Opening Statement,
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Opening Statement for the public session of the Joint Committee on Agriculture and the Marine on the subject of **Rewetting of peatlands and the impact on drainage for surrounding farmland**.

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Introduction

Peatlands are unique ecosystems in the context of Earth's carbon cycle as they are the largest and most concentrated global store of carbon of all terrestrial ecosystems, storing twice the amount of carbon contained in the forest biomass[1, 2]. In this regard, they play (and indeed have played) a hugely significant role in maintaining and regulating the Earth's climate, despite covering only 3% of the land surface.

In Ireland, peat soils cover approximately 1.46 million hectares or 21% of the land surface[3] and store approximately 2.3 billion tonnes of carbon[4]. The accumulation of this carbon has occurred over the last 10,000 years, as a consequence of permanently waterlogged conditions in the soil that prevent the complete decomposition of organic matter. Undrained peatlands are net carbon sinks[5, 6] as the amount of carbon dioxide (CO_2) sequestered from the atmosphere by the peatland is greater than the amount of methane emitted by the peatland, and the amount of carbon released into streams and rivers.

The vast majority of peatlands in Ireland (~85%) have been drained either for turf cutting, energy production, horticulture, agriculture, and forestry (Figure 1). In each case, the fundamental goal of drainage is to lower the water level within the soil to facilitate the movement of machinery across the peat (e.g., for peat extraction or farming activities), for the grazing of livestock, and the growth of plant species, such as agricultural grasses, and trees, which do not thrive under water saturated conditions.

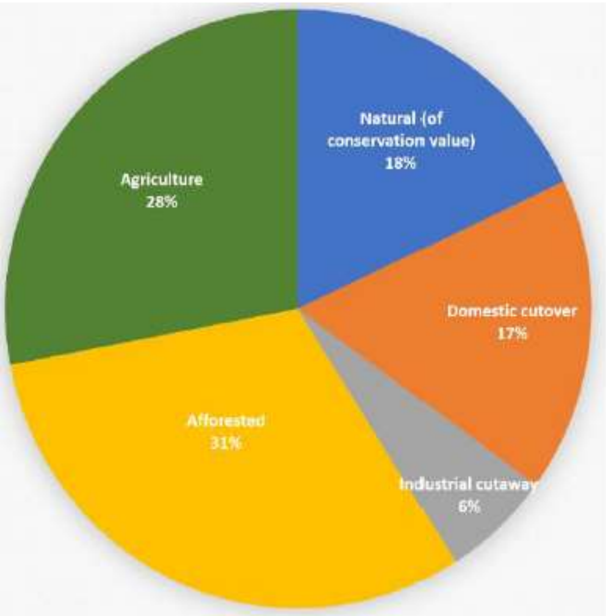

Figure 1: Estimated peatland area cover (%) in Ireland under major land use classifications.

Drainage and GHG emissions

Drainage results in considerable changes in many aspects of the peatland. For carbon dynamics, the lowering of the water level increases the oxygen content of the peat, which stimulates microbial decomposition of the organic matter (and the release of the carbon contained therein), with decomposition occurring 10,000 times faster in the presence of oxygen. Studies in Ireland and abroad have shown that drained peatlands are a net CO_2 source[7-10], emit less methane[10] than undrained sites, and release more carbon to adjacent water bodies than undrained sites[10].

<u>Grassland</u>

In Ireland's National Inventory Report (NIR) 2020, GHG emissions from the estimated 330,000 hectares of drained grassland on organic (peat) soils under the LULUCF sector are reported at 8.3 million tonnes CO_2-eq[11]. Moreover, recent work by Teagasc[12] indicates that the area of grassland on drained peat soils could be 450,000 hectares, which would suggest that emissions from this land use category may be currently underestimated by 3 million tonnesCO_2-eq.

<u>Peat extraction</u>

Industrial peat extraction sites (cutaways) are a persistent source of CO_2[7, 13] for as long as the drains and/or water pumping remain in operation. Work in Ireland and UK indicates that drained cutaway and cutover sites emit approximately 6 tonnes CO_2 per hectare every year[7, 14]. Moreover, while methane emissions may decrease from the main peat extraction areas, methane continues to be released from vegetated drainage ditches[10], and carbon loading on adjacent water bodies is significantly increased[15]. In NIR 2020, emissions from peat extraction areas are reported at 1.15 million tonnes CO_2-eq[11]. However, this is likely to be a gross underestimation as the areas impacted by domestic turf cutting are nominally estimated in the report at 400 hectares, due to the absence of high-resolution land use data.

<u>Forestry</u>

In NIR 2020, forestry on organic soils under LULUCF is reported as a sink of 1.88 million tonnes CO_2-eq on 450,000 hectares[11]. However, recent data suggest that the default soil emission factor used in the models may be unrealistic and that soil emissions from the forest stand may be much higher, in which case forestry on peat could switch from acting as a net CO_2 sink to a net CO_2 source[16].

Other environmental impacts

In addition to having a deleterious impact on climate forcing, peatland drainage also results in the release of aquatic organic carbon, nitrates, ammonium, loss of flood control and water storage capacity, and increased risk of fires. Recent research has also highlighted the presence of trihalomethanes (TTHMs), a potential carcinogen, in the waters located in peat catchments[17].

Rewetting of drained peatlands

Rewetting of peat soils has been suggested as an important climate change mitigation tool to reduce GHG emissions, to create suitable conditions for carbon sequestration, to stimulate biodiversity[18, 19] and to improve water quality. So how do we define rewetting?

The Inter-Governmental Panel on Climate Change Wetlands Supplement[20] describes it "*as the deliberate action of raising the water table on drained soils to re-establish water saturated conditions, for example, by blocking drainage ditches or disabling pumping facilities, and managing the water table so that it remains close to the surface*". Clearly, in this regard, rewetting does not equate to flooding.

Rewetting is achieved through a suite of management actions that are tailored to the site in question[21]. The principal method is to block the drains, which involves stopping/slowing the flow of water along the drain. This can be achieved through the use of peat dams, where are a specially adapted tracked digger excavates peat from an area near to the dam (known as a borrow pit) and places layer after layer of peat until it is above the ground surface, after which it is covered with a 'scraw' of vegetation[21]. Alternative dam materials include plastic sheets and wood, while coconut fibre logs (coir) have been used in some peatland sites to reduce overground lateral flow of the water. In some sites, a berm (peat barrier) is installed at the edge of the site to prevent water from leaving the site, while in others a compartmental approach is employed to hold rainfall on the site[22].

Peatland rewetting can have several objectives, such as restoration, which aims to establish a functioning peatland ecosystem, although rewetting can also allow other management practices, such as paludiculture (i.e., wet agriculture) to take place on the saturated peat soils[23].

In Ireland, peatland rewetting has mainly focused on cutaway and cutover sites, with a smaller amount of former forest lands also rewetted under various EU funded projects (e.g., LIFE projects). From a carbon and climate point of view, the aim is to establish a water level where GHG emissions are reduced, CO_2 sequestration resumes, and methane emissions are minimised. Studies have shown that the optimal water level to be 10–15cm below the soil surface[24] but it must be maintained at that level as much as possible throughout the year, but particularly during the growing season, to minimise soil emissions. In sites where GHGs have been monitored, CO_2 emissions are significantly reduced following rewetting, and in many instances the rewetted site can quickly become a CO_2 sink once more, in tandem with the re-establishment of suitable plant communities[14, 25-28]. However, a wide range of GHG values [26, 28, 29-34] have been reported for rewetted peatlands, largely driven by differences between climate zones (e.g. boreal, temperate and tropical) and peatland nutrient status[25]. Other factors such as time since rewetting, current vegetation composition and previous land use management are also likely to have a significant influence post-rewetting.

Rewetting and adjacent lands

My experience of working on Bord na Móna rewetted cutaway bogs over the last 20 years has been that for the majority of these sites, flooding of adjacent lands has not been an issue[35, 36], an experience in agreement with the community living around Abbeyleix bog, for example[37]. However, issues might exist for those areas around the Shannon where industrial extraction was previously facilitated by active pumping of drainage water, and where flooding (as opposed to rewetting) may be a problem when the pumps are switched off[35].

For cutover sites, rewetting of drained Special Area of Conservation (SAC) sites has been mainly carried out by NPWS, who have rewetted, or are in the process of rewetting, 50,000 hectares of raised bogs[38]. NPWS place considerable emphasis on developing site-specific drainage management plans that utilise aerial imagery, ground surveys and hydrological modelling/monitoring[21], they actively engage with landowners/farmers, and provide compensation when required[21, 39]. To ensure that the water remains on the target area at all rewetted raised bog sites, the marginal drain is generally retained, although it can be blocked if the adjacent landowner is in agreement. Technical implementations include the construction of berms or bunds (peat barriers) to hold water back, while in some sites the installation of outfalls and weirs even permit a degree of control of the water level on the site.

The momentum for peatland rewetting is clearly increasing. The Peatlands Climate Action Scheme, launched in November 2020, initially targets 33,000 hectares for rewetting in over 80 Bord na Móna bogs. Under the Department of Agriculture, Food and the Marine *Ag Climatise Roadmap*, released in December 2020, at least 40,000 hectares of drained grassland on peat soils have been targeted for rewetting (referred to as reduced management intensity in the report). Rewetting of these soils is interesting as it has not been widely implemented in this country, although it has been carried out in other jurisdictions[40, 41]. In contrast to cutover and cutaway sites where there is an emphasis on restoration to a functioning peatland ecosystem, with a desire to bring back characteristic peatland flora and fauna, rewetting of drained grassland sites offers the opportunity to solely target a reduction in GHG emissions. To date, only one study in Ireland[28] has evaluated the potential for GHG emission reductions in this land use category, and showed that CO_2 sequestration and minimal methane emissions could be achieved even at water levels down to 25cm depth. The *Ag Climatise Roadmap* also identifies the requirement to identify the drainage status of this land use category to reduce carbon losses through water table management. This is critical to accurately determine (a) the area of drained soils, (b) the differentiation between deep drained and shallow drained soils, (c) nutrient status, as GHG emissions from drained nutrient rich fen peats are considerably higher than emissions from drained nutrient poor peats, and (d) the area of rewetted soils, to ensure that Ireland can avail of GHG emission reductions in future National Inventory reporting. A new Teagasc project will address some of the uncertainties associated with the rewetting of grasslands and enable Ireland to benefit from the 2018 EU Effort Sharing Regulation.

The experience of farmers, landowners and organisations, such as the Community Wetlands Forum, that will participate in the new European Innovation Partnerships (EIP) announced by Minister Hackett on February 12th 2021, will be highly informative, and will build on the outstanding work carried out by ongoing farmer-orientated projects, such as the Burren-Life, Pearl Mussel and Hen Harrier projects. These new EIP will provide an important platform to evaluate the potential of transitioning from current conventional practices to new “carbon farming” models.

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