Rialtas na hÉireann
Government of Ireland

A REVIEW OF THE USE OF PEAT IN THE HORTICULTURAL INDUSTRY

Key Issues Consultation Paper

Contents

A REVIEW OF THE USE OF PEAT IN THE HORTICULTURAL INDUSTRY

Rialtas na hÉireann
Government of Ireland

Key Issues Consultation Paper

Executive Summary

This purpose of this Issues Paper is to examine the use of peat moss in the horticultural industry in Ireland and the potential of using alternative materials. This arises from an action set out in the National Peatlands Strategy 2015.

Peat is used within horticulture principally as a growing medium both by amateur and professional gardeners, professional growers and by the mushroom industry.

Peatlands have been one of the most abiding features of the Irish landscape since the last Ice age and together with the remnants of primeval forests, they form our oldest surviving ecosystems and provide a range of benefits for plants, animals and humankind. As they grow, peatlands also slowly remove carbon from the atmosphere and store it in the form of peat.

Peatlands have been utilised for afforestation, agriculture, domestic and industrial turf-extraction and also commercial peat moss extraction. They have also been used for extensive and intensive grazing and for various types of infrastructural development.

Between 1997 and 2002, Ireland selected a total of 53 raised bog sites for designation as Special Areas of Conservation (SACs). 75 raised bog Natural Heritage Areas (NHAs) have also been designated under the Wildlife Acts to supplement this network. Ireland has also identified 50 areas as SACs for the protection of blanket bog. A further 73 sites containing blanket bog habitat have been designated as NHAs.[1]

The Irish horticultural industry makes a very significant contribution to Irish gross agricultural output with a farm gate value of €437 million in 2018. An estimated 6,600 were employed full time in primary production activity with a further 11,000 employed in value added and downstream businesses.

Peat has many properties that make it a favourable and flexible material that can be adapted to grow plants and produce mushrooms. Within the commercial horticulture sector, peat is used within the mushroom, amenity and soft fruit sectors. Producers within these sectors have been exploring ways to reduce peat usage, through and embracing peat diluting material such as bark/wood fibre and coir in their growing medium and exploring ways to reuse peat through the circular economy.

This Key Issues Consultation Paper has been produced under the auspices of a working group comprised of representatives of the Departments of Agriculture, Food and the Marine, Communications, Climate Action and Environment, Culture, Heritage and the Gaeltacht and

[1] For further information on this topic please see Appendix 3.

the Environmental Protection Agency. Submissions on this paper and on any other issue considered relevant to the review of the use of peat in the horticultural industry are now invited.

1. Introduction

The purpose of this Issues Paper is to examine the value of using peat moss in the horticultural industry in Ireland, arising from an action set out in the National Peatlands Strategy 2015[2], the effect on local employment where peat moss is currently extracted and the potential effect of using an alternative material in terms of potential loss to the local economy, local business, potential alternative employment, and the potential improvement of maintaining bog habitats rather than harvesting them for peat.

Peatlands have been one of the most abiding features of the Irish landscape since the last Ice age and together with the remnants of primeval forests, they form our oldest surviving ecosystems and provide a range of benefits for plants, animals and humankind. Irish peatlands are the remnants of this country's great areas of wilderness, hovering between land and water, providing unusual habitats for their unique and specialist flora and fauna. They cover a large area of the land surface, occurring as raised bogs, blanket bogs and fens and form distinctive landscapes in many parts of the country.[3]

[2] Action 5 of the National Peatlands Strategy 2015 www.npws.ie – A review of the use of peat in the horticultural industry will be undertaken.

[3] BOGLAND: Sustainable Management of Peatlands in Ireland - PROTOCOL DOCUMENT - Prepared for the Environmental Protection Agency by University College Dublin - Authors: Florence Renou-Wilson, Tom Bolger, Craig Bullock, Frank Convery, Jim Curry, Shane Ward, David Wilson and Christoph Müller.

Peatlands provide a wide range of services that benefit humankind, some are well known and more are less obvious. The obvious benefits include the economic value to rural areas, for example employment and fuel, but the less obvious benefits include their key biodiversity value and their provision of a range of ecosystem services.[4] Peatlands are considered among the most important ecosystems of the world because of their huge carbon stores and their ability, when growing, to capture carbon and thus to help regulate climate. Peatlands also provide significant benefits related to water filtration and regulation of water supply and provide amenities that can improve the welfare and wellbeing of local communities and visitors. [5]

As they develop, peatlands slowly remove carbon from the atmosphere and store it in the form of peat. By absorbing the carbon dioxide from the atmosphere over long periods and by emitting other greenhouse gases such as methane, natural bogs affect and regulate global climate. Over the centuries peatlands have been naturally "cooling" the atmosphere, the opposite to human-induced "warming" caused by the emission of carbon dioxide and other 'greenhouse gases' into the atmosphere. Intact natural peatlands act as natural climate regulators. [6]

2. The changing view of Irish Peatlands

Peatlands have been drained for afforestation, agriculture, domestic and industrial turf-extraction and also commercial peat moss extraction. They have also been used for extensive and intensive grazing and for various types of infrastructural development, such as wind farms. In the 20th century large-scale peat production on raised and blanket bogs was undertaken by Bórd na Móna, which was established by the State for that purpose and which is now focused mainly on the drained, raised bogs of the Irish midlands. These activities continue to contribute significantly to the local economy by supporting employment both directly and indirectly as well as providing a secure source of indigenous energy, albeit with a substantial State subsidy. Many Irish peatlands were also drained and reclaimed for agricultural use and forestry. More recently, there has been a growing awareness and appreciation amongst policy makers, semi-state bodies, and the general public of the other values of functioning bogs and the benefits that they provide.

[4] For further information on this topic please see Appendix 1.
[5] National Peatlands Strategy 2015.
[6] National Peatlands Strategy 2015.

The National Peatlands Strategy 2015 provides a long-term framework within which all of the peatlands within the State can be managed responsibly in order to optimise their environmental, economic and social contribution to the well-being of this and future generations. The responsible management of peatlands will optimise the contribution of different uses to current and future human wellbeing, taking account of the economic, social and environmental services that peatlands provide. This will facilitate an increased focus on the value and costs of alternative uses. Agriculture, forestry, peat extraction and commercial development should be undertaken in a manner that minimises environmental damage, realises opportunities regarding environmental protection and enhancement, and contributes to the State meeting its objectives and obligations relating to air, climate, water, nature and the environment.

Protected Peatlands in Ireland

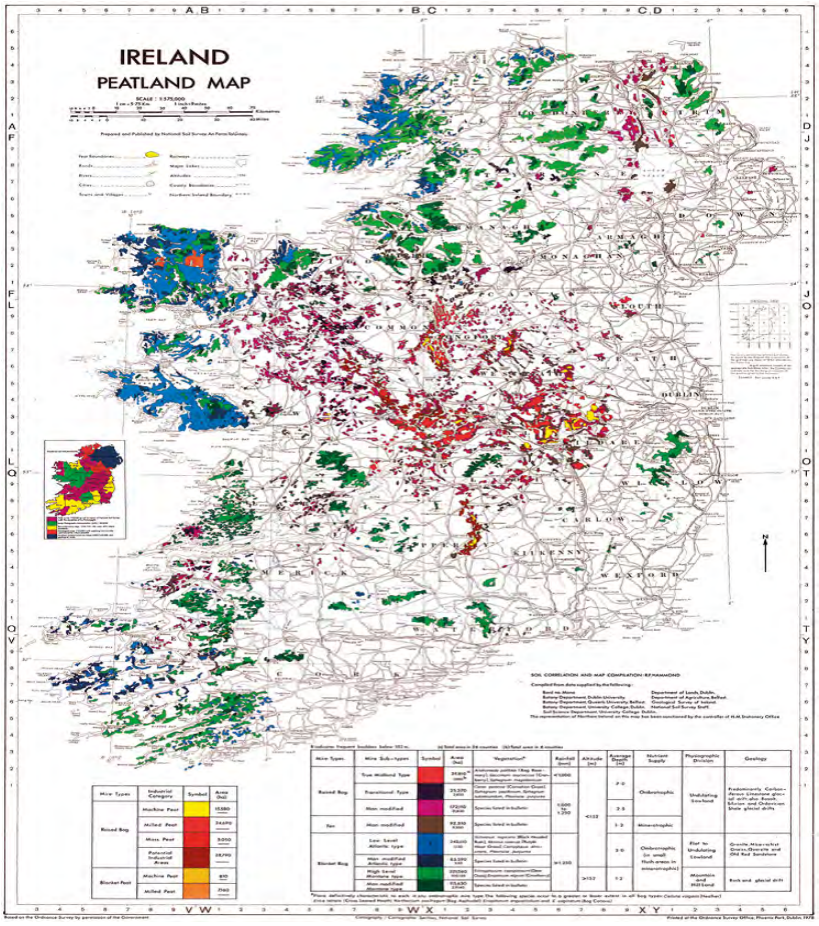
Peat soils cover around 21% of the national land area. The original area of raised bogs in the State was approximately 311,000 ha and the original area of blanket bogs was approximately 774,000 ha (Hammond 1979). Fens were once common in Ireland but they have all been reclaimed except for some 20,000 ha of conservation importance (Foss, P. (2007)). It has been estimated that only 10% of the original raised bog, and 28% of the original blanket bog, resources are deemed suitable for conservation. The remainder of the peatland areas have been managed to various extents.[7]

Distribution of the main land use categories of peatlands. (National Peatlands Strategy 2015 – Pg 5)

Natural Peatlands	269,270ha[8]
Cutover Peatlands(affected by domestic turf cutting)	612,380ha[9]
Afforested Peatland	300,000ha[10]

[7] National Peatlands Strategy 2015.
[8] Malone S. and O'Connell C. 2009. Ireland's Peatland Conservation Action Plan 2020 – Halting the Loss of Biodiversity. Irish Peatland Conservation Council, Lullymore.
[9] Ditto.

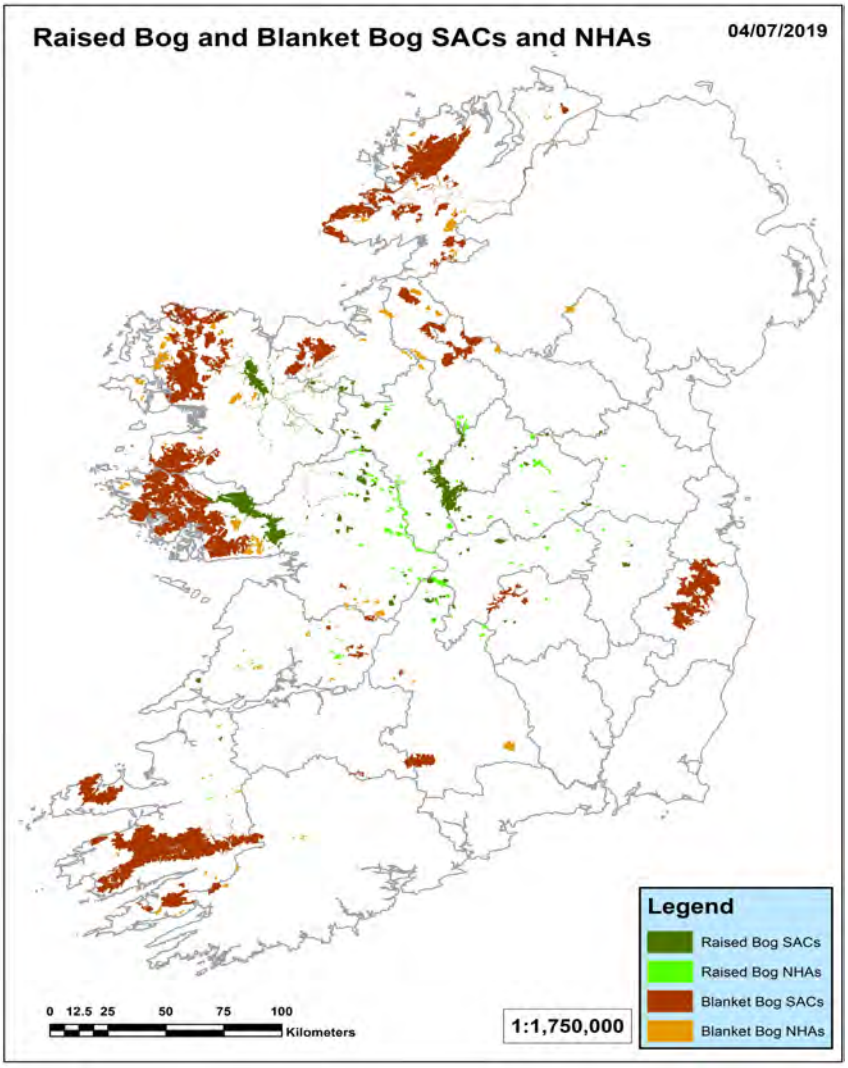
Farmed Peatland(grassland)	295,000ha[11]
Industrial cutaway peatlands	70,000ha[12]
Rehabilitated cutaway	18,000[13]



Natura 2000 is the centrepiece of EU nature and biodiversity policy. It is an EU-wide network of nature protection areas. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SACs) (also referred to as Sites of Community Importance or SCIs in the EU context) designated by Member States under the 1992 Habitats Directive and Special Protection Areas (SPAs) which are classified under the 1979 Birds Directive. The establishment of this network of protected areas also fulfils a Community obligation under the UN Convention on Biological Diversity.

[10] Black K., O'Brien P., Redmond J., Barett F. & Twomey M. 2008. The extent of recent peatland afforestation in Ireland. Irish Forestry 65 (1&2): 71-81.
[11] 7 CRF Table 5.C, National Inventory Report 2007-2009 (Environmental Protection Agency).
[12] 57,000 ha (including hard surfaces and fringes) belongs to Bord na Móna and the remainder is an estimate of the area that is cutaway by private companies extracting peat mainly for horticulture.
[13] Figures provided by Bord na Móna, composed mainly of rewetting cutaway but also afforested as well as for cultural or other commercial users.

Irish peatlands contain rare and threatened habitats and species which are in danger of disappearance. Ireland has undertaken to protect these habitats and species, through selecting areas as Special Areas of Conservation, Natural Heritage Areas and Special Protection Areas.



3. Use of Peat in Horticulture

Peat is used principally as a growing medium within horticulture by amateur and professional gardeners, professional growers and by the mushroom industry. Within the commercial horticulture sector peat is used by mushroom producers, containerised nursery stock producers and soft fruit producers. Peat has many properties that make it an ideal and favourable material that can be adapted to grow plants and produce mushrooms.

Peat is also used in the pursuit of gardening by consumers and amateur gardeners, where it is also used as a growing medium to raise and grow on ornamental and edible plants in pots, containers and hanging baskets as well as its use as a soil conditioner.

Bord na Móna is the largest producer of horticultural peat in Ireland with six other medium sized companies: Bulrush, Clover, Erin Peat, Harte Peat, Klasmann-Deilmann Ireland and Westland. There are up to 30 small producers as well as small semi-agricultural producers that supply both fuel sod peat as well as sod and milled horticultural peat (National Peatlands Strategy 2015).

Large scale industrial and agricultural activities are licensed by the Environmental Protection Agency (EPA) under Integrated Pollution Control (IPC) licensing. IPC licenses aim to prevent or reduce emissions to air, water and land, reduce waste and use energy/resources efficiently. Under IPC licensing a restoration plan must be drawn up and implemented for the industrial peat extraction site. At present Bord na Móna is the only moss peat company in Ireland which holds an IPC license.

4. The importance of Horticulture to the economy

Peat Exports[14]		
Country	**Year**	**Tonnes**
Great Britain and Northern Ireland	2018	422,672
Great Britain and Northern Ireland	Jan to April 2019	190,212
European Union Excluding GB and NI	2018	277,587
European Union Excluding GB and NI	Jan to April 2019	118,264
All other countries	2018	120,889
All other countries	Jan to April 2019	122

In 2018 peat exports from Ireland amounted to 422,672t to Great Britain and Northern Ireland, the rest of the EU 277,587t and to all other countries 120,889.

The Irish commercial horticultural industry makes a very significant contribution to the Irish gross agricultural output with a farm gate value of €437 million in 2018, which is the 4th highest sector in terms of gross agricultural commodity output value – only Beef, Dairy and Pigs are larger. Within the industry an estimated 6,600 were employed full time in primary production activity with a further 11,000 employed in value added and downstream businesses (not including the wholesale trade) with an employment value of €497m (Bord Bia "Labour Review of Horticulture in Ireland 2016" prepared by Agenda Consulting Ltd).

Of the total industry output of €437m, the output value for the sectors that use peat as an input are, Mushrooms €117m, Protected Fruit €38m, Protected Vegetables €29m, Nursery Stock €36m and Protected Ornamental Crops €19m. Two of these sectors are important sources of foreign revenue, where 90% (€105m) of Irish mushroom production is exported and €7.3 million of nursery stock are exported, mainly to the UK and Northern Ireland.

[14] Figures obtained from the CSO July 2019.

Output	**€m**
Mushrooms	117
Protected Fruit[15]	38
Protected Vegetables	29
Nursery Stock	36
Protected Ornamental Crops	19
Total Output	**437**

It is estimated that approximately 50% of the total industry output of €437m is dependent on peat as a growing medium.

At retail level, consumers spend an estimated €795 million on products such as cut flowers, outdoor and indoor plants, garden products and landscaping (Bord Bia, "Survey on the amenity market 2018" by Ipsos MRBI).

5. Sectors reducing their peat use

Many alternatives to peat have been evaluated and incorporated into growing media in recent years, such as bark (pine and spruce/larch mixes), wood fibre, coir and specifically selected composted green wastes, but for many commercial growers, peat remains the raw material of choice. However, there has been considerable success in using some of these alternatives as peat diluting material within growing media within the horticultural industry.[16]

The principal users of peat in the commercial horticultural industry in Ireland are the mushroom, amenity, and soft fruit sectors. These sectors are focused on proactively reducing their peat usage. In the nursery stock and soft fruit sectors, peat usage has been reducing where these sectors have embraced the use of peat diluents such as bark/wood fibre and coir in their growing medium.

In the mushroom industry the level of peat in the growing media represents 15% of the total mushroom growing substrate. The remaining 75% is made up of wheaten straw, poultry manure, gypsum and water. Peat is used as a "casing" material, which is placed on top of the growing substrate to hold in moisture. There are ongoing efforts within the industry looking

[15] Protected from birds.

[16] Examples of research related to new growing medium - EPA Strive Programme 2007–2013 - Published by the Environmental Protection Agency, Ireland**.** UK Agriculture and Horticulture Development Board - Sustainable resource use in horticulture: a systems approach to delivering high quality plants grown in sustainable substrates, with efficient water use and novel nutrient sources. PhD Project: "Can we use soil microbes to help produce novel, sustainable growing media?" (Royal Holloway, 2013 – 2017). PhD Project: "Developing non-peat growing media with microbial amendment" (Royal Holloway, 2017 – 2021).

at alternatives to include the possible recycling of casing either for further mushroom growing or for other plant cultivation.

Peat free products are a viable alternative for use by consumers and amateur gardeners, with peat free products currently available on the retail market.

The Irish Peatlands Conservation Council (IPCC) have been campaigning together with NGOs in the UK Peatlands Campaign Consortium to promote the recycling of organic waste and the use of peat free products through an outreach education programme entitled "Growing Wiser Wildlife Gardening". Its campaign, targeted at gardeners and community groups, has motivated them to set up individual and community based composting schemes.

Other countries have outlined strategies to encourage alternatives. There are benefits to the use of non-peat horticultural growing media in the retail market. The use of sustainable environmentally-friendly compost could be promoted further and potential may exist to fill the growing demand for such a product. While there is not at present a technically, environmentally suitable alternative material that could replace peat in professional horticultural crop production, the opportunity exists for Ireland to exploit this growing market (National Peatlands Strategy 2015).

6. Properties of Peat Moss versus Compost or Green Waste

Peat moss has a uniform composition. Composts often have variable composition, especially among sources. This is an important consideration when buying composts. Composts also may contain contaminants, depending on what was added.

Peat moss doesn't compact, so can last for years in soils, providing good aeration and water holding. Composts often compact, so should be added yearly to soil. Since composts lose their nutritional value over time as well, yearly replenishment helps here too.

Both peat moss and composts hold water, although peat moss tends to be better. This trait is important in sandy or rocky soils that tend to dry out quickly.

Peat can be much less costly than its substitutes. However, peat moss may be more expensive, especially if there is a local source of compost, ability to buy in bulk, or home made compost.

Peat moss has a low nutrient content, while compost is richer. The nutritional value of compost often comes from its effect on soils and the soil microorganisms. Peat moss helps the soil hold nutrients by increasing what is called the CEC or "cation exchange capacity."

Peat moss has a low pH, so if a lot is used, it is recommended that lime be added. Plants that do well in acidic soils, termed "ericaceous" such as blueberries, benefit from peat moss. Compost usually has a neutral (pH 7) or slightly alkaline soil reaction.

Peat moss is hard to wet initially and to re-wet once it dries out. Composts vary, depending on source, on how easy they are to re-wet.

Peat moss contains few microorganisms. Composts are rich in microorganisms. Most of these are beneficial, improving soils in many ways, from aeration to nutrition.

Peat moss contains no weed seeds. Good compost "shouldn't" contain weed seeds if it has been produced properly-- at high enough temperatures in the compost pile to kill weed seeds, covered to prevent seeds from blowing in and not made from weedy plants.

Peat moss isn't generally used as a mulch, while composts are often used as a mulch side-dressed around plants. Unless used thickly, however, composts won't suppress many perennial weeds. If peat moss is used as a mulch, it may actually dry out soils by absorbing water from them. Or, when dry, it may blow off the surface.

7. Disadvantages of Peat Use in Horticulture

a) Peat 'grows' or forms in living peatland habitats, at an exceedingly slow rate, of only one millimetre per year in a natural untouched peatland[17].

b) Peat used in growing media decomposes over time and hence releases its stored carbon to the atmosphere.

c) Once peat is extracted from a bog it cannot be replaced and restoring peat-accumulating conditions is difficult and expensive.

d) Peat extraction results in the loss of many of the multiple ecosystems services and benefits provided by a living/functioning/peat-forming bog including climate, air, soil, water, biodiversity (with food, fibre, medical, art, environmental monitoring (pollen and macrofossils), and cultural benefits (including archaeological artefact preservation). For example, the release of carbon from the extracted peat store and the loss of the carbon capturing service formerly provided by the living bog.

e) Continued use of peat moss as growing media may reduce the incentives for a greater research effort to be put towards investigation of environmentally sustainable growing media.

8. Peat-free growing substrates and difficulties in usage

Materials such as coir, green compost, composted pine bark and wood fibre are all widely used in growing media mixes. All have different properties in terms of water retention, water distribution and nutrient provision. When mixed together, as a product, this complexity is often compounded and chemical and physical properties can differ from mix to mix. This variability in properties could also offer potential benefits to growers, assuming growers can adapt their management practices with water use and nutrient savings potentially feasible, in turn improving the sustainability of production.

[17] Peat in horticulture and conservation: the UK response to a changing world
P.D. Alexander, N.C. Bragg, R. Meade, G. Padelopoulos and O. Watts.

There are several other organic materials that could be considered for adding to gardens or landscapes for various purposes. These include mulches such as bark or straw, (weed free, not hay), green manures or cover crops, manures, and paper.

The Royal Horticultural Society (RHS) is demonstrating what's possible; its gardens are largely peat-free and it is committed to reducing peat use, wherever practicable. However, this needs to be balanced against the commercial reality faced by professional growers in the production of ornamental and edible crop production.

There are difficulties for professional growers within the commercial horticulture sector in using peat-free substrates such as green waste, which is proving a variable replacement for peat in growing substrates. Such compost is reported to be generally unsuitable for use on its own, as it is too heavy and its nutrient content is too high and therefore must be blended with different media to achieve the appropriate nutrient level and structure. Another reported significant issue with green waste is its lack of uniformity as its raw material comes from different sources. It also needs to be managed differently, which has presented difficulties in terms of irrigation and effects on plant growth. Such variability is reported to cause significant problems in horticulture if it affects growth rates, nutrition, or plant quality, as successful container production of crops and plants rely on growing media to produce consistent quality plants and produce. In addition, the mushroom industry relies on peat as casing material, the main function of the casing layer is to aid with moisture retention in the substrate.

Most of the peat alternatives mentioned currently are being blended with peat. The use of such diluting material does provide a real and practical way towards reducing the horticultural industry's usage of peat. Further research is needed to identify and develop appropriate peat diluting material and possible alternatives as well as exploring opportunities for waste valorisation and re-use of peat coming from commercial horticulture.

9. Challenges in moving from the use of peat moss in the Horticultural Industry

The vast majority of peat extracted in Ireland for horticultural use is being exported to markets outside of Ireland and there is growing need to consider the long term viability and sustainability of this practice as other countries restrict their peat extraction and usage.

Education and community interaction would be of key importance to successfully managing any move from the use of peat in the Horticultural Industry. Land owners and the local communities would need to be engaged in what would be a disruption to the cultural practices that have developed through many generations. Clear communication and engagement between the public sector, industry and communities would be the lynchpin to determine success or failure. Encouraging growth in the area of conservation and, in particular, in the area of natural compost/green waste for use in both the domestic and industrial horticultural sector would be a key factor.

Engaging in publicity designed to inform the public about the downside of using peat moss as a growing medium would encourage the end user to choose sustainable alternatives – this in turn would encourage the producers to steer away from peat as a growing medium and encourage them to develop sustainable alternatives.

The challenges ahead are considerable. For example, in the UK, in 2011, a voluntary target for amateur gardeners to phase out the use of peat by 2020 was introduced and a final voluntary phase-out target of 2030 for professional growers of fruit, vegetables and plant. Yet, in the Department for Environment, Food and Rural Affairs' 25 Year Environment Plan, it is stated that "If by 2020 we have not seen sufficient movement to peat alternatives, we will look at introducing further measures."

10. Public Consultation Questions

A. What are your views on what more could be done to support and enable the switch to peat free horticulture at professional crop production level and consumer level?

B. What are your views on alternatives to the use of peat in the Horticultural Industry (from, for example, the perspective of the professional grower or consumer/amateur gardener)?

C. What are your views on whether Ireland should cut back or cease the export of peat for use outside of Ireland even if this would result in job losses in Ireland?

D. Do you consider that a working group should be established to advise on how best to overcome the barriers to reducing peat use in professional horticultural crop production and in the amateur horticultural market?

E. If you are in favour of the establishment of a working group, which stakeholder groups do you think should be represented on it?

F. How do you think that those involved in harvesting peat for horticulture could be compensated for any loss arising from a cessation of this activity (for example, on the basis of the profit loss arising or related to the value in ecosystem services retained/provided)?

G. How do you think that those involved in harvesting peat for horticulture could be guided towards alternative activities, for example, developing an environmentally suitable alternative material that could replace peat in professional horticultural crop production?

H. What do you consider the value of peatlands to be to (please score out of 100):

carbon storage	
nature conservation	
the provision of ecosystem services	
the economy	
social and cultural needs	
	100

I. In your opinion should the use of peat within (i) the amateur horticultural market and (ii) the professional horticultural industry be phased out over the next 3, 5, 10, 15 or 20 years and if so, how should this be done bearing in mind the potential job losses and the difficulties with alternative growing media?

J. Does more need to be done to educate and build consumer awareness of peat free products which are available at retail level?

Submissions may be made in relation to these questions and/or on any other issue considered relevant.

12. Next Steps in relation to this Key Issues Consultation Paper

Action 5 of the National Peatlands Strategy 2015 provides for a review of the use of peat in the horticultural industry. Arising from the First Progress Report to the Government on the Implementation of the National Peatlands Strategy, a working group comprised of representatives of relevant Government Departments and the Environmental Protection Agency, chaired by the Department of Culture Heritage and the Gaeltacht, has undertaken the first phase of this review. This Key Issues Consultation Paper has been produced under the auspices of the working group.

Submissions on this paper and on any other issue considered relevant to the review are now invited. Submissions must be made in writing, by post or email, and must be made by 20 January 2020 to National Peatlands Strategy Co-ordination Unit, Peatland Issues and Land Designation Section, National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, 90 King Street North, Smithfield, Dublin 7 D07 N7 CV or to peatinhorticulturereview@chg.gov.ie, (within three months of publication of the paper).

Please note that all submissions received will be published on the website of the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht, subject to Freedom of Information, Access to Information on the Environment, and data protection legislation.

APPENDIX 1 – PEATLANDS AND ECOSYSTEM SERVICES

Peatlands and Climate.

The vegetation of undamaged peatlands captures carbon from the atmosphere and stores it in the form of peat. When peatlands are drained or damaged, the peat oxidises and the carbon is released back to the atmosphere. Peat oxidation can be stopped or reduced through the restoration of peatlands involving hydrological management measures.

An assessment carried out within the Bogland project indicates that near-intact Irish peatlands may actively capture around 57,402 tonnes of carbon per year.

The role of peatlands in the carbon cycle is a key consideration in their future management. In this regard, the Government's Climate Action Plan 2019 (To Tackle Climate Breakdown) sets out a series of actions for the better management of peatlands and soils, the steps necessary for delivery and timelines and the lead stakeholder and other key stakeholders.

Peatland and Water

Peatland management influences the level, quantity and quality of water in the surrounding countryside. It can affect the water quality in rivers and lakes. The costs of treating drinking water may be reduced by peatland management. Peat siltation can impact water quality for human consumption and can damage the health of fish spawning grounds and the habitat quality of other aquatic species. Management choices can exacerbate or help prevent flooding of other lands and property in the same catchment.

Peat extraction for commercial or domestic purposes, and modification or drainage of peatlands for other uses such as forestry or agriculture, have been identified as significant pressures in 119 (8%) of water bodies that are at risk of not meeting their water quality objectives (River Basin Management Plan 2018-2021). This is the sixth most prevalent and significant pressure type in river water bodies. The main impacts on water quality and river habitat arising from peat extraction and drainage include the release of ammonium and fine-grained suspended sediments and physical alteration of aquatic habitats.

Peatlands and Biodiversity

Human societies have been built on biodiversity. We not only benefit from, but are dependent on, the diversity of organisms that we have learned to use for medicines, food, fibres, and other renewable resources. In addition, biodiversity has always been an integral part of the human experience and there are also many reasons to conserve it for its intrinsic value. What has been less recognised is that biodiversity also underlies human survival through its integral role in the ecosystem processes that lie at the core of the Earth's vital life support systems including its role in soil processes, global climate systems, processes that supply clean water, regulate flooding, maintain soil nutrient cycles, and which ecosystems if functioning provide

us with multiple essential services and benefits that also offer us security in the face of environmental change.

Peat Use and Environmental Sustainability

- Peat bogs are increasingly recognised as valuable habitats for wildlife and important stores of carbon, yet the Irish horticultural industry still relies heavily on peat.
- Environmentalists, Government and horticultural businesses in Ireland now recognise the environmental consequences of using peat in horticulture and the industry is turning increasingly to sustainable raw materials.
- This move also reflects increased societal awareness of sustainable production in general and more specifically the sustainable use of materials within horticulture itself.
- Under the title of 'Project 4', a working group of industry stakeholders in the UK is attempting to balance a robust sustainability assessment with a pragmatic and cost effective approach that has been re-titled "responsibly sourced growing media".[18]
- Whichever driver is pertinent, adapting to new growing media means revising the growers' approach to managing plant quality. This includes management of water and nutrition and both remain a challenge**.**

[18] See the website of the UK's Royal Horticultural Society.

APPENDIX 2 - PEATLAND SITES SELECTED FOR CONSERVATION

Between 1997 and 2002, Ireland selected a total of 53 raised bog sites for designation as Special Areas of Conservation (SACs). The raised bogs SACs contain most of the functioning remnants of the extensive raised bog complexes that once covered much of the midlands. What makes them so special is that they still have substantial areas of active raised bog, where the conditions are suitable for peat to continue to form and where the typical assemblages of peatland plant and animal communities can thrive. 75 raised bog Natural Heritage Areas (NHAs) have also been designated under the Wildlife Acts to supplement this network.

Ireland has also selected 50 sites as SACs for the protection of blanket bog. These SACs include lowland and mountain blanket bogs areas, the former being confined to the Atlantic seaboard and the latter being more widely distributed. A further 73 sites containing blanket bog habitat have been designated as NHAs.[19]

The National Raised Bog Special Areas of Conservation Management Plan 2017-2022, published in December 2017, sets out how the raised bog SACs are to be managed, conserved and restored and how the needs of turf cutters are to be addressed. The national restoration programme for Ireland's raised bog SACs and NHAs is contained within this Plan. It is intended to restore all designated raised bogs within 3 cycles, with the first cycle operating for the duration of this Management Plan.

[19] Blanket bog has a very restricted, but widespread global occurrence. This is due primarily to the relatively narrow range of climatic conditions in which the habitat can develop. The high rainfall and low temperature climatic conditions required for the formation of lowland blanket bogs are only found in limited locations around the globe, for example, Scotland and Norway in the northern hemisphere or New Zealand and Argentina in the southern hemisphere. Northwest Europe appears to contain some of the best developed areas of blanket bog in the world.

APPENDIX 3 – PEATLANDS RESEARCH

A number of topics of research were identified within the National Peatlands Strategy 2015 to be pursued (most of which were previously identified in the BOGLAND Report (Renou-Wilson et al. 2011)):

Topics:

1. **Investigation of the Greenhouse Gas emissions from peat soils under various management practices (to be used towards reporting on the Kyoto Protocol).**

   Several Environmental Protection Agency(EPA)-funded research projects in recent years have focused on this subject matter. For instance:

   A 3-year, EPA-funded project started in January 2016: Peatland Properties Influencing Greenhouse Gas Emissions and Removals (the AUGER Project). The main objective of this project is to carry out a nationwide survey to document the properties of various types of peatlands and peat soils, how they are affected by various management options and how this influences the Carbon and Greenhouse Gas dynamics of these systems, thereby quantifying the role of human activities on the climate footprint of Irish peatlands.

   Bord na Móna is developing and supporting new research into the carbon fluxes of peatlands at Lullymore, County Kildare. The Lullymore Carbon Flux Tower Project, led by Professor Ger Kiely (University College Cork) is examining the Carbon fluxes in a birch woodland on cutaway peat. Together with the comprehensive scientific literature on this research topic (Bonn *et al*., 2016) and other research projects, there is now a substantial amount of research output on this issue.

   EPA studies of greenhouse gas fluxes and vegetation on County Kerry, under the supervision of Professor Ger Kiely, Glencar blanket bog over a period of c. 10 years have yielded very valuable information on inter-annual variation of carbon sequestration functioning of a relatively undisturbed low to moderate altitude blanket bog. The bog proved to be a modest carbon sink in most years of the study but in years of drier weather conditions, greenhouse emissions exceeded amounts captured.

2. **Identification and review of practical peatland restoration projects and techniques to assess their effectiveness in terms of hydrology, carbon storage and sequestration potential and biodiversity at all levels.**

   The Network Monitoring Rewetted and Restored Peatlands/Organic Soils for Climate and Biodiversity Benefits (NEROS) Report (Report No.236), prepared by University College Dublin and funded by the Environmental Protection Agency, directly

addressed this research requirement. The research quantified both biodiversity and climate mitigation benefits (i.e. Greenhouse Gas fluxes) across three rewetted [restored] peatland land use categories: forestry; grassland and peat extraction sites (domestic cutover and industrial cutaway on nutrient poor and nutrient-rich soils).

The research project "Framework for the Restoration of Degraded Peatlands" led by Professor Laurence Gill (Trinity College Dublin) also directly examined this research topic. This research focused primarily on quantifying the hydrological conditions necessary to sustain the vegetation that permits peat formation and carbon sequestration at two raised bogs – Clara Bog and Abbeyleix Bog.

Two projects supported by the European Union's INTERREG VA Programme commenced in 2017. Collaborative Action for the Natura Network (CANN) is a conservation project that will protect endangered species and restore natural habitats on an Ireland and North of Ireland cross-border basis. The project team is led by Newry, Mourne and Down District Council[20]. It is focussed on blanket bog habitat and, upon completion, will improve the condition of protected habitats. In total, CANN will produce 7 species action plans and 25 conservation action plans covering over 25,000 ha of SAC land in the cross-border region. It also includes a proposal to rewet c. 50ha of drained blanket bog in the Cuilagh Mts,/Slieve Anierin SAC, Counties Cavan/Leitrim.

Co-operation across Borders for Biodiversity (CABB) is the second conservation project supported by the EU INTERREG VA Programme. It is led by the Royal Society for the Protection of Birds (RSPB) Northern Ireland and also involves RSPB Scotland, Birdwatch Ireland, Butterfly Conservation, Moors for the Future and Northern Ireland Water. Conservation measures include drain blocking, fencing, adoption of appropriate grazing levels and the writing of conservation action plans for a total of 2,228 ha across three counties in the Ireland and North of Ireland cross-border region. Within Ireland c. 164 ha of drained blanket bog in the Ox Mountains Bogs SAC, Co. Sligo is planned for rewetting. The effect of the restoration works on the hydrology of the bog will be monitored within the project timeframe as well as changes, if any, in plant community composition. Where alternative funding can be secured, post-project vegetation and hydrological monitoring will also be undertaken as vegetation changes are likely to lag behind hydrological changes. This is the first blanket bog restoration project in Ireland to include a baseline hydrological and vegetation study and it is hope that it will help develop best practice methods for future blanket bog restoration projects. Habitat mapping and conservation management plans are also being produced for 4 additional blanket bog SACs and within the Pettigo/Oughtcarn Bog SAC, Co. Donegal, fencing of area of blanket bog is being undertaken to allow better management of grazing in order to improve

[20] Other partners are Golden Eagle Trust, Agri-Food And Biosciences Institute, Armagh City, Banbridge and Craigavon Borough Council, Institute of Technology Sligo, East Border Region, Monaghan County Council, Ulster University, Argyll & The Isles Coast and Countryside Trust, Scottish Natural Heritage and Ulster Wildlife. Match-funding for the project has been provided by the Department of Agriculture, Environment and Rural Affairs in Northern Ireland, the Department of Housing, Planning and Local Government in Ireland and Scottish Natural Heritage.

vegetation cover. Habitat mapping and conservation management plans are also being devised for this and three other blanket bog SACs in Co. Donegal.

Research studies are being facilitated by the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht in order to quantify silt losses to water of a drained and eroding area of blanket bog and to review the condition of blanket bog restoration works completed some years ago by the National Parks and Wildlife Service on another area within the Liffeyhead blanket bog system. The efficacy of drain blocking was also studied by a comparative study of vegetation in the restored area and an undrained area. These studies will help inform on whether restoration work to arrest the peat erosion is feasible.

3. **Classification, identification and mapping of all of the State's peatlands, including wet heaths, along a degradation scale.**

A Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from Land Use Land Use Change and Forestry (LULUCF) means mandatory accounting of 'all' managed wetlands is to commence from 2026. The availability of accurate information on wetlands in Ireland (of which peatlands are a large sub-group) is a key issue when considering the inclusion of wetlands as an emissions reduction measure. In order to undertake a thorough analysis, high-resolution wall-to-wall GIS mapped land-use data would be needed; this is currently in the early stages of development. High-resolution is needed as a lot of the relevant activity (*e.g.* restoration, turbary, etc.) can take place on the fringes of large bogs. A cross-Departmental working group (led by the Department of Communications, Climate Action and Environment) is actively engaged in progressing this large-scale mapping project. The costs for this work have not yet been estimated.[21]

Mapping of habitats including blanket bog and other peatlands within a suite of upland SACs has been advanced within the National Survey of Upland Habitats commissioned by the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht. Stratified random monitoring plots in which condition assessment data was recorded indicate the condition of Annex I habitat including peatlands.

4. **Research to address the lack of baseline data on fens.**

The National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht will be procuring ecological services in 2019 to address the lack of

[21] The National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht has carried out a desk study using aerial imagery to map and estimate the extent of domestic cutting within blanket bog occurring in the 50 SACs selected for protection of blanket bog. The mapping project will provide data on the extent of domestic peat cutting generally on raised and blanket bogs.

baseline data on fens. Presently, a contract is in place for the collation and analysis of existing data on fens e.g. the fen and wetland surveys undertaken by some local authorities. This analysis will be used to inform the national conservation assessments of Annex I fen habitats for reporting to the European Commission.

5. **Research and development into alternative material to replace peat in horticultural and other products.**

   There is a continued need for research into alternative material to replace peat in horticultural and other products. Bord na Móna has conducted research on the effects of using high quality compost from organic (plant) waste material. However, this product tends to be focused on the gardening market where user needs differ significantly from the commercial growing situation.

   A number of peat diluting material are currently available such as "coir" and "wood fibre" but there are other environmental impacts in using these to substitute for peat.

6. **Research into the use and calculation of the economic value of ecosystem services**

   In 2015, the Department of Culture, Heritage and the Gaeltacht secured funding under the EU LIFE Programme 2014-2020 for a €5.4m project[22] to restore 12 raised bogs in Ireland - 'Restoring Active Raised Bog in Irelands SAC Network 2016-2020' (LIFE NAT/IE/000032). As part of this project, an assessment of the socio-economic impact of the project actions on the local economy and population will be undertaken, as well as an assessment of the ecosystem functions restoration resulting from the project actions. These assessments will be published in due course. Both assessments are expected to be completed by 2020.

   The project "Quantification of blanket bog ecosystem services to water (QUBBES)" - led by Dr Raymond Flynn (Queens University Belfast) is ongoing and is based on upland blanket bog sites in Ireland and Northern Ireland. The aim of the project is to produce high resolution quantitative outputs from modelling that will permit economic analysis of the impact of contrasting land use activities in terms of water treatment and flood prevention.

   The international economic valuation literature on peatland ecosystem services is very limited (Bonn *et al*., 2016).

7. **Investigation of the cultivation of Sphagnum moss and more generally paludiculture on degraded peatlands.**

   Bord na Móna established Sphagnum inoculation trials in 2012 and 2013 at Kilberry Bog, Co. Kildare. Prevailing weather conditions hampered the success of the trials but the environmental characteristics of the residual peat (higher than optimum pH and excessively decomposed peat) are likely to have hindered better Sphagnum establishment. This is an issue for a lot of Irish cutaway sites where the peat resource

[22] Project website: www.raisedbogs.ie

has been largely removed leaving the substrate more suitable for the development of fen habitat rather than peat-forming conditions for rapid sphagnum development, which requires lower pH supporting conditions.

The Environmental Protection Agency has funded a large number of peatland-focused research projects examining various priority topics within this subject area and considerable research investment has been made to advance our understanding of the issues and potential solutions. The EPA has invested over €1.75 million in peatland-related research projects since 2012, with investment in three projects awarded in 2015 and 2016 alone amounting to €1.1 million.

REFERENCES

Agriculture and Horticulture Development Board. Sustainable resource use in horticulture: a systems approach to delivering high quality plants grown in sustainable substrates, with efficient water use and novel nutrient sources.

Alexander P.D., Bragg N.C., Meade R., Padelopoulos G., and Watts O..
Peat in horticulture and conservation: the UK response to a changing world. Mires and Peat Volume 3 (2008), Article 08, International Mire Conservation Group and International Peat Society 2008.

Black K., O'Brien P., Redmond J., Barett F., and Twomey M. The extent of recent peatland afforestation in Ireland. Irish Forestry 65 (1&2): 71-81 2008.

Bolger Tom, Bullock Craig, Convery Frank, Curry Jim, Müller Christoph, Renou-Wilson Florence, Ward Shane, and Wilson David. BOGLAND: Sustainable Management of Peatlands in Ireland STRIVE Report Series No. 75 EPA STRIVE Programme 2007–2013 Prepared for the Environmental Protection Agency by University College Dublin. EPA 2011

Bolger Tom, Bullock Craig, Convery Frank, Curry Jim, Müller Christoph, Renou-Wilson Florence, Ward Shane, and Wilson David. BOGLAND: Sustainable Management of Peatlands in Ireland - PROTOCOL DOCUMENT Prepared for the Environmental Protection Agency by University College Dublin. EPA 2011

Bord Bia. Labour Review of Horticulture in Ireland 2016. December 2016.

Bord Bia. Amenity Sector Full Year 2018 – Management Report. February 2019.

Department of Arts, Heritage and the Gaeltacht. National Peatlands Strategy 2015. National Parks and Wildlife Service Dublin 2016.

Department of Culture, Heritage and the Gaeltacht. National Raised Bog Special Areas of Conservation Management Plan 2017-2022. Department of Culture, Heritage and the Gaeltacht December 2017.

Department for Environment, Food and Rural Affairs. A Green Future: Our 25 Year Plan to Improve the Environment. HM Government 2018.

Department of Housing, Planning and Local Government. River Basin Management Plan for Ireland 2018-2021. Department of Housing, Planning and Local Government 2018.

Foss Peter. Study of the extent and conservation status of Springs, Fens and Flushes in Ireland. National Parks and Wildlife Service January 2007.

Government of Ireland. Climate Action Plan 2019 (To Tackle Climate Breakdown). Department of Communications, Climate Action and Environment, June 2019.

Malone S., and O'Connell C.. Ireland's Peatland Conservation Action Plan 2020 – Halting the Loss of Biodiversity. Irish Peatland Conservation Council, Lullymore. 2009.