha by 2030, if the gap was closed using rewetting alone.

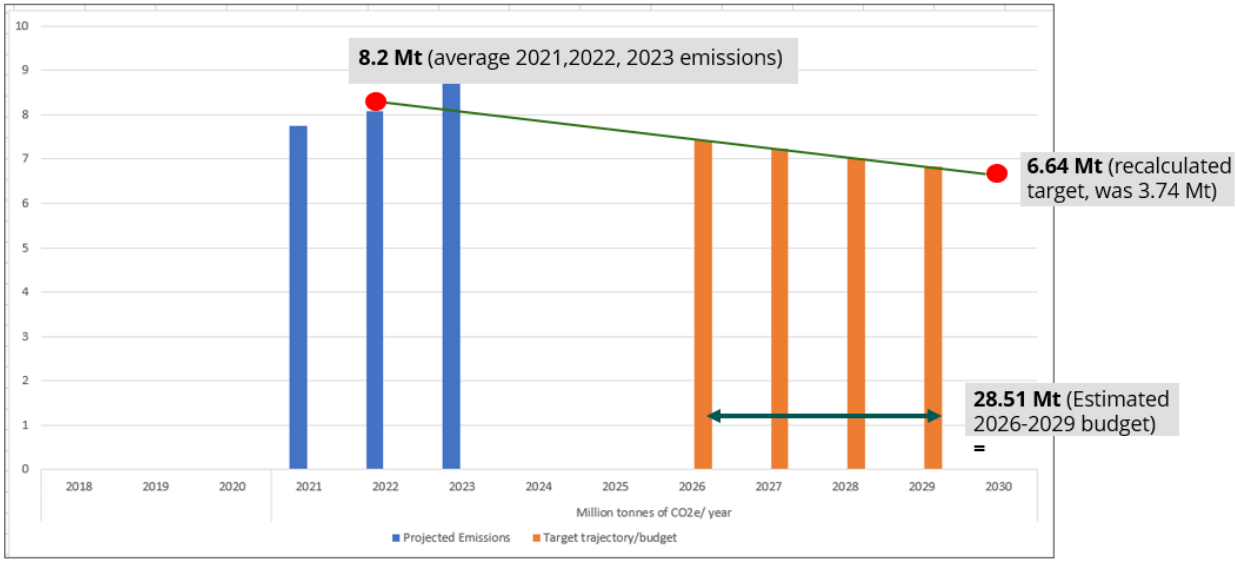

Table 1: Methodology to calculate the EU LULUCF 2026-2029 budget using a linear trajectory starting from the average of 2021, 2022,2023 gross net LULUCF emissions and ending at Ireland's 2030-point target, revised to reflect the 2022 inventory refinement.

The amended regulation contains target governance under a new Article, 13(C) which was previously covered under Article 9 of the ESR. This rules that a multiplier of 1.08 should be applied to any 2026-2029 budget deficit and added to the 2030-point target. The aim is to incentivise early action and to avoid budget deficits.

[21] Jovani-Sancho, Cummins and Byrne, in print (accepted) Soil carbon balance of afforested peatlands in the maritime temperate climatic zone. Global change biology.

Existing 2018 EU LULUCF flexibility

Under the original Effort Sharing Regulation (ESR), Ireland's whole of economy emissions reduction target in the period to 2030 was 30%. Under the arrangements agreed at that time, Ireland was allocated a maximum flexibility to count net-net accounting credits of 26.8MT (or 5.6%) from improvements in the LULUCF emissions profile over the 2021-2030 period against this overall target. This was provided as an express recognition by the Commission of the low mitigation potential of agriculture which constitutes almost half of Ireland's ESR emissions; the risk of carbon leakage through displacement of food production to less efficient agricultural systems; and the misinformed nature of Ireland's overall 2020 Effort Sharing target. In effect this meant that ESR emission reductions only needed to reach 24.2%, with the gap to 30% potentially made up by the LULUCF flexibility.

Under the new regulation, Ireland will no longer have access to this LULUCF flexibility in the period 2026 -2030. While in theory the flexibility remains in the proposal, it may only be accessed to the extent that Ireland can reduce its LULUCF emissions below the 3.7 Mt CO_2 eq target.

The new ESR target is a 42% cut in emissions. Because the LULUCF flexibility has, for all practical purposes, been removed from 2026 onwards, only half the original flexibility (2.8% as opposed to 5.6%) will be available to offset these increased emissions reduction targets.

Article 13b (6) Land Use flexibility mechanism for the period 2026-2030

Peatland afforestation and the draining of peatlands for agricultural use has been part of Irish agricultural policy and afforestation programmes from the early to mid-20th century. This policy was driven by the need to create employment in severely disadvantaged rural areas, to Increase agricultural production and to increase forest cover from 1.4% in 1950.

New research on forested organic soils shows larger emissions than previously estimated. Furthermore, there is a clear trend of increasing emissions from older forest land established in the 1950's and 60's, due to afforested peatlands becoming a net emission after 1-3 rotations. As a legacy issue, there are limited interventions open to redress these emissions.

Ireland requested that these legacy issues, which were neutralised through existing accounting rules, be addressed through an additional compensation/flexibility. These issues were recognised by the EU and as a result, Article 13b (6) was included in the amendments. This is a special flexibility for countries with legacy issues related to a high proportion of organic soils.

However, last minute amendments means that the organic soils flexibility will have a greater burden to carry and be less able to satisfy Ireland's needs.

Other issues with the flexibility include:

- Access to the flexibility is conditional on achievement of the overall EU Target of 310 Mt CO_2eq by 2030 which is not guaranteed.
- The actual level of compensation that may be afforded to Ireland is unknown and will be contingent on the number of other Member States that may also seek to apply and secure compensation for organic soils.
- The process to secure a set flexibility for IE is post-2030 which causes a lack of certainty for land use policy decisions pre-2030.

As a result, this flexibility will have limited use to Ireland.

Key differences between the EU LULUCF Regulation and the Sectoral Emission Ceilings

Governance

Three key pieces of climate legislation currently implement the overall European Union GHG emissions reduction target: Directive 2003/87/EC on the EU emissions trading system (the ETS Directive), Regulation (EU) 2018/842 (the Effort-sharing Regulation, ESR), and the LULUCF Regulation (EU) 2018/841. Land use emissions and removals continue to be treated separately to the non- ETS emissions in the EU due to the unique nature and biogenic-biochemistry limits of the sector, the uncertainty due to a lack of data and research resulting in inventory refinements, the variation of emissions from year to year and the long-term nature of land use changes.

The LULUCF flexibility (among others) between the LULUCF regulation and the Effort Sharing regulation can be maintained due to this separation, albeit curtailed somewhat in the amended regulation.

The Climate Action and Low Carbon Development (Amendment) Act 2021 requires Ireland to achieve a 51% reduction in emissions by 2030, relative to 2018 levels, and net-zero emissions by 2050. In contrast to the EU GHG framework, LULUCF emissions are combined with ESR emissions and are included in the baseline for the 51% reduction. As a result, there is no consideration of the specifics of the land use sector mentioned above, the inclusion of flexibilities or the projected increase in emissions to 2030, mainly caused by land use decisions up to 30 years ago (larges areas of forestry planted on peat soils) with limited interventions to redress rapidly.

The inclusion of the LULUCF emissions in the Sectoral emissions Ceilings has caused issues for the budgeting process. It has not been possible to assign a ceiling due to recent inventory refinements and the failure of an alternative accounting mechanism to bridge the gap between feasible land use measures and the unrealistic target set for the sector.

Target Setting

Ireland's contribution to the new EU 2030 target of 310 Mt CO_2eq for the whole EU was based on a reference scenario which comprised of a series of interlinked models that produced detailed projections per sector and per country. The MS forestry projections were carried by the International Institute for Applied System Analysis (IIASA) using the G4M model taking several years and included intensive engagement with member states to reflect national specificities. The objective of this work was to understand the current and projected emissions so a fair and realistic target could be assigned.

In contrast, the Climate Act included LULUCF emissions in the overall 51% reduction target without any due consideration to the projected rise in emissions to 2030. The lack of feasible measures within the sector to achieve the levels of reductions required were to be overcome with the use of an alternative accounting mechanism, separate to EU accounting rules called "accounting forward", which, after further analysis is now unlikely to be utilised due to issues it would cause post 2030.

A National LULUCF Target

The use of a percentage reduction target can be problematic. If there is an inventory refinement and the baseline is revised. An increase to the 2018 baseline means the 51% gap to target becomes bigger and a decrease means the abatement required is smaller.

The EU target setting overcomes this issue with the use of a relative target, i.e., a fixed CO_2eq reduction amount of a baseline that can change without affecting the ambition of the target. For Ireland the fixed reduction is set at 0.626 CO_2eq (see Annex 2). At the time of the release of the amended regulation, Ireland's LULUCF baseline emissions were 4.35 Mt CO_2eq and hence the 3.7 Mt CO_2eq target set. The 2022 national LULUCF inventory refinement revised the emissions in 2016, 2017 and 2018 because of updated science, and lead to an updated baseline of 7.27 Mt CO_2eq. The revised target can then be easily calculated at 6.64 Mt CO_2eq by 2030.

LULUCF emission and removals are very uncertain due to knowledge and data gaps and as a result, inventory refinements are guaranteed over the next number of years. The EU relative target allows the reduction targets to stay constant in a fluctuating emissions profile. In contrast the LULUCF emission reduction gaps under the Sectoral Emission Ceilings will fluctuate in line with the inventory refinements making it difficult to plan appropriate policy.

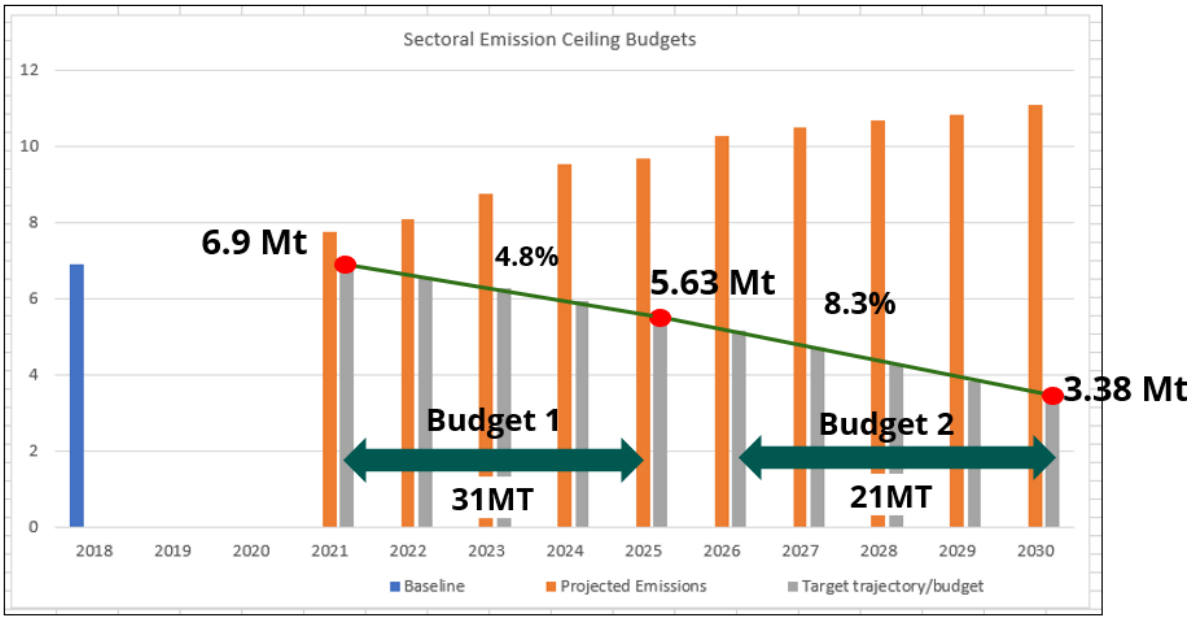

Table 2: Estimated Sectoral Emission Ceiling budgets based on new figures from the 2022 inventory refinement.

Allowing for the full implementation of the very ambitious Climate Action Plan 2023 LULUCF measures, Ireland would expect to still have a shortfall of approximately 10.37 Mt CO_2eq against budget 1. For illustrative purposes only, closing this gap would require the equivalent of rewetting 250k ha of grasslands on drained organic soils by 2025, if the gap was closed by rewetting alone.

Annex 1 – Land Use Accounting Methods

Land Use Accounting

When accounting for carbon sequestered by an ecosystem, there are two main ways that these values can be expressed: Gross-net accounting and net-net accounting. Gross-net is the total amount of carbon sequestered, while net-net is the change in carbon sequestration relative to a reference year. So for example, if an ecosystem sequestered 4 Mt CO2-e in 1990 and 5 Mt CO_2-e in 2020, then the gross-net value is 5 Mt CO_2-e but the net-net value is 1 Mt CO_2-e.

To keep track of this target, the 2018 EU LULUCF Regulation defines accounting rules against which progress is measured. There are different reference values for six defined land use sectors against which a target for GHG emissions and removals is compared to. The six defined land-use categories are set out in Table 2 below:

Table 2 – 2018 LULUCF accounting rules for each land use sector

Sector[22]	Reference Value
Managed Grassland	Reference values are the average net emissions and removals of the years 2005 to 2009. The average annual net emissions and removals in the commitment period will be compared to the reference value (net/net accounting). As a result, a country with decreasing net emissions in the commitment period would receive credits under this approach (even when the category remains a net emission); a country with a declining sink would have to account this as debits (although the category is still a net sink). In January 2021, Ireland decided to account for Managed Wetlands from 2021 – 2030. Accounting was optional for the first period (2021-2025) but is mandatory for the second period.
Managed Cropland	
Managed Wetlands	
Afforestation	All forests that are 30 years old or less during the reference period 2021-2030 are included in this category. All GHG gas emissions and removals are calculated based on the area planted, which includes the majority of recent grant aided afforestation. New forests that are more than 30 years of age during the reference period transition to the "Managed Forest Land" category. The positive contributions of stored carbon in Harvested Wood Products (HWP) are also included in this category.
Deforestation	All areas that are deforested during the 2021-2030 period irrespective of age are accounted in this category. HWP from deforested lands cannot be used for compliance purposes.
Managed Forest Lands (MFL)	MFL includes all forests that are older than 30 years of age. Removals and emissions are accounted against a Forest Reference Level (FRL). The FRL is a forward-looking benchmark for accounting net emissions from existing forests based on a continuation of sustainable forest management practices from the period 2000-2009. The FRL adopted for Ireland for the 2021-2025 period is approximately 0.1 Mt CO2-e/year. This means that if emissions from MFL are 0.1 Mt CO2-e/year during the reference period, it will be accounted as ZERO. If emissions are higher or lower than 0.1 Mt CO2-e/year, the difference will be accounted for as either an emission or a removal. The

[22] **Note** that 'Peatlands' can be found in all the above sectors as it refers to the ground underneath the activity. In international reporting these are termed 'organic soils'. Industrial bogs such as those used by Bord na Mona fall under the 'Wetland' category as do pristine, non-exploited bogs.

	positive contribution stored carbon in HWP are also included in this category[23].

Annex 2- Extract from Amended 2018 LULUCF Regulation showing Member State Target calculations.

Annex IIa

The Union target ***(column D), the average greenhouse gas inventory data for the years 2016, 2017 and 2018 (column B)*** and the national targets of the Member States ***(column C)*** ▌pursuant to Article 4(3) to be achieved in 2030

A	*B*	*C*	*D*
Member State	***The average greenhouse gas inventory data for the years 2016, 2017 and 2018 (kt of CO2 equivalent), 2020 submission***	***Member State targets, 2030 (kt of CO2 equivalent)***	***Value of the ▌greenhouse gas net removals ▌ in (kt of CO2 equivalent) in 2030, 2020 submission (Columns B+C)***
Belgium	***-1 032***	***-320***	-1 352
Bulgaria	***-8 554***	***-1 163***	-9 718
Czech Republic	***-401***	***-827***	-1 228
Denmark	***5 779***	***-441***	5 338
Germany	***-27 089***	***-3 751***	-30 840
Estonia	***-2 112***	***-434***	-2 545
Ireland	***4 354***	***-626***	3 728
Greece	***-3 219***	***-1 154***	-4 373
Spain	***-38 326***	***-5 309***	-43 635
France	***-27 353***	***-6 693***	-34 046
Croatia	***-4 933***	***-593***	-5 527
Italy	***-32 599***	***-3 158***	-35 758
Cyprus	***-289***	***-63***	-352
Latvia	***-6***	***-639***	-644

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Appendix 2: Previous Council Positions on Land Use Strategy and Policy

The Council has commented on issues related to LUUCF in a number of previous annual reviews, with some examples outlined below.

2022 and 2021 Annual Reviews reiterated the recommendations of the 2020 report.

In its Annual Review 2020, the Council highlighted ongoing research which explored cost-negative mitigation opportunities through diversification of land use related to afforestation and agroforestry, based on the approach developed by Duffy et al., 2020

In seeking transition, key areas noted for action by Council include:

- *Policy should focus more on nature-based carbon removals, and*
- *Long-term land-use strategy is required.*

2020 Annual Review:

Ireland does not have a comprehensive national land-use strategy designed to manage the diverse demands for land-based resources and ecosystem services.

The outcome of such [the land use] review may provide the stimulus for greater coherence in policy design for rural development. ***There is a need for a strategy towards rural development that recognises the diverse range of environmental, economic and socially sustainable activities that can thrive and support local communities and the national economy****. The production of food will remain the dominant land use in Ireland, but greater innovation and diversification is also required in food production, energy supply, raw materials, ecotourism and other social and environmental ecosystem services. Current planning and policy development is fragmented between competing sectors and activities, leading to confusion and uncertainty for investors and other stakeholders.*

An important precursor to a land-use strategy is the need for high-resolution mapping of current land use across the country, and analysis of the options for alternative management that would provide indicative information to farmers.

Appendix 3: Relevant NCAP23 LULUCF Actions

NCAP 2023 sets a number of targets relevant to this thematic area. Chapter 5 of NCAP 2023 also sets out the ambition and high-level pathways for each sector under the sectoral emissions ceilings.

Action #	NCAP Action	Completion Date	Current Status
LU/23/19	Publication of Phase 1 of the Land Use Review – Evidential Review	Q1 2023	Phase 1 Report published
LU/23/20	Commencement of Phase 2 of the Land Use Review - Policies, Measures and Actions	Q1 2023	Ongoing

LU/25/1	Publication of Phase 2 of the Land Use Review – Polices, Measures and Actions	Q1 2025	Ongoing
LU/23/1	Develop, assess, and adopt as appropriate the new Forestry Programme 2023-2027, which aims to introduce new afforestation measures and increased financial supports	Q2 2023	Pending- Adoption of a new forest strategy and launch of the Forestry Programme and measures contained therein
LU/23/2	Develop, assess, and adopt as appropriate Coillte's Strategic Vision, which aims to capture additional carbon dioxide in its forests, soils and wood products by 2050	Q1 2024	
LU/23/3	Develop, assess, and adopt as appropriate the new Forestry Programme 2023-2027, which aims to introduce new supports to promote Sustainable Forest Management	Q2 2023	
LU/23/15	Continue to restore and rehabilitate former peatland production lands. Impact of activities on carbon emissions assessed using a network of flux towers, hydrometric stations and strategic flux chambers from representative ecologies	Q4 2023	
LU/23/17	Continuation of NPWS restoration programme on Special Areas of Conservation and National Heritage Area protected raised and blanket bog. Impact of activities on carbon emissions assessed usinga network of flux towers, hydrometric stations and strategic flux chambers from representative ecologies.	Q4 2023	
LU/23/18	Commission a review of all peatland restoration work carried out across Ireland by different Government Agencies, organisations, NGOs and others	Q4 2023	
LU/23/21	Protect, enhance, and increase the number of hedgerows and trees on farms	Q1 2023	Support by CAP Eco-scheme
LU/23/7	Launch the CAP Strategic Plan and include measures on mineral	Q1 2023	On-going

	grasslands to improve sequestration under the Agri- Environment and Climate Measure and EcoSchemes		
LU/23/8	Under the Nitrates Regulations impose mandatory requirements under derogation to enhance carbon sequestration	Q1 2023	Revisions implemented, additional constraints under consideration.