

**AFBI SUBMISSION TO THE AERA COMMITTEE IN SUPPORT OF THE ORAL BRIEFING
ALIGNED WITH THE CLIMATE CHANGE BILL**

EXECUTIVE SUMMARY

The Agri-Food & Biosciences Institute (AFBI) is Northern Ireland's (NI) largest publically funded science and research organisation, which is aligned with the delivery of agri-food, veterinary, environmental and marine sciences. As a science based organisation, AFBI does not have the expertise to comment on the legal drafting of the Bill. However, our paper provides comment and a number of key considerations aligned with NI's agriculture and land use sectors contribution to addressing Climate Change.

Key points made include: -

- a) NI's climate and soil types are generally well suited to growing grass and converting this land use practice to a nutrient dense protein for human consumption, i.e., meat and milk.
- b) Due to NI's current economic model, and assuming this model is to be maintained and supported, (i.e., significant dependence on grass based livestock farming), achieving net zero carbon in NI over the coming 25-30 years will be very challenging using all current known solutions.
- c) Whilst a range of tools exist, and more are under development, to reduce emissions and increase carbon capture to levels associated with net zero carbon, based on current knowledge, a dramatic change to this economic model (including a reduction in livestock numbers) will very likely be needed as well as very significant investment in new solutions to further reduce emissions and capture carbon.
- d) Due to the transboundary nature of greenhouses gases (GHGs) it is also important to consider the global and national goal of net zero carbon, aligned with local targets. It could be argued that 'global net zero carbon' is of equal importance than a local goal to achieve the overriding objective of mitigating the impact of climate change. Indeed, where the overarching goal is to reach net zero carbon, which will be governed by national inventory accounting, there is risk that the ultimate goal of contributing positively to global net zero, will NOT be achieved due to the transboundary nature of GHGs.
- e) The need for collaboration within sectors, between sectors and between countries is essential to ensure the goal of a just transition on the pathway to a low carbon and/or net zero carbon status in NI.
- f) Healthy ecosystems are central to any adaptation policy and can help mitigate climate change impacts. There will be a range of symbiotic benefits in addressing soil, water and air quality as well as biodiversity and working towards a 'low carbon and/or net zero carbon' NI position. Separate measures will, however, also be required to fully address the quality of soil, water and biodiversity and there will be a range of unintended consequences. These have not yet been fully identified or scientifically quantified but will likely mostly affect rural communities due to the NI economic model noted above.
- g) Climate change challenges, including the reduction of GHG emissions, achieving 'net zero' and achieving improved soil, water and air quality are interlinked but often conflict with socio-economic objectives, policies and strategies

Contents

- 1.0 Climate Change Bill – AFBI’s Contribution to the Debate**
- 2.0 Considerations on the Climate Change Bill**
 - 2.1 The Bill**
 - 2.2 The Pathway to Deliver the Climate Action Plan**
 - 2.3 Carbon Budgets and Transboundary Considerations**
 - 2.4 Achieving a Low Carbon Position in Agriculture and LULUCF**
 - 2.5 Low Carbon Agriculture and LULUCF in NI**
 - 2.6 Soil Quality**
 - 2.7 Water Quality**
 - 2.8 Biodiversity**
- 3.0 Conclusions**

1.0 CLIMATE CHANGE BILL – AFBI’S CONTRIBUTION TO THE DEBATE

1.1 AFBI is delighted to be invited to present to the AERA Committee on the Climate Change Bill as sustainability, climate impact and environmental changes are at the heart of our science.

1.2 As a Non-Departmental Public Body of DAERA and NI’s largest provider of scientific services. AFBI’s science focuses on leading improvements in the agri-food industry, protecting animal, plant and human health and enhancing the natural and marine environment.

1.3 Using our extensive expertise and well established, highly instrumented research platforms our work delivers scientific research, statutory surveillance, analytical and diagnostic testing for a range of stakeholders.

1.4 Primarily, AFBI provides the scientific evidence base and research in support of DAERA’s policy development and implementation as well as for stakeholders across the agri-food industry and those involved in sustainable management of the environment.

1.5 Our letter of invitation asked for comment on the Bill’s ability to meet the four objectives noted below:

- Enable the mitigation of the impact of climate change in NI;
- Establish a legally binding net-zero carbon target for NI;
- Provide for the establishment and powers of a NI Climate Commissioner and NI Climate Office;
- Guarantee existing environmental and climate protections

1.6 As noted, AFBI is a science based organisation. As such AFBI will not be able to comment on the legal drafting of the Bill since we do not have the required legislative expertise to do so. For the same reason we have no comments to make on the establishment and powers of a NI Climate Commissioner and NI Climate Office. Furthermore, AFBI’s expertise is aligned with the Agriculture (h), Land Use, Land Use Change and Forestry (g) and waste (f) sectors noted in the Bill. As such we are not able to comment on the following sectors:

- (a) *energy production and supply (including for residential, public and district heating and cooling purposes);*
- (b) *transport (including shipping and aviation);*
- (c) *infrastructure (including infrastructure for electric vehicular transport);*
- (d) *business and industrial processes;*
- (e) *residential and public (in relation to buildings in these sectors);*
- (i) *the provision of financial assistance to any person in connection with— (i) the promotion of economic development in NI or any part of NI; and (ii) the provision of infrastructure, goods or services in NI or any part of NI;*

This paper outlines AFBI’s contribution to the debate on the Bill, based on our expertise and remit as a science based organisation.

2.0 CONSIDERATIONS ON THE CLIMATE CHANGE BILL

2.1 *The Bill*

- 2.1.1 Within the Climate Change Bill (the Bill), a Climate Action Plan is identified as a key driver to achieve the overriding climate objective of: 'The establishment in Northern Ireland of a net zero carbon, climate resilient and environmentally sustainable economy by the year 2045'.
- 2.1.2 Net GHGs emissions, water quality, soil quality and biodiversity are the four areas identified in the Bill, which will have a 'target' within the Climate Action Plan. The Bill also highlights that the annual reduction target for 'net GHGs' should be set in a way best calculated to achieve the overriding climate objective. The setting of all targets should also account for the impact on the environment, public health and well-being and on fiscal, economic and social circumstances specific to NI, as well as international law.
- 2.1.3 The climate action plan also proposes to include measures which relate to carbon budgets, nitrogen budgets, sectoral plans and programmes aligned with adaptation. These all represent important areas of focus; **however, improvements could be made to understand how these targets, measures and the action plan as a whole will interact with current legislation to improve water quality and biodiversity in particular, as well as current strategies to manage nitrogen budgets.**

2.2 *The Pathway to Deliver the Climate Action Plan*

- 2.2.1 In order to achieve the targets, an implementation pathway will be needed. As noted above, AFBI is a science based organisation and is well placed to contribute to the setting, reviewing and refining of this implementation pathway, aligned with the agriculture, Land Use Land Use Change and Forestry (LULUCF) and waste sectors.
- 2.2.2 Firstly, NI's climate and soil types are generally well suited to growing grass and converting this land use practice to a nutrient dense protein for human consumption, i.e., meat and milk.
- 2.2.3 However **due to NI's current economic model (i.e., significant dependence on grass based livestock farming), achieving net zero in NI over the coming 25-30 years will be very challenging using all current known solutions.**
- 2.2.4 **Whilst a range of tools exist, and more are under development (noted below) to reduce emissions and increase carbon capture, based on current knowledge, a dramatic change to this economic model (including a reduction in livestock numbers) will very likely be needed as well as significant investment in new solutions to further reduce emissions and capture carbon to meet a net zero carbon target.**
- 2.2.5 The Climate Change Committee (CCC) is the statutory advisory body for climate change in the UK who engage widely and strive to use the most up to date science. It **provides, as a competent authority, high level strategic advice on a net zero target as well as on potential pathways to achieve it for the UK.**
- 2.2.6 It is AFBI's understanding that they constantly evolve their strategic advice on the basis of changes to the science.
- 2.2.7 The following outlines a range of considerations when designing the pathway to a low carbon and/or a net zero carbon NI position with a specific focus on the agricultural and LULUCF sectors.

2.3 Carbon Budgets and Transboundary Considerations

- 2.3.1 The Bill refers to the need for proposals, especially aligned with carbon budget proposals, to take into account the transboundary element in NI. **It is not wholly clear what is meant, but it is noted that this could work in both a negative and positive manner against the goals of the Bill.**
- 2.3.2 Setting and working towards a net zero goal will be governed (based on current circumstances) with national inventory accounting of GHG emissions and carbon sequestration. Carbon budgets (assuming they are based on life cycle analysis calculators) could (and should) take into account emissions and sequestration from other countries. As noted above, **methane, nitrous oxide and carbon dioxide are global gases and in order to contribute to the global 'climate change' ambitions it is essential that global emissions of these gases are reduced and that global sequestration and/or capture of carbon is achieved. NI's contribution to 'net zero carbon' is important. However, due to the transboundary nature of GHGs, it is the collective achievement of net zero carbon at a global and national scale that is of equal importance.**
- 2.3.3 Whilst transboundary consideration is essential when considering contributions to a global goal of 'net zero', it is unclear as to how it will interface with the national calculation of GHG emissions and carbon capture and how the two can align to achieve the global, national and local objectives in parallel.
- 2.3.4 Furthermore, reducing emissions through addressing carbon budgets and making use of transboundary opportunities, could have an unintended consequence across the UK as a whole and/or globally as NI could reduce its emissions by producing less food, but at a national or global level that food may be replaced by producing products with higher GHG emissions.
- 2.3.5 One the other hand, the use of carbon budgets, recognising the transboundary nature of GHG's, could be used to utilise 'carbon credits' from elsewhere to offset NI's emissions. This would require collaboration with others nationally and internationally.
- 2.3.6 It is also important to highlight that whilst the underlying emission factors and calculations of emissions and carbon capture have some commonality between life cycle assessments (LCAs) and inventory accounting, this is not always the case.
- 2.3.7 There can be much variance in output when adopting different LCAs due to the use of a range of boundaries (e.g., cradle to gate) as well as metrics (e.g., emissions per kg meat produced, emissions per kg of protein produced, etc.).
- 2.3.8 **It is suggested that the ultimate goal is to ensure NI is contributing to the global and national position of net zero under a just transition for NI. Based on the potential for unintended consequences, care should be taken within the action plan to ensure this goal is met. To meet the goal will require collaboration within and between sectors in NI and between national and international partners.**
- 2.3.9 Lastly, the emission factors and calculations which contribute to the inventory, require constant reviewing and updating to incorporate new evidence and scientific findings. Such updating can create both positive and negative changes to the overall position. This constant reviewing and updating to align with state of the art knowledge, however, is essential to accurately establish, review and refine the implementation pathways and progress towards the targets set.

2.4 Achieving a Low Carbon Position in Agriculture and LULUCF

- 2.4.1 In 2020 the Centre of Innovation Excellence in Livestock (CIEL) produced a report entitled '[Net Zero Carbon & UK Livestock](#)'. This report was prepared by leading livestock, environmental and climate scientists from across the UK. AFBI chaired the consortium which formulated the report and contributed to it.
- 2.4.2 The report outlined the main challenges for the livestock sector to reach a low carbon/net zero carbon position due to the inherent nature of the biology involved in the production of meat, milk and eggs. **The consensus across the science base was that it would be extremely challenging for the UK livestock industry to reach a low carbon/net zero carbon position in its own right based on current solutions and adoption rates.**
- 2.4.3 This position was supported by work conducted by Scotland's Rural University and College (SRUC), which forecast that while the gross level of GHGs could be reduced in the agricultural sector and the gross level of carbon capture could be increased by 2050, due to other sectors such as transport and energy having a greater potential to reduce gross emissions, it is likely that the percentage contribution of GHGs from agriculture will increase due to the inherent challenges of decarbonising the food system. This analysis was based on using 'current available solutions' albeit at a high adoption rate and an assumption that livestock productivity would increase.
- 2.4.4 The CIEL consortium also concluded that very significant investment in new solutions to both reduce emissions and capture carbon as well as increase adoption, education provision and collaboration with other sectors and industries would be needed to strive towards a low carbon livestock sector.

2.5 Low Carbon Agriculture and LULUCF in NI

- 2.5.1 **In NI, assuming the economic model of NI is to be maintained and supported, achieving low carbon food production will involve a significant reduction in gross emissions (methane in particular as well as nitrous oxide and carbon dioxide) from the agriculture and LULUCF sectors, as well as a significant increase in carbon capture within both these sectors.**
- 2.5.2 LULUCF
- Currently the LULUCF sector in NI (and RoI) is a 'source' of emissions (i.e., it emits more GHGs (carbon dioxide and nitrous oxide) than it sequesters). In other parts of the UK the LULUCF sector is a 'sink' (i.e., it sequesters, or captures and stores, more carbon than it emits).
- 2.5.3 In 2022, the level of emissions reported from the LULUCF inventory will likely increase due to the inclusion of peatland habitats. Work is, however, ongoing to quantify and subsequently ensure representation within the LULUCF aligned with the carbon sequestered by hedgerows.
- 2.5.4 An analysis of water habitats (inland, coastal and marine) is also required to establish its contribution as either a source or sink of carbon. The subsequent inclusion of the aquatic environment will also require discussion with inventory committees when such scientific evidence is available.

2.5.5 Agriculture

Overall, methane gas, as a by-product of digestion from cattle and sheep, is the main contributor to emissions aligned with the agricultural sector, whilst for LULUCF conversion of grass to settlements or crops are key contributors to the emissions of GHGs, the practices of managing improved grassland and forestry are currently the main sinks of carbon.

2.5.6 AFBI is investigating a range of nutritional interventions to reduce methane from cattle and sheep, reduce waste within the agriculture system (e.g., improving efficiency of production and reducing ill health) and drive improved circularity of nutrients and nutrient use efficiency.

2.5.7 AFBI science supports the use of agro-forestry, forestry and hedgerow management to further increase carbon sequestration in NI. AFBI science has also highlighted an increased potential for improved grassland to sequester carbon and this evidence is currently being discussed with inventory committees.

2.5.8 **Whilst these will all contribute to reduce emissions, a reduction in livestock numbers is the obvious direct mitigation strategy. However, the impact of this on the NI economic model is unknown. Assuming the NI policy is to maintain and support the current NI economic model and optimise value from it, major investment will be needed to bring forward and adopt a substantial volume of additional practices which have significant impact to achieve a low carbon position for agriculture in NI. In addition to nature based solutions, it is likely these will include engineered technologies to capture carbon, further improve the circularity of nutrient flows and even harness carbon from the agri-food system to offset carbon dioxide emissions from other sectors such as transport and energy.**

2.5.9 Going forward, a thorough analysis, akin to that conducted by SRUC for Scotland and by Teagasc for Republic of Ireland is required as well as detailed integrated modelling to assess the economic, socio-economic and ecological impacts of mitigation and adaptation measures.

2.5.10 Furthermore, and as mentioned above, collaboration within and between the sectors locally and our national and international partners will be needed.

2.6 Soil Quality

2.6.1 Soil is a natural resource that sustains plant and animal productivity, maintains or enhances water and air quality, and supports human health and habitation.

2.6.2 Good soil health provides ecosystem benefits in that it will maximise the capacity for carbon sequestration within soils and above ground vegetation, be more resilient to extreme weather events, provide for a productive agriculture industry, encourages natural pest control and supports healthy natural ecosystems.

2.6.3 **Overall, our soil has a key role in managing carbon, phosphorus and nitrogen cycles within farming and land use.**

2.6.4 AFBI's science programme on soil quality focuses on sustainable soil management, soil biogeochemistry and crop nutrition aimed at enhancing soil health and optimising nutrient (phosphorus (P) and nitrogen (N)) efficiency in grass-based production systems.

- 2.6.5 Linked to this is also a resource programme focussing on agri-environmental technologies to transform 'wastes' of agri-food and municipal origin into products of value within the circular economy.
- 2.6.6 Soil quality integrates the physical, chemical, and biological components of soil and their interactions. Soil quality relates to soil functions and in agricultural terms nutrient management is key to address overall quality issues.
- 2.6.7 Going forward, the provision of accurate soil test and risk mapping information to farmers is a key first step to improve soil nutrient management. For example, in two small catchments 700 fields were first sampled in 2016 and maps of soil nutrient status and run off risk maps were provided to farmers. These fields were resampled in 2020 and the results show that soil nutrient management improved on 60% of farms.
- 2.6.8 This work represents a strong foundation for future transformational change with regard to climate smart farming in NI. This **transformational change which is closely aligned with the goals of the Bill could be facilitated significantly by expanding such a soil testing programme at field, farm, and catchment scales.**
- 2.6.9 The information gathered could then be used to develop strategies for improving the sustainability of the region-wide soil resource, agriculture and the natural rural environment with particular emphasis on vulnerable terrestrial and aquatic ecosystems.

2.7 Water Quality

- 2.7.1 Water quality, together with air quality, is one of the biggest environmental challenges in NI.
- 2.7.2 **A holistic approach to the management of water quality is needed and requires the protection and improvement of all aspects of the water environment, including rivers, lakes, estuaries, marine and coastal waters and groundwater.**
- 2.7.3 The most significant water quality issue is nutrient enrichment. There are a number of sources of nutrient enrichment of rivers and marine waters, such as wastewater and septic tanks, but the most significant cause remains the run-off of organic and chemical fertilisers from agricultural land.
- 2.7.4 Phosphorus (P) is the main nutrient causing water quality problems in NI freshwater system, whereas dissolve inorganic nitrogen (DIN) is the main nutrient causing water quality problems in our coastal marine environment.
- 2.7.5 In recent years, levels of P have increased and it is a cause for concern that there are signs of a sustained upward trend. In NI levels of winter DIN have been monitored since 2012 and this currently remains relatively stable.
- 2.7.6 AFBI's work on water quality monitoring and research follows a catchment based approach due to water quality mainly being effected by land use practices. AFBI's work highlighted the strong link between nutrient management on land and water quality.
- 2.7.7 Strategies for addressing diffuse nutrient loss must focus on improving soil nutrient management. The provision of accurate soil test and risk mapping information to farmers, i.e., nutrient management to improve soil quality, is also a key first step in addressing water quality issues.

- 2.7.8 This approach is already delivering results in the Upper Bann monitoring catchments and the Nutrient Action Programme has been implemented in NI to mitigate the loss of P from agriculture to waterbodies.
- 2.7.9 AFBI is conducting a number of monitoring and modelling studies that aim to evaluate the effectiveness of these regulations.
- 2.7.10 While improvements have been made in water quality across NI as a result of the improvement in farm nutrient management, AFBI recognises there are still significant challenges ahead if we are to achieve the targets of “good” status in the majority of water bodies.
- 2.7.11 **Key transformational programmes to address water quality issues will need to focus on manure management, not only on farm but also at regional scale.**
- 2.7.12 **The circular economy concept will also be key in delivering solutions. For example, slurry management research in AFBI has suggested that there are clear opportunities to valorise slurry in terms of energy recovery and importantly nutrient recovery.**
- 2.7.13 Whilst the work on these next generation technologies is underway, it is possible our surplus nutrients could provide economic returns in terms of contributing to the decarbonising of NI’s energy supply and valuable trading opportunities for recycled phosphorus.
- 2.7.14 AFBI has also been working on nature based solutions, specifically the use of willow, for protecting water quality from diffuse runoff.
- 2.7.15 **There is, however, no single solution to solving the water quality challenges we face in NI and success will only be achieved through a catchment based approach that considers all sectors contributing to nutrient enrichment as well as pollutants and contaminants.**

2.8 Biodiversity

- 2.8.1 Biodiversity is an indicator of health of our environment and ecosystems, which are central to any climate change adaptation and can help mitigate climate change impacts.
- 2.8.2 Protecting and restoring ecosystems can help us reduce the extent of climate change and cope with its impact. Healthy ecosystems will be more resilient to climate change and thus more able to maintain the supply of ecosystem services on which our prosperity and well-being depend.
- 2.8.3 Biodiversity issues, therefore, cannot be addressed without addressing climate change, but equally it is impossible to tackle climate change without addressing biodiversity.
- 2.8.4 **Protecting habitats such as forests and peatlands are important with these habitats being major stores of carbon. Protecting them can help to limit atmospheric GHG concentrations, but poorly managed peatlands, for example, can become a source of carbon emissions.**
- 2.8.5 The UK 25-year Environmental Plan focusses on restoring and enhancing the environment through measures such as increasing conservation or protected areas and habitats, which will require more effort and investment than protection.

3.0 CONCLUSIONS

- 3.1 To achieve net zero in NI, based on its current economic model, will be extremely challenging and even to strive for a low carbon status will require significant investment and behavioural change. Using current knowledge and available solutions, a reduction in livestock numbers is an obvious mitigation alongside significant investment to bring forward the development and adoption of solutions to both reduce emissions and increase carbon capture towards a net zero target.
- 3.2 However, due to the transboundary nature of GHG's, the achievement of global (and national) net zero carbon is of equal importance to achieving low carbon and/or net zero carbon locally. Whilst NI must contribute to the national and international efforts to achieve net zero carbon, utmost care needs to be taken to ensure a just transition as well as the avoidance of unintended consequences which would increase emissions from other food producing countries.
- 3.3 Healthy ecosystems are central to any adaptation policy and can help mitigate climate change impacts. There will be a range of symbiotic benefits in addressing soil, water and air quality as well as biodiversity and working towards a 'low carbon and/or net zero carbon' NI position. Separate measures will, however, also be required to fully address the quality of soil, water and biodiversity and there will be a range of unintended consequences. These have not yet been fully identified or scientifically quantified but will likely mostly affect rural communities, due to the NI economic model noted above.
- 3.4 Climate change challenges, including the reduction of greenhouse gas (GHG) emissions, achieving 'net zero' and achieving improved soil, water and air quality are interlinked but often conflict with socio-economic objectives, policies and strategies.
- 3.5 Going forward, further science is required to further inform budgets, measures and key actions within the pathways required. Science will also be required to review and refine the pathways most applicable for NI on an ongoing basis.
- 3.6 Overall to achieve long term objectives and ensure success, it is essential that the Bill allows for flexibility to enable the adoption of new evidence and knowledge from scientific research to update baselines, targets, evaluate measures and consider trade-offs through an outcome based approach.