Recommendations for Agriculture in Ireland's *National Energy and Climate Plan (NECP) 2024*

Research for the Environmental Pillar and An Taisce:
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12 Recommendations for Agriculture in Ireland's *National Energy and Climate Plan 2024*

1. **Public participation in preparation of Ireland's NECP must be ensured by the Department of the Environment, Climate and Communications (DECC).** Respondents require plain language documents and sufficient time to express views that will be fully considered in revisions toward the final NECP.
2. **Acknowledge the evident failure of industry-led Government policy and Teagasc advisory measures since 2010, in agriculture, forestry and land use (AFOLU).** Policy-driven dairy expansion has increased greenhouse gas emissions, cancelling out the ineffective, voluntary, technical measures to date.
3. **Ireland's 2023 NECP must include a detailed plan to 2030 and 2050 for low-carbon transition to a balanced agroecological system.** Ireland's current agri-food system is severely unbalanced toward high emissions, intensive meat and milk production for export. This has failed the majority of small farmers and the natural environment. System change to agroecological methods and more space for biodiversity will be more socio-economically sustainable for farmers, less polluting for nature, and can produce more food for society with far less waste.
4. **The NECP needs to plan for a just transition.** There is a risk that the necessary transition to a climate neutral society may neither be sustainable or just, unless environmental and socio-economic sustainability are rapidly hardwired into relevant policies. Integrating principles of a just transition, adaptation planning and agroecology into climate policies can deliver a fairer and greener society, as well as a more resilient farming future.
5. **All NECP agriculture plans must align with meeting Ireland's legally binding five-year carbon budgets and meeting the deeper 42% national emissions reduction required across for agriculture, transport, and waste.** The NECP must quantify the near-certain need to further cut the *Sectoral Emission Ceilings* for 2026–2030 (and onwards) in all sectors, including agriculture.
6. **NECP targets for agriculture must ensure early, deep, and sustained cuts in annual methane emissions (mostly from cattle and sheep).** This is crucial to achieve Ireland's fair-share climate action. Total methane is primarily related to total milk and meat output, so production quotas are highly effective mitigation measures, as shown by the sharp rise in dairy methane emissions that has been strongly coupled to rising milk production since ending the milk quota.

7. **The NECP needs to reduce high current agriculture emissions through diversification away from intensive animal farming rather than land use offsets from "carbon farming".** Land-based CO_2 removals to forest and soil are of very limited mitigation value in meeting climate targets: they are costly to verify, not equivalent to cutting fossil carbon use due to their impermanence, and are only relevant in addition to cutting methane warming from cattle farming and animal manure. However, rewetting of organic soils is an important action to reduce land use emissions and in parallel with changes in forestcover can deliver very important ecological, biodiversity and water quality benefits.

8. **Enforce ecological quota limits on national and by-catchment use of nitrogen (from fertiliser and feed) to ensure increased local nitrogen cycling through agroecological methods.** Milk and meat quotas act as effective nitrogen quotas. Reduced cattle production can increase net system food output and efficiency, cut GHG emissions, and limit nitrate and ammonia pollution.

9. **Apply the "polluter pays" principle:** Profitable and polluting livestock farms must lead from the front and be prioritised for herd reduction where it is evident that the environmental carrying capacity of the land has been exceeded. The greatest polluters must shoulder the burden for there to be a just transition with other farmers. Perverse agricultural subsidies should be identified and withdrawn.

10. **Ireland's must transform commercial forestry and tree cover policies.** Radical change is needed in Ireland's forestry sector to address serious environmental legacy issues, especially biodiversity loss, and to ensure it can contribute positively to climate mitigation and adaptation.

11. **Advisory assessments have overlooked major bioenergy sustainability failures** from poor forest management, biomass imports, and methane losses in anaerobic digestion. Bioenergy can increase emissions and pollution unless strong regulatory safeguards are in place. Solar and wind are far more land efficient.

12. **The NECP must ensure energy, agriculture and land use planning coherence with existing national policy objectives and environmental boundaries.** Urgent action is needed to ensure agriculture's rapid compliance with the ammonia ceiling and the Water Framework Directive. A coherent land use plan needs to protect nature and chart a just transition path to a sustainable, food secure, biodiverse and resilient agri-food system.

The draft National Energy and Climate Plan, released in December 2023 for public consultation, fails to address any of the above points adequately.

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1 Introduction

1.1 This report: research-based NECP recommendations for agriculture

As set out above, this report sets out *Twelve Recommendations for Agriculture* for consideration and inclusion in Ireland's draft and final NECPs. Below, following the Introduction, each of the recommendations is supported by research summarised in correspondingly numbered subsections, 2.1 to 2.12,in Section 2.

Decades of agri-food policies in Ireland have prioritised a productivist model of agriculture, focused on intensification, concentration, and specialisation which has locked Irish farmers into an unsustainable commodity-driven food production system. This has left them and Ireland's food system at the mercy of volatile global markets, heavily dependent on imports of fertiliser and fuel and in the case of many, heavily in debt to banks. These policies – in particular the market driven prioritisation of the dairy expansion since the lifting of the EU milk quota in 2015 – have resulted in Ireland being less food secure and farmers fodder insecure and more financially exposed. This general intensification of agriculture and land use, requiring increased inputs of imported fertiliser and feed, resulting in more emissions and pollution losses, has negatively impacted on Irelands biodiversity, water, air, and climate. Successive governments and state bodies tend to facilitate incumbent sectoral interests in increasing production but too often this results in reducing the effectiveness of environmental law and favours ineffective environmental measures rather than compliance with ecological requirements.

The ongoing trajectory of the sector has been based on deeply flawed claims around environmental sustainability, even over the past decade of expansion when ecological quality indicators have continued to worsen. Government policy has rubber-stamped agri-strategy, developed in appointed committees dominated by agri-food industry representatives, that appears to be founded on a delusional belief that farming could remain insulated from the increasing likelihood of climate breakdown, ecological collapse, and international geo-political upheavals. As shown by increasing extreme weather and sudden price shocks due to war and trade issues, this kind of "magical thinking" has resulted in farmers and farming in Ireland now even more exposed to international issues, meeting climate mitigation requirements, and damaging climate events than they were a decade ago, just as scientists, and NGOs following their reports, repeatedly warned.

Therefore, there is an urgent need for planning on a resilient basis. What is needed now is a new vision for agriculture and land use and the leadership to deliver it, while leaving no one behind. Ireland's National Energy and Climate Plans (NECPs) have an important role in outlining a new roadmap for the agri-food sector, ensuring it respects both environmental and social boundaries. For government and all readers replying to the public consultations for the NECP this report aims to provide the context, recommendations, and evidence for an NECP to chart a far more resilient agro-ecological transition to a future with greater societal food security, sustainable livelihoods for all farmers, and a biodiverse environment.

1.2 The importance of agriculture in the 2023 NECPs for Ireland and the EU

The NECP aims to plan a rapid national transition to a low emission future, meeting a national climate objective in 2050 'consistent with'[a] meeting the Paris Agreement goal of equitable action to prevent global warming above the internationally agreed limit of 1.5ºC above pre-industrial global average surface temperature.

Agricultural production of food, feed, and the production of derived biofuels, results in substantial emissions of two potent, non-CO_2 greenhouse gases: nitrous oxide (N_2O), primarily from the use of chemical nitrogen fertiliser; and methane (CH_4) from animal agriculture, primarily from the digestion of ruminant animals (cattle, sheep and goats) and a smaller fraction from manure. In Ireland, 92% of nitrous oxide and 95% of methane are emitted by the agriculture sector[1], mostly due to intensive pasture production of livestock and dairy, 85% of which is for export. For richer nations like Ireland, fair share action limiting climate change to the 1.5ºC Paris Agreement[2] goal (Article 2) now requires early and deep reductions in these non-CO_2 greenhouse gases in addition to immediate, radical reductions in carbon dioxide (CO_2) emissions from global fossil fuel use, cement, and deforestation.

Globally, and particularly in wealthier countries like Ireland, achieving early, deep and sustained reduction in annual methane emissions from agriculture is particularly important to equitable climate action[3], otherwise equitably meeting the Paris temperature goal is quickly becoming physically impossible[4,5]. Moreover, the global use of nitrogen and phosphorus already exceeds planetary boundaries[6], particularly due to inefficient use in intensive agriculture, especially in livestock and milk production which are inherently nitrogen inefficient[7]. Most human food globally comes directly from food crop production, through tillage and horticulture with animals in a supporting role mainly to process farm wastes for manure to re-fertilise fields, with meat and milk as a lesser system output.

Therefore, any agri-food system which is biased towards the intensive production of animal-derived foods (meat and dairy), as in Ireland, is highly food-inefficient due to its dependence on externally sourced, substantial inputs of fertiliser and feed, much of it using land (domestically or elsewhere) that could be used more effectively to grow food crops, rather than forage or feed. In contrast to agri-food industry claims of climate efficient beef and dairy production, efficient agri-food systems are planned to ensure that farmed animals are secondary to, and in support of food crop production by tillage and horticulture.

Therefore, given likely escalating climate impacts on global society and weather, it is essential that the NECP reflects the urgent need for Ireland to reorientate its agri-food system away from a predominant focus on livestock, toward increasing overall food production efficiency, by reinvigorating the tillage and horticultural sectors through diversifying land use, thereby reducing chemical inputs, especially nitrogen, to reduce GHG emissions and pollution . This would revitalise

[a] This paraphrases the wording in Section 5 of the Climate Action and Low Carbon Development (Amendment) Act 2021, generally referred to in short-form as the Climate Act.

the tillage and horticultural sectors and also benefit the environment and climate while improving food security and diversification within the rural economy. This pathway is entirely possible, if supported by policy, but, instead, policy in the last decade has gone in the opposite direction increasing system inefficiency by intensifying grass-based cattle farming beyond both the carrying capacity of the local environment, and beyond a fair and equitable international footprint. As a result, private and corporate profits have benefited in the short-term but environmental and socio-economic costs have been socialised when things go wrong as in the fodder crises and in response to price shocks following Russia's invasion of Ukraine.

1.3 NECP status, process, information, and timeline

The National Energy and Climate Plans (NECPs) submitted by EU Member States are not just tick-box exercises, they are fundamental national planning documents that need to set out a coherent combination of targets, policies, and measures to achieve their climate and energy commitments, including agriculture and land use[9,10]. The inclusion of agriculture in NECPs is now crucial due to the increased understanding in IPCC reports of importance of cutting the methane and nitrous oxide emissions. Meeting the EU *Farm to Fork Strategy*[11]commitment to limit nitrogen fertiliser and agro-chemical use by 2030 is particularly important as it will also facilitate reductions in agricultural pollution to air from ammonia and water from nitrates.

Reports by Environmental Justice Network Ireland and the European Environmental Bureau[12] (EEB) provide an excellent summary of the legal obligations for public participation during the updating of the National Energy and Climate Plans. In short, governments must ensure compliance with Articles 7 and 10 of the Aarhus Convention, to provide a clear and consistent framework for transparent, broad and fair public participation. The consultation process must provide sufficient information to the public, enough time for meaningful public responses, and enable full consideration and due accounting by government.

Under the EU Strategic Environmental Assessment Directive (SEA) and for due information provision (as per the Aarhus convention), national planning documents such as the NECP must outline their coherence with other plans and objectives[13], report on the environmental characteristics of the current situation, and ensure the plan includes full discussion of reasonable alternatives. Therefore, the NECP needs to report an accurate summary of the environmental and the agreed environmental policy objectives to provide the public with an informed view of what the proposed plans must address.

EU Member States were legally required to submit their revised draft NECP by June 2023 with details of prior and intended public participation. Early in the 2024, the European Commission will then comment on the quality and completeness of national NECPs. Following further public participation (in Ireland likely in May), nations are required to submit their improved, final NECP in June 2024.

1.4 Ireland's 2020 NECP

Ireland's 2020 NECP[14] prioritised energy planning despite the fact that agriculture and land use contributes a third of total emissions. It did not provide any clear target emissions reduction pathway, nor an investment or regulatory plan, to direct a low-carbon transition for agriculture, forestry or land use. In agriculture the plan claimed 'substantial verifiable greenhouse gas abatement through adoption of a specified range of improvements in farming practice' would occur, including improved nitrogen (N) use efficiency.

However, actual outcomes have showed this to be incorrect and it failed to identify that the expansion in grass area for dairy farming – resulting in less tillage area, more feed use of less N-efficient grass, and increased feed imports – had *already* worsened Ireland's, already poor, agri-food system N-use efficiency[15,3]. In forestry, the 2020 NECP called for expansion of forest planting, despite the continuing failure for over a decade to achieve planned afforestation rates, and it failed to propose any harvest-limit measures to avoid the widely projected "carbon cliff" climate mitigation failure due to increased timber harvest from mature plantation forestry[16]. Serious carbon-loss issues with forestry on deep peat and broader sustainability issues across Ireland's industrial forestry model need to be addressed urgently.

The NECP also identified the need to deliver reduced management intensity of grasslands on drained organic soils at a rate of at least 40,000 ha per annum, but failed to deliver agri-environmental schemes on the scale required, either within or outside of the Common Agricultural Policy. To date only two small pilot projects, the FarmCarbon and FarmPeat EIPs, have been implemented and these lack the necessary guaranteed long-term supports or a clear plan to expand their reach. There was also a vague target of 'better management of grasslands, tillage land and non-agricultural wetlands.' The Department of Agriculture initially delayed the implementation of GAEC 2 until 2024, which relates to the new standard rules around the protection of carbon rich soils. Negotiations are ongoing with the Commission to further delay the implementation of GAEC 2 to 2025. We are also aware that the Department has adopted an unambitious approach to the scope and implementation of GAEC 2, within ongoing negotiation with the European Commission. We are therefore sceptical of Ireland's willingness to deliver changes in land use that will result in the scale of emissions reductions needed.

Overall, the 2020 NECP language on agriculture, forestry or land use was so vague as to be meaningless: it failed to identify obvious existing problems, lacked detailed plans or defined targets for GHG reduction pathways to 2030 and 2050, and omitted any urgency in achieving policy coherence with policies to meet the biodiversity crisis or guarantee human health. The NECP projected 'continued non-compliance with the ammonia ceiling over the entire compliance period to 2030' and failed to even mention the importance of meeting the Water Framework Directive

requirement that all inland and coastal waters reach at least good status by 2027 at the latest[b]. It is evident that agriculture and land use needs a better plan and stronger implementation.

1.5 Ireland's delayed 2023 draft NECP and required NECP information

EU Member States were required to submit a revised draft NECP to the European Commission by June 2023, but Ireland failed to so. Ireland's draft NECP was only released in December for a public consultation in February 2024, with a consultation on the finalised plan possibly in May 2024 ahead of the EU deadline for submission at the end of June 2024. As a result, far less time has been allowed available for assessment and improvement by the Commission and public consultation.

2 Supporting evidence for the recommendations

This sub-sections below summarise supporting research for each of this report's opening Twelve Key Recommendations for Agriculture in Ireland's *National Energy and Climate Plan (NECP) 2023.*

2.1 Public participation in preparation of the 2023 NECP must be ensured

Early and engaged public participation will improve Ireland's NECP. However, by delivering its draft NECP several months later than the June 2023 deadline, Ireland's has already restricted the potential for inclusive and meaningful public participation (and for EU review) before its final submission in June 2024. Therefore, it will be important that the Department of the Environment, Climate and Communications (DECC) provides additional "open" time in the public participation in NECP consultations for both the draft and the final document.

EU law also requires governments to set up a *Multilevel Climate and Energy Dialogue*[18] that could be utilised for substantive NECP improvement and public participation, but as yet no such process has been established in Ireland. It could be set up immediately to assist the ongoing NECP public consultation process.

2.2 Acknowledge failure of agricultural mitigation policy and measures

The NECP must provide quantified mitigation pathways, with clear waypoint targets and timelines, demonstrably meeting national carbon budgets and sectoral ceilings, and alignment with the EU ESR target of a 42% reduction across agriculture, transport and waste national emissions by 2030 relative to 2005. Based on EPA reporting and scientific evidence, environmental NGOs in Ireland have repeatedly warned Government, departments and the agricultural advisory service, Teagasc, that dairy expansion targeting the 2015 milk quota removal and continued focus on increasing

[b] In January 2023, the European Commission referred Ireland to the Court of Justice[17] for failing to correctly transpose or apply the Water Framework Directive protecting waters from pollution.

output from intensive animal agriculture would worsen GHG emissions, biodiversity loss, and air and water pollution[19–23].

Denmark[24] and the Netherlands[25], the other two nations with a Nitrates Directive derogation, already had, or introduced nitrogen and phosphorus farm quotas, but the removal of the milk quota has nonetheless correlated to serious additional ammonia and phosphorus pollution problems in the Netherlands particularly[26–28]. In contrast, Ireland failed to apply any effective national or regional total-nitrogen input limits on livestock farming, resulting in by far the highest growth in dairy cow numbers and related pollution among all EU nations, many of which reduced dairy cow numbers.

Figure 1 shows the absolute change in dairy cow numbers from 2010 to 2022, Ireland is an extreme outlier in the EU with a 50% increase by over 503,000 up to 1,510,310 cows in 2022. On average, dairy cow numbers in the EU have decreased, by -6%.

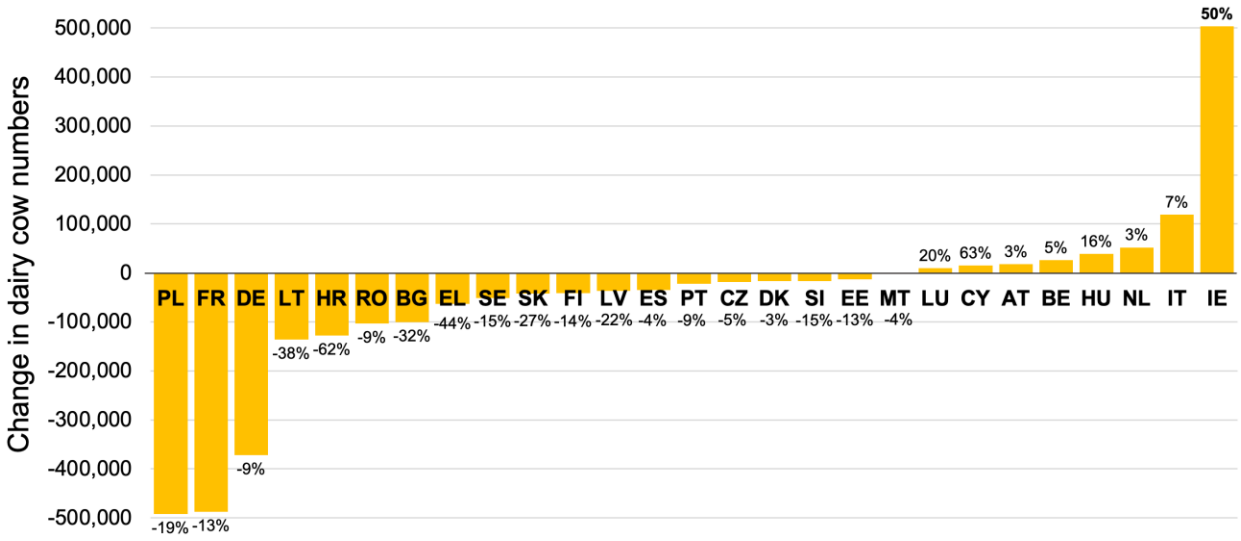

Figure 1. Dairy Cows by EU nation: absolute change in cow numbers 2010—2022 with percent change label. *Data: Eurostat. December values. The rise in dairy cow numbers in Ireland (IE) relative to 2020 is by far the largest in both absolute and proportionate terms.*

In agriculture, EPA reporting shows that total climate pollution has trended sharply upward after trending downward previously, cattle and sheep emissions of methane have risen to the highest ever level[1], the ammonia air pollution ceiling continues to be breached[29], and nitrate leaching from fertiliser, cattle urine patches and slurry spreading is continuing to degrade water quality[30]. No other EU Member State targeted the 2015 removal of the milk quota for dairy expansion as aggressively as Ireland, which has leveraged the Nitrates Directive derogation to enable the expansion of dairy based on intensive pasture-and-silage.

The societal costs of emissions and pollution increases due to Ireland's agricultural governance failure are now becoming obvious. In 2020, the Supreme Court found that the Irish Government failed to take adequate action on climate change[31] and now faces the another legal challenge regarding failure to deliver emissions reductions in line with the legally binding carbon budgets[32]. Due to increasing water quality concerns[33], in September 2030 the EU reduced the Nitrates derogation level on spreading organic nitrogen fertiliser from January 2024 and it is possible that

the derogation enabling higher organic nitrogen application than 170 kgN/ha will be completely removed. This is no surprise, as EPA water quality assessments have shown worsening pollution trends – warnings from the EU and NGOs have consistently amplified these science-based concerns but only limited, ineffective measures have been introduced.

Ireland could have acted to introduce and enforce milk and meat production quotas or to apply nutrient input limits on livestock agriculture to ensure agricultural emissions targets and pollution ceiling limits would be met without fail. But instead, Government policy, government departments, and Teagasc Marginal Abatement Cost Curve (MACC) mitigation analyses, have focused on ineffective, voluntary uptake of technical efficiency measures that are liable to result in merely notional GHG savings and pollution reduction, whereas rebound effects cancel out these savings, thereby even worsening outcomes. Entirely predictably, and as Teagasc acknowledge, "EBI improvement", the most attractive of these voluntary measures, has enabled cost-savings and increased profits that were then reinvested in more production, thus such cost-saving measures have in fact helped to *increase* total GHG emissions[c]. Therefore, the continued recommendation of EBI as a methane mitigation is unwarranted given Teagasc report that it has enabled rebound cost savings and reinvestment in production that have increased absolute methane emissions.

2.3 The NECP needs a plan for agroecological transition to 2030 and 2050

Ireland's 2024 NECP is very important in setting out a course for Ireland's agri-food system and land use generally to transition toward the Climate Act's *national climate objective* of achieving a 'climate neutral economy' by 2050 that is also 'consistent with' equitably meeting the Paris Agreement temperature goal. However, the measures in the Climate Action Plan 2024 are derived from Teagasc economic modelling that assumes a largely "business as usual" scenario of growth in global meat and milk demand and the voluntary uptake of technical measures that may have unproven efficacy. This approach to agriculture, forestry and land use planning has failed to evaluate alternative futures to 2030 and 2050 that are likely to be more sustainable for farmers and society in a world meeting the Paris Agreement, requiring more plant-based diets, greatly reduced nutrient inputs and more resilient agri-food systems.

It would be better for the NECP if the government and advisors inputting to agriculture were to start planning with the question: what does the transitioned agri-food system in Ireland look like in 2050, especially given escalating climate impacts that will act as a serious risk multiplier for geopolitical events and extreme weather by 2050, and ever more beyond.

Recent scientific modelling research for Europe, as in Schiavo et al. 2023 and Billen et al. 2021[35,36], has shown the importance of achieving an agro-ecological transition by targeting very low chemical fertiliser use and very limited animal feed imports to ensure long-term farming resilience

[c] Research describes this as a "backfire" effect, meaning a "rebound" effect that cancels out all, or more than all, of the claimed savings. See the Teagasc MACC 2023 Updated Analysis[34] p. 36, which notes that this has occurred in the dairy sector due to improvements in Enhanced Breeding Index (EBI). Despite this finding the 2023 MACC continues to claim that EBI will cut emissions.

and increased food sovereignty and security. Directing policy and measures to this course toward 2050 would reduce Ireland's increased over-dependence on intensive animal agriculture, in favour of diversified farming and agroforestry that can include animals, but has a far greater emphasis on growing food crops, from tillage and horticulture, with locally closed nitrogen cycles. Charting a path to meeting these objectives would also limit the exposure of farmers and the agri-food system to negative impacts of geopolitical events and severe weather that will be multiplied by human-caused climate change. This includes the potentially enormous economic costs of biodiversity loss, for example from loss of pollinators.

2.4 The NECP needs to plan for a just transition

Transitioning to a climate neutral economy by 2050, represents a significant but necessary challenge to all sectors of society. Strong, rapid and sustained reductions in emissions will necessitate unprecedented changes, with far reaching consequences for affected communities and the environment. The failure to act over preceding decades means that significant change must now happen rapidly. There is a risk that the transition to a climate neutral society may neither be sustainable or just, unless environmental and socio-economic sustainability are rapidly hardwired into relevant policies. Conversely if the principles of a just transition and environmentalism can be integrated into climate policies then this significant policy driver could be harnessed to deliver a fairer and greener society.

Teagasc have modelled scenario's for both the size of the national dairy and suckler herds for both the Climate Change Advisory Council's carbon budget technical report[37] and Teagasc's own MACC mitigation report. In both of these Teagasc scenario sets there is a significant projected reduction in the suckler herd with declines in dairy cow numbers for the CCAC report but a largely BAU trajectory for dairy cow numbers in the MACC report. The onus has clearly been placed on the suckler herd to reduce significantly to facilitate the ongoing intensification within the dairy sector. In the case of the CCAC this is due to the interpretation of the legislation[d] which "*requires that the carbon budgets take into account, insofar as is practicable, the need to maximise employment, the attractiveness to the State for investment and the long-term competitiveness of the economy*." Thus, the focus on economic output and job creation has biased the scenarios in favour of dairy production. The CCAC have interpreted the need to maximise employment and State investment at an aggregated national level. However, intensive dairy production is concentrated in the regions of the country with the most productive land, with the dairy processing sector mirroring that distribution. This bias in favour of overly simplistic economic indicators fundamentally undermines the scenarios, which fail to consider: regulatory options to limit emissions, the need to ensure equity in opportunities and burden sharing across society, or, considering the disproportionate regional impacts.

[d] Climate Action and Low Carbon Development (Amendment) Act 2021
https://www.irishstatutebook.ie/eli/2021/act/32/section/9

This prioritisation of the dairy sector also has a domino effect on national land use policy as the CCAC have identified that emissions from the Ag sector will also need to be offset within the land use sector. This isn't straight forward however as the forestry sector is projected to be a net source of emissions by 2030, further increasing the substantial net emissions from the land use sector as a whole (due to carbon losses from farmed organic soils, degrading wetlands, and ongoing peat extraction). In order to achieve the desired emissions reductions in the land use sector, dramatic changes in land use are will be required, which in the case of forestry will in itself result in negative impact on water quality, biodiversity and climate unless there is a rapid shift away from the existing industrial plantation model. Based on existing government policies (which often contradict stated objectives) these afforestation and management targets seem unrealistic. Given Ireland's track record when it comes to environmental sustainability and public participation in the peat and forestry sectors it is unlikely that the targets could be achieved sustainably without significant changes to relevant policies.

Either way, it is clear that rewetting and afforestation are actions that will not be applicable to the dairy heartlands, again placing the substantial responsibility of action on farmers on marginally productive land. From a Just Transition perspective, while the economic opportunities presented by the dairy sector are concentrated in the wealthiest parts of the country, the burden of offsetting the resulting GHG emissions through herd reductions and land use change falls to farmers who have been historically marginalised by a range of factors, such as the physical constraints of the land or socio-economic isolation.

We believe that the scenarios produced by Teagasc do not reflect the complex multifaceted legal or policy framework that underpins our modern democracy, and the stated aspirations for a fair and sustainable rural economy. It is our view that a Just Transition requires policies that ensure that there is equity and equality in the responsibility and opportunities presented by the agri-food sector and climate action.

The scale of the changes proposed by the targets set for herd reduction and land use change will have wide ranging implications for affected communities. The advisory council has given some recognition to these concerns but they raise the need for government policy to mitigate negative impacts rather than ensuring that positive outcomes across all regions are prioritised in tailored scenarios. We would like to see scenarios that maximise the environmental benefits of sustainable farming practices, and environmentally beneficial land use and habitat management. By judging the value of a farm to society based only on economic output alone we risk exacerbating the decline in High Nature Value farms which deliver a range of public goods and services such as biodiversity, carbon sequestration, flood attenuation and cultural and recreational landscapes.

Reducing agricultural emissions by destocking intensive farms where environmental indicators such as water quality and air pollution indicate that the intensity of farming has exceeded the environment's carrying capacity would deliver multiple environmental benefits, while also representing a fair justification for intervention. Ignoring the climate impact of intensive farms won't wish away their negative impacts on biodiversity, water and air quality. The reduction in Ireland's Nitrates derogation is one example of where action is already been thrust upon the State.

Moving forward we need a more holistic vision for the future of Irish agriculture and land use that recognises the multitude of environmental and cultural goods and services provided by some farmers and the unsustainability of current market driven policies. We need to ensure a just and a sustainable transition for farming in response to our climate and biodiversity crises. Sooner rather than later, intensive farms must pull their weight to ensure a Just Transition.

2.5 The NECP for agriculture need to align with agreed climate goals

Agriculture's sectoral emission ceilings (SECs) – as related to the national five-year carbon budget (CB) periods, CB1 2021–2025 and CB2 2026–2030 – were set by Government in 2022 as 106 $MtCO_2e$ and 96 $MtCO_2e$, respectively. However, 26.25 $MtCO_2e$ in "unallocated savings for CB2" will have to be distributed among the non-LULUCF sectors, which represents reduction in agriculture's CB2 SEC to under 89 $MtCO_2e$ – based on *pro rata* proportional cuts across all sectors in projected CB2 SECs. Within the agreed national carbon budgets, further reductions in the SECs for agriculture and other sectors will very likely be required under Climate Act provisions. This outcome is likely, due to: almost all sectors exceeding their sectoral emission ceilings (SECs), as the EPA and CCAC have reported; far higher LULUCF emissions than originally assessed[16,38]; and the likely overshoot of CB1 that must be carried forward to reduce CB2[39].

In each EU Member State, the EU Emissions Sharing Regulation (ESR) covers the national emissions from agriculture, transport, waste, and other emissions not included in the EU's Emission Trading Scheme (ETS) for high emitting plants. Under the new revised EU ESR, a major increase in Ireland's required climate action ambition has occurred. The previous agreed requirement for a 30% reduction in CO_2e emissions (by 2030 relative to 2005) has been deepened to a 42% reduction for Ireland's national emissions – which include transport, agriculture, and heating. This represents a much more stringent binding target than the Sectoral Emission Ceiling (SEC) for agriculture than is associated with the 25% reduction relative to 2018 set by the Government. Thus, earlier, faster and deeper reductions in agricultural emissions are now required than the "by 2030" framing suggests.

Member States are allowed to meet their ESR linear pathway to their 2030 target with different sectoral contributions; however, if any sector achieves less than their *pro rata* share then other sectors need to achieve deeper mitigation. Therefore, any agricultural methane mitigation analysis, including Teagasc's, must at least consider a *pro rata* ESR goal for agricultural emissions. As Ireland's agreement to meeting the revised EU ESR reduction (42% cut relative to 2005) is more onerous than the SEC reduction (25% cut relative to 2018) and UNFCCC Parties must pursue 'highest possible ambition', the more difficult ESR target is logically the guiding commitment to be met, so it is concerning that the Teagasc's updated MACC assessment only mentions the updated ESR target in its summary[40] and does not examine adherence to it at all.

It will be the responsibility of government to set out policy and actions in the NECP that ensure that agriculture and land use, combined with all other societal activity sectors, meet the national carbon budgets and the Ireland's EU ESR commitment without fail.

2.6 Early, deep, and sustained reduction in agricultural methane is crucial

As of 2022, EPA provisional data shows that agri-methane emissions had increased by 20% since 2010, reaching their highest ever level. This policy outcome is entirely contrary to the well understood requirement for climate action to cut emissions of each greenhouse gas in every sector as quickly as possible[e]. The importance of cutting methane to limit peak global warming has been well understood by climate science for decades and the imperative becomes greater once global or fair-share carbon budget overshoot becomes likely, as is now the case. However, from 2010 onwards successive Governments in Ireland have completely ignored this science for the climate commitment, instead supporting expansionary animal agriculture policies[f] that have increased methane emissions[46–48], especially to expand grass-based milk production. Troublingly, instead of accepting the urgent requirement to cut methane emissions to meet global and national targets equitably under the Paris Agreement, the livestock sector and some related researchers have been invoking misleading interpretations of "climate neutrality" and inappropriate climate metric usage[49].

Figure 2 compares agri-methane emissions in 2010 and 2021. Figure 2(a) shows that total annual agri-methane emissions are dominated by enteric fermentation (digestion emissions) from cattle and sheep with significant additional methane from animal manure – including manure from pigs and poultry as well as cattle and sheep. As shown in Figure 2(b) a 60% rise in dairy sector methane (due to a 66% rise in milk production) has not been offset by any emissions decrease in other animal types, in fact methane emissions from beef cattle, sheep and pigs have slightly increased.

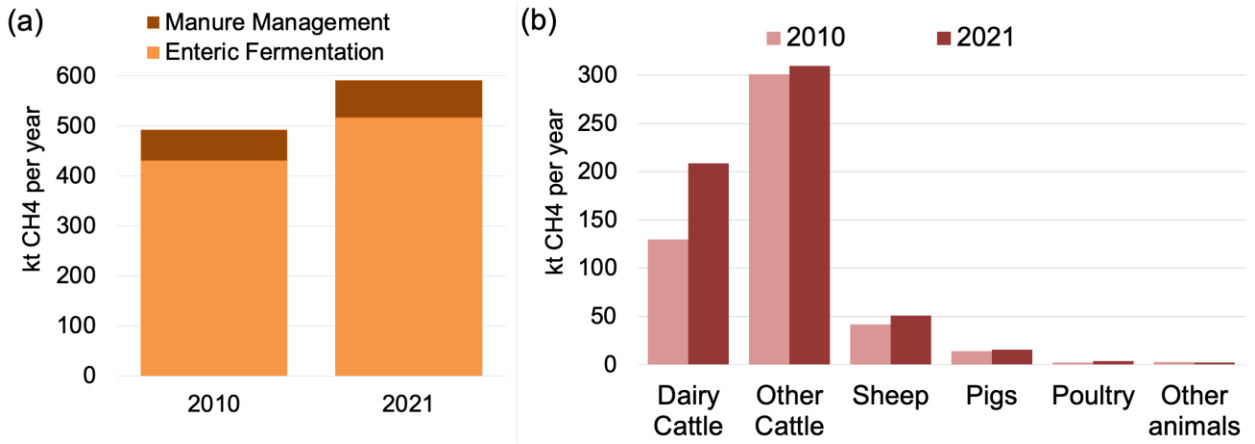

Figure 2. Animal methane in kilotonnes 2010 and 2021 (a) Total; and (b) By animal type total.

Data: EPA (2023). (a) shows 2010 and 2021 national total animal methane in ktCH_4/yr from enteric fermentation (only from ruminants) and manure management. (b) shows total methane emissions by animal type for 2010 and 2021.

[e] Climate science analysis, globally[41,42,5] and in Ireland[43,37,3] shows that cutting annual methane emissions is crucial to aligning equitable climate action in Ireland with meeting the Paris Agreement climate goal, otherwise even deeper and even more radical reductions in fossil fuel use are required[4,44].

[f] Notably, this policy direction was described by the former Bord Bia CEO as 'industry-owned' [45].

Previous analysis of EU and Irish agri-methane emissions data (and a forthcoming warming analysis of Irish agri-methane by An Taisce) strongly indicates that the 2009 EU decision (supported by Ireland) to remove the EU milk quota, which placed a limit on milk production in each country, has been a major climate error. In the EU, the prior trend of continuous methane emission reduction ended and no further decrease in annual agri-methane emissions has occurred since 2010. In Ireland, the effect of the milk quota removal is even more obvious in the data: agri-methane emissions had been falling slowly from 1998 to 2010, but from 2011 a change to rising methane. This policy outcome has greatly increasing the marginal and additional warming due to Irish agricultural methane[50].

Although the 2023 Climate Action Plan acknowledges the importance of reducing methane emissions, for agriculture it then merely restates the outdated Ag Climatise[51] aim for:

> *'a stabilisation of methane emissions alongside a significant reduction in fertiliser-related nitrous oxide emissions, to achieve an absolute reduction in the agricultural GHG inventory by 2030'.*

However, this is not in line with the 2021 CCAC carbon budget technical report scenarios[37] that require equal and substantial percentage reductions in mass emissions for both methane and nitrous oxide by 2030. The CCAC analysis indicated that substantial reductions in annual agri-methane emissions, cut by at least 20% and up to 51% by 2030, are crucial to meeting a fair share national target. On the -25% guideline basis set out by Government, the CCAC report shows Teagasc modelling (between Scenario C and D in Figure 3-1 in the CCAC report) indicating a cut in dairy cow numbers by 150,000 by 2030 and a cut in suckler cow numbers by over 300,000[g]. However, methane reduction meeting the now-deeper 2030 EU ESR target and adjusted downward sectoral emissions ceilings to 2030 (corrected to account for overshoot exceedance in the first 2021–2025 budget period) would require far deeper reductions in livestock numbers[h].

[g] A serious limitation of the Teagasc approach in this CCAC modelling is that it appears to be heavily biased in favour of intensive dairy on the basis of near-term profitability to the exclusion of other ecological and social factors that could be important in ensuring reduced pollution, increased biodiversity and Just Transition.

[h] See the forthcoming An Taisce Legacy4LIFE agri-methane report[50], which provides a precautionary basis to meet EU ESR and national carbon budget targets quantification of 2030 livestock numbers based on projected 2030 emission factors and the numbers ratios indicated by Teagasc

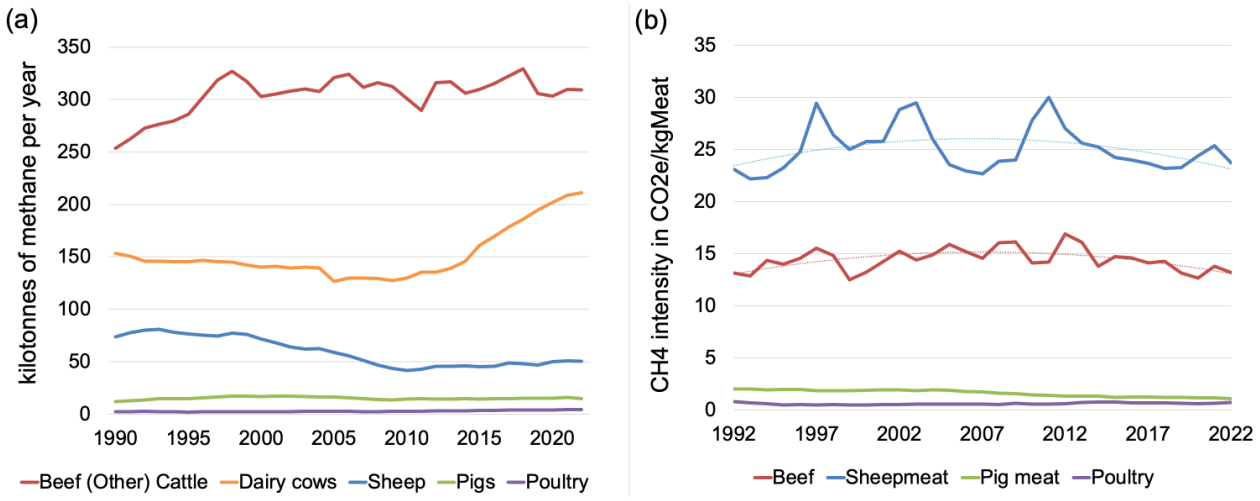

Figure 3. (a) Total methane emissions by animal type (b) Methane intensity of Irish meat.
EPA (2023) data for 1990–2022. CSO data for meat production.

For agri-methane mitigation, the 2023 Climate Action Plan relies on voluntary adoption of technical measures, including using methane-reducing slurry additives, a focus on low-methane traits within animal breeding programmes, new feed technologies, and by providing diversification opportunities. However, animal breeding improvement and new feed technologies do not currently register in EPA GHG reporting and, as Teagasc admit, they are subject to rebound effects. Therefore, as experience since 2010 has shown, these CAP23 measures are liable to fail in delivering the required substantial or sustained methane reduction. Continuing the current myopic focus on intensive pasture dairy farm production and livestock pasture farming – currently providing lower cost commodity inputs for processors – is unlikely to deliver meaningful methane mitigation. Reliance on chemical methane inhibitors is unlikely to be credibly monitored for sufficient emissions inventory certainty. Thus, only a structural diversification away from this model toward a more balanced, agri-food system with a far greater focus on tillage and horticulture food (rather than feed) production, with increased local nutrient cycling, is likely to reduce methane emissions.

Furthermore, achieving substantial reductions in annual methane emissions and maximising carbon dioxide removal are now essential to Ireland limiting overshoot and enabling a rapid return to a fair share achievement of the Paris Agreement goal[52]. Thus, it does not make scientific sense to suggest forest or soil carbon sequestration additions can be used to offset Ireland's nitrous oxide or methane emissions as both of these options are now essential to meeting the goal. Cutting annual agri-methane emissions would provide and earlier and more certain "warming reduction" effect for climate action than carbon dioxide removal (CDR) to unreliable land sinks or costly, as-yet-unavailable geologic storage. This is becoming increasingly important for any chance of meeting a fair share goal for Ireland aligned with meeting the Climate Act's national climate objective consistent with the Paris temperature goal[3]. The major impediment to this achieving transition is the influence of the incumbent sectoral actors that benefit most from the current system and use this power to delay effective policies and measures to cut livestock methane emissions.

NECP targets for agriculture must ensure early, deep, and sustained reductions in annual methane emissions (primarily via *enteric fermentation* from cattle and sheep digestion) to meet Ireland's fair-share global warming target[i]. Total methane is primarily related to total milk and livestock output. Establishing production quota limits on national meat and milk that reduce over time in line with emission targets would be highly effective methane mitigation measures. Despite the demonstrated success of the EU milk quota regime in reducing total dairy emissions, Teagasc MACC analyses have failed to include assessment of production quota or other regulatory measures in climate action for the agricultural sector.

NECP must reduce emissions in the agriculture and land use sector while avoiding "carbon farming" offsets Including incentives for carbon farming – rewarding additional land storage of carbon (in trees and soils) – in climate policy is problematic because it is subject to high measurement uncertainties and it is 'slow in, rapid out'[53] – it takes time to for measures to store additional carbon, that can then be easily lost very quickly through events such as harvesting, forest fires for trees and ploughing and land drainage for soils. Therefore, due to this vulnerability and impermanence, land carbon storage is of very limited mitigation value in comparison to ensuring that geologically secure fossil carbon – in coal, oil, or gas, and peat to a lesser extent – remains unextracted.

Nonetheless, reducing emissions within Ireland's Land Use sector is critical to climate action, and would deliver additional ecological benefits and restoring peatlands would also deliver a range of benefits for biodiversity, water quality, health and flood mitigation. There are strong reasons for public monies to be spent in rewarding landowners who invest in efforts to rewet organic soils and removal of forestry types that locally damage biodiversity or degrade water quality.

2.6.1 Rewetting organic soils

In the most recent EPA inventory, Ireland land use sector or Land Use Land Use Change and Forestry (LULUCF) was a net source of 7.3MtCO_2eq in 2022. Grassland is the largest net source of emissions within the LULUCF sector, the drainage of an estimated 339 kha of organic soils has resulted in emissions of 6.9 MtCO_2eq annually. The Climate Change Advisory Council (CCAC) has clearly highlighted that the rewetting of drained organic soils, peatland restoration and afforestation must be a key government priority if Ireland is going to achieve a long-term reduction in net CO_2 emissions in the LULUCF sector[j]. Rewetting is also important for ecological restoration of wetland systems to increase biodiversity and water quality.

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[i] As confirmed in the "Paris Test" temperature impact charts in the CCAC carbon budget technical report and subsequent analysis[3].

[j] It should be noted that relying on carbon sequestration increases uncertainties in carbon accounting and that the CCAC carbon budget modelling scenarios assumed an unlikely 51% reduction in land use sector (LULUCF) emissions by 2030 was possible, when in fact emissions are projected to increase. Also, the rewetting assessment largely overlooked the climate action requirement to account for increased warming due to higher methane emissions from higher water levels, balancing CO_2 reduction.

The EPA Land Use Review concluded that only those modelled scenarios which included both ambitious rewetting of grasslands on organic soil (up to 90% or 302,000ha) and restoration of exploited peatlands (70,000ha) would achieve net-zero in the AFOLU sector by 2050. While the EPA highlighted that the restoration of degraded peatlands would have significant co-benefits for climate mitigation, biodiversity, water quality and water regulation an analysis of existing Irish policy indicated that in many cases stated policy targets were not consistent with the levels of land use change required.

According to the EPA, Irelands future approach to organic soils must:

(1) ensure that these carbon stocks remain in the ground and

(2) promote the development of carbon sinks in all types of land use.

Reducing emissions from the land use sector and supporting land use policies that will result in the sector transitioning to a net emissions sink is a necessary goal within itself.

Therefore, given the scale of the challenge of reducing emissions in the land use sector any discussion around "carbon farming" offsets for agriculture (on mineral soils particularly) are a dangerous distraction and cannot be countenanced as an alternative to sustained and deep reductions across both the agriculture and land use sectors.

2.6.2 Forestry in climate action

Land-based CO_2 removals to forest and soil are not equivalent to cutting fossil carbon use, they cannot offset methane in stringent carbon budgeting and are of doubtful mitigation value, therefore the NECP should minimise reliance on offsets, such as "carbon farming" or land carbon "credits" or "offsets" for energy.

On forestry inclusion in climate action, Mackey et al.[54] clearly describe crucial understandings that are too often overlooked in climate action policies and advisory measures. They state:

> *the 'mitigation value of forests lies not in their present net uptake of CO_2, but in the longevity of their accumulated carbon stocks',*

therefore,

> *'avoiding emissions by protecting high-carbon ecosystems from land-use change that depletes their carbon stocks is an important part of a comprehensive approach to greenhouse gas mitigation'*

and so,

> *'the most effective form of climate change mitigation is to avoid carbon emissions from all sources. This means that there is no option but to cut fossil fuel emissions deeply, and not to continue these emissions under the erroneous assumption that they can be offset in the long term by the uptake of CO2 in land systems.'* |

2.6.3 Problems with rewarding carbon farming as climate action

Similarly, carbon farming makes an invalid assumption that impermanent land carbon storage, in plantation forestry or in soils, can be assumed to offset the warming from agriculture due to nitrous oxide emissions that are long-lived in the atmosphere.

There are multiple reasons against allowing carbon farming to be rewarded within EU climate policy[55]: the complexity of ensuring ongoing measurement, monitoring and verification that is sufficiently reliable for meaningful value[56]. These issues will need to be addressed if carbon farming is to be viewed as credible climate action. The European Commission's support for carbon farming is all too likely to enable mitigation deterrence[57], in effect, enabling another questionable carbon credit scheme of doubtful value that is highly liable to allow perverse incentives that can be exploited by high GHG emitters, land owners, as profitable schemes that fail to enable reduce climate action and reap financial rewards at a high cost to society while achieving little or no public good.

For all of these reasons, Ireland's NECP, and the EU NECPs across all Member States, should support actions to reduce emissions from the land use sector as an end in themselves, while severely limiting any strong GHG mitigation dependence on "carbon farming". If any dependence on it is permitted then the following must apply, then carbon farming:

- Must be for long term storage not just sequestration
- Must allow for weather extremes (rainfall and drought)
- Must be subject to rigorous and accurate measurement and accounting
- Must be easy and not expensive to measure/calculate
- Must include penalties if carbon lost
- Must be independently checked and enforced
- Must be just for all - farmers and non-farmers alike

As noted above, rewarding the rewetting of peatlands and organic soils can have ecological and societal benefits, but it is possible to reward landowners for these efforts without enabling a system of highly uncertain carbon farming that is liable to undermine reliable carbon accounting.

2.7 Quota limits on animal agriculture are effective mitigation measures

In agriculture, GHG emissions (and water and air pollution) have gone up instead of down over the past decade. This abject failure of government policy and advisory measures since 2010 has likely delayed a low-carbon transition and pollution management by twenty years, with large ongoing costs for farmers and society due to policies that have increased rather than decreased intensive animal production.

Past experience in agriculture clearly shows that setting national, catchment, and farm quotas on nitrogen inputs (as used in Denmark) and/or production quotas (as in the national EU milk quota applied until 2015) is the most certain and fairest regulatory method to limit climate and pollution impacts. In contrast, Ireland's

reliance in policy on efficiency measures and voluntary uptake has failed to limit agricultural emissions or pollution.

Ireland's failure to achieve climate action aligned with its agreed EU and national climate targets is strongly related to a failure to limit the annual input *quantities* of the key drivers of its emissions, that is, the tonnage of fossil fuel carbon combusted, the tonnage of land carbon lost, and the tonnage of nitrogen fertiliser used (relative to the net food and protein produced). Therefore, it is crucial that the NECP for Irish agriculture, forestry, and land use (AFOLU) adopts a precautionary, guardrail mitigation approach that commits to meeting climate, water, and ammonia targets *without fail* by setting target-aligned limits on the input nutrient quantities and/ the outputs from high-GHG dairy and other livestock production.

Enforced nitrogen quota limits on farm and catchment limits or milk quotas would drive farm and system efficiencies that will cut total system emissions without fail, as is required to meet climate and pollution targets while maintaining or increasing net food production. Unfortunately, in the current regime with high milk prices, reducing the Nitrates directive limit on organic N application per hectare is a largely insufficient measure as profitable dairy farms can simply rent or buy more land – pushing out tillage and more extensive farming[58] – to apply the same total N input to a watershed resulting in similar or only marginally reduced high levels of water and air pollution. N quota limits applied nationally and by watershed would be fairer to all farmers, limit land price increases, and direct reduced system nitrogen use, aligned with achieving sustainable agroecological transition.

2.8 Enable the "polluter pays" principle to underpin a just and sustainable transition for farmers and society

EPA data since 2010 shows that a small improvement in "carbon footprint" of milk (kg CO2e per kg milk) has been massively overwhelmed by the large increase in the total amount of milk produced. Farmers have done what was asked of them but that it is the direction from government and Teagasc and a lack of leadership from farming representative organisations and processors toward a Just Transition that is the main issue. The total annual amounts of methane and nitrogen excretion from all livestock animal types has increased since 2010, even though mitigation action required bringing them down. Up to 2015, the milk quota effectively limited nitrogen inputs to dairy farming, but since its removal no pollution taxes or nutrient input limits other than the weak Nitrates Directive have limited dairy sector profits.

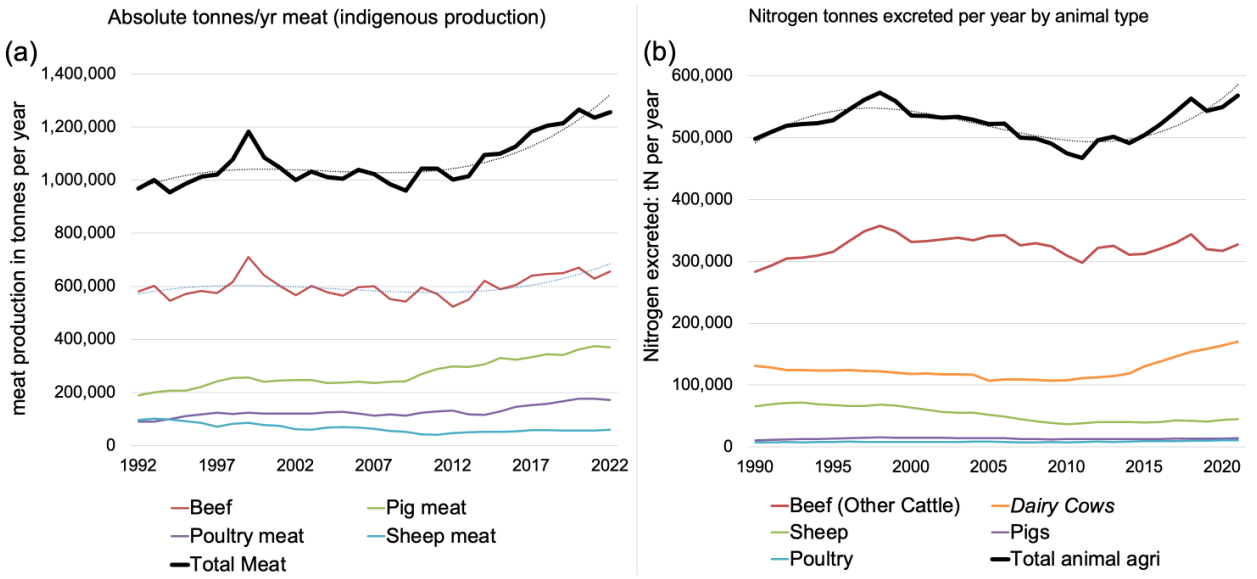

Figure 4. Ireland 1992–2022 (a) Annual meat production in tonnes. (b) Annual animal nitrogen excretion
Data: (a) CSO 2023. (b) EPA 2023.

As shown in Figure 4, annual indigenous meat production, now above 1.2 million tonnes per year, has increased by about 20% since 2010, adding related increases in nitrogen-excretion by beef cattle and pigs, in addition to the large increase due to dairy cows. Ammonia emissions from nitrogen excretion and fertiliser have continued to exceed Ireland's agreed ammonia air pollution ceiling on use. In effect, by enabling this substantial rise in nitrogen-excretion[k] since 2010, Ireland's policy of expanding milk and livestock production has ignored the objectives of the *Water Framework Directive* and *National Emission reduction Commitments Directive*[59]. In effect, Ireland's policy and governance since 2010 has provided the animal agriculture sector a substantial license to pollute without paying for the additional pollution cost.

Studies by the Central Statistics Office (CSO) show that very large financial benefits to agriculture from *Potentially Environmentally Damaging Subsidies.* In 2016[60], direct subsidies to agriculture reached €1,255 million, including multiple government programmes and supports, and indirect subsidies reached €235 million, including the zero rate of VAT on fertiliser and capital acquisition reliefs. Direct and indirect subsidies for fossil fuel usage, including the reduced levy on agricultural diesel, mean that the related climate and pollution costs of agriculture and forestry production are borne by society rather than the polluting activity. A special report in 2021 by the European Court of Auditors[61] found that 'the €100 billion of CAP [Common Agricultural Policy] funds attributed during 2014-2020 to climate action had little impact on agricultural emissions, which have not changed significantly since 2010' and that:

> *'Livestock emissions, mainly driven by cattle, represent around half of emissions from agriculture and have been stable since 2010. However, the CAP does not seek to limit livestock numbers; nor does it provide incentives to reduce them. The CAP*

[k] Nitrogen excretion the best measure of the nitrogen pollution losses due to animal agriculture that result in nitrous oxide (climate pollution) from animal manure and urine,

market measures include promotion of animal products, the consumption of which has not decreased since 2014.'

The rapid expansion of Ireland's intensive dairy farming sector since 2010 has been enabled by government and industry policy that has leveraged Ireland's unenforced climate targets and ineffective pollution regulation. **In effect this regulatory failure acts as a substantial economic subsidy for the dairy sector in Ireland relative to other nations that do enforce nitrogen and phosphorus input controls and GHG emission limits.** Thus the EU data indicates that the past decade has seen more of a "carbon leakage" to Ireland, far more than away from it. This result has been facilitated by ignoring climate, pollution and health policies in favour of maximising a "business-as-usual" 'productivist imperative[62 l].

Given these serious pollution issues, not just the lack of pollution taxation but subsidies that are shown to increase pollution, it is reasonable to expect that in effective policy:

- Ruminant livestock farming should be prioritised for destocking, particularly where it is evident that intensive farms have exceeded the carrying capacity of the environment, resulting in pollution and environmental degradation.
- There needs to be a review of perverse subsidies in the agricultural sector and where they are identified they should be withdrawn

Ultimately polluting activities must be regulated and public money must be used for the delivery of public goods and services, this must include environmental sustainability and prioritising socio-economic viability of the majority ahead of the profitability of the few.

2.9 Ireland's must transform commercial forestry and tree cover policies

Radical change is needed in Ireland's forestry sector if tree cover is to be increased and if the commercial sector is to contribute positively to climate action. Climate change should not be used as an excuse to accelerate afforestation while failing to address serious environmental legacy issues and maintaining a business as usual approach to forest management. As with carbon farming, afforestation should not be viewed as an alternative to sustained cuts in emissions within the agricultural and land use sectors. As outlined by the Intergovernmental Panel on Climate Change, such land sequestration is impermanent (relative to the thousands of years of mitigation required), highly uncertain, and subject to carbon cycle rebound effects that seriously reduce their value.

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l Kenny et al. [62]: 'Food policy is critical to public health and the sheer absence of public health voices throughout the FH2020 process [in developing the Food Harvest policy, published in July 2010] indicates a distinct blind spot in Ireland's public health landscape, a silo mentality, and a clear disconnection between government, people, food, health and the environment; a situation reflective of the broader international trends'.

2.9.1 The need for climate change adaptation in Ireland's forestry

Ireland's Forest Strategy (2022-2030)[m] highlights the need for increased resilience of the national forest estate to the effects of climate change through climate adaptation stating that:

> *"the changing climate will also impact the health and productivity of our forests. This may include, the frequency and intensity of forest fires, drought, extreme storms, as well as phenology (seasonal timing of biological activity), and the distribution and abundance of invasive species and pests. This has the potential to reduce the adaptability of trees to climate change, and may consequently affect the range of social, economic and environmental services that forests provide, including the ability to sequester carbon. Therefore, our forests need to be resilient to cope with, or even take advantage of, future growing conditions that a changing climate may bring."*

We strongly agree; however, unfortunately, this statement is not reflected within the actual detail of the strategy. The ongoing commitment is to a forestry model predominantly focused on mono-culture plantations of non-native conifers that will be manufactured into short-lived wood products is not in line with the need for climate adaptation.

Plantations of even aged stands of monocultures that are harvested using clear-cuts are particularly vulnerable to the projected increase in climate driven biotic and abiotic pressures such as disease, pests, wind throw and fire[n]. We have already seen the impact that tree diseases such as *Phytophthora ramorum* and Ash Dieback (*Hymenoscyphus fraxineus*), wind throw and forest fires have had on Irish forestry in recent decades. Internationally new approaches are being adopted to transition plantation forestry to forests that are more resilient to the effects of a changing climate. These changes in forest management also present new opportunities to improve biodiversity values within existing and new plantation forests. Increasing species diversity within forests is one common approach to improving the biodiversity value and climate change reliance of commercial forestry[o].

Research in the UK has concluded that 'business as usual' forest management will become unsuitable under the two warmest and driest climate variants, marginal under four variants, and borderline suitable under the remaining five variants. To safeguard the ability of forestry to continue to deliver forest products and a wide range of ecosystem services some adaptation measures to climatic impacts are needed, such as transformation to more diverse species forests managed using low-impact silviculture systems[p].

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[m] Ireland's Forest Strategy 2022–2030: https://assets.gov.ie/269571/90a5e49b-0481-4c58-b296-7c27ac9a7ad6.pdf

[n] Watt, M. S., Kirschbaum, M. U., Moore, J. R., Pearce, H. G., Bulman, L. S., Brockerhoff, E. G., & Melia, N. (2019). Assessment of multiple climate change effects on plantation forests in New Zealand. Forestry: An International Journal of Forest Research, 92(1), 1-15.

[o] Pawson, S. M., Brin, A., Brockerhoff, E. G., Lamb, D., Payn, T. W., Paquette, A., & Parrotta, J. A. (2013). Plantation forests, climate change and biodiversity. Biodiversity and Conservation, 22(5), 1203-1227.

[p] Ray, D., Bathgate, S., Moseley, D., Taylor, P., Nicoll, B., Pizzirani, S., & Gardiner, B. (2015). Comparing the provision of ecosystem services in plantation forests under alternative climate change adaptation management options in Wales. Regional Environmental Change, 15(8), 1501-1513.

With careful design and proper management, mixed-species plantations can be more productive and have more advantages in biodiversity, economy and forest health over monocultures[q]. Resilience and sustainability can be achieved if policies control standing stock, age class distribution and the use of diverse species mixes[r].

Close-to-nature silviculture (CNS) has been widely advocated as being the best approach for managing forests to cope with future climate change[s]. Many attributes of CNS can increase the adaptive capacity of European temperate forests to climate change. CNS promotes structural diversity and tree resistance to stressors, and growing stocks can be kept at low levels.

Research has identified six principles for enhancing the adaptive capacity of European temperate forests in a changing climate[t]:

(1) increase tree species richness, (2) increase structural diversity, (3) maintain and increase genetic variation within tree species, (4) increase resistance of individual trees to biotic and abiotic stress, (5) replace high-risk stands and (6) keep average growing stocks low.

Therefore:

- **Ireland must set ambitious targets to transition towards Close-to-Nature Silviculture (CNS) and Continuous Cover Forestry (CCF).** The Programme for Government has committed to the promotion of "*close to nature-continuous cover forestry systems to ultimately create permanent biodiverse forests containing trees of all ages*." Coillte in particular as a public body and the largest forest owner in the state is well placed to lead this national movement towards a new regime of forestry management that has the capacity to deliver ongoing ecosystem and forest services under various climate change scenarios.
- **DAFM and Coillte should support the development of an EU "closer-to-nature" voluntary certification scheme**, which is proposed within the European Commission's communication on the New EU Forest Strategy for 2030, so that the most biodiversity friendly management practices could benefit from an EU quality label.

Irish peatlands and peat soils are the dominant soil type in Irish forests accounting for 38.7% of the total area[26]. Forestry covers 450,940 ha of peatlands in Ireland[27] with 60% of the forestry on peat being State owned[28], with Coillte being responsible for 232,500 ha of forestry on peatlands making them the largest owner of peatland habitat in Ireland[29]. The EPA calculate that forestry on organic soils may emit from 0.59 t C/ha/yr to 1.7 t C/ha/yr[30] [31] which implies national emissions in the region of 0.2 Mt CO_2 / yr to 0.8 Mt CO_2 / yr. The legacy issues associated with the

[q] Liu, C. L. C., Kuchma, O., & Krutovsky, K. V. (2018). Mixed-species versus monocultures in plantation forestry: Development, benefits, ecosystem services and perspectives for the future. Global Ecology and Conservation, 15, e00419.
[r] Freer-Smith, P. H., Muys, B., Bozzano, M., Drössler, L., Farrelly, N., Jactel, H., ... & Orazio, C. (2019). Plantation forests in Europe: challenges and opportunities (Vol. 9, pp. 1-52). Joensuu, Finland: European Forest Institute.
[s] Gömöry, D., Krajmerová, D., Hrivnák, M., & Longauer, R. (2020). Assisted migration vs. close-to-nature forestry: what are the prospects for tree populations under climate change?. Lesnicky Casopis, 66(2), 63-70.
[t] Brang, P., Spathelf, P., Larsen, J. B., Bauhus, J., Boncčina, A., Chauvin, C., ... & Svoboda, M. (2014). Suitability of close-to-nature silviculture for adapting temperate European forests to climate change. Forestry: An International Journal of Forest Research, 87(4), 492-503.

afforestation of peatlands have been largely ignored by policy makers in Ireland and, unfortunately are not addressed by the CCAC Carbon Budgets Technical report and national forestry policy.

Thankfully Ireland's latest Climate Action Plan does acknowledge the need to address the legacy issues associated with afforested peatlands. However, some Irish studies unfortunately continue to fail to consider the broader benefits of peatland restoration or have failed to consider the climate mitigation benefits of restored peatlands over the medium to long term[32], which is essential when considering the Global Warming Potential of short-lived and long-lived GHGs.

The NECP must set clear targets for the restoration of afforested peatlands, prioritising the rewetting of drained deep peat soils to ensure that CO_2 are reduced.

2.10 Improved due-diligence assessment of bioenergy is urgently required.

Insufficient advisory assessments of bioenergy in Ireland and the EU have failed to address major sustainability issues that seriously affect the climate benefits of increasing wood biomass combustion for heat and electricity and Ireland's planned increase in biomethane production from anaerobic digestion of animal slurry and grass-silage. In fact, depending on the exact policy details. For example, bioenergy use relying on biomass combustion or biomethane from anaerobic digestion (AD) may have little or no climate benefit, or may even cause more climate or air pollution, compared to using fossil fuels. Crops, including grass, grown for bioenergy also competes for land area that could be used to grow food or fibre, or used for solar energy. The NECP needs to acknowledge the major issues detailed below, the advisory assessment failures to date, and state how these issues will be addressed.

2.10.1 Bioenergy can be carbon intensive: do not assume it is carbon neutral

Problematically, EU and Irish assessments generally continue to assume that bioenergy production is "carbon neutral" – incorrectly suggesting that the climate impact of bioenergy emissions can be taken as, on average, equal to the carbon removed from the atmosphere by plant regrowth. However, multiple scientific studies[u] find this assumption to be highly misleading because exactly where and how biomass is produced, harvested and used is crucial to whether or not bioenergy reduces emissions compared to fossil fuel use. Although the SEAI website acknowledges the validity of these issues[66], actual advisory reports like the SEAI Heat Study[67] nonetheless only account for the bioenergy emissions from cultivating, processing, transporting, and using biomass fuel, they fail to account bioenergy emissions relative to alternative uses of land, including unharvested forest, or given the often large time lags between biomass combustion and any equivalent carbon uptake by land. Moreover, imports of biomass from other countries result in major biomass carbon accounting issues that can easily enable emissions to go unaccounted,

[u] including reports by the European Environment Agency[63] and the European Academies' Science Advisory Council[64,65]

thereby making heat and power from woody biomass appear beneficial when the reality be very different[68].

2.10.2 Biomass sustainability criteria are weak in the EU and Ireland

The EU has failed to develop sustainability criteria strong enough to protect global and EU forest ecosystems, meaning that only strong provisions in the proposed *Nature Restoration Law* (NRL) and additional market regulation might limit these shortcomings[69]. However, the forest ecosystem improvement elements in the NRL already appear to have been significantly weakened. It is also up to EU Member States to do more but the weakness of Ireland's biomass sustainability criteria is evident in the increasingly apparent national forest management emissions failure.

As a result of forest harvest rates exceeding recent afforestation rates, managed forests in Ireland are now a net CO_2 emitter, contrary to climate action objectives. Recent science also shows that forest plantation on peaty organic soils has been, and continues to cause, substantial CO_2 emissions, such that an additional 2 $MtCO_2$ has been added to national forest emissions for every inventory year since 1990, thereby decreasing the recorded total annual CO_2 removal sequestration values and increasing the need for additional emission reduction in other sectors to meet Ireland's five-year carbon budgets.

In the words of the Climate Change Advisory Council, the long predicted "carbon cliff" is now occurring, whereby forest land is no longer providing a net sequestration benefit so that the carbon storage potential is much reduced. For over a decade Irish government policy has been appealing to future rises in afforestation rates that have not materialised, therefore, enforced limits on timber harvest (effectively increasing the average harvest age of plantations) must be considered as a strong climate policy option to address this ongoing failure. This is potentially a less costly mitigation option in meeting Ireland's carbon budgets than additional high-cost measures to achieve rapid reductions in other sectors including fossil fuel energy and agricultural emissions[70].

Therefore, forestry which is ecologically sound and sequestering carbon should be harvest-limited, Complexity nonetheless arises because, from a biodiversity/water point of view, there is forestry in Hen Harrier areas which should be removed if we want them to survive. Similar concerns apply to protection of the freshwater pearl mussel.

2.10.3 AD problems have not been properly assessed or addressed

Due to a lack of due-diligence, and despite serious scientific concerns, the Government has now approved a large scale roll-out of a network of hundreds of anaerobic digestion (AD) plants using silage-slurry feedstock from livestock farms. This policy has been jointly promoted by vested interests in high emissions industries, fossil gas delivery (Gas Networks Ireland) and intensive livestock farming, further enabled by an uncritical biogas sector interested in profitable growth. The 2023 Climate Action Plan places a heavy emphasis (seven Actions[71]) on the production of biomethane from AD.

However, as detailed below, it is evident that advisory assessments have been uncritical of AD biomethane by not fully reporting or addressing scientific analyses that raise serious negative

issues that limit or cancel the economic viability and environmental benefits of bioenergy production at increased scale – using domestic and imported woody biomass to produce heat and power, or anaerobic digestion (AD) of grass silage and livestock slurry at a network of AD plants to produce biomethane for the gas grid and AD digestate as fertiliser.

Feedback EU has produced a strongly evidenced briefing[72], also applicable to Ireland, on the key issues that must limit the scale of biogas ambition in the EU to avoid serious negative climate, pollution, and human health impacts.

Appendix 1 of this report details further issues with bioenergy from anaerobic digestion.

2.11 Agriculture in the NECP needs to be coherent with policy objectives

NECP planning for agriculture and land use needs to meet national policy objectives and planetary boundaries. The NECP recommendations in this report on agriculture in Ireland's NECP specifically relate to agriculture and climate change, but a coherent land use plan needs to protect nature and enable Just Transition to resilient sustainable farming and forestry. This report's recommendations therefore also correlate with the more general Recommendations for Government as presented and detailed in the report *Towards a New Agricultural and Food Policy for Ireland* [73], published in 2021 by Ireland's environmental NGOs (including the Environmental Pillar, the Stop Climate Chaos Coalition and the Sustainable Water Network).

That environmental NGO report begins by stating the reality that:

> *Agriculture is by far the most significant pressure on Ireland's nature, water and air, and greenhouse gas emissions. There has been a long-standing failure to align the sector with Ireland's obligations under environmental law. Current policies that prioritise a productivist model of agriculture (i.e. focused on specialisation and intensification) lock farmers into an unsustainable commodity driven food production system which leaves them economically vulnerable. These policies have also undermined Ireland's international reputation on food security.*

The report goes on to set out and supports the following recommendations:

1. Develop an Overarching Policy Framework Aligned with Ecological Limits and Environmental Commitments
2. Protect and Restore Biodiversity on Farmland
3. Protect and Restore Peatlands and Woodlands on Farms
4. Ensure that Agriculture Delivers its Fair Contribution of the 51% Reductions in Greenhouse Gas Emissions by 2030 Committed to in the Programme for Government
5. Urgently Improve Air Quality
6. Halt and Reverse Water Quality Decline
7. Support Sustainable Livelihoods and Incentivise Farm Diversification
8. Contribute to Public Health and Sustainable Consumption
9. Contribute Meaningfully to Food and Nutrition Security

10. Facilitate Inclusive Dialogue and Participation to Envision an Alternative Model for Agriculture in Ireland

An NECP that sets out effective climate mitigation action in agriculture, as detailed in the recommendations in this report, strongly aligns with achieving all of the above NGO recommendations. It is extraordinary that the recent trajectory of climate pollution from Ireland's agriculture, forest and land use emissions has been aligned with climate breakdown rather than the necessary emergency response to set a more resilient course for farming and nature. Even the reduction in agricultural emissions in the last year appears to be more in response to market circumstances rather than intended policies or measures, and it comes after the large increase in emissions and pollution since 2010. Recent reports suggest nitrogen fertiliser use is liable to increase again in 2024[74], likely increasing emissions, meaning that recent industry claims[75] of meaningful nitrogen use and emission reduction may well prove illusory. What matters is a downward trend in total nitrogen use and no such trend is yet evident.

Setting a clearly defined milk and meat quotas pathways aligned with meeting the EU ESR and carbon budgeting targets, and limiting animal nitrogen excretion by river catchment, would provide farmers with clear market signals to achieve a low carbon transition for Ireland's agri-food system with greater food security and a more resilient, diversified rural economy.

3 Conclusion: Irish agriculture needs a new vision

Based on the research presented, this report finds that policy misdirection and ineffective mitigation advice over the last decade has seriously delayed a low-carbon agri-food system transition for Irish farmers and society. Ireland's 2024 NECP urgently needs to redirect existing AFOLU funding to support a transition agri-food system to away from its high input, high emissions cattle farming and plantation forestry to a far more diversified farming system which is focused on food crop production and biodiverse ecosystems including extensively grazed grassland and permanent native woodland.

Planning land use for agriculture, forestry, and nature, within agro-ecological limits and meeting climate targets will ensure long-term economic sustainability, greater food productivity, and climate resilience, for nature, farmers and society as a whole.

References

1. EPA. *Ireland's Provisional Greenhouse Gas Emissions 1990-2022. July 2023*. https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/2023-EPA-Provisional-GHG-Report_Final_v3.pdf (2023).
2. UNFCCC. Paris Agreement. (2015).
3. Price, P. R. *Carbon Budgets to Inform Climate Action: A Society-Wide, Integrated GHG Quota and Accounting Perspective*. https://www.climatecouncil.ie/councilpublications/councilworkingpaperseries/Paul%20R%20Price%20Working%20Paper%20No%2019.pdf (2023).

4. Ou, Y. *et al.* Deep mitigation of CO2 and non-CO2 greenhouse gases toward 1.5 °C and 2 °C futures. *Nat Commun* **12**, 6245 (2021).
5. Harmsen, M. *et al.* Uncertainty in non-CO2 greenhouse gas mitigation contributes to ambiguity in global climate policy feasibility. *Nat Commun* **14**, 2949 (2023).
6. Rockström, J. *et al.* Safe and just Earth system boundaries. *Nature* 1–10 (2023) doi:10.1038/s41586-023-06083-8.
7. Uwizeye, A. *et al.* Nitrogen emissions along global livestock supply chains. *Nature Food* 1–10 (2020) doi:10.1038/s43016-020-0113-y.
8. Cassidy, E. S., West, P. C., Gerber, J. S. & Foley, J. A. Redefining agricultural yields: from tonnes to people nourished per hectare. *Environmental Research Letters* **8**, 034015 (2013).
9. EU. *Commission Notice on the Guidance to Member States for the Update of the 2021-2030 National Energy and Climate Plans*. https://energy.ec.europa.eu/document/download/844d6896-2fe8-4e2b-b052-bf7169d9be3a_en (2022).
10. CAN Europe. Why is this a crucial year for national climate action and what are "NECPs"? *CAN Europe* https://caneurope.org/why-is-this-a-crucial-year-for-national-climate-action-and-what-are-necps/ (2023).
11. European Commission. Farm to Fork Strategy. (2020).
12. EEB. Legal obligations for public participation during the updating of the National Energy and Climate Plans. (2023).
13. EJNI. *Legal Obligations for Public Participation during the 2023 Updating of National Energy and Climate Plans (NECPs)*. (2023).
14. DECC. *National Energy & Climate Plan 2021-2030*. https://energy.ec.europa.eu/system/files/2020-08/ie_final_necp_main_en_0.pdf (2020).
15. Erisman, J. *et al.* An Integrated Approach to a Nitrogen Use Efficiency (NUE) Indicator for the Food Production–Consumption Chain. *Sustainability* **10**, 925 (2018).
16. Price, P. R. *Projected Reduction in Forest Carbon Removals to 2030 Requires Greater Climate Action Policy Focus*. https://drive.google.com/file/d/1-Vn4NXwMzT0EJ0Z6tkSgc4VTO1N49bpS/view?usp=drive_link (2021).
17. European Commission. Water: Commission decides to refer IRELAND to Court. *European Commission - European Commission* https://ec.europa.eu/commission/presscorner/detail/en/ip_23_166 (2023).
18. Faber, R., Kocher, D. & Duwe, M. Progress on the implementation of national Multilevel Climate and Energy Dialogues: Assessing Member States' own reporting. (2023).
19. An Taisce. An Taisce questions the Agriculture Minister's Claims on Dairy Herd Expansion. *An Taisce - The National Trust For Ireland* https://www.antaisce.org/news/taisce-questions-agriculture-ministers-claims-dairy-herd-expansion (2014).
20. Environmental Pillar & Stop Climate Chaos. *Not So Green: DEBUNKING THE MYTHS AROUND IRISH AGRICULTURE*. https://www.stopclimatechaos.ie/download/pdf/not_so_green.pdf (2016).
21. An Taisce. An Taisce has called on Minister Creed to retract misleading Dáil statements on rising dairy emissions - The National Trust for Ireland - An Taisce. https://www.antaisce.org/articles/an-taisce-has-called-on-minister-creed-to-retract-misleading-d%C3%A1il-statements-on-rising (2018).
22. An Taisce. *Are Teagasc's Climate Mitigation Projections Credible?* https://www.antaisce.org/TeagascClimateCredibility (2019).
23. SWAN. Water pollution crisis fuelled by reckless intensification of agriculture. *Sustainable Water Network* https://swanireland.ie/2020/12/water-pollution-crisis-fuelled-by-reckless-intensification-of-agriculture/ (2020).
24. Petersen, R. J., Blicher-Mathiesen, G., Rolighed, J., Andersen, H. E. & Kronvang, B. Three decades of regulation of agricultural nitrogen losses: Experiences from the Danish Agricultural Monitoring Program. *Science of The Total Environment* **787**, 147619 (2021).

25. Klootwijk, C. W., Van Middelaar, C. E., Berentsen, P. B. M. & de Boer, I. J. M. Dutch dairy farms after milk quota abolition: Economic and environmental consequences of a new manure policy. *Journal of Dairy Science* **99**, 8384–8396 (2016).
26. Mukpo, A. How manure blew up the Netherlands. *Mongabay Environmental News* https://news.mongabay.com/2023/09/how-manure-blew-up-the-netherlands/ (2023).
27. Mukpo, A. In the Netherlands, pitchforks fly for an empire of cows. *Mongabay Environmental News* https://news.mongabay.com/2023/09/in-the-netherlands-pitchforks-fly-for-an-empire-of-cows/ (2023).
28. Mukpo, A. In the clash over Dutch farming, Europe's future arrives. *Mongabay Environmental News* https://news.mongabay.com/2023/09/in-the-clash-over-dutch-farming-europes-future-arrives/ (2023).
29. EPA. Ireland's Air Pollutant Emissions 1990-2030 (May 2023). (2023).
30. EPA. *Assessment of the Catchments That Need Reductions in Nitrogen Concentrations to Achieve Water Quality Objectives*. https://www.catchments.ie/download/assessment-of-the-catchments-that-need-reductions-in-nitrogen-concentrations-to-achieve-water-quality-objectives/?wpdmdl=7515&ind=Q2F0Y2htZW50IG5pdHJvZ2VuIHJlZHVjdGlvbnMgYXNzZXNzbWVudCAtIEp1bmUgMjAyMS5wZGY (2021).
31. Climate Case Ireland. Climate Case Ireland. *Climate Case Ireland* https://www.climatecaseireland.ie/ (2020).
32. Law Society Gazette. Legal challenge to Government on its climate action steps. *Law Society Gazette* https://www.lawsociety.ie/gazette/top-stories/2023/september/legal-challenge-to-government-on-its-climate-action-steps (2023).
33. An Taisce. Explainer: What is the EPA nitrates derogation 'Red Map'? *An Taisce - The National Trust For Ireland* https://www.antaisce.org/blog/red-map-explainer (2023).
34. Lanigan, G. J., Hanrahan, K. & Richards, K. G. *An Updated Analysis of the Greenhouse Gas Abatement Potential of the Irish Agriculture and Land-Use Sectors between 2021 and 2030*. https://www.teagasc.ie/media/website/environment/climate-action/climate-centre/MACC-2023.pdf (2023).
35. Billen, G. *et al.* Reshaping the European agro-food system and closing its nitrogen cycle: The potential of combining dietary change, agroecology, and circularity. *One Earth* **4**, 839–850 (2021).
36. Schiavo, M., Le Mouël, C., Poux, X. & Aubert, P.-M. The land use, trade, and global food security impacts of an agroecological transition in the EU. *Front. Sustain. Food Syst.* **7**, 1189952 (2023).
37. CCAC. *Carbon Budget Technical Report October 2021*. https://www.climatecouncil.ie/media/climatechangeadvisorycouncil/Technical%20report%20on%20carbon%20budgets%2025.10.2021.pdf (2021).
38. Price, P. New projected Land Use emissions take up a greater and increasing fraction of the carbon budgets - DCU ECRN. https://www.eeng.dcu.ie/~mcmullin/gsites-frozen/dcuecrn/news/newprojectedlanduseemissionstakeu-db2fb1e421d18291.html (2022).
39. An Taisce. Ireland's carbon budgeting situation is far more pressing than the EPA Projections report has indicated. *An Taisce - The National Trust For Ireland* https://www.antaisce.org/News/irelands-carbon-budgeting-situation-is-far-more-pressing-than-the-epa-projections-report-has-indicated (2023).
40. Teagasc. Executive Summary: Marginal Abatement Cost Curve 2023. (2023).
41. Collins, W. J. *et al.* Increased importance of methane reduction for a 1.5 degree target. *Environ. Res. Lett.* **13**, 054003 (2018).
42. Nzotungicimpaye, C.-M., MacIsaac, A. J. & Zickfeld, K. Delaying methane mitigation increases the risk of breaching the 2 °C warming limit. *Commun Earth Environ* **4**, 1–8 (2023).
43. McMullin, B. & Price, P. *Synthesis of Literature and Preliminary Modelling Relevant to Society-Wide Scenarios for Effective Climate Change Mitigation in Ireland 2016-CCRP-MS.36*. https://www.epa.ie/publications/research/climate-change/Research_Report_352.pdf (2020).

44. Price, P. R., Mcmullin, B. & O'Dochartaigh, A. Methane mitigation achievement, including agriculture, is crucial to limiting dependence on uncertain carbon dioxide removal in national carbon budgeting equitably meeting Paris goals [As Submitted to Neg CO2 conf 2022]. in 22 (2022).
45. Gibbons, J. Green in name, but not in nature | ThinkOrSwim (the Climatechange.ie Blog). https://www.thinkorswim.ie/green-in-name-but-not-in-nature/ (2020).
46. DAFF. *Food Harvest 2020: A Vision for Irish Agri-Food and Fisheries*. https://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodharvest2020/2020FoodHarvestEng240810.pdf (2010).
47. DAFM. *Food Wise 2025*. https://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/report/FoodWise2025.pdf (2015).
48. DAFM. *Food Vision 2030*. https://assets.gov.ie/179717/910771f6-05ed-43f1-b8ce-52ef7c602710.pdf (2021).
49. Donnison, C. L. & Murphy-Bokern, D. Are climate neutrality claims in the livestock sector too good to be true? *Environ. Res. Lett.* (2024).
50. Price, P. R. *Agricultural Methane in Irish Climate Action: Greenhouse Gas Metrics, Methane Mitigation, and Related Quantification of Livestock Numbers*. (2023).
51. DAFM. *Ag Climatise: A Roadmap towards Climate Neutrality*. https://assets.gov.ie/100931/7c8b812c-d857-4f39-96b9-1e7f134ba896.pdf (2020).
52. Price, P. R., McMullin, B. & O'Dochartaigh, A. Methane mitigation achievement, including agriculture, is crucial to limiting dependence on uncertain CDR in national carbon budgeting equitably meeting Paris goals [Conference abstract and presentation]. (2022) doi:10.5281/zenodo.7534820.
53. Körner, C. Slow in, Rapid out—Carbon Flux Studies and Kyoto Targets. *Science* **300**, 1242–1243 (2003).
54. Mackey, B. *et al.* Untangling the confusion around land carbon science and climate change mitigation policy. *Nature Climate Change* **3**, 552–557 (2013).
55. Appunn, K. Carbon farming explained: the pros, the cons and the EU's plans. *Clean Energy Wire* https://www.cleanenergywire.org/factsheets/carbon-farming-explained-pros-cons-and-eus-plans (2022).
56. Thamo, T. & Pannell, D. J. Challenges in developing effective policy for soil carbon sequestration: perspectives on additionality, leakage, and permanence. *Climate Policy* **16**, 973–992 (2016).
57. McLaren, D. Quantifying the potential scale of mitigation deterrence from greenhouse gas removal techniques. *Climatic Change* **162**, 2411–2428 (2020).
58. Sargent, N. Irish tillage being squeezed out in favour of renting land to dairy farmers. http://www.noteworthy.ie/against-the-grain-pt1-6185038-Oct2023/ (2023).
59. EEA. Emissions of key air pollutants continue to decline across the EU, reducing ammonia poses biggest challenge. *European Environment Agency* https://www.eea.europa.eu/en/newsroom/news/emissions-of-key-air-pollutants (2023).
60. CSO. Fossil Fuel and Similar Subsidies 2012-2016. (2018).
61. European Court of Auditors. *Common Agricultural Policy and Climate: Half of EU Climate Spending but Farm Emissions Are Not Decreasing*. https://www.eca.europa.eu/Lists/ECADocuments/SR21_16/SR_CAP-and-Climate_EN.pdf (2021).
62. Kenny, T., Cronin, M. & Sage, C. A retrospective public health analysis of the Republic of Ireland's Food Harvest 2020 strategy: absence, avoidance and business as usual. *Critical Public Health* **28**, 94–105 (2018).
63. EEA. Opinion of the EEA Scientific Committee on Greenhouse Gas Accounting in Relation to Bioenergy. (2011).
64. EASAC. *Multi-Functionality and Sustainability in the European Union's Forests*. (European Academies' Science Advisory Council, 2017).

65. EASAC. *The EU's Renewable Energy Ambitions: Bioenergy from Forests Is Not Always Carbon Neutral - and May Even Increase the EU's Carbon Emissions (Press Release)*. https://easac.eu/press-releases/details/the-eus-renewable-energy-ambitions-bioenergy-from-forests-is-not-always-carbon-neutral-and-may-e/ (2018).
66. SEAI. Bioenergy and SustainabilityWood. *Sustainable Energy Authority Of Ireland* https://www.seai.ie/blog/bioenergy/index.xml (2019).
67. SEAI. *Sustainable Bioenergy for Heat: Spatial Assessment of Resources and Evaluation of Costs and Greenhouse Gas Impacts*. https://www.seai.ie/publications/Sustainable-Bioenergy-for-Heat.pdf (2022).
68. Brack, D., Hewitt, J. & Marchand, T. M. *Woody Biomass for Power and Heat: Demand and Supply in Selected EU Member States*. 97 (2017).
69. Stubenrauch, J. & Garske, B. Forest protection in the EU's renewable energy directive and nature conservation legislation in light of the climate and biodiversity crisis – Identifying legal shortcomings and solutions. *Forest Policy and Economics* **153**, 102996 (2023).
70. Daly, D. H., Matthews, A., McMullin, B. & Price, P. *The Role of Agriculture Emissions in Irish and Global Climate Mitigation Pathways*. 31 (2021).
71. Government of Ireland. Climate Action Plan 2023: Annex of Actions. (2023).
72. FeedbackEU. *The 35 Bcm Biomethane Target: At Best Unattainable, at Worst an Environmental Disaster*. https://feedbackeurope.org/briefing-biomethane-target/ (2023).
73. Environmental Pillar, Stop Climate Chaos, & Sustainable Water Network. *Towards a New Agricultural and Food Policy for Ireland Recommendations for Government*. https://assets.gov.ie/162850/7eb71aa4-8b17-4913-a011-b73e9dcc6178.pdf (2021).
74. O'Brien, A. 'Hangover' from high fertiliser prices persists - importers. *Agriland.ie* https://www.agriland.ie/farming-news/hangover-from-high-fertiliser-prices-persists-importers/ (2024).
75. Teagasc. Environment - Irish farmers achieve key 2030 nitrogen fertiliser reduction target. https://www.teagasc.ie/news--events/daily/environment/irish-farmers-achieve-key-2030-nitrogen-fertiliser-reduction-target.php (2023).
76. Beausang, C. Anearobic Digestion: Opening statement for the Joint Oireachtas Committee on Environment and Climate Action. (2022).
77. SEAI. *Low Carbon Gases for Heat*. https://www.seai.ie/publications/Low-Carbon-Gases-for-Heat.pdf (2022).
78. Bakkaloglu, S., Cooper, J. & Hawkes, A. Methane emissions along biomethane and biogas supply chains are underestimated. *One Earth* **5**, 724–736 (2022).
79. Haughey, E., Styles, D., Saunders, M., Coady, R. B. & Moran, J. *Land Use Review: Fluxes, Scenarios and Capacity: Synthesis Report*. https://www.epa.ie/publications/research/evidence-synthesis-reports/Evidence-Synthesis-Report-4.pdf (2023).
80. Dillon, P. Teagasc Opening Statement to the Joint Oireachtas Committee on Agriculture, Food and the Marine concerning Biomethane Renewable Gas, 4th May 2023. (2023).

Appendix 1: Additional detail on issues with bioenergy from anaerobic digestion

Major AD issues have not been sufficiently addressed or adequately reported by government and advisories, thereby enabling a poorly evidenced roll-out of AD biomethane production at scale, which is liable to have negative societal outcomes:

Three major problems for AD biomethane production at increased scale are described below:

1. **Enforced land use system limits on agricultural nutrient input and livestock production are crucial to AD development at scale.** Unless binding and declining national and catchment limits on nitrogen use or livestock production are enforced then there is a serious danger that policy to support AD could increase total chemical nitrogen use and monetises waste streams from livestock production, in effect further supporting nitrogen-intensive, high-GHG agriculture rather than reducing it.
    - A key system misunderstanding apparent in advisory reporting is a widely adopted, but incorrect, assumption that using the nitrogen-rich AD digestate co-produced in AD plants as a fertiliser can displace the system inputs of reactive nitrogen in chemical fertiliser (and animal feed). In fact, of course, all of the nitrogen in AD digestate comes from animal slurry or more solid feedstocks, including grass silage, and for these the total system quantities produced are highly dependent on total system nitrogen input. In other words, as the Oxford Martin *Grazed and Confused?* study noted for manure, digestate does not magically create nitrogen: system nitrogen imports are required to compensate for nitrogen losses. Even if multi-species swards, which include nitrogen-fixing clovers, are deployed at large scale in Ireland then it is these swards, not the AD digestate, that would displace some of the nitrogen-import requirement within an otherwise unchanged system.
2. **It is essential to monitor and address AD plants for: methane losses, nitrogen fertiliser use for AD-silage, and AD digestate usage. However, uncritical advisory reports have failed to assess the related biomethane negative issues or set out precautionary regulatory measures necessary to limit them.** Research shows that bioenergy using silage grass production and dairy slurry could all too easily result in *farm-level* perverse incentives that could minimise system-level benefits or even increase nitrogen use and GHG emissions.
    - Work at UCD by Beausang et al.[76] shows that the high silage (low slurry) feedstock for AD – as recommended by the SEAI Heat Study *Low Carbon Gases for Heat*[77] (using Teagasc modelling) – is very likely to be worse than using fossil "natural" gas and chemical nitrogen due to increased fugitive methane losses from AD plants, and higher ammonia losses, due to nitrogen fertiliser use in growing AD silage and using AD digestate.
    - As Beausang noted to the Oireachtas Committee[v], effective monitoring and reporting (MMV) is critical to ensuring that nitrogen inputs are limited and

[v] Beausang[76]: 'using high shares of grass silage may have negative environmental impacts. While this approach avoids competition with feed production, the results showed that this can lead to an increase in greenhouse gas emissions when higher proportions of grass silage are digested due to the additional fertiliser that is required. The impact arises from both the [grass] production of the [AD digestate] fertiliser itself and the [ammonia] emissions that are released when it is spread on land.'

methane leakage from AD plants is addressed immediately[w]; however, the importance of monitoring and addressing methane loss is given no prominence by SEAI or Teagasc reporting, nor is any precautionary government regulatory action planned.

- In fact, the AD climate impact of methane losses from high silage AD feedstocks is worse than the standard (GWP_{100} CO_2e) carbon accounting suggests. A warming analysis (GWP* CO2we)[3], using the mass methane data provided by Beausang et al.[76], combined with the high rates of methane leakage reported in field measurements of AD plants, shows that only uneconomic low-silage AD feedstocks (mostly slurry) are likely to be climate-beneficial relative to using "natural gas" (fossil methane). The high silage AD feedstock being advocated by Teagasc and SEAI is shown to be far worse than using fossil gas for the reported real-world AD methane leakage rates.
- A 2022 meta-analysis of 51 studies[78], mainly at EU agricultural AD plants, found 'lower direct methane emissions than the oil and natural-gas supply chain but much higher methane loss rates than the oil and natural-gas supply chain biogas supply chain'. The bioenergy methane losses are double that estimated by the International Energy Agency (IEA) with an average methane loss of 5.2% and high-end losses of 12.7%. Despite this field evidence, the recent Teagasc MACC[34] (p. 120) only applies a high-end rate of 2% methane leakage to AD biomethane production, finding that this halves the mitigation benefit; therefore applying the meta-analysis real-world values would likely more than cancel any AD mitigation benefit.
- **The negative issues confirmed by these scientific studies mean that assessments <u>should not</u> simplistically assume that bioenergy from grass land has a beneficial climate mitigation effect**, yet this misleading simplification is repeatedly advanced Irish advisory reporting, as in the SEAI Heat Study, the recent *Land Use Review*, Table 3.2 (S6)[79], and in Teagasc's unnuanced declaration to the Oireachtas Joint Committee on Agriculture that it is 'an organisation is fully committed to embracing biomethane'[80].

3. **Assessments must evaluate land use alternatives to silage-for-AD, including: more land-efficient energy from solar and wind, more food-efficient crop production on the better land, and/or favouring more carbon-efficient CO_2 removal by more biodiverse, permanent, native woodland through natural regrowth on lesser quality land.** Using a mix of these options, and applying them appropriately to each specific land area, it is entirely likely that a more advantageous overall societal outcome is possible than Although solar PV is evaluated toward energy

[w] Beausang[76]: 'As methane loss may be the largest contributor to the carbon footprint of biogas production it would be important that biogas plants in Ireland monitor, report and address methane losses.' [76]

production by the SEAI Heat Study, and forest carbon sequestration and storage is considered by Teagasc toward offsetting agricultural emissions, these alternatives to land uses for silage-AD are not considered in assessing AD biogas expansion. Similarly, the recent *Land Use Review*[79] does not consider the carbon, food, or energy opportunity costs foregone by the allocating land use to bioenergy crops or livestock agriculture.