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Transitioning towards peat-free horticulture in the UK: an assessment of policy, progress, opportunities and barriers

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Executive Summary

During the last two decades the UK government has increasingly pressed for significant reductions in the quantity of peat used for commercial and domestic horticultural purposes. In 2010 a consultation was published in which the government set three specific targets for England: (i) the eradication of the usage of peat by amateur gardeners by 2020 (ii) the eradication of the usage of peat by commercial growers by 2030; iii) phase-out target of 2015 for Government and the public sector on direct procurement of peat in new contracts for plants.

This report was commissioned in order to better understand exactly what has changed in the last decade in terms of the availability and usage of alternatives to peat and to identify the opportunities and barriers to further increases in the uptake of peat-free products. It is important to recognise the broader context within which these policies targets have been set, whereby global demand for growing media is rising rapidly whilst there is increasing pressure to reduce disturbance of peatlands in the fight to mitigate climate change.

The report illustrates how progress towards the targets has fallen short, with peat currently constituting around 50% of all growing media by volume down from 70% in 2009. Early efforts to promote peat-free alternatives were stymied by the inconsistency and poor quality of products, which had long term impacts on consumer perceptions. However, considerable research and trialling has transformed the quality of alternative mixes to the extent that these can successfully match the performance of peat-based products.

Major progress has been made in setting up frameworks to drive further reductions towards an end goal of eradication. Significant steps have included the inception of the Responsible Sourcing and Manufacture of Growing Media (RSMGM) scheme which has led to the development of a system for assessing the sustainability credentials of the individual materials contained within a commercial growing media product. Through this system each product can be assessed to ensure that it meets an agreed benchmark whereby it can be considered to be 'responsibly sourced'. The scheme highlights that sourcing responsibly is not as simple as cutting out peat, as other factors such as carbon and water footprints and labour issues also need to be considered as part of a holistic approach to sustainability. Developing the scheme has enabled some of these hotspot issues to be highlighted. Full implementation of the scheme has taken longer than hoped but now offers a significant opportunity for enabling consumers to make more informed choices.

It is currently unclear how far and fast the transition to peat-free horticulture can realistically unfold. Significant barriers exist due to challenges with securing sufficient volumes of good quality alternatives at a price that will prove palatable with consumers. The pioneers of mass market peat free products have been highly strategic in developing strong relationships with key suppliers of alternative products. However, increasing the overall volume of alternatives will prove difficult without adjustments in other areas of policy making, such as heat and power generation which provides for incentives for wood biomass sellers to focus on markets more lucrative than growing media manufacturer.

It is estimated that volumes available for peat extraction in the UK and Ireland under current licences will be exhausted in the next two decades. This will necessitate significant re-structuring within the industry, including a relocation of key production sites. Therefore, there are strong incentives for the UK and Ireland growing media industry to drive ahead with the transition to peat-free production. Considerable work needs to be undertaken in partnership with governments, conservation bodies and commercial organisations to ensure that the transition is as smooth as possible. The progress made in developing effective peat alternatives indicates that the horticulture sector's economic viability and strong contribution to the wider economy need not be diminished in the long term. Managing the impacts of greater global demand for growing media and a step-change approach to reducing reliance on peat, will pose significant challenges, and opportunities, for those in the growing media industry. Given the quality of technical research undertaken in the last decade and the innovations being made by leaders in the field of growing media production there is every reason to be optimistic that the broader industry can evolve successfully and continue to underpin the national horticultural sector as a whole.

The report concludes with a set of recommendations for continuing the drive towards meeting the targets set by the UK government and ensuring that all growing media can be justifiably labelled as 'responsibly sourced'.

Summary of Recommendations:

1) Fully assess the potential supply of bark, wood-fibre and coir and undertake price sensitivity analyses for different market segments.
2) Undertake a full appraisal of the composting sector's potential to supply more, good quality green compost.
3) Prompt and full implementation and rollout of the Responsible Sourcing and Manufacturing of Growing Media scheme.
4) Implement consistent labelling protocols for growing media which are clearly communicated to consumers.
5) Communication and knowledge exchange with hobby gardeners about peat-free growing media.
6) Engage the retail sector to ensure their full commitment to promoting new generation peat-free growing media.
7) Ongoing R&D to develop the next generation of peat alternatives.
8) Continued knowledge exchange with commercial growers to increase confidence in, and use of, peat-free media.
9) Develop clear climate change impacts messaging about impacts of growing media and horticultural more broadly.
10) Ensure that data on growing media production and sales trends is collected and communicated in a transparent way.
11) Lobby government regarding issues that constrain the development of alternative sources of growing media constituents.
12) Review, update and refresh the Roadmap Towards Sustainable Growing Media.

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4 Introduction

This report was borne out of a need to assess the progress made in changing the composition of growing media in England. During the last two decades the government has increasingly pressed for significant reductions in the quantity of peat used for commercial and domestic horticultural purposes. Following a consultation process in 2010, the Environment White Paper was published in 2011 in which three significant targets were proposed for England: (i) the eradication of the usage of peat by amateur gardeners by 2020; (ii) the eradication of the usage of peat by commercial growers by 2030; (iii) a progressive phase-out target of 2015 for Government and the public sector on direct procurement of peat in new contracts for plants.

The Natural Environment Minister in 2010, Richard Benyon, stated:

"The horticultural industry has made real progress in reducing peat use, but I want to see peat eliminated from the amateur gardener market by 2020. We need to go further if we are to protect our natural environment and reduce greenhouse gas emissions."

Subsequent progress towards these targets has been somewhat uneven. This report was commissioned in order to better understand exactly what has changed in the last decade and to identify the opportunities and barriers to further progress. The report is intended to provide the Horticultural Trades Association (HTA)[1] and the UK Growing Media Association (GMA), with an appraisal of the key issues which underpin the future sustainability of the growing media sector. Such an appraisal requires a thorough interrogation of the environmental, economic and social implications of utilising different forms of growing media and the implications which would likely result from significant changes in the composition of growing media. The document will also identify gaps in current knowledge bases and indicate critical areas for future research.

The critical importance of the horticultural sector to the UK economy should be recognised including the role it can play in contributing to bigger issues such as biosecurity, climate change, health and wellbeing and, of course, the economy (Oxford Economics 2018).

For the purposes of this report the focus is largely upon peat and the most viable alternatives to it. The original terms of reference (see Appendix 22.5) for this report identified several key facets to the debate around peat use including, inter alia, the following:

- The threat to peat lands as a natural habitat and impact on biodiversity
- The role that peat lands play in global climate regulation due to carbon sequestration.
- The role that UK ornamental horticulture plays in the extraction and use of peat globally and within the UK.
- The availability of alternative growing media materials and the extent to which they can be sourced sustainably.

[1] The GMA 's membership comprises manufacturers and suppliers covering 90% of the sales of growing media in the UK into the domestic and professional sectors of the UK ornamental horticulture industry. The GMA in turn is a part of the HTA thus providing representation for its members in this wider industry body.

- The impact in terms of carbon footprint of each product which may be used in growing media.
- Detail the barriers and opportunities for increasing usage of different alternatives to peat.
- Assess the viability of government targets to eradicate usage of peat in different spheres of activity.

5 Aims and objectives of the project

The primary objectives of this report are to:

(i) critically evaluate the progress that the growing media industry has made in meeting the targets set out by the government in 2011;

(ii) provide a thorough overview of the opportunities and challenges confronting the horticultural industry in producing a roadmap for reducing peat usage in growing media to zero in recreational and commercial settings within manageable timescales.

This report is structured as follows:

- Explanation as to why peat is used in growing media and projections for future global growing media demand
- Description of the strategies and policies which have aimed to reduce peat usage in the UK.
- Evaluation of the existing roadmap towards peat reduction in growing media.
- Description of the Responsible Sourcing and Manufacture of Growing Media (RSMGM) scheme and the associated calculator.
- Evaluation of the sustainability credentials of each category of growing media
- Evaluation of the effectiveness of non-peat products
- Assessment of shifts in the growing media marketplace in the UK.
- Conclusions and recommendations.
- Appendices providing contextual information, supporting evidence and the project brief.

6 Methodology

The project involved the deployment of a range of research methods. In brief these included:

(i) Searching for government, industry, press and academic references which shed light on the key questions.

(ii) Analysing and summarising the key themes to emerge from the above documents.

(iii) Attendance at events such as GLEE, the HTA's 'Cultivating Retail' conference and ADHB event 'The transition towards responsibly sourced growing media'.

(iv) Analysis of trends in growing media composition and sales.

(v) Analysis of consumer trends and consumer focused marketing/information provision.

(vi) Formal and informal interviews with key stakeholders in the industry including representatives from growing media companies, retailers, and government.

The analysis underpinning the reports analysis and recommendations is based upon a holistic approach to sustainability. This approach views true sustainability as occurring at the intersection of economic, environmental and social dimensions. For a product, policy, strategy or decision to be considered truly sustainable it must have positive outcomes within each of these three spheres. Further detail can be viewed within Appendix 22.6. The term 'responsibly sourced' is important within the document as it has been adopted as a core component of the Responsible Sourcing and Manufacture of Growing Media which has led to production of a responsible sourcing calculator. It should be noted that 'responsibly sourced' refers to the act of procuring a product whereby the decision to procure takes into account social and environmental factors. Such decisions will usually, as with the growing media calculator, be based upon assessment of a set of sustainability-based criteria. Viewing these criteria collectively enables a responsible decision to be made by the purchaser.

7 Projected Global Demand for Growing Media 2017-2050

Predictions concerning future global food requirements indicate that there will be a need for substantial increases in the volume of food crops produced. This will be driven in part by ongoing population growth and increases in living standards, which lead to higher consumption levels. Global population may well rise by a further 2 billion people in the next 30 years. The situation in China is especially acute as living standards and calorific consumption have risen markedly in the last two decades, however the amount of land available to grow arable crops is relatively low – 0.1 ha per person compared to 0.5 ha in the USA. Considerable increases in usage of growing media will be required to support intensive food production in China, perhaps as much as 100Mm^3 by 2030, which is double the current global production of commercial peat (Meng Xianmin 2016 https://peatlands.org/assets/uploads/2019/06/ipc16p51-54a085meng.pdf; Klassmann-Dielmann 2020). At a global scale such trends are projected to lead to substantial increases in demand for all types of growing media (see table 1 below). Overall demand for growing media is projected to increase from 59Mm^3 per annum to 244Mm^3. Peat would be the largest single contributor to this increased demand, but its overall significance would decline from 65% to just under 30% of all growing media by volume. Coir, soils/tuffs, and wood fibre would be the main alternative contributors.

Table 1: Projected increases in global demand for growing media (Mm³ per year)

Raw material	2017	2050	Increase %
Peat	40	80	100
Coir	5	35	600
Wood fibre	2	25	1150
Bark	1	10	900
Compost	1	5	400
Perlite	1.5	10	567
Stone wool	0.9	4	344
Soils/tuff	8	33	313
Other/new	0	43	n/a
Global volume	**59**	**244**	**314**

Source: Growing Media Europe 2018 (drawn from work of Chris Blok, Wageningen University)

8 Why is Peat so popular?

Peat has been the leading constituent of growing media since the 1960s when commercial extraction began in earnest. Indeed, by the late 1990s peat comprised 94% of growing media in the UK. Reliability is a critical feature for growing media, most especially in commercial horticulture which has become increasingly capital intensive and competitive. Commercial producers simply cannot afford for plants to grow at different rates or for there to be noticeable non-germination. The production system needs to be as finely-tuned as possible. Variables have to be controlled as much as possible. Whilst, growing media used for recreational purposes does not require the same levels of precision it is the case that peat has proven to be reliable when used by non-experts. Consumers tend to favour products that they are familiar with and which they perceive have given them good outcomes. Schmilewski (2008) provides a table (see below) outlining the key properties that a growing media requires to possess and concludes that peat has proven the most reliable media in terms of controlling these properties for different products.

Figure 1: Key Growing Media Properties

PHYSICAL	CHEMICAL	BIOLOGICAL	ECONOMIC
structure and structural stability	pH	weeds, seeds and viable plant propagules	availability
water capacity	nutrient content	pathogens	consistency of quality
air capacity	organic matter	pests	cultivation technique
bulk density	noxious substances	microbial activity	plant requirements
wettability	buffering capacity	storage life	price

Source: Schmilewski 2008 p.2.

It is the combination of the physical, chemical and biological characteristics of peat that has made it exceptionally suitable as a growing medium (Bunt 1988; Bragg 1995). Peat has a

physical structure that allows for an appropriate balance of air and water in the medium to facilitate healthy root growth, a property measured as air-filled porosity (AFP). Peat can be sourced, extracted and processed to provide products with different AFP, as required for different production systems and sizes of containers in which the plants are grown (Schmilewski 2008; Alexander 2020). Importantly peat has a very stable physical structure (i.e. peat does not readily break down or decompose in the pot), which enables the required balance between water and air to be maintained over the entire growing period of the plants, whether this is a few weeks or several months. In terms of its chemical properties, peat has a naturally low pH and very limited concentrations of nutrients (consequently a low electrical conductivity). This means that with addition of liming material, the pH can easily be adjusted to the range required for different plants species and the precise amounts of major and minor plant nutrients can be added to provide both the correct balance of nutrients and concentrations appropriate for different uses (Barrett et al 2016). Indeed, after fertilising and liming, peat is often used as the sole constituent in media for a wide range of uses (Schmilewski 2008).

From a biological point of view, peat is importantly largely free from pests, diseases and weed seeds and other weed propagules, owing to the specific conditions under which has developed. This is vital for making the process of growing plants simple and risk free, whilst negating processing and input costs. Peat is often referred to as being 'sterile', and although this is not strictly the case, micro-organisms in peat are only present at low numbers and with low microbial activity. The low microbial activity, together with the stable structure of the carbon and the absence of nutrients, also mean peat products can have long storage life (Bunt 1988; Bragg 1995; Lennartsson 1997; Alexander et al. 2008; Schmileswski 2008; Barrett et al. 2016; Litterick 2019).

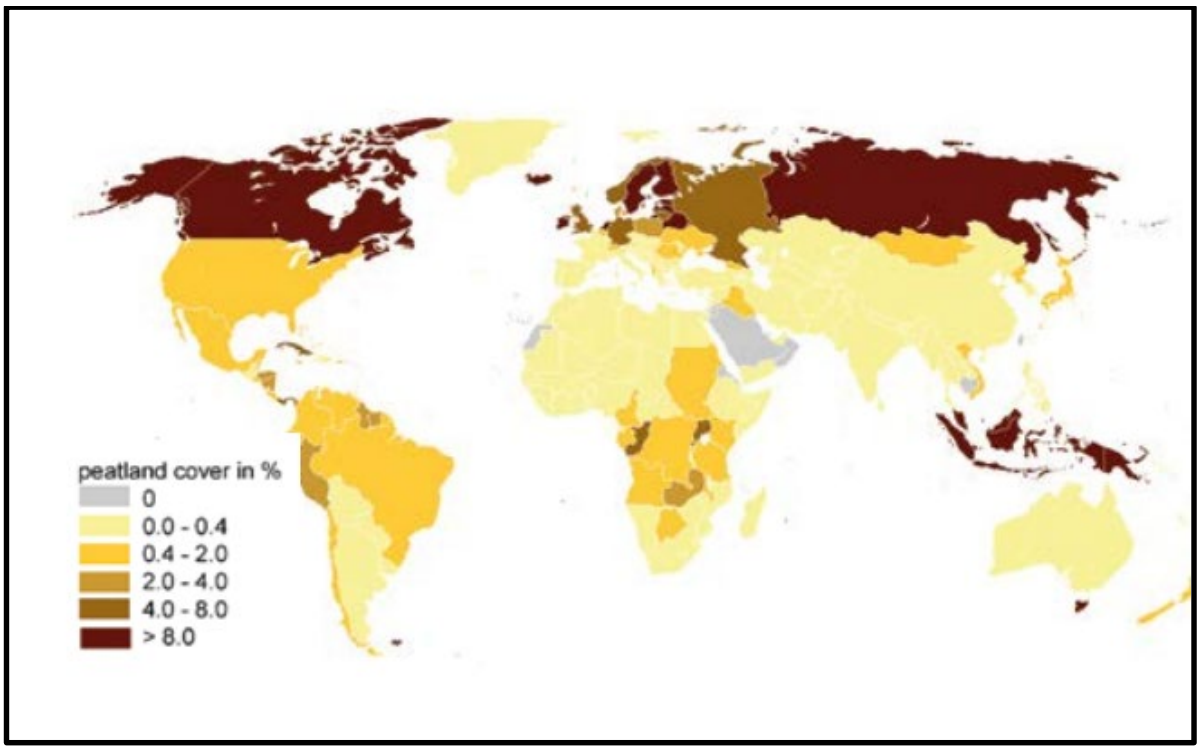
The economic factors that that have favoured the use of peat are related to the fact that peat has been available in plentiful supply, with a consistency in quality and at a low price, especially as the environmental costs of peat extraction have not been internalised. Overall, peat production is relatively low cost, especially as licences were obtained decades earlier and capital infrastructure has been long established. Thus, the commercial price of peat has always been highly competitive compared to other growing media constituents. So, it is a combination of both economic factors and the unique technical properties that have made peat so popular over the last 40 years. Indeed, many of the commercial horticultural systems that are used today have been designed and developed around the use of peat as the growing medium.

9 Peatlands – the Global Context

Peatlands are a type of wetland which cover 3% of the global land surface, covering an area greater than 3 million km^2 (IUCN 2017). Peat landscapes take many forms from blanket bogs through to swamp forests. In their natural state peat landscapes provide a range of important ecosystem services. Of especial value is their role in regulating water flows, helping to prevent floods, mitigating the impacts of droughts and ensuring water quality. Peatlands are also major contributors to biodiversity and contributors to local economies. The role of peatlands in climate change is becoming increasing well understood. Carbon from the atmosphere is

fixed into plant tissues which in turn is locked away within peat formations. Peatlands are the world's largest carbon store, containing more than 550 Gt of carbon. This represents 42% of all soil carbon. In Europe peatlands contain five times more CO_2 than forests.

Figure 2: Estimated Global Distribution of Peatlands



Source: IUCN 2017

Therefore, disturbance to peatland areas is highly problematic in terms of greenhouse gas release and impacts upon climate change. CO_2 emissions from drained peatlands are estimated at 1.3 Gt per year, which represents 5.6% of human caused emissions. Around 15% of peatlands have been drained, in the process releasing huge volumes of greenhouses gases.

Figure 3: Distribution of Peatlands in the UK

Source: IUCN 2017

Protection and restoration of peatlands has risen rapidly up the global political agenda owing to the potential that peatlands have to sequester carbon or release it. In 2016 an IUCN Resolution was published, recommending 'a moratorium on peat exploitation until legislation is strengthened to ensure peatlands are protected or managed through wise use principle' (IUCN 2017). In the UK a strategic action plan for peatlands has been established to support the UK's climate mitigation plans and international biodiversity targets (IUCN-UK 2018).

10 Policy Background

The horticulture sector is a very important contributor to the UK economy. According to a major study by Oxford Economics (2018) the ornamental and landscaping sector was worth £24.2 billion and provided 568, 700 jobs. This does not take into account the food production component of the sector, which is also hugely significant. The growing media industry clearly underpins all such activity through the provision of consistent, high quality, reasonably priced products. The economic contribution of the sector is therefore extremely important and is a critical component of the overall drive towards sustainability. This is reflected in UK, Irish and EU policy in recent decades, which recognise the role of horticulture within the wider economy (Government of Ireland 2019; Altmann 2008).

Policy discourses related to the horticultural usage of peat have evolved during the last two decades. Initially the focus of policy (1999) was upon protection of lowland raised bogs in the UK via Habitat Action Plans (DEFRA 2009). Targets at this time were for 40% of the total market for soil improver and growing media to be peat free in the UK by 2005 and 90% by 2010. While DEFRA (2009) record that the 2005 target was achieved, the 2010 target was

missed by a substantial margin with 58% considered to be peat-free at that time. The UK Government's Environment White Paper of 2011 re-positioned the targets as follows:

'We want to reduce peat use to zero by 2030, setting the following milestones:

- a progressive phase-out target of 2015 for Government and the public sector on direct procurement of peat in new contracts for plants;
- a voluntary phase-out target of 2020 for amateur-gardeners;
- a final voluntary phase-out target of 2030 for professional growers of fruit, vegetables and plants,

Source: HM Government 2011 The Natural Choice: Securing the value of Nature, Environment White Paper (Defra 2011).

It is important to note that these targets were non-mandatory. In the last five years **three key trends** have emerged within policy narratives around peat. Firstly, the relationship between peat landscapes and climate change has come into much sharper focus. Secondly, there is increasing pressure to consider mandatory rather than voluntary policy approaches. Thirdly, global and regional institutions are focusing upon the management of peatlands. These trends can be observed in policy pronouncements at different levels of international governance.

At a global level, the UN Food and Agriculture Organisation has identified ten strategic actions to enhance the conservation status of peatlands and to ensure that contributions are made towards the goals of the Paris Agreement and the Sustainable Development Goals. These actions include; 'protecting and restoring peatlands with targeted financial support' and 'stimulating market-based mechanisms to support peatlands' (IUCN 2020). The International Union for the Conservation of Nature (IUCN) support the work of the UN Food and Agriculture Organisation and in 2016 adopted a resolution proposing 'a moratorium on peat exploitation until legislation is strengthened to ensure peatlands are protected or managed through wise use principles' (IUCN 2020). The IUCN in their 2018 'UK Peatland Strategy 2018-40' note that 'Peatlands are among the most valuable ecosystems on Earth…(O)ccupying just 3% of the Earth's land surface, peatlands are our largest carbon store on land…they are also of global significance for biodiversity' (IUCN 2018). Such sentiments are a far cry from those expressed decades earlier when peatlands were described as 'wastelands' crying out for development' (Government of Ireland 2019).

The European Commission have noted that "much stronger efforts are needed" to reach the EU Biodiversity Strategy for 2020, namely to "[halt] the loss of biodiversity and the degradation of ecosystem services in the EU" (European Environment Agency 2020) as 70% of EU species are threatened by habitat loss. The EU has drawn up a set of interlinking policy areas which enact conservation policies, subsidies and incentives in order to generate conservation and restoration measures. The management of peatlands cut-across these policy areas and is an increasingly important area of focus, particularly with respect to climate change. The main areas of policy intervention have been nature protection, via Natura 2000, and infrastructure planning, EU water policy, Common Agricultural Policy, rural development and structural funds, and LIFE energy policy, and climate change regulations (Peters and von Ungar 2017).

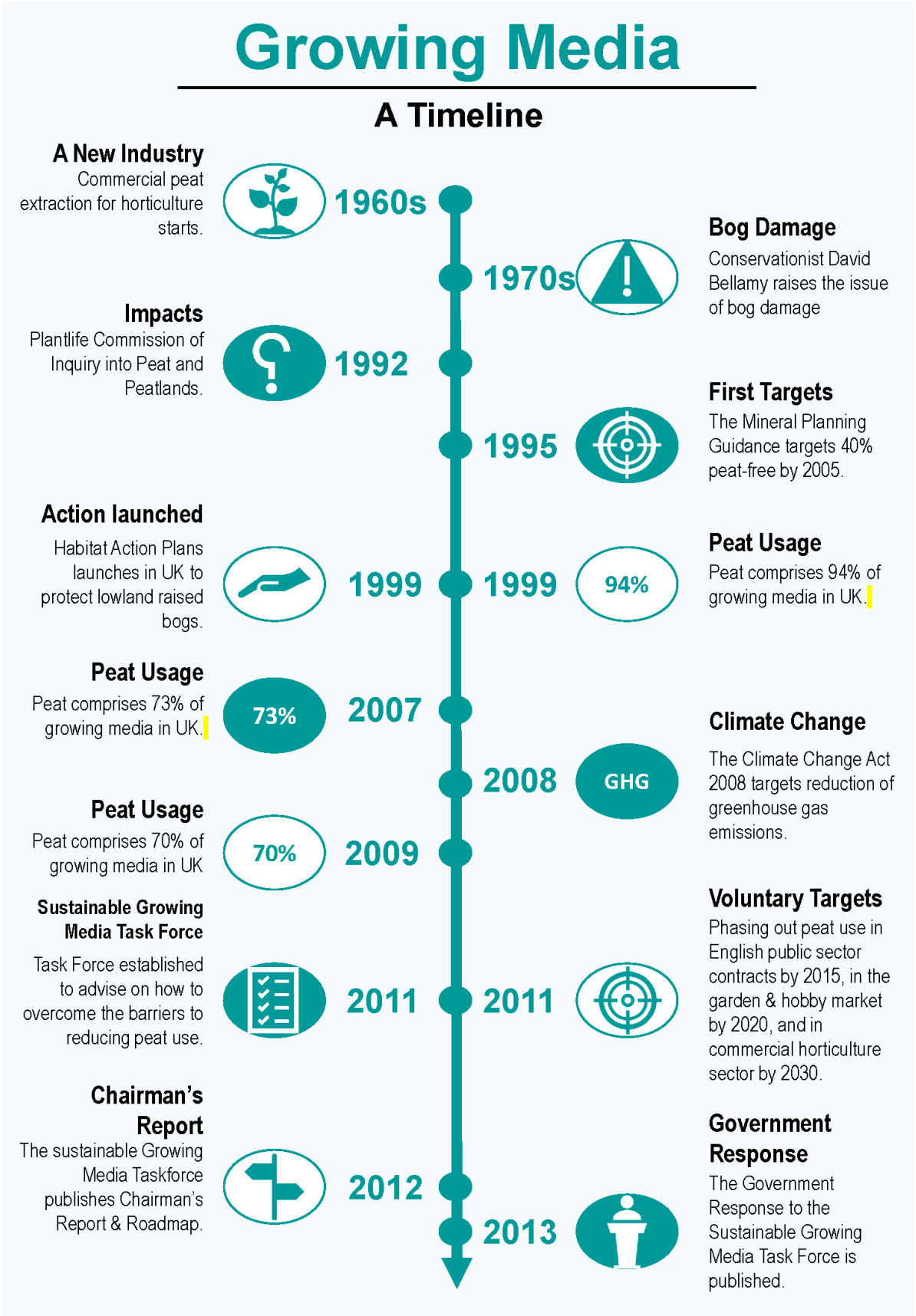
At a national level, governmental interest in the status of peatlands is also evident in an Irish Government key issues consultation paper which was launched in 2019 as an action emanating from the 2015 National Peatlands Strategy. The central aims of this consultation were to examine the value of peat moss extraction for the horticultural industry and the impacts of moving towards the use of alternatives. The consultation document recognises the tensions inherent in managing the peatland ecosystem within Ireland – on the one hand industries, which offer employment in marginal areas, are backbones of the wider economy, whilst on the other the landscape offers critical ecosystem services, including acting as a bulwark against climate change.

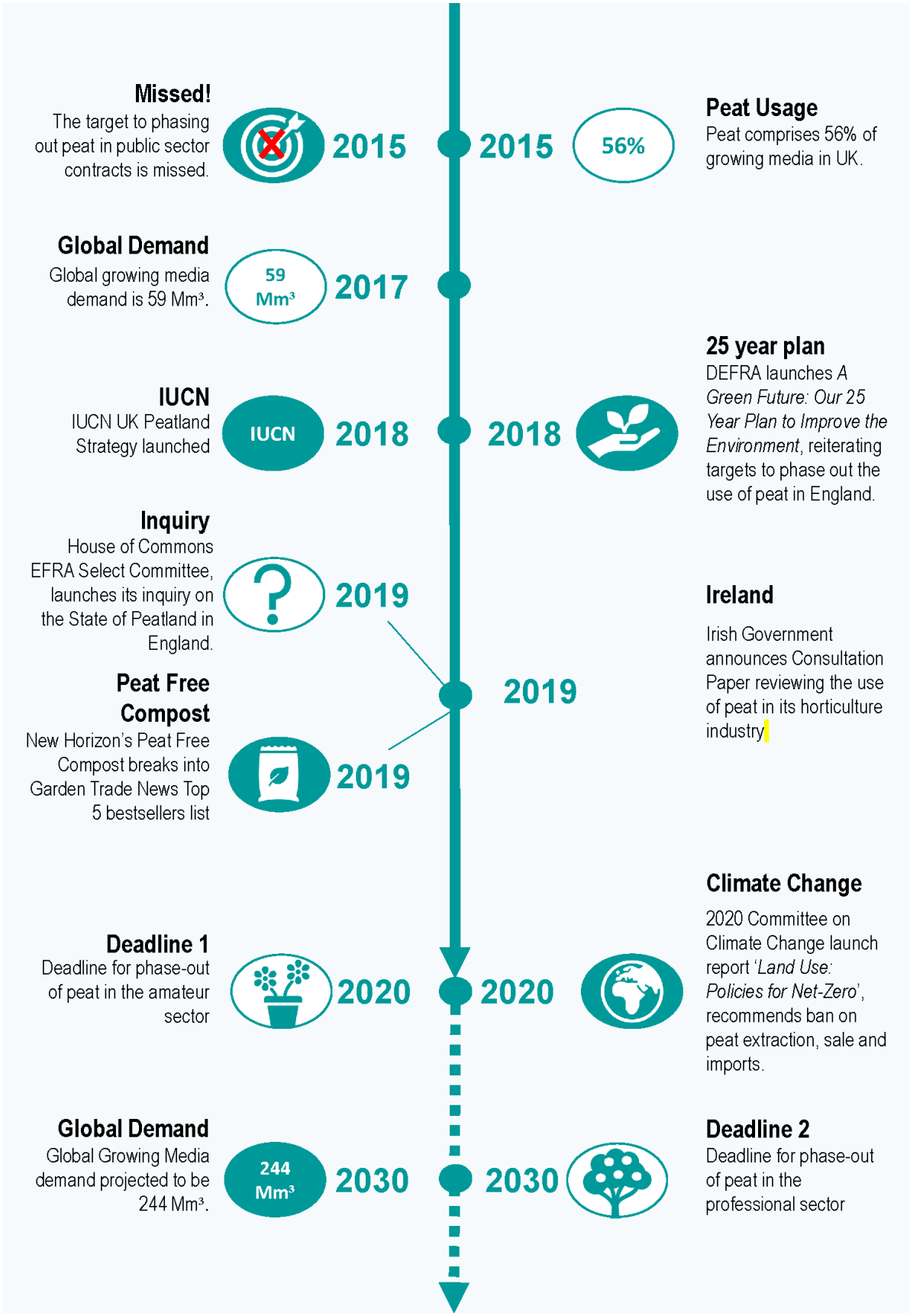
The UK Government's 25 Year Environment Plan, published in 2018, (Defra 2018) focuses upon the imperative to restore and protect peatlands. The language in the document also starts to indicate a shift from a voluntary approach towards other forms of influence, 'In 2011 we introduced a voluntary target for amateur gardeners to phase out the use of peat by 2020 and a final voluntary phase-out target of 2030 for professional growers of fruit, vegetables and plants. If by 2020 we have not seen sufficient movement to peat alternatives, **we will look at introducing further measures**' (emphasis added p. 45). Whilst, the Conservative Party manifesto for the 2019 General Election stated: 'The UK should act decisively to protect this overwhelmingly valuable ecosystem by setting an end date to peat extraction, peatland burning and the sale of peat products'. The move towards enforcement and bans is also evident in the recent (2020) Committee on Climate Change document 'Land Use: Policies for Net-Zero', which explicitly refers to banning peat extraction.

Therefore, a sea change in understanding of the importance of peatlands is evident in policy making at all levels of governance. The environmental case has become pre-eminent due to the contribution of natural peatlands to carbon budgets and also due to wider biodiversity benefits which contribute to climate change mitigation strategies. There is a clear shift in language from voluntarism to enforcement. As policy has evolved, so have the debates amongst industry members and commentators. Appendix 22.4 below provides insights into the positions adopted by different stakeholders as policy shifted in the second decade of C21.

Section 11 below provides a timeline which documents the key points of influence upon the evolution of policies towards peat extraction and usage. It also records responses from the growing media industry and public bodies. The establishment of a Growing Media taskforce, the identification of a roadmap towards the eradication of peat usage and the development of the Responsible Sourcing and Manufacture of Growing Media (RSMGM) scheme and the associated calculator are critical points in this journey. Further details on the implementation of the RSMGM scheme and the calculator are provided in sections 12 and 13 below.

11 Transitioning towards Peat-Free Media: A Timeline of key events




Missed!
The target to phasing out peat in public sector contracts is missed.
2015
2015
56%
Peat Usage
Peat comprises 56% of growing media in UK.
Global Demand
Global growing media demand is 59 Mm³.
59 Mm³
2017
25 year plan
DEFRA launches A Green Future: Our 25 Year Plan to Improve the Environment, reiterating targets to phase out the use of peat in England.
IUCN
IUCN UK Peatland Strategy launched
IUCN
2018
2018
Inquiry
House of Commons EFRA Select Committee, launches its inquiry on the State of Peatland in England.
2019
Ireland
Irish Government announces Consultation Paper reviewing the use of peat in its horticulture industry
Peat Free Compost
New Horizon's Peat Free Compost breaks into Garden Trade News Top 5 bestsellers list
2019
2019
Climate Change
2020 Committee on Climate Change launch report 'Land Use: Policies for Net-Zero', recommends ban on peat extraction, sale and imports.
Deadline 1
Deadline for phase-out of peat in the amateur sector
2020
2020
Global Demand
Global Growing Media demand projected to be 244 Mm³.
244 Mm³
2030
2030
Deadline 2
Deadline for phase-out of peat in the professional sector

12 Summary of trends in growing media consumption usage in the UK since 2000.

Given the pressure to reduce the consumption of peat within growing media, it is appropriate here to examine the available data which illustrates trends in peat usage, both in terms of the proportion of peat used in all growing media and the total volume of peat that has been used. Between 1999-2015, two projects tracked the use of peat in horticultural growing media in the UK. The final reports from these studies provide the source for the information summarised below. The reports are:

- **Monitoring the horticultural use of peat and progress towards achievement of the UK Biodiversity Action Plan targets (SP08020)** (Defra 2010). Reporting on the trends between 1999-2009.

- **CP100 Tracking peat usage in Growing Media Production – Final report 2016** (AHDB 2016). Including detailed figures for volumes of growing media and growing media ingredients (peat and alternatives) supplied to the amateur and professional use markets. Reporting on trends between 2011-2015.

Data was collected for 2016 and 2017, however, the methodology guiding its collection was retrospectively considered to be inadequate. There no reliable data is available for these years. Subsequently, an agreement was reached between the GMA, Defra and ADHB to restart data collection from 2018. As yet, no data has been released into the public domain.

In summary:

- There was a steady decline in the **total volume of peat** used in growing media between 1999-2013, from approx. 3.29 Mm^3 to 1.96 Mm^3. However, there was a slight increase to 2.13Mm^3 in 2015.

- The **overall volumes of growing media** supplied in UK increased from 3.5 Mm^3 in 1999 to 4.5 Mm^3 in 2011, but have since then fluctuated between 3.6 – 3.9 Mm^3 for the period 2012-2015.

- Overall (retail and professional sector combined) the **proportion of peat** in growing media was reduced from 94% in 1999 to 62% in 2011, 57 % in 2012 and then remained at 55-56% (56% in 2015). Anecdotal evidence indicates that steady downward progress has been maintained with the figure now being around 50%.

- Overall (retail and professional sector combined) **the proportion of peat alternatives** in growing media has been increased from 6% in 1999 to 38% in 2011 and to 45% in 2013 and 2014.

A more detailed analysis of trends in growing media consumption can be viewed in Appendix 22.4 below.

13 Evaluation of the alternatives to peat

Obviously if the volume of peat being used is to be reduced substantially (or even eradicated altogether) then there need to be viable alternatives. Such alternatives need to have three major properties. Firstly, they need to be comparable in performance to peat, most especially in the commercial sector but they should also be palatable to recreational consumers. Secondly, they need to be sustainable in environmental and social terms, so that their sourcing can be considered responsible. Thirdly, they need to be economically viable. The following sections examine the alternatives through each of these prisms.

The potential sustainability credentials of the main peat alternatives, namely bark, wood-fibre, coir and green compost, were provisionally assessed as part of the development of the Responsible Sourcing and Manufacture of Growing Media (RSMGM) scheme and the associated calculator (GMA 2018). Within this this scheme, environmental and social sustainability is assessed based on seven criteria: energy use; water use; social compliance; habitat and biodiversity; pollution; renewability; and resource use efficiency. For each of these criteria, materials can be assessed by following the steps in the accompanying decision trees to derive a score for each criterion. Scores out of 20 have been separated into categories, illustrated using a traffic light system. For every growing media product, each bulk ingredient is assessed individually and awarded a score for each criterion and at present all criteria have equal waiting. The score for the formulated product (potentially containing a mixture of bulky ingredients) is calculated as the sum of the ingredients' scores weighted by % volume. Once this final score has been reached then a decision can be made as to whether sourcing that product can be regarded as 'responsible'.

For the development of the RSMGM calculator, **hypothetical examples** of bark, wood-fibre, green compost and coir, and mixtures thereof, were assessed and the results were presented as illustrative examples in the Guidance Notes that accompany the calculator, see Tables 2-6 (GMA 2020). Since the launch of the calculator in 2016, the growing media manufacturers have undertaken assessments of the **actual** bulky materials that they use in the formulations of the media that they manufacture and sell, and the results are currently being independently audited. In order to evaluate the sustainability credentials of the different materials for this study, the score values for both the **hypothetical examples** provided in the Guidance Notes document (GMA 2018) and for some **actual materials** that have been assessed using the calculator, as shown in Alexander et al. 2016, have been outlined below. In the text below, some of the assumptions made for the hypothetical examples have also been outlined (GMA 2018), which provide insight to how the scores were derived.

13.1 Sustainability of bark

In the worked example for bark in the RSMGM guidance notes, the background assumptions were that the bark had been manufactured from a virgin material (by-product) and, therefore, the starting point for this material was the forest. For some criteria (energy use and water

use) generic data was used at the forest and for transport to the sawmill (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment was the sawmill. The end point is the end of the mixing system. In the worked hypothetical example, the bark was considered as responsible for 7% of the impact at the forest, 7% of the impact at the sawmill, and 100% of the impact after the sawmill up to the mixing system (GMA 2018). The summary of the scores for the hypothetical bark and the actual example of bark is shown in Table 2.

Table 2: Summary of the scores for hypothetical and actual bark

Criteria	Hypothetical Bark	Actual Bark
Energy	10	14
Water	20	20
Social compliance	9	11
Habitat & biodiversity	15	15
Pollution	12	20
Renewability	17	17
Resource use efficiency	15	15

Source: Alexander et al. 2016; GMA 2018

With regards to the criterion for water, both barks scored the maximum of 20 and were labelled green. The actual bark also scored 20 for pollution. Both barks scored yellow for habitat and biodiversity, renewability and for resource use efficiency and orange for social compliance. With regards to energy the hypothetical bark scored 10 (orange) whilst the actual bark sample scored 14 (yellow). Neither of the barks scored any reds. Further details of how the scores were derived for the hypothetical bark are available in GMA (2018).

13.2 Sustainability of wood-fibre

In the hypothetical example for wood-fibre in the RSMGM guidance notes, the background assumptions were that the wood-fibre was manufactured from a virgin material (by-product) and, therefore, the starting point for this material was the forest. For some criteria (energy use and water use) generic data has been used at the forest and for transport to the sawmill (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment was the sawmill. The end point was the end of the mixing system. The material was produced from wood chips; therefore, it was considered as responsible for 33% of the impact at the forest, 33% of the impact at the sawmill and 100% of the impact after the sawmill (e.g. processing of wood chips into wood fibre) up to the mixing system. It was also assumed that 1 m^3 of wood chips produces 3 m^3 of extruded wood-fibre (GMA 2018). The summary of the material score for this example of wood-fibre is shown in Table 3, which also includes the scores for two actual examples of wood-fibre (referred to as wood-based in Alexander et al.2016).

Notably, the scores for the hypothetical example of wood-fibre, were broadly similar to the scores for the two actual examples. The two actual examples of wood-based material scored the maximum score of 20 (green) for pollution, which was higher than that in the hypothetical example. For the criteria water, habitat and biodiversity, renewability and resource use

efficiency, all of the samples of wood fibre scored yellow, whilst for energy the scores were orange. For social compliance the hypothetical sample scored 5 (red) but the actual samples scored yellow. The red for social compliance of the hypothetical sample, resulted from the requirement for the social compliance assessment for wood-based materials to be demonstrated at the sawmill and this was explained as: The company had completed a self-assessment questionnaire to demonstrate social compliance. This is valued at 0.5 of an audited third-party assessment, but neither of the sawmills had undertaken any form of assessment and had no proof of their social compliance. The level of proof of social compliance, was thus calculated using the social compliance calculator, as 30% and the material scored 5.

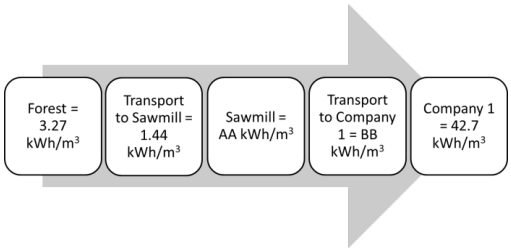
Table 3: Summary of the scores for hypothetical and actual wood-fibre/wood-based examples.

Criteria	Hypothetical wood fibre	Actual wood-based 1	Actual wood-based 2
Energy	6	8	8
Water	16	16	16
Social compliance	5	13	15
Habitat & biodiversity	13	15	15
Pollution	12	20	20
Renewability	17	17	17
Resource use efficiency	15	15	15

Source: Alexander et al. 2016; GMA 2018

All of the wood-fibre samples scored orange for energy and for the hypothetical example, this was explained to be because the wood-fibre had been produced through an extrusion process, which is energy demanding (42.7 kWh m^{-3}) see Figure 4. Wood-fibre can also be produced by milling/sieving processes which are less energy demanding. The production process for the actual samples of the wood-based materials is not known, but they scored a slightly higher score of 8 and were thus still orange.

Figure 4: Energy use for the example of wood-fibre used in the RSMGM guidance notes



Source: GMA 2018

13.3 Sustainability of coir

In the worked hypothetical example for coir in the RSMGM guidance notes, the background assumptions were that the coir had been manufactured from a virgin material (by-product)

and, therefore, the starting point for this material was the coconut plantation/small holding. Much of the data used in the assessment were based on the sustainability assessment undertaken on coir in a separate project (Drewe 2012). For some of the criteria (energy use and water use) generic data was used at the plantation/small holding and for transport to the fibre mill (unless site specific data is available) and for other criteria (social compliance, pollution and resource use efficiency) the starting point for assessment was the fibre mill. The end point is the end of the mixing system. As the coir is produced from the outer husk of the coconut, in the calculation the coir was assessed as being responsible for 5% of the impact at the plantation/small holding, 50% of the impact at the fibre mill, and 100% of the impact from the pith factory to the mixing system. It was assumed that 1t of coconuts produces 1.9 m^3 of coir pith. 1 m^3 of compressed coir pith produces 12 m^3 of coir (note these were company specific values that should not be regarded as standard values). The summary of the material score for the hypothetical coir and also for two actual coir sample are shown in Table 4.

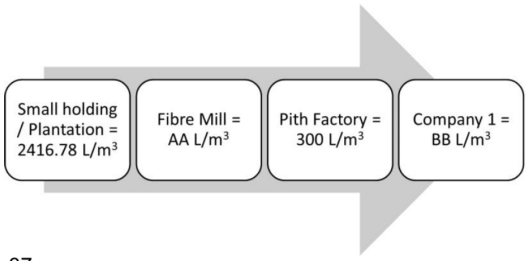
Table 4: Summary of the scores for hypothetical and actual coir.

Criteria	Hypothetical coir	Actual coir 1	Actual coir 2
Energy	12	10	10
Water	6	5	5
Social compliance	13	15	13
Habitat & biodiversity	12	12	12
Pollution	8	8	8
Renewability	20	20	17
Resource use efficiency	15	15	15

Source: Alexander et al. 2016; GMA 2018

With regards to the criteria for renewability, the hypothetical coir and one of actual coir samples scored the maximum of 20 (green), and for the hypothetical sample this was explained as the material was produced annually. The second actual coir sample scored 17 for renewability, and the explanation for this is not known. The hypothetical coir scored orange for water, whilst both of the actual samples scored red and all of the samples scored orange for pollution. The high water use for the production of coir results from the use of potable water both in the production of the coconuts and in the processing of the husks at the fibre mill. In the worked example, it was assumed that at the coir pith factory, water was used to wash and buffer the coir in a controlled (tanked environment). The waste-water was treated and used to irrigate the coconuts and this recycling had been taken into account in the calculation, see Table 4. The red water scores for the actual coir samples indicated even higher water use. The scope for reducing the water requirement for the production of coir is an area that needs to be further investigated and clarified. The scores for energy, social compliance, habitat and biodiversity and resource use efficiency were all yellow.

Figure 5: Water use for the example of coir used in the RSMGM guidance notes



Source: GMA2018

13.4 Sustainability of green compost

In the worked example for green compost in the RSMGM guidance notes, green compost was described as: recycled material, which was PAS100 certified and produced to the WRAP Guidelines for the Specification of Quality Compost for use in Growing Media (WRAP 2014). Therefore, the starting point for the material was the transfer station or the composting site for material not arriving from a transfer station. The end point was the end of the mixing system. The summary of the material score for the hypothetical sample and for three actual samples of green compost is shown in Table 5.

Table 5: Summary of the scores for the example of green compost used in the RSMGM guidance notes

Criteria	Hypothetical green compost	Actual green compost 1	Actual green compost 2	Actual green compost 3
Energy	14	16	16	16
Water	20	20	20	18
Social compliance	5	20	20	15
Habitat & biodiversity	20	20	20	17
Pollution	12	20	20	20
Renewability	20	20	20	17
Resource use efficiency	6	10	15	8

Source: GMA 2018; Alexander et al.2016

With regards to the criteria for water, social compliance, habitat and biodiversity, pollution and renewability, two of the actual green compost samples scored the maximum of 20 and these were thus labelled green. The third actual sample scored yellow for social compliance, habitat and biodiversity and for renewability, and the reasons for the lower scores for this sample are not known. Compared with the other peat alternatives assessed by the calculator, the number of green scores achieved for green compost was more than that for any of the

others i.e. wood-fibre, coir or bark. All of the green compost samples scored yellow for energy and orange for resource use efficiency, apart from actual sample 2, which scored yellow. The hypothetical green compost example scored red for social compliance, and this was explained as being due to the hypothetical company had only completed a self-assessment questionnaire to demonstrate social compliance. As per the guidelines, this was valued at 0.5 of an audited third-party assessment. As neither of the Transfer Stations had undertaken any form of assessment, they had no evidence of their social compliance. However, the two of the actual samples scored the maximum 20 for social compliance and the third actual scored yellow, indicating that an audited third-party assessment of social compliance being in place.

13.5 Responsible sourcing and manufacturing scores for actual samples of the main growing media materials.

For easy comparison between the materials, the scores for the actual examples of bark, wood-fibre, coir and green compost, as shown in Alexander et al. 2016, have been summarised in Table 6. For comparison, this table also includes two actual samples of peat and one actual sample of loam, which were also assed using the calculator (Alexander et al. 2016).

Table 6: Summary of responsibly sourcing and manufacturing scores for actual samples of peat alternatives and for peat.

Criteria	Bark	Wood-fibre		Coir		Green compost			Peat		Loam
	1	1	2	1	2	1	2	3	1	2	1
Energy	14	8	8	10	10	16	16	16	12	12	6
Water	20	16	16	5	5	20	20	18	20	18	20
Social compliance	11	13	15	15	13	20	20	15	19	17	15
Habitat & biodiversity	15	15	15	12	12	20	20	17	15	15	20
Pollution	20	20	20	8	8	20	20	20	20	20	20
Renewability	17	17	17	20	17	20	20	17	1	1	1
Resource use efficiency	15	15	15	15	15	10	15	8	8	8	15

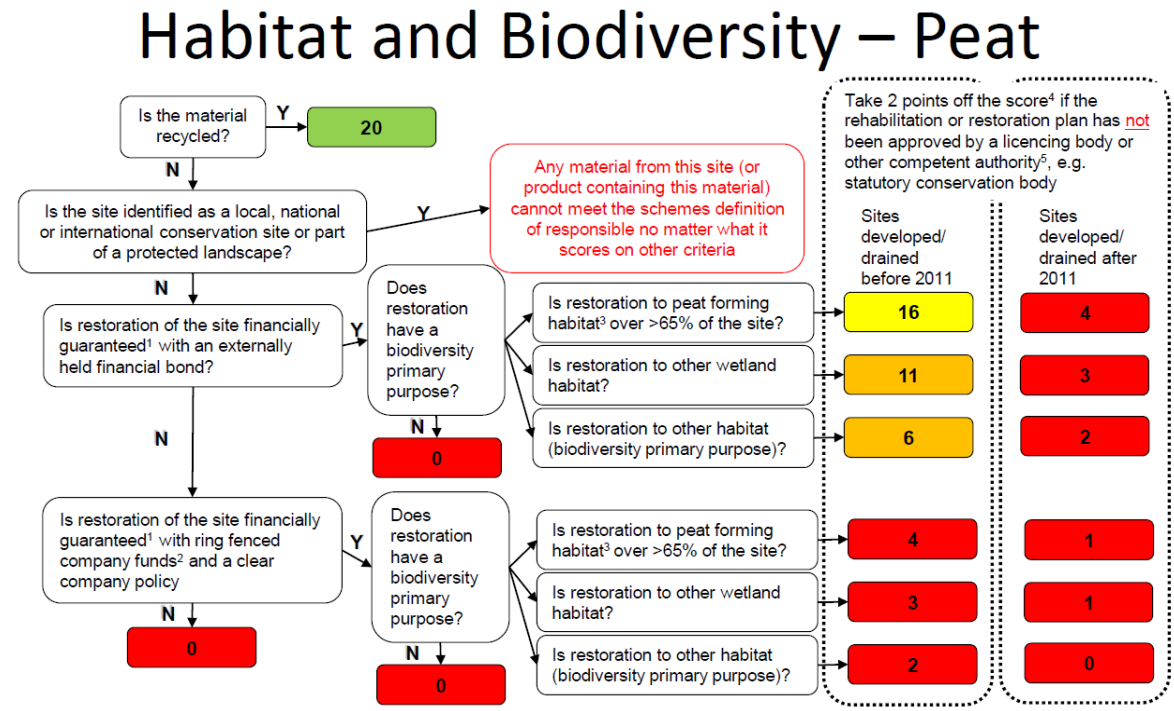
Source: Alexander et al. 2016

Notably, *both of the actual peat* **samples** and the loam scored green for water use and for pollution, and the peat sample 1 also scored green for social compliance and the loam for habitat and biodiversity.

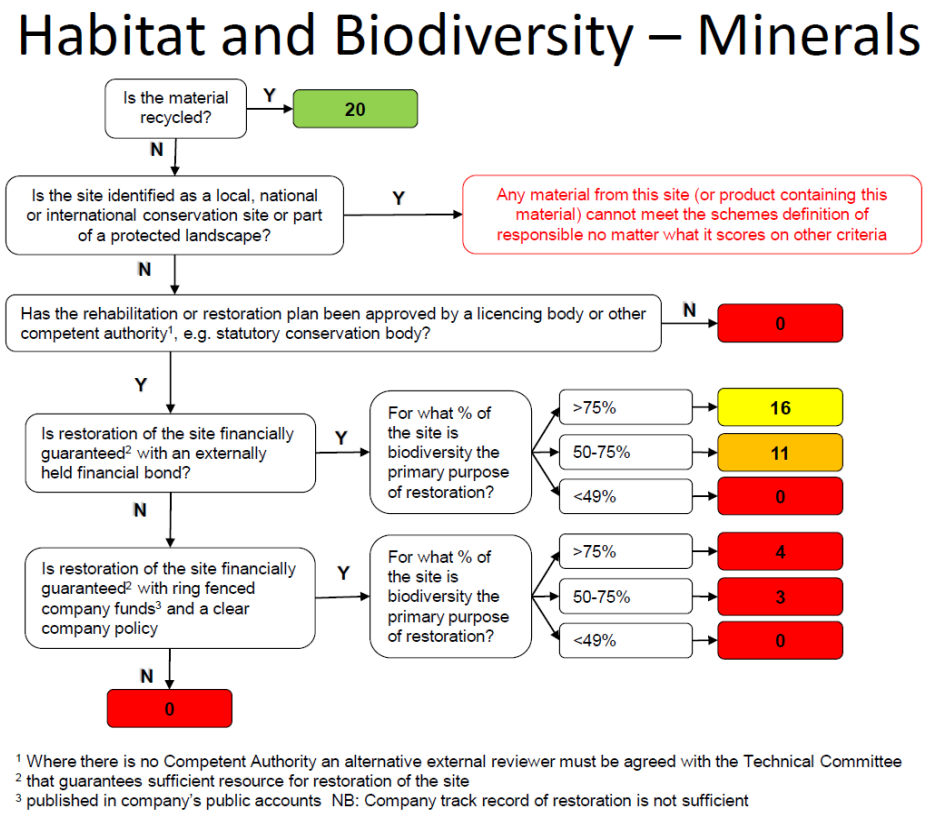
In the RSMGM guidance notes (GMA 2018) it has been explained that the habitat and biodiversity issues associated with land management and land use change for each of the common bulk materials of growing media were considered to be too diverse to use a single scoring decision tree and therefore five different categories of bulk ingredients were considered in separate scoring decision trees. The five categories were: peat, wood-based material, coir, minerals and recycled materials, see Figure 6 as an example.

According to the assessment scores for habitat and biodiversity both of the peat samples scored 15 (yellow), indicating that these peat products were from land that were previously used for agriculture/forestry and that a restoration plan for the habitat was in place. The loam sample scored 20 (green) for habitat and biodiversity indicating that loam was recycled. With regards to renewability, the peat samples and the loam scored red, as these materials are non-renewable at the same site within 1000 years.

Figure 6: Scoring decision trees for peat and minerals



[1] that guarantees sufficient resource for restoration of the site
[2] published in company's public accounts NB: Company track record of restoration is not sufficient
[3] appropriate to the country of the site (as demonstrated by restoring hydrological conditions)
[4] Negative scores are rounded to zero
[5] Where there is no Competent Authority an alternative external reviewer must be agreed with the Technical Committee



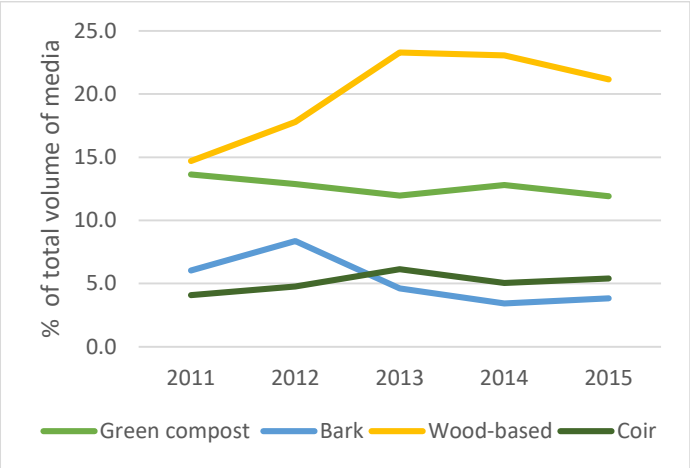
Source: GMA 2018

At this stage the, we are still awaiting clarification on how the results from the responsible scoring calculator are going to be used or displayed within the horticulture sector and to consumers. It has been indicated (GMA, 2018 and 2019b) that it will be the scores for the formulated product (potentially containing a mixture of bulky ingredients) calculated as the sum of the ingredients' scores weighted by % volume for each of the criteria, that will be displayed to the customer, as opposed to the scores for the individual bulky ingredients. Also, at this stage, any potential differences in the weighting of the different criteria or the minimum thresholds for the scores, for either the formulated medium or the individual ingredients, for the materials to be considered as being responsibly sourced, have not yet been defined or agreed within the sector. Therefore, the impact of any individual bulky growing media ingredient scoring one or more red scores, or indeed green scores, are not known at the point of publication.

14 Trends in the use of peat alternatives in horticultural growing media

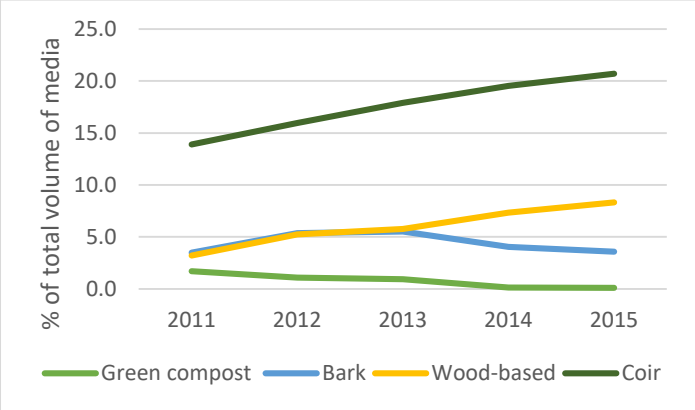
Based on the data in AHDB (2016), Figures 7 and 8 show the trends between 2011-2015 in the proportions (% of total volumes of media) of the main peat alternatives, bark, wood-fibre, coir and green compost, in growing media supplied to the retail and profession sectors, respectively.

Figure 7: Proportions of peat alternatives used in growing media in the retail sector



Source: AHDB 2016

Figure 8: Proportions of peat alternatives used in growing media in the professional sector



Source: AHDB 2016

According to AHDB (2016), in 2015 a total of 142,822 m^3 of bark was used in growing media in the UK (104,198 m^3 for media supplied in the retail sector and 38,624 for media supplied into the professional sector) and a total of 664,465 m^3 of wood-based substrate was used in growing media (574,381 for media supplied to the retail sector and 90,084 for media supplied to the professional sector).

During the period 2011-2015, the trend for the use of bark was a decline, with a peak in 2012 when a total of 289,397 m^3 was used. The peak in 2012 was thought to be related to a shortage of peat due to adverse weather conditions affecting the peat harvest in previous years (UK supplier of bark-based media, personal communication). For wood-based substrate the trend was a steady increase during the period 2011-2015 (Figures 7 and 8). Figures for the use of bark and wood-based product in horticultural growing media since 2015 are not yet available.

According to AHDB (2016), in 2015 a total of 370,159 m^3 of coir was used in growing media in the UK (104,198 m^3 for media supplied in the retail sector and 223,590 for media supplied into the professional sector). For growing media in the professional sector, coir was the most commonly used peat alterative, with volumes fluctuating between 0.18 Mm^3 – 0.22 Mm^3 in the period 2011-2015 the proportion (of the total volume of media) increasing from 14% to 21 %. between 2011–2015.

According to AHDB (2016), in 2015 a total of 324,215 m^3 of coir was used in growing media in the UK (323,085 m^3 for media supplied in the retail sector and 1,130 m^3 for media supplied into the professional sector). Green compost has primarily been used for media supplied to the retail sector and in this sector the volumes have fluctuated between 0.42 Mm^3 used in 2011 to 0.3 Mm^3 in 2013 and 0.32 Mm^3 in 2015. For media supplied to the professional sector there has been a steady decline in the volumes of green compost to only 0.11 Mm^3 in 2015.

15 Availability of peat alternatives, barriers and opportunities for increasing the supply

15.1 Bark and wood-fibre

Although both bark and wood-fibre are significant parts of the forest economy, the availability of these products, which are essentially by-products of the timber industry, is largely affected by factors outside the control of the horticulture industry. Some manufacturers source bark from UK forests, but others are also reliant on imports, mainly from southern Europe. The availability of bark is, therefore, largely dependent on overall economic performance of the building industry and the demand for timber, thus during the economic crash in 2007/08 with the collapse of the building industry, the supply of timber was reduced, and therefore also the supply of bark (Bragg 2018).

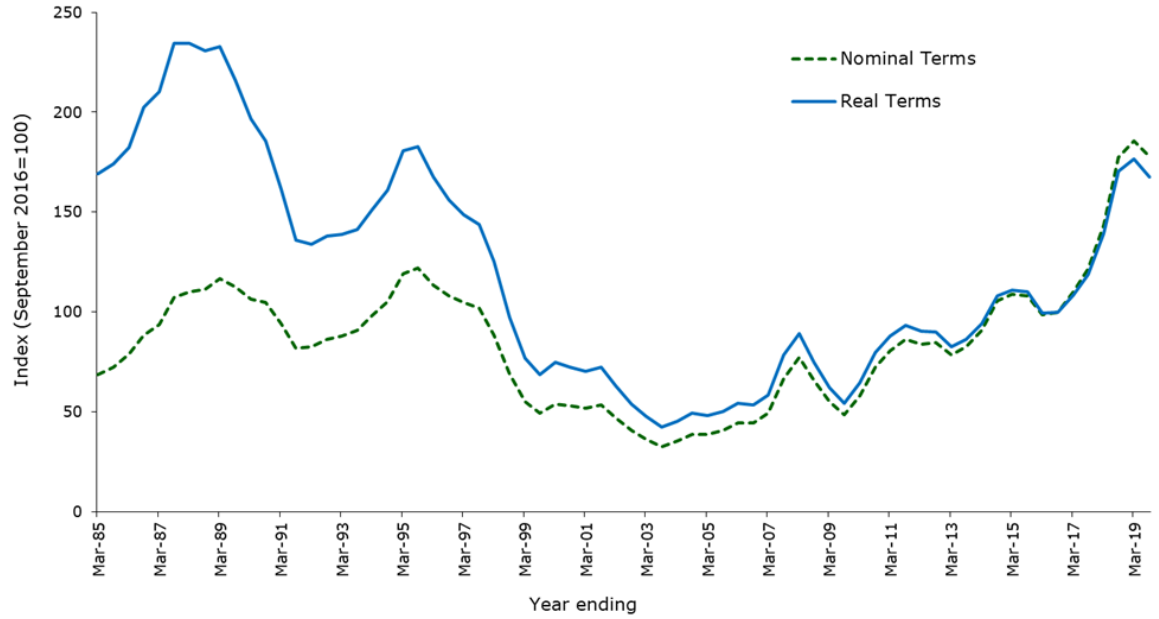
With regards to the availability of bark and wood-fibre, a representative from Melcourt Industries (a specialist company using bark in their growing media formulations) (personal communication, January 2020), commented that '*although the supply of bark and wood-fibre is potentially limited, in our view, there are currently sufficient volumes available in the UK to accommodate a large increase in the supply relative to what is being used at present*'. It is important to note, however, that the volumes of bark currently used for growing media purposes in the UK are relatively small, 0.143 Mm^3 in 2015 (or 4%) of the total volume of approximately 3.5 Mm^3 of growing media used and compared with 1.96 Mm^3 of peat used for growing media (AHDB 2016). According to the representative from Melcourt, the challenge for increasing the supply of their growing media is not the supply of bark or wood-fibre as such, but instead it is the investment required for the company to increase their production capacity e.g. in terms of machinery, equipment and space for handling and storing the products. Nevertheless, with the investment made in machinery and R & D in recent years, the company are currently able to build the capacity required to meet the increased demand in future (personal communication, January 2020).

The term wood-fibre is used for wide range of materials, sourced and processed in different ways. It can be sourced from different types of forestry by-products such as roundwood offcuts from trees supplied to the timber industry and sawdust from the sawmills (both considered as virgin by-products) or from woody prunings from landscaping/amenity horticulture sector, including oversized woody fractions from green waste composting facilities (considered as recycled material). To transform these wood by-products into wood-fibre suitable for use horticultural growing media, the products are often first shredded or chipped. The material is then further processed using different machinery; it can be processed using a heat, steam and pressurised expansion process, or through twin disc refiners, mechanical extrusion or milled using a hammer mill process. The method by which the wood is processed will determine the final characteristics of the wood-fibre and the processed material can be light 'cotton-wool'-like materials, have long or short fibres, or be a finer/denser 'chip style' material.

As for bark, the availability of some of the wood used to produce wood-fibre is largely affected by factors outside the control of the horticulture industry, including the overall demand for timber by the building industry. In recent years, there has been a very strong demand for both timber and for forestry by-products, with the demand for the latter being especially fuelled by the demand for wood biomass for heat and power generation. At present there are strong competing markets for both bark and wood-fibre. The wood/woodchips that can be used produce wood-fibre, is also in demand for a range of high value products such as equestrian bedding, production of fibreboards, fencing and by the landscape industry. However, at the present time, it is the demand for wood biomass for heat and power generation that is thought to be having the greatest impact on the availability and price of forestry by-products. The competing demands for bark and bark-fines are again the landscaping industry, fibreboard production, but not for animal bedding or for biofuel. The representatives from this sector (personal communication, January and February 2020) confirmed that for wood products supplied for biomass burners, there is a penalty if it contains too much bark, as this produces too much ash when burnt.

With regards to the price of wood and forestry by-products, there has in, recent years, been unprecedented increases in the price of wood and naturally this will also influence the price for wood-fibre. The benchmark price figures that are used by the industry are the Forestry Commission Timber Price Indices, and according to this there was a 86-point (86%) increase in the Conifer Standing Sales Price Index for Great Britain from September 2016 (2016=100 in the index) to March 2019, with the average price increasing from £16.70 m^{-3} in September 2016 to £31.66 m^{-3} in March 2019 (overbark standing price). Over the last 10 years (up to September 2019), there was an increase of 265% in the Conifer Standing Price (Forest Research. Timber Price Indices https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/). This increase in the price has been influenced to a large degree by the demand and the subsidies that are available for wood biomass, as outlined in the text box below.

Figure 9: Coniferous Standing Sales Price Index for Great Britain 1985-2019



Source: https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/

Box 1

Incentives for the use of wood biomass for heat and power generation.

The use of wood biomass for generation of heat and power is supported by various Government schemes, primarily The Renewable Heat Incentives and The Renewables Obligation.

The Domestic Renewable Heat Incentive is a government financial incentive to encourage a switch to renewable heating systems and in this way help the UK reduce carbon emissions and is for households both off and on the gas grid. The Non-Domestic Renewable Heat Incentive is a government environmental programme that provides financial incentives to increase the uptake of renewable heat by businesses, the public sector and non-profit organisations.

The Renewables Obligation (RO) is one of the main support mechanisms for large-scale renewable electricity projects in the UK. The RO came into effect in 2002 in England and Wales, and Scotland, followed by Northern Ireland in 2005. It places an obligation on UK electricity suppliers to source an increasing proportion of the electricity they supply from renewable sources. Under the Renewable Obligation, energy companies receive subsidies called Renewable Obligation Certificates, or ROCs, for every unit of electricity they produce from an eligible technology. Although, the Renewable Obligation has now been phased out and replaced by other subsidies called Contracts for Difference (CfDs), schemes that were awarded ROCs prior to 2014 can continue receiving them until 2027.

Source https://www.ofgem.gov.uk/environmental-programmes

Although industry representatives from this sector (personal communication, January and February 2020) were not able to speculate on precise volumes of bark and wood-fibre that could potentially be available, they went as far as to say that substantial investments are

being made with the view to facilitate, already this year (2020), a 'substantial increase in the supply' of both bark and wood-fibre products, and also for the future. As the price of these materials is financially sensitive information they were not able to quote precise prices for either bark or wood-fibre, but confirmed that these products are, and are likely to remain, more expensive than peat, unless, of course, the environmental costs of peat extraction become internalised in the price of peat. They also confirmed that neither the retailers or the growing media manufacturers had much bargaining power with regards to the price, as there are other valuable market outlets for the materials. However, one of the industry representatives (personal communication, February 2020) estimated that the price of bark-fines (the ideal product for growing media) would likely be 35% less than that for processed coir. Phytosanitary issues related to bark are a further concern. For example, the presence of beetles and nematodes has prevented the import of untreated barks from Southern Europe.

15.2 Coir

Coir, which is a by-product of the coconut industry, has been highlighted as a peat alternative with great potential in terms of fitness for use as a growing media ingredient. According to Van Doren et al. (2019), in the past 20 years, the production and processing of coir pith has increased from 1 Mm^3 to 9.6 Mm^3. With regards to the potential supply of coir, Van Doren et al. (2019) have estimated that the potential worldwide supply of coir to be 50.2 Mm^3, based on the worldwide acreages of coconut trees. However, at present approximately 90% of the world's coir comes from India and Sri Lanka, which together produce approximately 8.6 Mm^3 out of the 9.6 Mm^3. The coir pith is dried and pressed in the countries of origin, and with the limitations in investments, infrastructure, skilled employment, stable political climate and proximity of sea ports in the countries, the options for increasing the speed of growth of the production were thought to be limited and Van Doren (2019) estimated that it would take 15 years of increasing coir production to fully replace horticultural peat (Van Doren et al 2019, Bragg 2018).

As the coir is essentially a by-product of the coconut industry, the potential for increasing the overall supply of coir is limited and largely determined by the overall demand for coconuts. As pointed out by Bragg (2018), however great the horticultural demand for coir this is unlikely to lead to new plantations of coconut. There are also ethical issues that need to be considered with regards to the exportation of materials like coir, or other types of organic matter, from their countries of origin. In some countries, organic materials like coir are important resources for fuel, as well as for soil amendments to improve soil structure, so from a sustainability perspective it is important to ensure that the export of the coir is not at the expense of local needs (Bragg 2018).

15.3 Green compost

A summary of the availability and the potential for the use of green compost as an alternative for peat in growing media was provided by Nichols (2019). This information was produced as the written evidence submitted by the Renewable Energy Association (REA) to the House of Commons Environment, Food and Rural Affairs Committee inquiry on the state of peatland in England. The REA is a not-for-profit trade association, representing British renewable energy producers and promoting the use of renewable energy in the UK. It has around 550 corporate members, making it the largest renewable energy trade association in the UK.

The REA's Organics Recycling Group comprises 207 members, numerous of which operate commercial composting facilities, and its 'Biogas Group' comprises 215 members, numerous of which operate commercial scale anaerobic digestion (AD) facilities. Considering that WRAP recorded 330 permitted compositing sites in 2014, the 207 REA members constitute a majority of compost producers (> 60%).

In their document (Nichols 2019), REA included the trends for the use of green compost in soil improvers and growing media in the UK for 2011 and 2015 and compared this with total volumes of growing media and soil improver supplied into the retail market Table 7. According to their information, in 2015 a total of 323,085 m^3 of green compost was used for growing media and soil improvers supplied into the retail market, out of a total of 2,678,500 m^3 of growing media and soil improvers produced, which was 12.1%.

Table 7: Annual volumes (m^3) of growing media and soil improver products supplied into the retail market

	2011	**2015**
Total growing media & soil improver	3,111,097	2,678,500
Composted green waste	428,150	323,085
Percentage	13.8%	12.1%

Source: Nichols (2019) referring to data from AHDB 2016

Nichols (2019) also provided data on REA the annual production of compost and reported data for two types of compost; **green compost** produced from separately collected plant wastes (e.g parks and garden plant waste) and **green+ AB P compost**, produced from source segregated food and plant wastes, both composted in accordance with PAS100. According to REA, in 2018 the total production of green compost was 954,361 t $annum^{-1}$ and the production of green+AB P compost was 446,257 t annum-^{1}. Based on the assumption that both of these types of compost have a bulk density 500 g L^{-1} (= 0.5 t m^{-3}), this would equate to 1,908,722 m^3 (1.90 Mm^3) green compost and 892,514 m^3 (0.89 Mm^3) green+AB P compost, and a total volume of the two types of compost of 2.8 Mm^3. A bulk density of 500 g L^{-1} was used for this calculation, considering that the guidelines for the specification of quality compost for use in growing media has a target value for bulk density of 400-500 g L^{-1} (WRAP 2014). Taking account of the latest available figures, the 323,085 m^3 of green compost used for growing media and soil improver products in 2015 represented 17% of the annual production of green compost in 2018 and 12% of the total volumes of the two types of compost produced. The compost products certified by REAL are those derived from wastes which have achieved product status and can be supplied, stored and used without being subject to waste regulatory controls. However, the UK total compost output from permitted composting sites was estimated to have been 3.51 Mt in 2014 and total product status compost was reported to be 3.22 M t (WRAP 2017, Organics Recycling Industry Status Report 2015), equating to 7.02 Mm^3 and 6.44 Mm^3, respectively, assuming a bulk density of 500 g L^{-1}. Out of this 1.3 Mt were reported to be quality green waste PAS100 compost (Veolia 2019),

equating to 2.6 Mm^3. Thus, considering the total green compost production in 2014 and the volumes of green compost used for growing media and soil improver in the retail sector in 2015, the proportion of the total amount of the PAS100 green compost used for growing media was only 5%.

Table 8: Input tonnages to composting processes certified by Renewable Energy Assurance Limited and their compost production tonnages per annum, as reported at the end of 2018

Composting process locations	Input tonnes to composting processes per annum					Compost tonnes per annum		
	Green (plant) wastes only	'Green only' % of all input types	'Green and Animal By-Product' wastes	'Green+ABP as % of all input types	Total of all input types	'Green compost'	'Green+ABP compost'	Total of all compost types
England	2,183,000	71	874,000	29	3,057,000	822,056	329,124	1,151,180
Wales	122,000	90	13,000	10	135,000	48,002	5,115	53,117
Scotland	136,000	50	134,000	50	270,000	59,161	58,291	117,452
Northern Ireland	73,000	32	156,000	68	229,000	25,142	53,727	78,869
Total	2,514,000		874,000		3,057,000	**954,361**	446,257	1,400,618

Source: figures in unshaded cells are from Renewable Energy Assurance Limited's (REAL's) Compost/ Biofertiliser Certification Schemes' Annual Report 2018 (see http://www.qualitycompost.org.uk/information/scheme-statistics). Figures in shaded cells have been calculated by the REA using figures reported by REAL (Nichols 2019).

At present, green compost and green+ABP composts are already substantially supplied as soil improvers for use in a range of markets, including amateur and professional horticulture (professional landscape horticulture). Although both green compost and green+AB P compost can potentially be used as ingredients in growing media (i.e for container grown plants) in accordance with the WRAP guidelines (WRAP 2014), it is assumed that most of the compost used for this purpose is at present green compost, though this needs to be confirmed.

Considering the volumes produced at present, there appears to be potential for more green compost and green + AB P compost to be used in peat-free and peat-reduced growing media if the manufactured quantities increase and/or the proportion of green compost in them can be increased. Given the typical characteristics, at present, green compost tends to be used at 20% (vol/vol) in good quality growing media, though green+AB P is likely to be included at a lower rate. Considering that in 2015, the total volume of growing media for container grown plants (multipurpose, specific media, soil-based media, growing bags and peat-free media) supplied to the retail and professional sector was approx. 3.6 Mm^3, if 20% of this was green compost a total of 0.72 Mm^3 would be required.

However, there are also other issues that need to be taken to account when considering the potential for more green compost to be used in growing media in future. The quality of the green compost must be adequate and consistent, sufficient amounts must be supplied at the times of year when the growing media and soil improver manufacturing facilities need them, compost sources must be within economic transport distance from the manufacturing facilities (composts are a relatively high-bulk-density-but-low-priced renewable resource),

physical contaminants in many of the composts produced need to be reduced, and compost prices need to be a) high enough that the manufactured growing media and soil improvers market is a commercially sensible sector for composters to sell to and b) not so high that other bulky substrates are chosen by the manufacturers.

15.4 Geographical availability of green compost

At present the logistics around the availability of green compost are unclear. It is important that sufficient quantities can be supplied at the times of year when the growing media manufacturers need them and that the compost is located within economic transport distance from the growing media manufacturing facilities. Compost have a relatively high-bulk-density and is therefore expensive to transport. REA has recommended that an appraisal should be undertaken of the composting sector's potential to supply more compost for use in growing media, considering the quantities available and the locations of the material. They recommend that this should be part of a wider assessment that includes the potential for increased use of the other bulky materials that can be used as alternatives to peat.

15.5 The quality of green compost

The quantities of green compost available in the UK (Table 8), as calculated by REA, is compost produced in accordance with PAS100. However, it is important to note that for green compost to be used as an ingredient in growing media, the growing media manufacturers will likely demand that the compost is produced to a higher standard than that of PAS100 and that, at least, it is produced in accordance with the WRAP Guidelines for the Specification of Quality Compost for use in Growing Media (WRAP 2014). It is important to note that there are differences in the quality specifications of the compost between PAS100 and the WRAP guidelines, for example, with regards to the limit levels for contamination of plastics; where PAS 100 requires the total level of plastic > 2mm to be no more than 0.12%, but the WRAP Guidelines recommends that plastic > 2mm should be no more than 0.05%. With regards to other contaminants e.g. sharp, glass, metal and potentially toxic elements, the limit levels are the same in both specifications.

With regards to desired quality requirements for green compost to be used for this purpose, schemes developed and adopted in Germany also provide good guidance. In Germany, the Federal Quality Assurance Association for Compost (BGK) have created quality parameters/requirements for green compost used in growing media. As in the UK, the green compost is mainly based on material from source segregated botanical wastes from municipal parks/gardens and from domestic gardens. The Quality Association for Plant Substrates (GGS; www.substrate-ev.org) use same quality assurance system as BGK and for quality assurance for growing media they have developed detailed data sheets for growing media and their constituents, including compost. Although the parameters of assessment are broadly the same in the German specifications and the WRAP specifications, there are some differences in the methodologies used and in how the limit levels have been defined and, therefore, further comparison of the different specifications is required. According to a GGS representative (personal communication April 2020), in Germany '*only high-quality green compost meets the limit levels'* set by BGK and GGS.

Contamination is a significant challenge with green compost due to the differing standards and processes applied by waste management firms. Whilst the PAS100 standard has been introduced to offer some level of assurance, our respondents all complained that procuring uncontaminated waste was a major challenge. Plastic is a major problem with one person referring to people's habit of throwing unwanted plant pots into their green waste bins. These can then be shredded into the compost mix. Others spoke of problems with contamination with herbicide residues. Such contamination issues are definitely contrary to the desires of the more environmentally aware consumer who would be purchasing products with significant levels of alternative growing media. Part of the challenge is that such contamination is unlikely to be found consistently within batches of green compost as they may result from a small number of sources and therefore be concentrated. Some manufacturers are able to procure good quality green compost in cases where they able to access from one source of well-regulated product. An example given was that of brewery waste where a relationship has been built with the supplier over time such that consistent standards are assured.

With regards to the physical and chemical quality characteristics, the guidelines for compost to be used for growing media are also more restrictive than the specifications in PAS100, for example with regards to bulk density, particle size distribution and electrical conductivity, the latter for which an upper limit has been set at 1500 µS cm^{-1}. According to the WRAP guidelines, 'with the full prior knowledge and prior written agreement of the purchaser, the compost might include food wastes that have been composted to the standards set in the Animal By-Products Regulation (ABPR), though it is not clear at present to what extent this type of compost (green + AB P compost) is currently being used as an ingredient in horticultural growing media. According to Nichols (2019), it is assumed that only lower quantities of green+AB P compost is currently used for growing media, one of the reasons being their tendency to have higher electrical conductivity, which limits its use for this purpose.

In the introduction to their new peat free growing medium, Happy Compost (based on coir, green compost, composted bark fines and a recycled wood fibre), Bord na Mona UK (2020) commented that there is a commercial opportunity to supply much more green compost to horticultural businesses but the recycling industry must note that PAS100 is a minimum standard, and most horticultural businesses are looking to exceed that quality standard to replace peat; the industry needs lower EC's, bulk densities and pH's which are available in high quality processes (https://www.thegreenergardener.com/peat-free-compost-the-current-market-and-bord-na-monas-latest-product-happy-compost/).

16 The price and availability of peat alternatives

The price of the peat alternatives is probably the most important barrier hindering the increase in the use these materials as ingredients in growing media, especially the price for bark, wood-fibre and coir. Peat is the cheapest raw material available to the market as licences have been paid for years earlier and all the infrastructure is in place to exploit peat *in situ.* Thus far, the industry has largely managed to absorb price increases resulting from

incorporating greater volumes of alternatives. According to Bord Na Móna (Anon. 2020), all other diluents are between 2 to 6 times more expensive than peat, and as the demand for the alternatives increases so it will become harder to maintain relatively low prices for growing media products. Bord Na Móna (Anon 2020) commented that although it will be possible to access more coir and more wood-based products, there is no way the growing media market could sustain the increase in prices for better quality materials. The price will also be impacted by Plant Passport regulation, 'raw material availability is only going to get tighter and tighter with plant passports as it will likely only be the products that we can produce ourselves as we won't be importing materials from other countries', (growing media manufacturer, February 2020). With regards to green compost, more information is needed on the price and the pricing strategies for this to be supplied to the horticulture industry.

Transport costs are an important factor in the final price of a growing media product. Different raw materials have varying densities and therefore have different transport costs and carbon footprints. Manufacturers with operations based next to sources of peat usually have to transport alternatives a considerable distance in order to mix them into the final product. Then the final product needs to be transported to market. Therefore, there can be considerable costs incurred and significant carbon footprints from the extra travelling required to assemble the ingredients. A requirement to significantly reduce peat composition or even to eradicate it would require many firms to re-locate their operations closer to the market and sources of alternatives.

The global demand for growing media is predicted to increase substantially in the coming decades as population increases and the global middle class expands. The Chinese government's strategy to address food security envisages that the country will require 100 million m^3 of growing media by 2030. This compares with current total global production of horticultural peat in 2017 which was around 40 million m^3 and a total global volume of growing media of just under 60 million m^3. Global predictions for growing media demand suggest that overall volumes will need to increase by over 400% by 2050 (Table 1). Therefore, there will be ever increasing competition for all sources of growing media which will lead to price increases for key constituents. With such high demand there will need to be strong legislation to protect peat sources and manufacturers will be challenged to find sources of consistent, reliable, affordable products. On the other hand, such demand will likely trigger new sources and manufacturers able to meet the demand will be well placed to thrive in the market.

Table 9: Summary: Opportunities and Barriers for Alternatives

Bark			
Responsibly sourcing scores		**Opportunities**	**Barriers**
	Actual 1		
Energy	14	• Some potential for increasing the supply from UK forests, potential volumes not confirmed • Good performance characteristics at high proportions in media • Orange score for Social Compliance can potentially be overcome.	• Supply from UK forests is ultimately limited • Energy score can be low relative to other materials • Investment required to increase capacity of growing media manufacturers. • Competing demand from landscaping industry for some types of bark. • High price compared with peat
Water	20		
Social compliance	11		
Habitat & biodiversity	15		
Pollution	20		
Renewability	17		
Resource use efficiency	15		

Wood-fibre				
Responsibly sourcing scores			**Opportunities**	**Barriers**
	Sample1	**Sample2**		
Energy	8	8	• Potential for increasing the supply from UK wood (volume tbc) • Good performance characteristics at high proportions in media	• Energy and social compliance scores can be low relative to other materials • Competing demand for the raw material from wide-range of high value uses, including equestrian bedding, production of fibreboards, fencing, by the landscape industry and importantly for fuel for heat and power generation • High price compared with peat, impacted by the financial incentives for wood biomass fuel
Water	16	16		
Social compliance	13	15		
Habitat & biodiversity	15	15		
Pollution	20	20		
Renewability	17	17		
Resource use efficiency	15	15		

Coir				
Responsibly sourcing scores			**Opportunities**	**Barriers**
	Actual 1	Actual 2		
Energy	10	10	• Potential for increasing the supply to UK to be confirmed • Good performance characteristics at high proportions in media	• Limited potential volumes of supply; supply related to world-wide production of coconuts (India & Sri Lanka at present) • Water and pollution scores are low relative to other materials, and potential for improving these needs to be confirmed • Competing demand from horticulture worldwide • Ethical considerations of exporting organic matter • High price compared with peat
Water	5	5		
Social compliance	15	13		
Habitat & biodiversity	12	12		
Pollution	8	8		
Renewability	20	17		
Resource use efficiency	15	15		

Green compost					
Responsibly sourcing scores				**Opportunities**	**Barriers**
	Actual 1	Actual 2	Actual 3		
Energy	16	16	16	• Potentially large volumes, (2018: 1.8-2.9 Mm^3, tbc), subject to quality characteristics • Strong sustainability credentials • Satisfactory performance characteristics when added up to 20% as ingredient.	• Future potential volumes are unknown due to changes in green waste collection • Volumes of compost with required quality is unknown • Potential contamination with plastic, herbicide residues, and microbial contaminants • High transport costs • Time of year when it is available • Competing demand from agriculture/landscaping industry. • Competing demand for compost feed stock from power generation and anaerobic digestion
Water	20	20	18		
Social compliance	20	20	15		
Habitat & biodiversity	20	20	17		
Pollution	20	20	20		
Renewability	20	20	17		
Resource use efficiency	10	15	8		

17 Other potential peat alternatives for the future.

Over the last two decades, most research undertaken in the UK to develop viable alternatives to peat for use in growing media has largely focussed on the use of coir, bark, wood-fibre and green compost. It has often been concluded that blends of these materials provide the most viable replacements, considering both the technical properties required of the media and

factors relating to the availability and price of the materials. To ensure that the transition towards the use of the most responsibly sourced materials continues also in future, it is important that the search for, and development of, new alternatives continues. Research on the use of a wide range of materials as potential peat replacements in growing media was reviewed by Barrett et al. (2016). The materials for consideration were transformed and untransformed waste materials from, for example, the food industry, such as rice hulls, which have been used with some success as a growing media ingredient in several countries (Zanin et al. 2018), spent brewer's grain, which has been successfully used in the past in the UK (Prasad and Carlile 2009), as well as other types of primary plant fibres such as bracken, switch grass, *Miscanthus* and willow (Barrett et al. 2016). Fibres derived from livestock farming, such as wool and animal manures have also been considered and growing media based on composted bracken and wool are indeed, already available on the UK market, supplied by Dalefoot Composts.

Anaerobic digestate fibre have also been highlighted as potential candidates as peat replacements, especially considering the likely future availability of this material with the current investments made in setting up anaerobic digestion facilities for biogas production and energy recovery. This includes facilities for large and small scale and for digesting mixed bio-wastes or single source materials, like maize. Consequently, research in the UK and elsewhere, has been undertaken to develop the use of anaerobic digestate fibres (the solid fibrous fraction derived from anaerobic digestion) and this material has been highlighted as a viable replacement for peat in growing media, often described as providing the best performance when blended with other materials (Zanin et al 2016; Ponchia et al 2017). In a review of the literature, Dimambro et al. (2015) concluded that digestate fibre or (co)-composted digestate fibre could be successfully used as growing media ingredients, but they needed to be blended with other materials to ensure that the final growing medium mix had a suitable EC and pH for the crop. Crop sensitivity to high concentrations of specific nutrients such as phosphate or sodium should also be considered. In a study, testing different types of digestate, Cheffins and Stainton (2015) concluded that digestate fibre separated from either maize-based digestion or source segregated biowaste could be successfully used to grow a range of high value ornamental and edible plant species and the fibre could be reliably incorporated as a growing media component up to at least 50% by volume. The maize-based digestate was regarded to be particularly suitable, as this material had the strongest structural integrity and no visible physical contamination.

Figure 10: Maize based digestate

Source: Cheffins and Stainton 2015

The cultivation of peat-moss to produce *Sphagnum* biomass - *Sphagnum* farming - has also been highlighted as a promising option to provide a replacement for peat. *Sphagnum* biomass has been shown to have similar physical and chemical properties to the 'white peat' extracted from raised bogs (Gaudig et al. 2014) and experiments have shown the suitability of media based on *Sphagnum* biomass for cultivating a wide variety of crops, from seedling to saleable plants (Wichmann 2015). In their review of the progress in *Sphagnum* farming in Germany, Gaudig et al. (2014) concluded that *Sphagnum* biomass was a suitable material for horticultural growing media, with *Sphagnum palustre* being the most promising species, both in terms of its suitability to be cultivated in farming systems and for its properties as a growing media constituent. *Sphagnum* farming has been practiced in re-wetted peatlands and deep water, in land-based cultivation systems and even on floating mats under greenhouse conditions. Research to develop farming systems for the production of *Sphagnum* has been driven by the growing demand for a supply of *Sphagnum* to be re-introduced to degraded peatlands and in restoration programmes following commercial peat extraction (Caporn 2018). At present there are a number of research programmes underway (or recently completed) investigating *Sphagnum* farming and the restoration of peatlands involving the re-introducing the peat forming vegetation species, including a project funded by the UK Agri Tech programme (UK Research and Innovation 2018) and a project funded by the EU LIFE Climate Change Mitigation programme (LIFE Peat Restore 2018), both of which involve active collaboration between academics, growing media manufacturers and peat producers. Investigations on the economic feasibility have shown that farming Sphagnum biomass can already now be profitable for niche markets with high revenues, but it has been emphasised that the challenge still remains to upscale the production process and to develop machines and methodologies for economic scale mass production (Gaudig et al. 2014). So, although the use of farmed *Sphagnum* as a renewable raw material in horticultural growing media may not be a viable option today, it may well become so in the longer-term future.

As an alternative to search for viable alternatives for peat in growing media, research has also been undertaken to develop new growing systems that are less reliant on the use of growing media. For example, as a response to the difficulties in finding suitable replacements for peat for vegetable transplant propagation in blocks, the Plant Tape system has been trialled by G's

(AHDB 2018). In this system, vegetable seedlings are grown in trays on paper strips supporting a small amount of a peat/vermiculite mixture and this system was shown to not only reduce the use of peat for each lettuce plant by 90-95%, but also had the potential to reduce labour costs by 80% as it was much faster than the traditional method of transplanting. According to G's, they are confident that the Plant Tape will have a place in its business in the future, but more research is needed to make it as reliable and to achieve a similar standard of output as the traditional method of using peat blocks (AHDB 2018).

Options for development of growing systems that are less reliant on the use of ready-formulated growing media may also be appropriate for domestic garden situations and research and information to help gardeners to, for example, make their own growing media mixes may offer opportunities to take the sustainability of gardening activities to an even higher level. Garden Organic has long been advising organic gardeners to make growing media using resources from their own gardens e.g. homemade compost and leafmould (Garden Organic 2020), and perhaps also by adding molehill loam as suggested by the PeatFreeApril campaign (2020). For the blending of these home-made mixtures, the option of also adding some brought-in material, such as bark or wood-fibre, would likely also improve the formulations, and in this case, there would be opportunities for growing media manufacturers to extend their product range to also include peat replacements for use as 'add-mixtures', which, of course would have to be accompanied by appropriate recommendations for use.

As we move forward, and whatever the new materials may be for the future, it is important that when a new peat replacement is made available for use in horticulture, whether it is in media for professional growers or for hobby gardeners, this is done based on a combination of robust evidence that it can be reliably used for high quality performance and that it has successfully passed the agreed benchmark for being responsibly sourced and manufactured.

18 The effectiveness of the alternatives

Twenty years ago, efforts to reduce and replace peat were stymied by problems with poor quality alternatives which significantly affected people's perceptions. The effects seem to have been long lasting in terms of consumer confidence. For professional growers the consequences of a poorly performing product (or one whose differing properties require different growing strategies) can be devastating (Altmann 2008). One of our interviewees referred to a grower on the South Coast who had enthusiastically trialled alternatives in the 1990s but suffered from poor outcomes which had put his business at risk. Such experiences soon become folklore and act to suppress people's enthusiasm for the alternatives in the future.

However, considerable research has been undertaken into the alternatives and the optimum combinations. It is clear that reduced and zero peat products can offer extremely good outcomes, on a par or even better than peat-based products. The key thing is to understand which plants grow best with which formula and what growing regimes are required to ensure

optimum growth. For example, water requirements in terms of quantities and timings may be different to those gardeners have become accustomed to.

Although peat has been the predominant constituent of peat since the 1960's, research to find peat replacements has been ongoing in the UK ever since the concerns over the environmental consequences of the destruction of peatlands were raised in the 1970s and 1980s. In the early years, research and development was undertaken on quite a wide range of materials thought to be suitable candidates as replacement for use in growing media. The use of bark-based growing media was to some extent already established in the UK, with substrates based on pine, spruce/larch or mixed conifer barks available on the market. In other countries with more limited peat resources, including southern European countries, USA and Australia, bark has been, and still is, the predominant constituent in horticultural growing media and research and development to formulate media with mixtures of different types of barks have resulted in substrates that can provide all the desired properties for good plant growth. In the USA, bark also became the ingredient of choice as it was found to have advantages in terms of providing suppressive effects against some of the common plant pathogens, such as *Pythium* root rots. Already in the 1980's, there were several academic papers reviewing the performance of bark-based substrates, including Aaron 1982; Scott 1984; and Verdnock 1984. Growing media based on other wood-based materials were also developed, using different types of forestry by-products, such as chipped or milled wood and sawdust, or by products from the wood fibre-board industry. In the 1990's some of the leading growing media manufacturers launched a number of new products such as New Horizon, Levington Peat-free Universal Compost and the Bulrush peat-free growing media range (Lennartsson 1997).

The performance of coir as a growing media constituent was also investigated in several of the research projects undertaken in the 1990s in the UK (Bragg 1995; Smith 1997), as well as in many other countries and coir has now become one of the most widely used alternative to peat in growing media. With some similar characteristics to peat, coir has a good balance between water and air capacity and according to Schmilewski (2008) has the potential to be used in growing media for a wide range of purposes.

In the 1990's, research was undertaken to produce growing media using different composted waste products. The composted materials broadly fell into two categories. Firstly, there were composts produced at a municipal level using a broad range of botanical, green waste, source segregated from domestic gardens and public parks and gardens - the compost that is now being referred to as green compost, and sometimes also using a mixture of green waste and source segregated household waste (i.e. kitchen waste). Secondly, there were composts produced from a narrow range of carefully selected feedstock, for example, high nitrogen materials such as animal manures, food and drinks industry wastes were co-composted with carbon rich materials such as straw and wood-based materials. Some of these products were composted specifically to produce growing medium without further processing, but for others the compost was mixed with peat or other bulky materials to produce the growing medium end-product. The green composts required further processing before they could be used as growing media and this could be done by either leaching the compost to reduce electrical conductivity or by diluting it with low nutrient materials such as peat, bark or coir.

Formulating green compost with other bulky organic materials was often also required to produce the desired physical structure of the medium, as the green compost tended to have high mineral component and relatively low organic matter content. Frequently there would also be an imbalance or deficiency of nutrients that needed to be corrected; Rainbow and Wilson (1997) for example, reported on a process converting green compost into effective growing media by application of phosphoric acid (to add phosphorus (P) and reduce pH) and ammonium nitrate (to add nitrogen (N)) followed by dilution with coir. In the UK, growing media containing a proportion (20-50%) of green compost (produced from municipal waste) were first introduced on the UK market in the early 2000s, a few years later than when they had been introduced in other European countries like Germany. Some composts in the second category were used, especially by organic gardeners and growers, as growing media without further formulation and these usually had longevity of nutrient supply. However, as a large proportion of the nutrients in the composts are in organic form and their availability is dependent on mineralization by micro-organisms, the prediction of nutrient availability and precise fertiliser application in accordance with crop demand was problematic (Lennartsson 1997).

In the 1980s and 1990s there was very little government funding for research to develop alternatives to peat, and peat-free or reduced-peat growing media were developed primarily through research undertaken in-house, or on contract, by the growing media manufacturers. The growing media products were primarily available for the retail sector and used by hobby gardeners and growers. However, unfortunately, the performance of many of this 'first generation' of peat-free was often reported to be poor and highly variable, and as a result, leaving the customer dissatisfied and reluctant to make a repeat purchase. As outlined by Litterick et al (2019), although there is very little published evidence on the actual performance of these media, and on the consumer dissatisfaction, the problem of poor performance was widely discussed in consumer gardening programmes, magazines and websites. For example, Gardening Which? (which publishes regular ratings of growing media, based on replicated trials) has often placed named peat-free growing brands at the bottom of its league tables. According to Litterick et al. (2019), Gardening Which also noted a lack of consistency in product performance scores between years, with named products (notably both peat-reduced and peat-based media) achieving a good test score one year, and an exceptionally poor score the next (Litterick et al. 2019), prompting a response by the head of research at Gardening Which? to comment 'the trials of garden composts show that some manufacturers have made decent peat-free products for many years but others, especially those at the cheaper end of the market, have been churning out pretty poor ones and consumers have been burned by using these'.

The reported poor performance of peat-free/peat-reduced media and the impact that this had on the transition to reduced use of peat in horticulture was also mentioned in the initial report of the Sustainable Growing Media Task Force in 2012, where the chairman stated, 'in 1991 the quality and performance of alternatives was just not good enough and the campaign resulted in peat-free products on the market that at best were not as good as peat and at worst did not work. Therefore, whilst intellectually the task of the anti-peat campaign was well intentioned, in hindsight the rapid drive to 100% peat-free products was a tactical error

whose legacy impedes consumer confidence to this day. If the campaign groups had been more sensitive to the economic and quality challenges of creating an alternative to peat at the launch of their campaign, I believe more would have been achieved' (Sustainable Growing Media Task Force 2012).

From the 1990's, with pressure from the major retailers' peat policies and realisation that the Government targets for phasing out the use of peat were not going to be relaxed, more research was undertaken aimed at the professional horticulture sector. Many of the trials were undertaken privately by growers, or through research funded by the Horticulture Development Council, by WRAP (Waste and Resources Action Programme) and by other funding programmes. According to Alexander et al (2008) the initial results often indicated performance levels below those of the peat-based controls, but as the knowledge and understanding of the new materials improved, so did the results of the trials. Alexander et al (2008) continued to note that already by the late 1990s, many of the trials were providing very successful results and yet, commercial uptake of the new media was very limited. Although the reasons for this was not researched, they were thought to include allegiance to long standing practices, commercial interests and the costs associated with the high-quality alternatives as well as with changing nursery practices.

The trials and grower experiences over the two decades, 1990 – 2010, saw the list of materials that could replace some or all of the peat in growing media refined and shortened, and the most likely candidates were considered to be barks, wood-fibres, coir and green compost (Bragg 2012) examples of which are shown in Figure 11. In the HDC News Growing media review in 2012, Bragg reported that Growing Media Association (GMA) members had, over the last two decades, made considerable progress in the development of media containing new materials and that the majority of commercial growers were now using media made up with at least 10% non-peat materials, while a few were using mixes that were just 50% peat (Bragg 2012).

The HDC News supplement 'Growing media review' 2012 (ADHB 2012) reported on the results of all the trials that had been undertaken in the UK over the previous 20 years, aiming to review what had been achieved in growing media development and to indicate what needed to be done to ensure that high quality responsibly sourced and commercially viable materials were to continue to be available in the future. (Bragg 2012). The review included projects that had been funded by HDC, Defra and WRAP as well as by other funding programmes such as Horticulture LINK. Interestingly, the first three articles in the supplement all provided quite compelling arguments for the continued use of peat, but this was then followed by a number of reports showing promising performance of many of the peat alternatives for different uses. The first article contributed by Schmilewski (2012) outlined 'The view from Europe' asserting that 'all growing media ingredients have environmental impacts and sourcing peat to recognised standards, rather than banning it, was the way forward'. Riley (2012) looked at the current levels of peat extraction in England and assessed its impact on greenhouse gas emissions and concluded that 'the use of peat in horticulture contributed a mere 0.04% to England's total greenhouse gas emissions' and therefore, questioned 'if this warranted the cost to the horticulture industry of a government policy to phase out peat use?'. This was the followed by a summary of a project (CP 41A) that had reviewed the use of peat alternatives

for commercial plant production in the UK collating up-to-date statistics and technical information on the use of and performance of materials used in the professional growing media in the UK and elsewhere in Europe. This study was also reported to 'confirm the vital role of peat', stating that apart from bark and some wood-derived materials, there were insufficient quantities of any one material that was consistent and that could be used with certainty in plant production. Other barriers that had also been identified included costs, high bulk density and lack of confidence in technical performance, including stability, nitrogen lock up and the need to research new feeding and watering regimes and overall it was concluded that peat was recognised as essential in commercial horticulture (Anon 2012).

The HDC review (ADHB 2012) reported on numerous studies testing peat-free and peat-reduced media for different horticultural subjects, including for forcing bulbs, for production of cut and pot lilies, for bedding plants such as geranium, petunia, impatiens, salvia, marigold, begonia and pansies, for nursery stock production, for pot grown herbs, for vegetable transplant raising, for strawberries grown in out-of-soil production systems and for the casings in mushroom production. Many of the trials focussed on improving the understanding of how the different peat alternatives worked and how the production systems could be adapted, for example with regards to irrigation and feeding regimes, to achieve the best performance. There were reports of numerous studies funded by WRAP and by the landfill tax, investigating the use of composted green waste as an ingredient in growing media for commercial horticultural production, driven by the desire to develop commercially viable growing media ingredients from composted materials which could reduce the amount of waste going to landfill.

According to the review (ADHB 2012) for the majority of these projects, the conclusions were that the performance of the plants grown in either peat-free or peat-reduced media was in many cases as good as that of plants grown in the standard peat-based control, especially in trials where the handling and irrigation practices had been tailored and adapted to the individual media. In their overall summary of all of the results, Bragg and Tones (2012) concluded that in trials where the growing medium was of uniform consistency and in which the provision of water and nutrients was well adjusted to crop requirement, the plant quality, vigour, and shelf-life were generally as good as, and sometimes better in reduced-peat or peat-free media than in peat. They acknowledged that some problems had been identified with the use of non-peat materials, for example retarded early root development in some cases and slightly reduced vigour and paler foliage colour in some, but concluded that these problems had generally been minor and had usually been attributable to physical inconsistencies in the medium- or short-term imbalances in water, nitrogen supply, EC or pH, all of which could be rectified by adjusting irrigation and base fertiliser rates. (Bragg and Tones (2012). It was also concluded that significant progress had been made even in the systems that had previously been thought to be difficult to tackle in terms of using peat alternatives, such as for raising vegetable transplants and for mushroom casings.

Some limitations of the use of peat-alternatives were pointed out, including lack of availability and uniformity of some alternatives, the increase in price and difficulties with handling the materials in automated productions systems designed around the physical properties of peat e.g. for vegetable transplants. For green compost, the problem with contaminants was

highlighted, including physical contaminant like plastic and glass, even in compost produced to the PAS 100 standard and also the potential contamination with herbicide residues, and these were problems that still need to be resolved. Equally, some advantages of the peat alternatives were highlighted, including the greater buffer capacity between irrigation cycles observed when using bark, the production of more compact plants size meaning that more plants could be loaded onto the trollies for transportation and that some peat alternatives had proven beneficial by reducing moss and liverwort growth on the media surface compared with the use of peat. It was also concluded that the research so far had shown that the incidence of plants diseases had generally been unaffected by using peat alternatives and that samples of PAS 100 green compost had been consistently free from plant pathogenic fungi. However, the use of green compost had been found to increase the incidence of sciarid flies and shore flies, which are very damaging pests (Bragg and Tones 2012). Alexander et al. (2019) also highlighted the potential benefits of using non-peat mixes in terms of water saving as well as nutrient benefits due to the component materials. They concluded from their work evaluating different watering regimes in peat-reduced and peat-free growing media (using coir and different wood-fibres) for Pelargonium that there were opportunities for reducing peat use combined with reducing water use whilst maintaining plant quality and size (Alexander et al 2019).

A large proportion of the R & D projects carried out in the 1990-2010 period had been aimed at not only answering specific technical questions but also to stimulate interest and engagement by growers, especially in the nursery stock and protected ornamental sectors where production in peat was the long-established norm and peat alternatives offered no financial advantage. Much less research had been required to encourage uptake of peat alternatives by strawberry growers using the table-top production system, where use of coir was already widely accepted as having cost benefits over peat by enabling a longer cropping cycle. The final recommendation made by Bragg and Tones (2012) was a call for continued technology transfer projects, saying that, 'even if every barrier to commercial use of peat-free media is eventually overcome, the industry will still need to be shown in practice how all of the research findings of recent years can be brought together and scale up into commercial systems capable of producing a consistently high output of marketable peat-free plants with uncompromised shelf life.'

During the decade that followed, the 2010s, the technical research to improve the understanding and use of peat alternatives continued, even if not on the same scale as before. During this period most of the technical research was funded by AHDB, Defra and by the industry itself, as WRAP diverted their priority for research to other areas. Considerable efforts were made by the growing media industry in response to the Sustainable Growing Media Taskforce established by Defra in 2011, set up to explore how the peat reduction targets set out in the Government White Paper, 'The Natural Choice, securing the value of nature'. The response from the industry successful brought together members of the Growing Media Association, Defra, the commercial horticulture industry, retailers and environmental organisations in tackling the issue of sustainable sourcing. This led to new research to investigate and develop peat alternatives that could either replace or at least significantly reduce the reliance on peat. The work focussed primarily on how to define sustainable growing media, setting performance standards for amateur products and on how to measure

progress (Bragg 2018; Harper 2018). The work to define sustainable growing media led to the development of the Responsible Sourcing and Manufacturing of Growing Media Scheme, which together with the associated calculator was launched in 2016. The protocol for the methodology for testing the performance standards of amateur growing media (DEFRA P7) was published in 2019 (GMA 2019).

Research continued to track the usage of peat in growing media production during the period 2011-2015 and a number of projects evaluating and developing new management systems for the use of peat-free or peat-reduced media were also undertaken. In 2018, AHDB published a new Growing Media review reporting on the progress towards peat reduction since 2012 and on the results of the recent research and development projects alongside case studies showing how businesses across the supply chain have taken a proactive approach to exploring a wider range of growing media materials (AHDB 2018). The review included a report of the horticultural fellowship project 'Sustainable resource use in horticulture: a system approach to delivering high quality plants grown in sustainable substrates with efficient water use and novel nutrient sources', funded by AHDB and RHS, which investigated how different combinations of the four most commonly used non-peat materials – coir, green compost, bark and wood fibre, influenced quality in nursery stock crops. The aim was to identify the best blends of materials and to understand more clearly why some combinations prove more effective than others. This 5-year study resulted in significant new information regarding the specific performance of the different blend for different plant species, but overall Barrett (2018) concluded that 'while the physical and chemical properties of the 14 blends varied widely, all but one proved capable of producing viburnum and hebe plants to good quality and uniformity in the trial, demonstrating that a wide range of peat-free and peat-reduced media could be used commercially with little or no modifications to existing commercial growing practices. While there was no evidence of any differences between the growing media in terms of their effect on the growth of viburnum (i.e. they grew equally well in all media), for the hebe, there was some evidence two of the mixed (one peat free mix and one peat-reduced mix) produced better quality plants than in the industry standard medium.'

In another project, 'Transitioning to responsibly sourced growing media use within UK Horticulture' funded jointly by AHDB and Defra and supported by growing media manufacturers and growers, a different approach was taken to assess the performance of different blends of peat-free and peat-reduced media. This project focussed on analysing the key characteristics of individual growing media materials and using the data to create a model that would be able to reliably and accurately predict how each will perform in any given blend without having to grow a plant in it first. The aim of this was to help manufacturers to design new growing media products that can match the performance of current peat-based media. The project covered the development of responsibly sourced media across the range of sectors, including vegetable and salad propagation, protected edible crop production, mushrooms, soft fruit propagation and production, and bedding plants and nursery stock propagation and production. The characteristics of the different ingredients were visualised by plotting them on three-dimensional graphs, which was a critical step in understanding how similar or different their performance was likely to be. Although no single raw material was found to have exactly the same combination of properties as peat, experiments were conducted to investigate how the physical characteristics changed when materials were

blended in various combinations. A number of blends, those for which the properties most closely resembled that of peat, were then tested in large-scale trials for with different horticultural system and the results showed that they proved to work well as prototype growing media. The project also involved extensive engagement with the industry, with numerous grower workshops, conference presentations, and plant response commercial trials (Anon 2018). When the final results of this project were presented at a recent conference, Mulholland et al. (2020; AHDB 2020) concluded that the project had successfully created a tool to expedite new product formulation and promote dialogue for high performing non-peat based growing media and had shown that the development of high performing peat-free media could be done.

Importantly, both the AHDB-RHS and the AHDB-Defra projects benefited from cross industry involvement and support by academics, growers, horticultural consultants, and growing media manufacturers, ensuring that the projects were robust and realistic from production of substrate through to use in the nursery in respects of for example how the materials is handled through automated systems (pot filling etc), irrigation systems, use of fertilisers and pest and disease control, growing period and crop type (Bragg and Alexander 2019). Furthermore, in recent years, various knowledge exchange projects were also undertaken, recognizing that this is the key to build confidence in the use of peat-free blends of growing media. The aim of these events has been to give growers the opportunity to understand both complex test results and how the findings can be implemented at a commercial level in practice. These events have included demonstrations and workshops right across the horticultural sector, from the production of vegetable transplants, to pot-grown herbs, ornamental bedding plants, pot plants and nursery stock, mushroom production and soft fruit propagation and production (AHDB 2018).

In the review of the achievements made in terms of moving away from the use of peat, Bragg (2018) outlined his view on what the future would hold and commented not only on the achievements that had been made in terms of developing appropriate blends of peat-alternatives that successfully had produced quality plants, but also discussed the shortcoming of some of these materials in terms of securing adequate supplies of materials like wood-fibre, bark and coir, also the impact that the high price of these materials will have on the industry. Bragg (2018) concluded that although these peat replacements, especially as blended mixtures tailor made to the demand of specific crops, were likely to perform effectively in practice, it was important to recognise that that the horticulture industry was competing for limited supplies of these materials and often with other markets supporting a high price for the materials, e.g. the use of wood biomass for heat and power generation. So, although these replacements are potentially viable peat alternatives, securing reliable supplies at realistic prices may not always be possible (Bragg 2018).

Figure 11: a. Composted spruce bark, b. wood-fibre, c, coir and d. green compost

In conclusion, although there were problems with the performance of the 'first generation' of peat-free media in the 1990's, the results from the comprehensive body experimental work undertaken on peat alternatives since then, provide clear evidence that these problems have now been resolved. Thanks to the combined efforts of the growing media manufacturers, growers, researchers and consultants and their endeavours to improve the knowledge on the sourcing and blending of peat-alternatives and the understanding of how these media work and how they need to be handled, for example with regards to irrigation and fertiliser inputs, the peat-free and peat-reduced media that available today have been shown to provide the same level of performance as the peat-based media, and sometimes, even better performance.

19 The commercial experience of peat-reduced and peat-free products in the amateur sector

Peat-reduced and peat-free products have struggled to enter the mainstream within the amateur horticultural sector. There have been concerted efforts by campaign groups over the years to educate consumers about the environmental impacts of peat and to choose alternative products. Whilst these campaigns have had some impact, overall there has not been a sea-change in buying behaviours, as one of our respondents stated, 'Consumer awareness of what is in a bag is extremely low. It is a low awareness category', (UK retailer, personal communication, February 2020).

In 2014 Which? magazine prompted controversy by giving universally bad reviews to peat-reduced and peat free products. 'Peat-free composts have never done brilliantly in our plant-raising trials and this year none were good enough to recommend.' Whilst spokespeople from Carbon Gold and the Soil Association challenged the ratings on methodological grounds, there was no mistaking that alternative growing media were struggling to alter negative perceptions. See:
https://www.independent.co.uk/property/gardening/which-sparks-controversy-by-telling-gardeners-not-to-bother-growing-plants-in-peat-free-compost-9101705.html

Consumer perceptions are always an important component of the marketing of any product. These can play out in various ways in the case of growing media and are influenced by factors other than plant growing success rates. Retail representatives we spoke to referred to the extent to which consumers were influenced by the different look and texture of many alternative mixes compared to the peat-based ones they are used to. Interestingly, consumer feedback focused far more on these qualities than the actual growing outcomes from the products. Unfortunately, consumers tend to associate 'different' with being inferior. Therefore, one of the challenges for brands is to persuade consumers that the differences they note are not indicators of an inferior product. As one of our interviewees stated, 'The only thing when we started upping the percentage (of non-peat) was the consistency, the difference in the bag when they first opened it up. It did not look like peat. It did not look like something they were used to. The more we introduced peat-free material, the more it looked a bit rough,' (UK retailer, personal communication February 2020).

However, there is strong evidence that the tide is starting to turn. Campaigns promoting peat-free approaches to gardening amongst the general public have been running for a number of years and gained increasing traction. As part of a parallel project looking at sustainability practices in the UK's small-scale flower growing sector we asked a sample of producers about their growing media practices (see Appendix 22.3). Interestingly this group considered that reducing or avoiding peat usage to be very important and the majority made relatively little, if any, use of peat. Appendix 22.4 also provides interesting insights into the debates being held in the trade press about the future of peat.

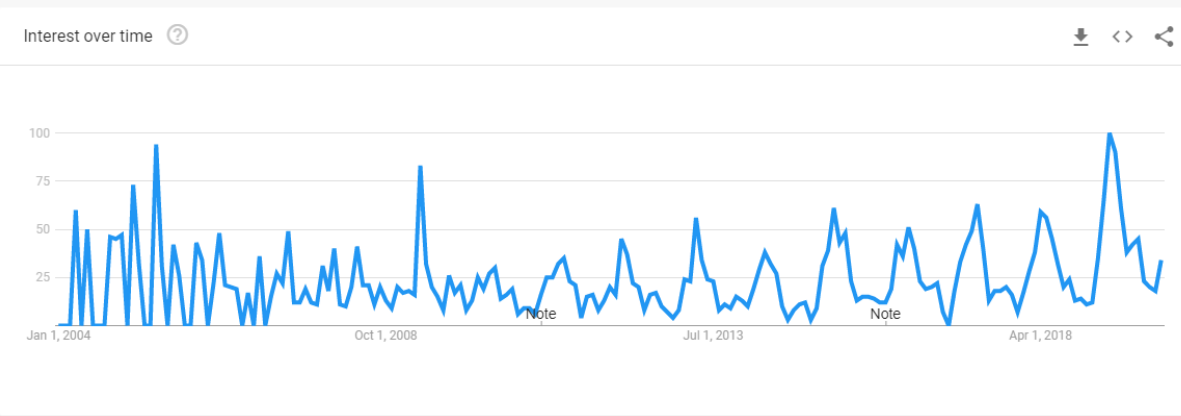
As Box 2 below illustrates consumers in the UK have been increasingly using the Google search engine to find out more about peat-free products. Such interest is starting to translate into noticeable purchasing behaviours. In October 2019, the re-formulated version of Westland's New Horizon product entered the top 5 best sellers list in Garden Trade Media's weekly listings, even reaching number 2 at one point (see figure 12 below). This was the first time that a peat-free product had performed so well commercially outside of spring growing season. Westland's marketing claims that the product, which comprises West+, composted bark, coir and fertiliser, outperforms peat-based composts. If consumers perceive this to be the case, then this could well represent a turning point for alternative products generally. Westland planned to launch the biggest ever advertising campaign for peat-free compost this spring, spending £1.5m on a New Horizon TV campaign running from 8 April to the end of May.

Box 2

Google Search Trends for 'peat-free'

One measure of consumer interest is to examine the regularity of searches for 'peat free' on Google. The trend data indicates that there was some interest in the issue in the mid-2000s, followed by a lull for about 8 years with interest starting to pick up again from around 2012. The largest number of searches since 2004 were recorded in 2019 when interest jumped sharply.

Figure 12: Trends in Google Searches for Peat-Free 2004-2019



Source:
https://trends.google.com/trends/explore?q=peat%20free&date=all&geo=GB

Bord na Móna in the guise of their re-brand 'The Greener Gardening Company', launched Happy Compost, a peat-free product comprised of coir, green compost, composted bark fines and a recycled wood fibre. No virgin products are used in the making of Happy Compost, all components are either recycled (including discarded kitchen units) or by-products of other production processes, such as coir. Furthermore, the bags are made from 30% recycled material, higher levels are difficult to achieve due to the need for the plastic to be strong. Forward orders for Happy Compost were three times higher than the total sales for peat-free compost in the first quarter of 2019. The firm expects sales of Happy Compost to increase eightfold between January and March 2020, compared with 2019, whilst 'Peat-free products are expected to account for 30% of The Greener Gardening Company's total growing media sales in 2020 versus a market rate, as stated by analyst GfK, of 9.9%' (Appelby, March 5th 2020).

Other notable developments include the adoption of a peat-free multi-purpose product (comprising the same core ingredients as New Horizons) as the leading own-brand line at Homebase. Own-brand products tend to be the best sellers in the retail setting and usually benefit from optimal placement within the store layout. Thus, this step by Homebase can be seen as a bold move, which if successful could be a significant shift in a move towards significantly reducing overall peat consumption within the recreational sector. Homebase has

promised price-matching and to stock one-third (three products) of its range (from Westland) peat-free, while B&Q's peat-free product GoodHome is placed at the front of stores, although the peat-free label is on the back of packs (Appelby, March 5th 2020).

Dobbies Garden Centres have launched a new own-label peat-free, from Westland, price-matched with conventional multipurpose with John Innes at £6.99 and three for £16. A reduced-peat with John Innes product has been reformulated from 60% to 40% peat. A multipurpose new line has been reformulated from 50% to 30% peat. The most popular multipurpose product is forecast to sell 650,000 units in 2020. Two years ago, the peat-free/peat ratio was 60:40 (Appelby, March 5th 2020).

Notcutts garden centres increased its peat-free range in 2020, including Happy Compost among others. Their peat-free sales rose noticeably in the first week of March 2020 compared to the same week last year, rising to over 8% of their mix compared to 2.5% last year (Appelby, 2020, March 11).

These examples indicate that there appears to be a decisive shift within retail towards an increased peat-free offer and that associated products are now being strongly promoted and even prioritised within marketing and store layout. According to our respondents there is clear segmentation between retailers - some are very much at the vanguard of this movement and moving clearly and decisively, some are largely offering lip-service, whilst others are making no significant changes. Our informants were largely of the opinion that the pioneers are setting the pace and that the others will eventually follow. Indeed, given the increasing publicity being given to the peat-free movement and the fact that peat-free products are now very much in the mainstream there will be significant reputational risks for retailers who do not follow suit.

Figure 12: Garden Trade May 2020

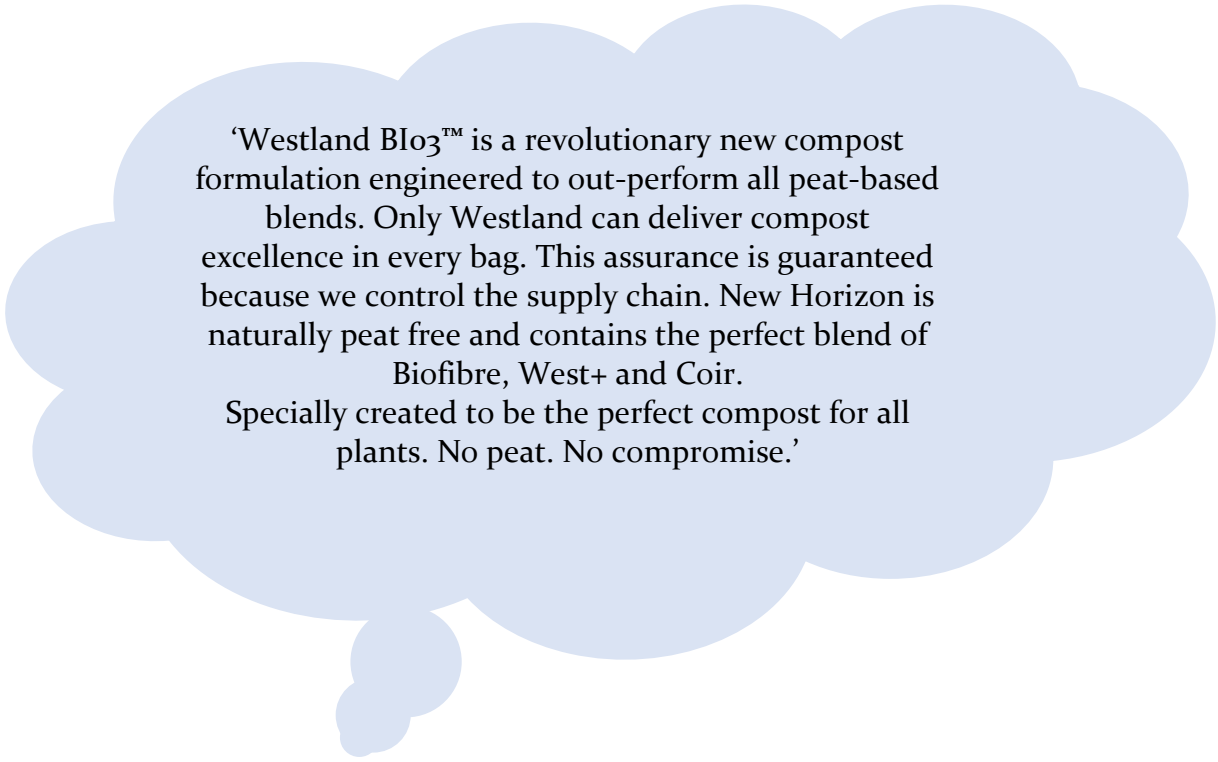
Peat Free Compost becomes a best-seller

Westland's New Horizon Peat Free Compost became a bestselling growing media line this Autumn, according to the weekly epos analysis for GTN Bestsellers. During October and November 2019 Westland New Horizon All Plant Compost 60 litres featured in the top 5 bestselling growing media lines and even reached as high as the No 2 bestselling line for one week in October, outselling many peat based products.

GTN Bestsellers analyst, Trevor Pfeifer, sees this as a significant move for the adoption of peat free growing media.

In previous years the only time peat free composts have featured in the GTN Top 50 have been in the high spring weeks when less keen gardeners come into the buying pool.

These sales during October and November 2019 are to keen gardeners and for them to be choosing a peat free option is good news for all. When they start telling other gardeners about their success and their contribution towards sustainability there is real potential for a snowball effect and much higher sales of peat free composts during 2020.



Source: https://www.gardenhealth.com/our-brands/new-horizon

20 Marketing and Labelling

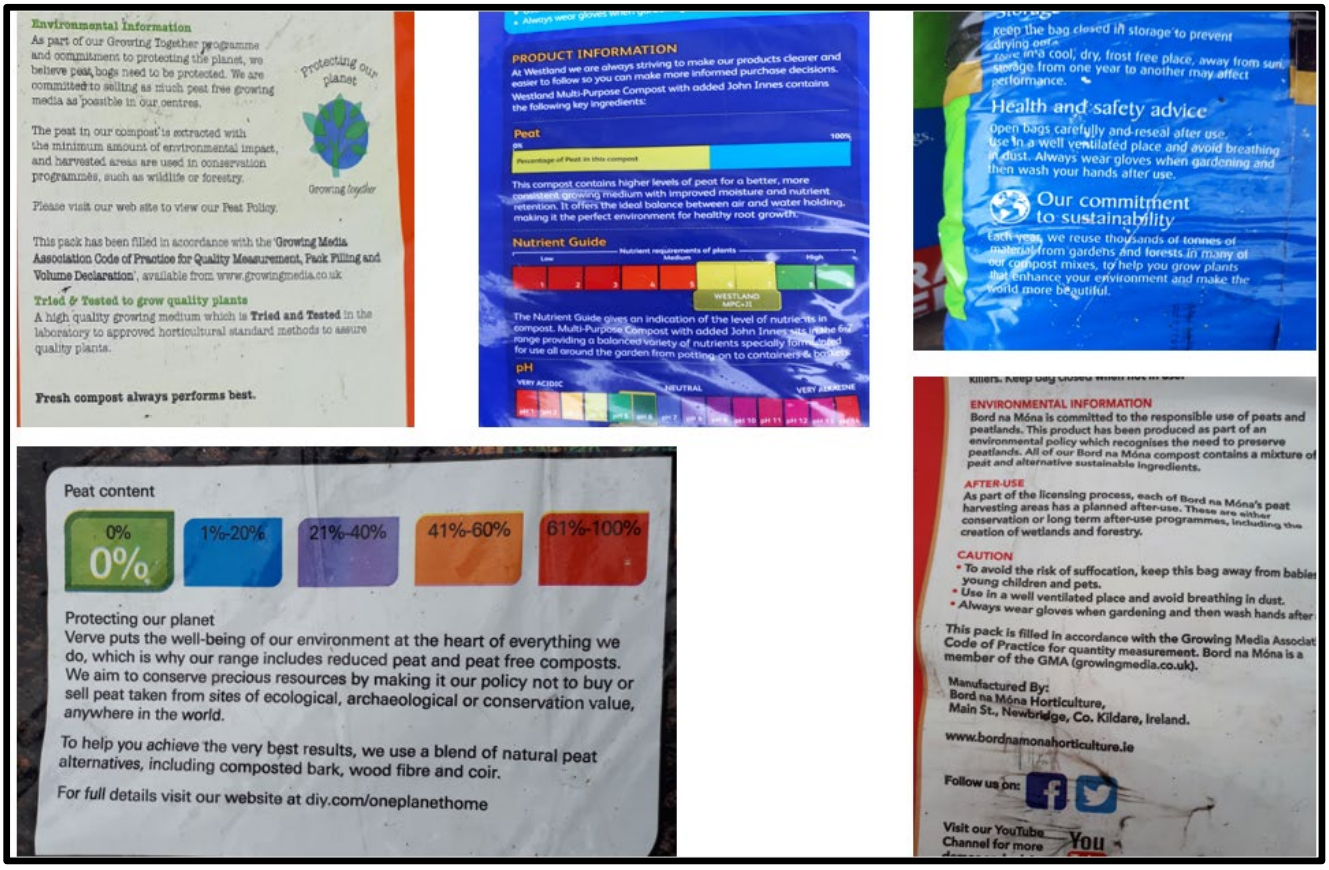
Labelling on products is a common means of communication with consumers. Information provided on packaging can take many forms, for example, food ingredients, country of origin, farm of origin, nutritional content, recycling attributes and certifications and standards. There are many debates about the value and purpose of such labelling. There is certainly a point of view that consumers are overloaded with information and are increasingly confused by the volume and range of labels and data provided on the most simple of products. On the other hand, others believe that consumers like communication and clear information so that they can make informed choices. An absence of information/assurance can be seen as negative statement about the integrity of a product. It is certainly the case that we are in an era where the default position is to provide information and assurance wherever possible.

Bags of growing media are fairly large items and offer ample space for product information and labelling. Currently, manufacturers pursue a range of different approaches to labelling and information provision. Figure 13 below demonstrates a range of these. Some provide considerable detail such as the nutritional properties of the compost, the percentage of peat contained therein and informaton about the environmental credentials of the product. Others provide more generic information such as stating a commitment to sustainability and industry codes of practice. Few products contain much, if any, information regarding the composition of the products or their sources. From a consumer perspective, there is no consistency in the information conveyed or sense of an overall standard that is being represented. Therefore, consumers cannot make informed decisions when choosing one

product over another from a sustainability perspective. Their choices will be guided by price, familiarity, placement in store and specified purpose. However, the newer ranges of peat-free products are starting to change labelling practices.

The inception of the Growing Media Calculator presages a new era in which the notion of responsible sourcing and sustainability will become more important within the marketing of growing media products. Decisions are yet to be made about exactly how the data from the calculator will be conveyed to consumers. It is highly unlikely that full scores will be publicised for each product, but it is likely that the overall performance against the benchmark will be communicated via some form of badge using a traffic light system. The narrative will shift from focusing on peat content specifically to a broader consideration of the responsible credentials of a product more broadly. At the time of writing, the plan was for manufacturers to be audited by the end of April 2020 and for the RSS logo to be finalised in June. Changes in labelling are unlikely to happen quickly due to the need for changes in bag design and printing. This normally operates on a cycle of several years and companies will have already invested in brand design and production for existing product lines.

Figure 13: Examples of Growing Media Labelling



Source: visits to garden centres in October 2019

21 Discussion, conclusions and recommendations

It is clear that the growing media industry has fallen some way short of the UK government's target of eradicating peat use within the amateur horticulture sector. However, the industry has come a long way from the 1990s when peat comprised more than 90% of growing media within the UK market. As pressure started to be brought to bear, so the industry began to make use of alternatives and the proportion of peat being used began to drop. Progress stuttered in the second decade of C21 but peat usage now appears to be on a new downward trend as growing media firms are prioritising the production and marketing of peat free product lines. This trend has been facilitated by various research projects which have tested and trialled many combinations of alternative components. After something of a 'false start' twenty years ago, when the reputation of peat-free alternatives was badly impacted by poorly performing pioneer products, the new generation of alternatives are able to match, or even exceed, the performance of traditional peat-based products.

Does this new generation of peat-free products offer a rapid route to a sustainable, peat-free future? Not necessarily. Significant progress has certainly been made. But questions remain about the scale-ability of the alternatives in terms of sourcing sufficient quantities of good quality inputs at an affordable price without compromising broader sustainability objectives. In the words of one of our interviewees, 'Most of them (*components of growing media*) have an issue somewhere. So, if we look at wood fibre, there will be issues as the energy used to create wood fibre is huge. When you look at coir it will have an issue around water. When you look at peat it will issues around biodiversity, habitat and renewability', (Representative of growing media production firm, February 2020). The inception of the responsible sourcing calculator will play an important role in identifying sustainability hotspots for different products and such identification will enable mitigation strategies to be deployed.

However, this still leaves the issue of cost. Production systems to exploit peat were established some years ago, therefore peat is cheap to extract and process. The challenge of transitioning to a higher proportion of non-peat inputs is captured by an industry representative who states, 'Now you are looking at a series of materials that cost anywhere between 2 and 6 times the cost of peat and yet, the consumer ultimately only wants to pay the same price for their product.' It may well be the case that the consumer will need to accept that they will be paying a higher price than they have been accustomed to. In some instances, a more level playing field for cost could be achieved via a government review of the incentives available to other users. As Keith Nicholson from Westland Horticulture explains, "In order for the industry to further reduce reliance on peat, we need improved access to raw materials and increased government support and collaboration."

The life span of the remaining productive peat bogs within the UK and Ireland is between 5-20 years. It is highly unlikely that further licences to exploit peat will be granted in the future as pressure to combat climate change and to value ecosystem services will only increase. Therefore, further drives towards peat reduction are inevitable, along with a re-structuring of the industry. Demand for growing media will remain strong, both for hobby and professional usage. The research undertaken into alternatives over the last two decades will stand the industry in good stead as it looks to push forward. The onset of the Covid-19 pandemic will certainly have impacts upon the industry. In the short-term demand for growing media was

reduced significantly by the lockdown process. As lockdown was relaxed and demand increased there were ongoing problems in meeting demand as supply chains and product supply were affected. In the medium term there may well be impacts upon the supply of alternative products, such as coir, which are sourced from parts of the world that continue to be affected by the pandemic. Hopes of direct UK government support to subsidise a full- scale transition to a peat-free future are likely to be dashed by the immense strain already being imposed by the impacts of the pandemic. Whether these pressures will lead to a reduction in legislative focus upon peat extraction remains to be seen. It is however, highly unlikely that environmental lobbying will decrease as efforts continue to be made to stave off a full-scale climate emergency.

Concerns have been raised by industry stakeholders about the potential socio-economic impacts of the eradication of peat within growing media. The argument being that jobs and local GDP would be diminished as a locally available resource had to be replaced. There is little doubt that a rapid push to reduce and eventually eradicate peat would have caused serious economic ruptures, not least due to the lack of available alternatives. However, there has been little compulsion in reality and the transition has been relatively slow. During this time considerable investment has been made into technical investigations of alternatives. This research is ongoing and becoming increasingly valuable in enabling producers to develop growing media products that can perform as well, if not better in certain circumstances, than peat. The research aligned to the intensive work undertaken as part of the Responsible Sourcing and Manufacturing of Growing Media scheme has ensured that the industry is well placed to move forward and promote 'responsibly sourced' growing media both in the recreational and commercial sectors.

What will the economic impacts of the ongoing transition look like? Clearly, there is a geographical dimension to this question. Growing media production has been centred around the locations where peat is extracted. However, as other sources become important so there will be a shift to be near points of production/entry of these inputs. Therefore, the geography of employment will shift but as long as the industry is able to produce marketable products there should be no overall drop in employment. There remain many issues to be resolved related to the commercial sector. Fears are frequently expressed that the UK's lucrative ornamentals sector would be undermined and outcompeted if it were unable to use peat – a relatively cheap product whose properties are a known quantity. The increasing body of technical research offers increasing optimism. The properties of individual components are now much better understood as are the properties of different mixes. Given that there is no immediate pressure to eradicate peat within the sector (2030 being the target set a decade ago and likely to be further extended) there remains time to assimilate expertise and support the ornamentals sector in successfully achieving the transition. Indeed, as the pressure to be sustainable ramps up so the industry will benefit from being able to demonstrate its progress in moving towards more responsible and sustainable behaviours.

The horticulture sector is a major contributor to the UK's national economy. Debates in the early years of the C21 expressed concern that a dash to reduce the role of peat in the sector would threaten UK horticulture's economic viability and render the sector unsustainable (Altmann 2008). However, the immense steps forward in understanding and developing

alternatives, led by various excellent research projects, suggest that such concerns are now less, if at all, relevant. The properties of the alternatives are now well understood as are the characteristics of different sources and blends. The confidence with which key retailers and industry leaders are now promoting peat-products indicates that the wider industry can continue to thrive as peat usage diminishes. However, there is much work to do in various spheres as outlined in the recommendations below. There will undoubtedly be pain points as the industry transforms and there will be winners and losers. The broader context of the still unfolding COViD-19 crisis, Brexit, geopolitical power struggles and the seemingly inexorable march of climate change is challenging to say the least. However, being at the forefront of global efforts to develop more responsible sourcing of growing media could well stand the UK industry in good stead, creating opportunities for sharing intellectual property and expertise.

The journey is ongoing and much work remains to be done, by a range of stakeholders. The authors offer the following recommendations for moving the industry forward:

Recommendations

1) Clarify issues around the limited availability of bark, wood-fibre and coir and the potential consequences of the price of these materials for the industry.

Recommendation: Detailed assessments should be undertaken to examine volumes and sources of these materials and to consider implications of growth in demand. In addition, robust price-sensitivity analyses for growing media should be undertaken for the different horticultural sectors, including within the retail market. Investigate the potential for sourcing and processing coir with improved scores for water and pollution, as the Calculator scores for these criteria for actual samples of coir are currently shown as red and orange, respectively.

2) Green compost is potentially available in high volumes, though more detailed information is required regarding the quantities of 'high quality' green compost (in particular in relation to risks of contamination with inert materials such as glass, metal and plastics, and herbicide residues) that is available and the location of this material.

Recommendation: Undertake an appraisal of the composting sector's potential to supply more green compost (and green + animal by-product compost) for use in growing media, considering the quantities available, the locations of the material and the quality of the compost, particularly in relation to risks of contamination with inert materials such as glass, metal and plastics, and herbicide residues. The quality and potential volumes of green compost and green + animal by-product compost should be considered against the WRAP Guidelines for the Specification of Quality Compost for use in Growing Media (WRAP 2014) or similar standards, e.g. those used in Germany.

3) The Responsible Sourcing and Manufacturing of Growing Media scheme has been under development for some time and should (according to the 2012 Roadmap) have been fully

implemented in the market place by now. However, this has not happened. It is very important that the scheme is rolled out as soon as possible in order to ensure that consumers and policy makers are made aware of the steps the industry has taken and so that consumers can begin to make much more informed choices. Furthermore, it is important that choice editing, as outlined by the Task Force, is implemented as a strategy so that consumers are indeed confronted only by products that are responsibly sourced according to a mechanism.

Recommendation: Prompt implementation of the Responsible Sourcing and Manufacturing of Growing Media scheme; incorporating published results of the scores for the actual growing media available on the market, including also media that contain peat and minerals; agree the benchmark for media considered to be responsibly sourced and manufactured and to which the retailers can then implement choice editing; and rollout the scheme ensuring clear and consistent communication with consumers.

4) Currently there is no consistency in the ways that different growing media products are labelled. Different companies provide different types of labels and provide different amounts of information about the product and its contents. Some are very detailed, others provide little information of value to an interested customer. However, consumers have become accustomed to labels as a means of communication about varying qualities of products that they buy. It is important that the industry addresses these inconsistencies and gaps in order to indicate that responsible sourcing is THE standard within the industry as a whole.

Recommendation: Develop consistent labelling protocols for growing media. Enhance consumer awareness of the labelling system and the implications.

5) The reputation of peat-free growing media was damaged by the introduction of poor products onto the market in the past. Subsequently, much research into peat-free and peat reduced growing media mixes has been undertaken and products are available that can match, or even exceed, the performance of peat-based products. In order to support the transition from niche to mainstream it is vital that positive and informative campaigns (knowledge transfer activities) are undertaken to ensure that gardeners better understand the new products that are available and how to make best use of them. This campaign could be a media campaign including gardening celebrities, but should ideally also involve active participation by gardeners (e.g. using citizen science approaches) to enable gardeners to learn from each other (which it is known that they prefer).

Recommendation: Establish and support an imaginative campaign for communication and knowledge exchange with hobby gardeners about peat-free media and how to achieve the best results when using them, with active use of different broadcast media and with active participation by gardeners.

6) Progress in achieving rollout of peat free products has been relatively slow in the retail sector, with some retailers being considerably more proactive than others. The major multiple retailers represent a significant proportion of the overall market share for growing media therefore they can plan an important role in transforming the sector. Furthermore, the values exhibited by retailers tend to be key influencers of consumer attitudes and behaviours.

Therefore, mainstreaming responsibly sourced products within the retail space could achieve a transformative impact upon the market as a whole.

Recommendation: Establish a joined-up concerted effort to progress towards the target to phase-out the use of peat in the retail sector, given that the performance of the new generation of peat-free growing media indicates that quality issues should no longer be limiting the transition.

7) The new generation of peat-free growing media that are available today have been developed thanks to large and long-term investments in R&D made jointly by the manufacturers, the industry and by the government. As we move forward, this work needs to be continued to ensure that also future generations of growing media can be successfully launched onto the market based on robust evidence that they can be reliably used for high quality performance and that they have been responsibly sourced and manufactured. At present, the research on some potential candidate peat-replacements appears to be relatively close to market e.g. digestate fibres from anaerobic digestion facilities, whilst for others, the research is more in its infancy e.g. for farmed Sphagnum, but both types of research should be pursued. Additionally, continued R&D is required to improve the use of peat-free growing media for horticultural sectors/plants where there are still problems that need to be resolved, e.g. formulations of blocking media for vegetable transplant production and for mushroom casing.

Recommendation: Continued research and development to develop the use of future generations of peat alternatives, e.g. digestate fibres from anaerobic digestion facilities, farmed Sphagnum etc. Additionally, continued research and development to improve the use of peat-free growing media for horticultural sectors/plants where there are still problems that need to be resolved.

8) Importantly, much of the R & D that has been undertaken to develop new growing for the professional horticulture sector has, in the past, benefited from cross industry involvement, including active involvement by commercial growers. In addition, various knowledge exchange projects have also been undertaken, recognizing that this is key to give growers the opportunity to understand complex test results and how the findings can be implemented at a commercial level in practice. It is vital that knowledge exchange activities are continued also in future, in order to build more wide-spread confidence and uptake in the use of the peat-free media among the professional growers

Recommendation: Continued technology transfer and knowledge exchange with commercial growers to increase confidence in, and use of, peat-free media.

9) Climate change is clearly a major issue of global importance. Peat extraction is seen as a significant threat to the carbon naturally sequestered within peatland sinks. The industry's messaging around climate change is not coherent and is often anecdotal. This is a threat in terms of policy maker and public perceptions. There are opportunities for the industry to communicate positively in relation to the reduced or even positive impacts of alternative

growing media constituents. The growing media industry is a foundational element of the wider horticultural sector which has the potential to generate greater benefits in terms of carbon sequestration.

Recommendation: Develop clear climate change impacts messaging and communicate with public how they can make positive choices with regards to growing media. Consideration should be given to adding a criterion regarding greenhouse gas emissions, loss of carbon sinks and restoration within the Responsible Sourcing and Manufacturing of Growing Media scheme. Link directly with the horticultural industry more broadly to develop a coherent set of messages and initiatives which illustrate the ways that climate change can be combatted.

10) Planning and monitoring of progress towards reducing peat usage requires the continual capture of detailed data which captures key trends such as overall volumes of peat and alternative diluents used each year in different sectors. Transparent sharing of aggregated data is important in order to support strategic planning and to effectively manage external stakeholders. The ongoing five-year hiatus in the publication of data is not helpful in securing public confidence that the industry is committed to government targets or the ideals promoted in the roadmap.

Recommendation: Ensure that data collection outcomes are communicated clearly i.e. quantities of different media produced each year, sources of different media etc. Expand the tracking of peat and peat alternatives usage by also requiring retailers to report sales on an annual basis.

11) It is clear that gaps and inconsistencies in government policy at different levels hinder progress in fully developing the potential of alternatives. For example, over the last 10 years the incentives for using wood biomass for heat and power generation have led to unprecedented increases in the price of wood and have thus made the wood-based materials less competitive for use in growing media; and the quality and availability of green compost is negatively affected by inconsistencies in green waste collection systems around the UK and in poor education/enforcement in relation to what consumers actually put in their bins, leading to problems of contamination. These are not insuperable problems and require political will and prioritisation to rectify.

Recommendation: Lobbying of government e.g. for levelling-off of playing field around incentives for wood biomass, for consistent green waste collection policy and to raise householder awareness of source segregation of waste in order to improve quality of green compost.

12) Much progress has been since the development of the original roadmap in 2012. In particular, there have been massive strides made in terms of the development of effective alternatives and research which assists growers in understanding the differing properties of these products. Some progress has been made in reducing the overall proportions of peat used but the target of eradication in the recreational sector has been missed by some

distance. Whilst the ongoing COVID-19 pandemic has distracted policy makers and public attention during 2020, it is likely that pressure from climate change campaigners and policy makers will become more concerted in the coming years. Therefore, the industry needs to be proactive and show its willingness to build on the gains in knowledge made through the various research projects funded via Defra and at the instigation of individual firms.

Recommendation: Update the Roadmap Towards Sustainable Growing Media: review data and market information in order to identify the current position statement (see recommendation 10 above); assess outcomes of calculator (see recommendation 3 above) – what do the initial results indicate about the realities of achieving sustainable supply chains?

22 Appendices

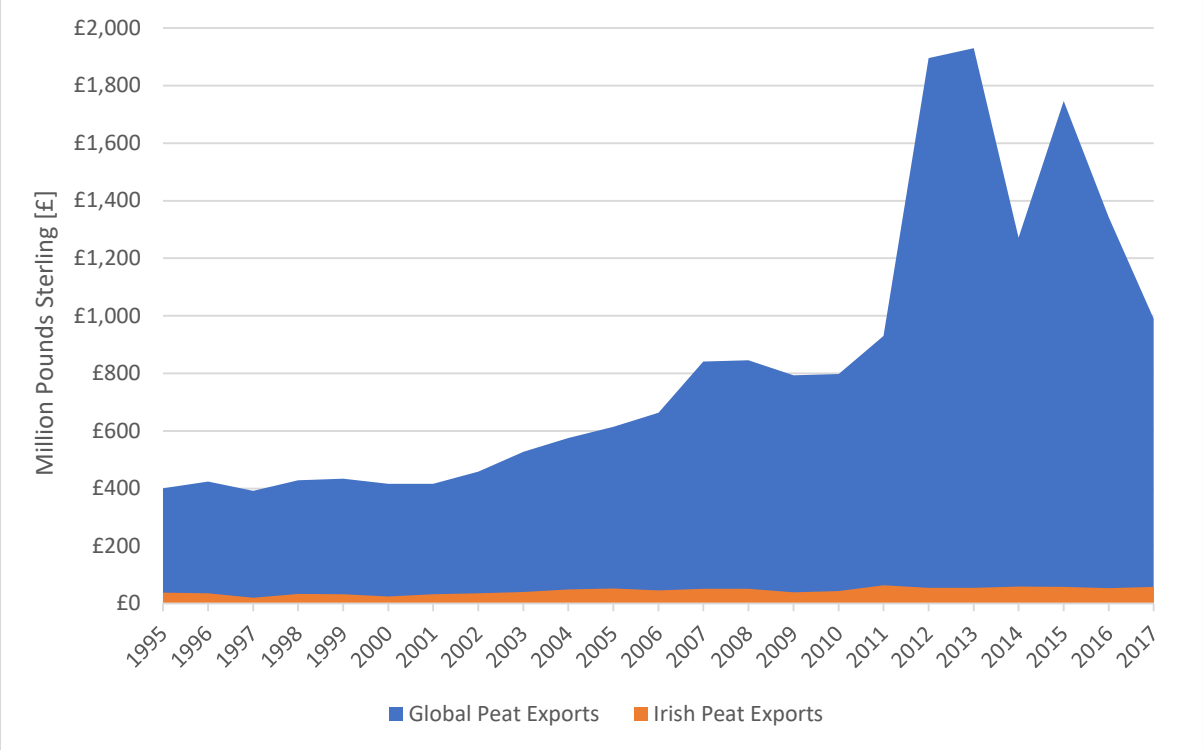
22.1 Trends in Global and UK Peat Exports and Imports 1995-2017

This section provides an overview of the major trends in trade patterns with respect to peat between 1995 and 2017. The analysis demonstrates that there has been a substantial increase in international trade in peat in the last 25 years. Trade between the USA and Canada is the most significant trade flow, with trade within Europe also being highly significant. Imports into the UK have grown by value steadily throughout the time period with Ireland being the most significant source of peat. Peat exports are a notable contributor to the Irish economy, rising 50% in value between 1995 and 2017, whilst peat supplies also underpin the nation's horticultural growing sector.

Global Peat Trade Patterns

- The value of peat traded internationally has grown substantially in the last two decades with a 250% increase during the period.
- Between 1995 and 2001 the value of exports hovered around the £400 million mark, over the subsequent decade there was a steady increase to £800 million followed by a jump to £1900 million in 2012 and 2013. Subsequently there has been a significant drop back to £100 million by 2017.
- Ireland is a relatively small, but still significant, contributor to global export trade.

Figure 14: Value of Global Peat Trade 1995-2017

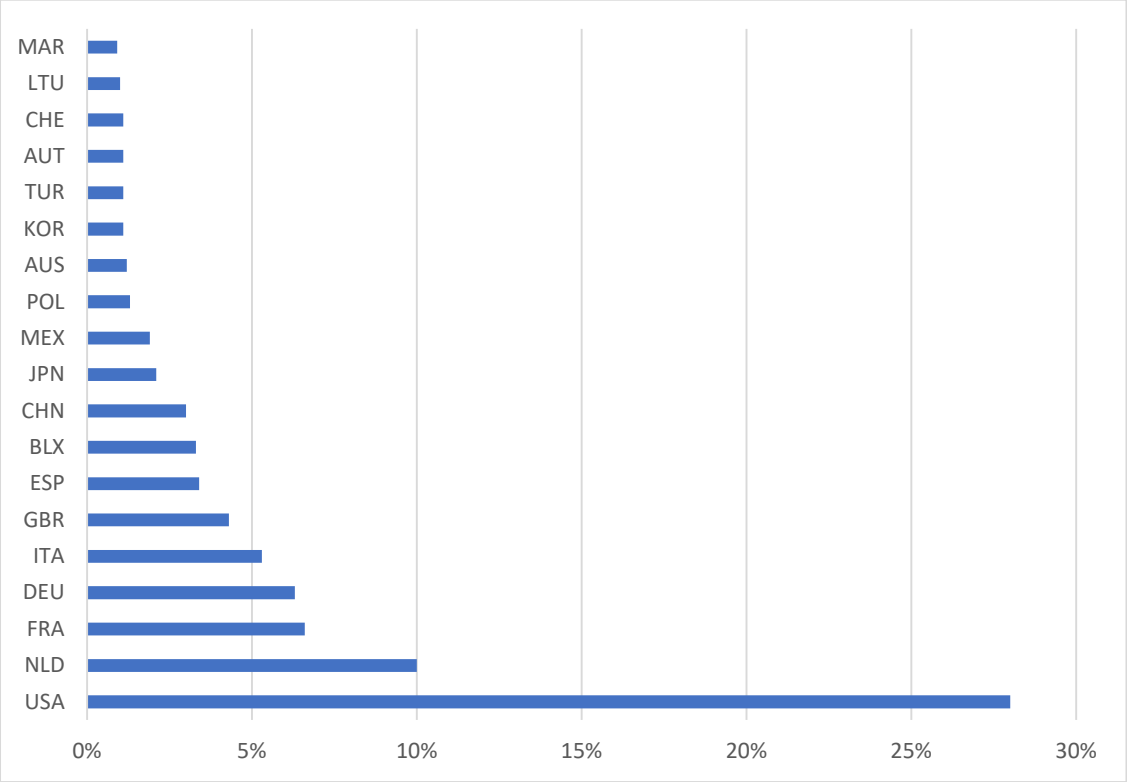


Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

Global Peat Import Trends

- The world's largest importer of peat is the USA which imports 28% of all globally traded peat.
- Holland is the next most significant importer with 10% of global share.
- Great Britain is the world's 6th largest importer.
- A total of 175 nations are listed as peat importers in 2017.
- Proximity to market is an important factor, i.e. Canada exporting to the USA, Ireland exporting to Great Britain etc.

Figure 15: Top 20 Importers of Peat by Global Share 2017

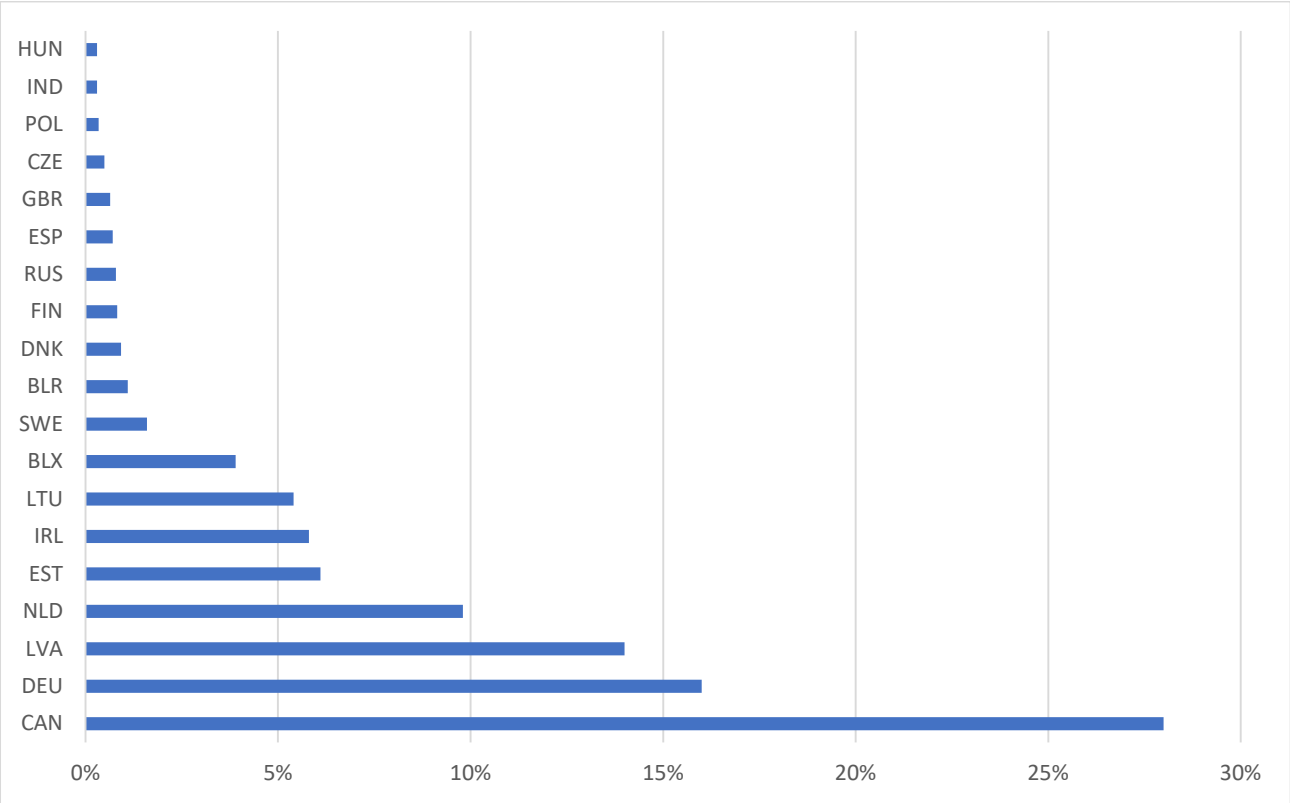


Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

Global Exports of Peat

- The largest exporter of peat is Canada with 28% of all the world's exports, followed by Germany, Latvia and the Netherlands with ≈10-16% of the global market.
- Ireland is the world's 6th biggest exporter and Great Britain the 16th.
- Seventy-nine countries are listed as exporters of peat, some of which are re-exporting peat that has been imported.

Figure 16: The top 20 Peat Exporters by global share 2017

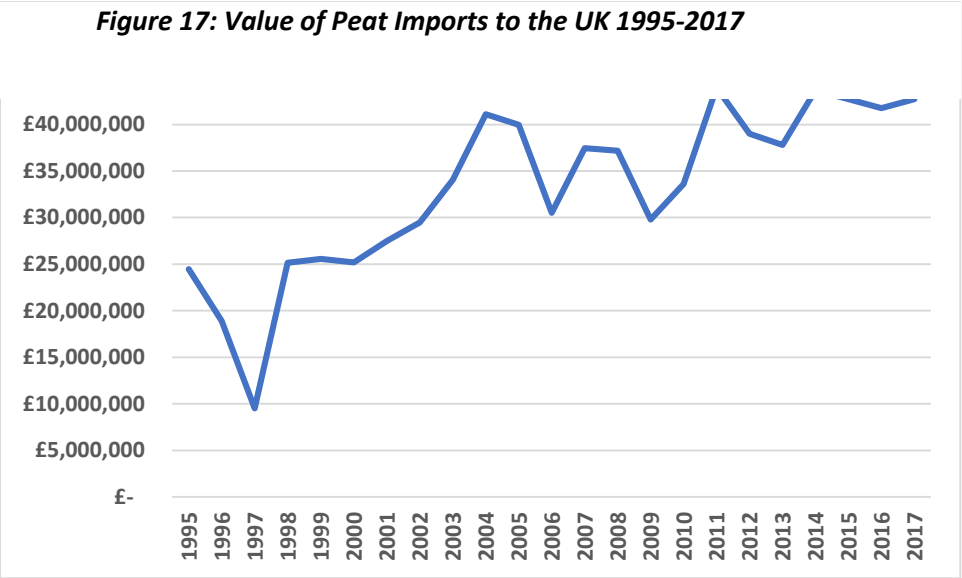


Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

Value of Peat Imports to the UK

- Between 1995 and 2017 the value of peat imports to the UK increased from £25 million to £43 million. Representing an increase of 72%
- There was a period of sharp growth between 2000 and 2004, when total imports topped £40 million for the first time.
- Between 2004 and 2010 annual import levels fluctuated before rising sharply to £45 million in 2011.
- In recent years imports have fluctuated slightly around the £43 million mark.

Figure 17: Value of Peat Imports to the UK 1995-2017

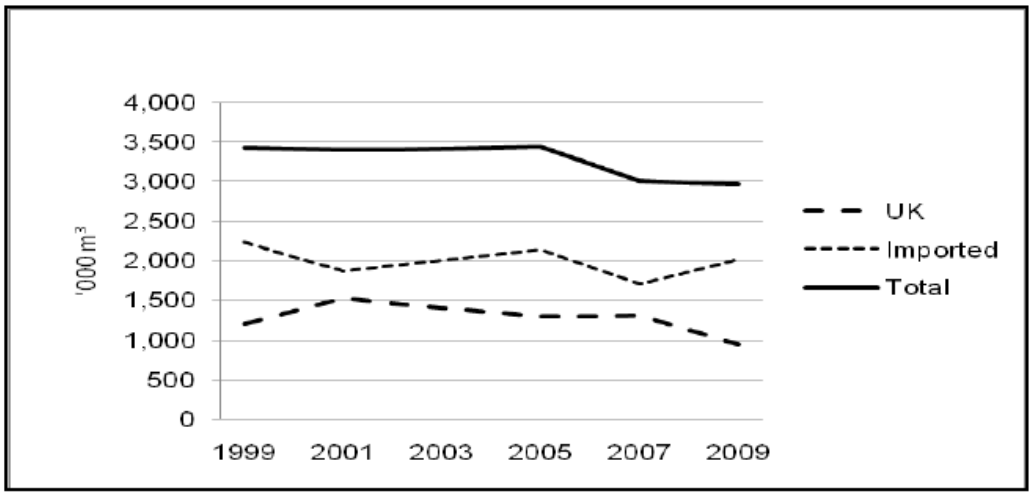


Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

Sources of Peat used in the UK 1999-2009

Defra data for the period between 1999 and 2009 indicates that the amount of peat used in the UK was steady at around 3.5Mm3 between 1999 and 2005. There was then a drop to 3Mm^3 in 2007. UK sourced peat rose from approximately 1.2Mm^3 in 1999 to 1.5Mm^3 in 2001, there followed a slight decline to around 1.4Mm^3 in 2007 followed by a steeper drop to just below 1Mm^3 in 2009. There was a corresponding rise in imports between 2007 (approximately 2Mm^3) and 2009 (approximately 2.3Mm^3) but these remained below the 1999 level.

Figure 18: Volume of used in UK 1999-2009



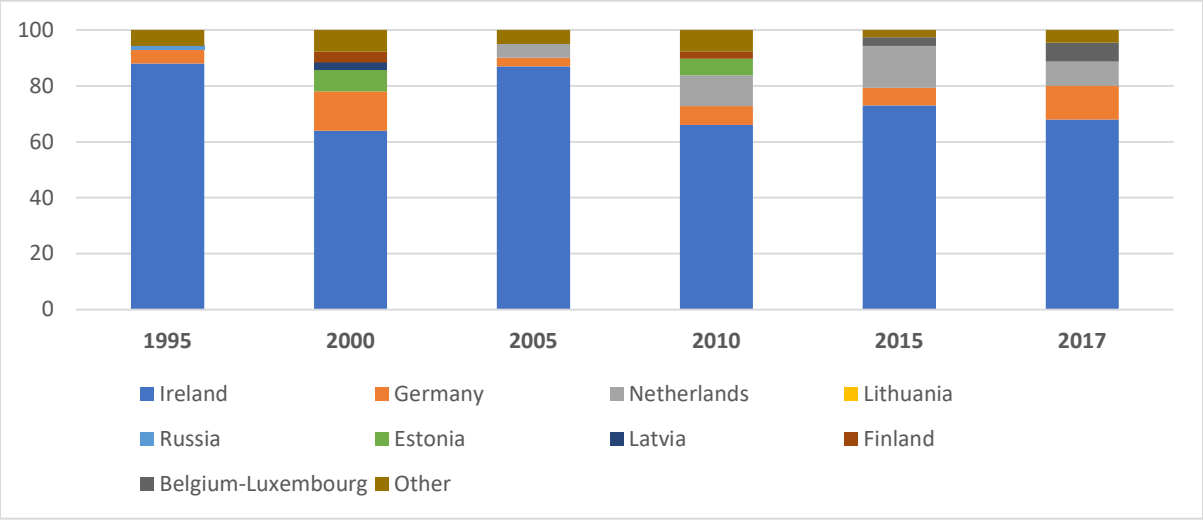
Source: Defra 2010

Peat Exporters into the UK

The main sources of peat supplied into the UK are Ireland, the Netherlands, Germany and Estonia.

- Ireland has been the dominant supplier into the UK throughout the period, at its peak supplying nearly 90% of all imports.
- Between 2005 and 2009 Ireland's share dropped from ≈80% to ≈70% where it has remained subsequently.
- Since 2007 the Netherlands share has increased was the second largest exporter to the UK, until 2017 when Germany overtook them.
- The largest annual share by any nation other than Ireland was 17% in 2014 by the Netherlands.
- Other nations that have supplied peat to the UK include, Estonia, Finland and Latvia.

Figure 19: Sources of Imported Peat to the UK 1995-2017



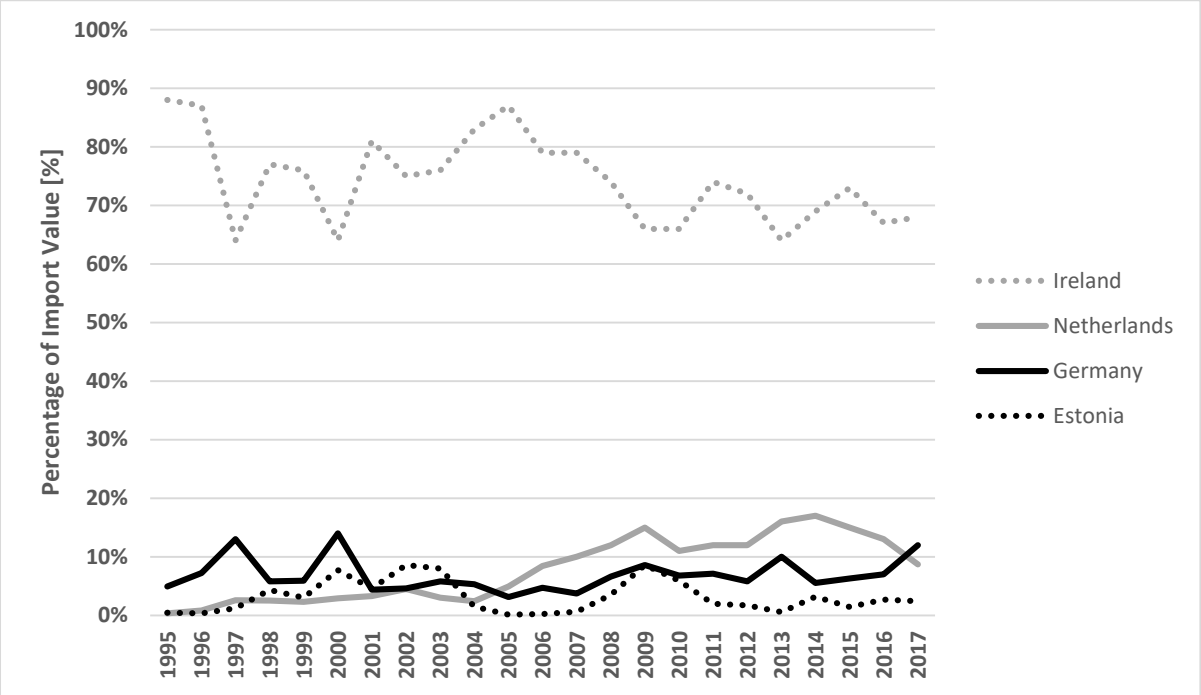
ADHB evaluations (2016) further disaggregate the data for the bulk of peat used in the creation of growing media so that levels of sourcing from the individual nations of the UK can be observed for 2015:

- Republic of Ireland approx. 1.16 M m^3
- England approx. 0.28 M m^3
- Scotland approx. 0.4 M m^3
- Northern Ireland approx. 0.21 M m^3
- Other EU approx. 0.16 M m^3

ADHB data indicates that the reliance on sources of peat from elsewhere in the EU other than UK and ROI fell in 2014 and 2015. Correlating the rainfall and the subsequent year's growing media volume which was accounted for by peat, suggested that the fall seen in the reliance on peat over the period 2011-2015 (and the uptake of alternative materials) was not solely the result of wet weather impacting peat harvesting.

Defra's response to the Government and Parliament Petition – Ban Peat Compost 2019 (Defra 2019), noted that 'two-thirds of the peat sold in the UK is imported from Europe, so it is also important that we focus on reducing demand for peat in horticulture to protect peatland outside of the UK'. This tallies approximately with the AHDB figures (AHDB 2016) indicating that 60% of the peat supplied to the market in the UK in 2015 (total volume approx. 2.21 M m^3) was imported from Europe (52% from Republic of Ireland and 7% from other EU countries.

Figure 20: Top Four Countries of Peat Imported to the UK by Value

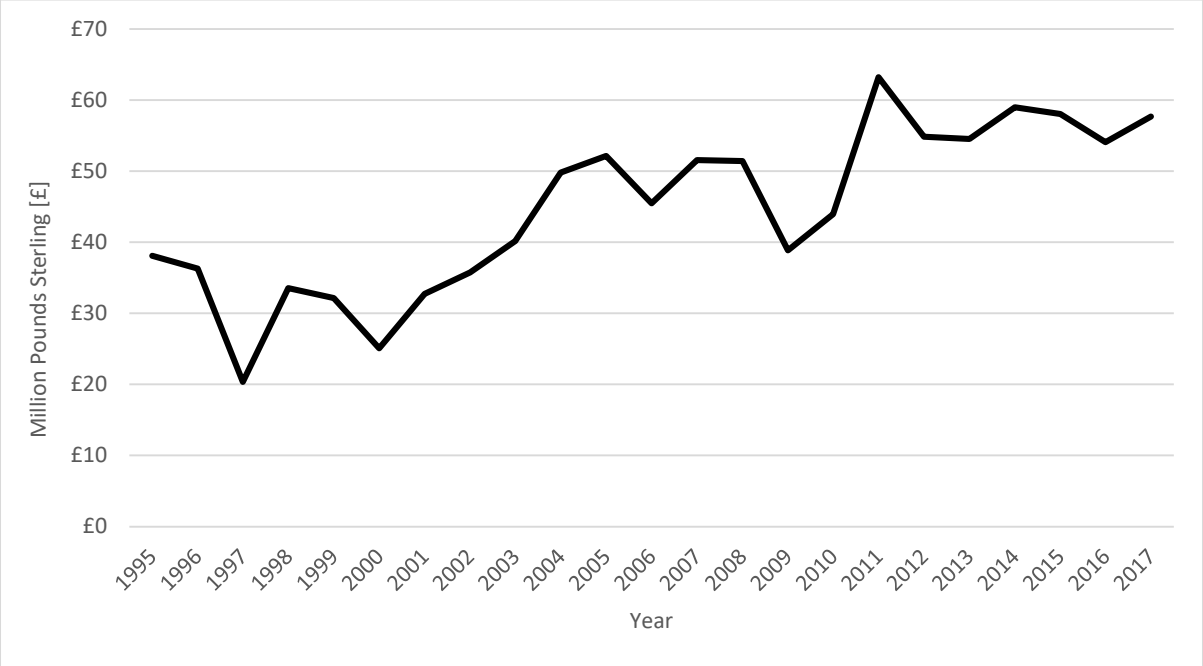


Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

Irish Peat Export Trends 1995-2017

- Peat exports are a notable contributor to the Irish economy, rising 50% in value between 1995 and 2017.
- Between 2000 and 2005 the value of exports increased sharply from to £25million to £52 million.
- A peak of £63 million was reached in 2011, subsequently values have fluctuated around the £58 million mark.
- In 2018 Ireland exported 422,672 tonnes of peat to Great Britain and Northern Ireland, 277,587 tonnes to the rest of the EU and 120,889 tonnes to the rest of the world.
- The Irish commercial horticulture sector is a very important contributor to the national economy, worth €437 million in 2018 (Klassmann-Deilmann 2020). It is estimated that 50% of the industry is dependent upon peat as a growing medium.

Figure 21: Total Value of Irish Peat Exports 1995-2017



Source: The Observatory of Economic Complexity by Alexander Simoes, HS92 Dataset by BACI International Trade Database, accessed via https://oec.world.

22.2 Appendix 2: Patterns/trends in growing media consumption usage

Between 1999-2015, two projects tracked the use of peat in horticultural growing media in the UK. The final reports from these studies provide the source for the information summarised below. The reports are:

- **Monitoring the horticultural use of peat and progress towards achievement of the UK Biodiversity Action Plan targets (SP08020)** (Defra 2010). Reporting on the trends between 1999-2009.

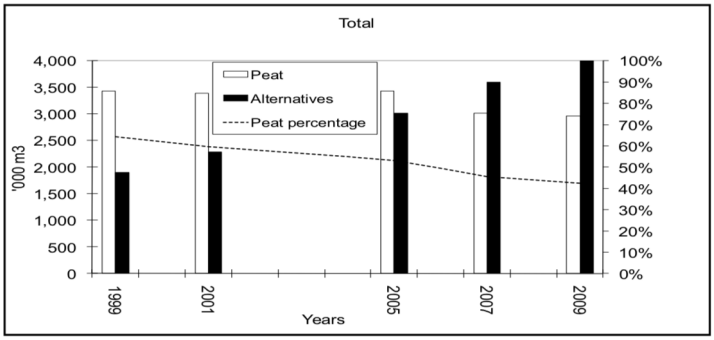
- **CP100 Tracking peat usage in Growing Media Production – Final report 2016** (AHDB 2016). Including detailed figures for volumes of growing media and growing media ingredients (peat and alternatives) supplied to the amateur and professional use markets. Reporting on trends between 2011-2015.

It was acknowledged in AHDB (2016) that due to differences in sampling and methodology the data from the two studies are not directly comparable. However, as part of the data checking for the information gathered in AHDB (2016) the figures on the peat content of growing media were cross referenced against the data in the previous project to check that the figures were broadly in line with what was expected (AHDB 2016).

Headline summary 1999-2009 (Defra 2010)

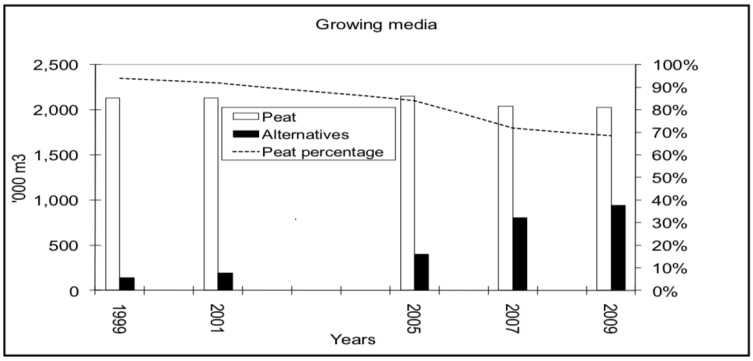
- In 1999, the total volume of peat and alternatives used in horticultural growing products (growing media and soil improvers) in UK was 5.3 Mm^3, of which the volume of peat was 3.4 Mm^3 and the volume of alternatives was 1.9 Mm^3. 64% of the substrate sold was peat.
- In 2009, the total volume of peat and alternatives used in horticultural growing products (soil improvers and growing media) was 6.98 Mm^3, of which the proportion of peat was 42% (2.96 Mm^3 peat and 4.0 Mm^3 of alternatives).
- The total market for *growing media* (i.e. not including soil improver) increased from 3.5 M m^3 in 1999 (94% peat; 3.3 Mm^3 peat; 0.2 Mm^3 alternatives) to 4.2 Mm^3 in 2009 (70% peat; 2.9 Mm^3; 1.3 Mm^3 alternatives).
- From 2005 to 2009, there was a steady increase in the volume of alternatives used, whilst the volume of peat declined.
- By 2009, the use peat in soil improver products had virtually ceased and the use of green compost had increased in this market.
- Within the growing media sector, the proportion of peat declined between 1999-2009, with the highest rate of change between 2005 and 2007.

Figure 22: Combined use of peat and alternatives in all sectors 1999-2009 ('000 m3)



Source: Defra 2010

Figure 23: Peat and peat alternatives used in amateur growing media 1999-2009



Source: Defra 2010

Headline summary 2011-2015 (AHDB 2016)

- Between 2011-2015 the total volume of growing media (retail, professional and export markets; peat and alternatives) sold by manufacturers in the UK fluctuated between 4.5 Mm^3 (in 2011) and 3.6 Mm^3 (in 2013).
- Due to poor weather conditions limiting consumer demand, the total growing media sales volumes fell from 2011 to 2013, and then increased in 2014 and 2015. There was a 1% decline in the total UK growing media supply (including export) between 2014 and 2015; from 3.88 Mm^3 in 2014 to 3.84 Mm^3 in 2015.
- The proportions of the volumes of growing media sold to retail, professional and export markets remained largely unchanged; approximately 70% to retail, 28-30% to professional, and 1-1.5% to export.
- Considering the overall growing media supply, there was a decline in the proportion of peat in growing media during the period 2011-2015; with peat accounting for 62% of overall growing media in 2011; 57% in 2012; 55% in 2013 and 2014 and 56% in 2015.
- In the professional sector, there was a decline in volumes and proportions of peat used, whilst in the retail sector the volumes have fluctuated between 1.27 Mm^3 - 1.83 Mm^3 and the proportions between 50-58% (see below).

- Between 2011-2015, the volumes/proportions of peat in growing media in the retail market were:
    - 2011 – 1.83 Mm^3 (58%)
    - 2012 – 1.39 Mm^3 (52%
    - 2013 – 1.27 Mm^3 (50%)
    - 2014 – 1.39 Mm^3 (51%)
    - 2015 – 1.44 Mm^3 (53%)
- Between 2011-2015, the volumes/proportions of peat in growing media in the professional sector were:
    - 2011 – 0.93 Mm^3 (72%)
    - 2012 – 0.83 Mm^3 (69%)
    - 2013 – 0.70 Mm^3 (67%)
    - 2014 – 0.72 Mm^3 (65%)
    - 2015 – 0.69 Mm^3 (64%)
- Adding the volumes used in both of these sectors, indicate that the total use of peat declined from 2.76 Mm^3 in 2011 to 2.13 Mm^3 in 2015.

Trends in the use of peat in growing media between 1999-2015

Based on the data from the two reports (Defra 2010; AHDB 2016), Figures 24 and 25 show the trends in the use of peat in growing media in the UK over the period 1999-2015.

Figure 24: Trends in use of peat and growing media in UK horticulture

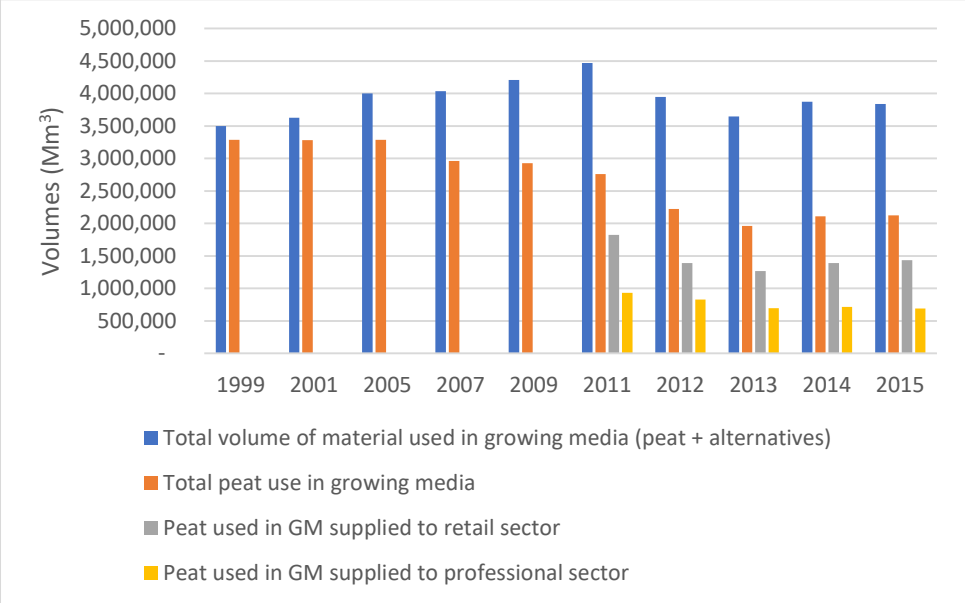
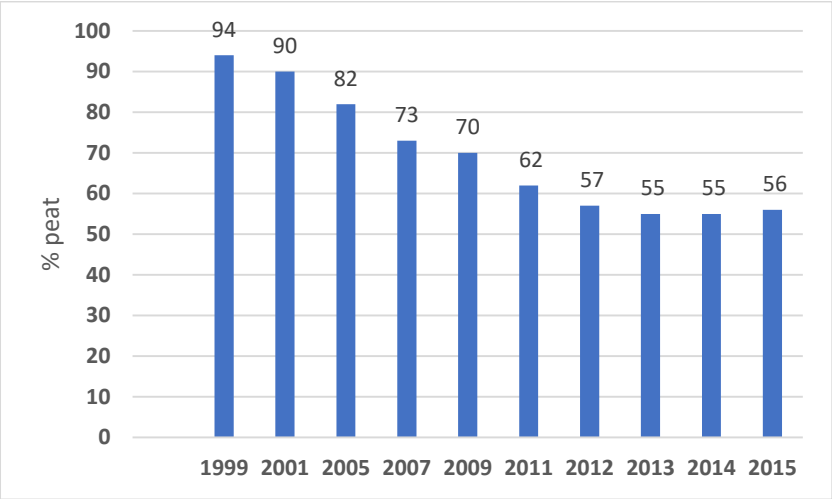


Figure 25: Percentage use of peat in growing media 1999-201

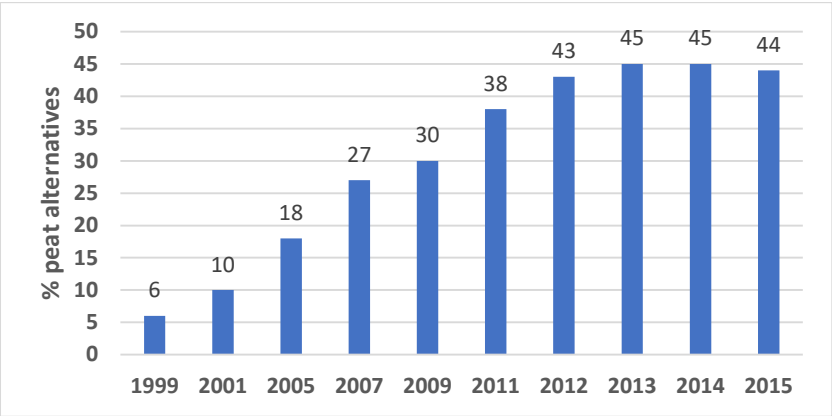


N.B. *Values relate to the overall growing media supply.*

Trends in the use of peat alternatives 1999-2015

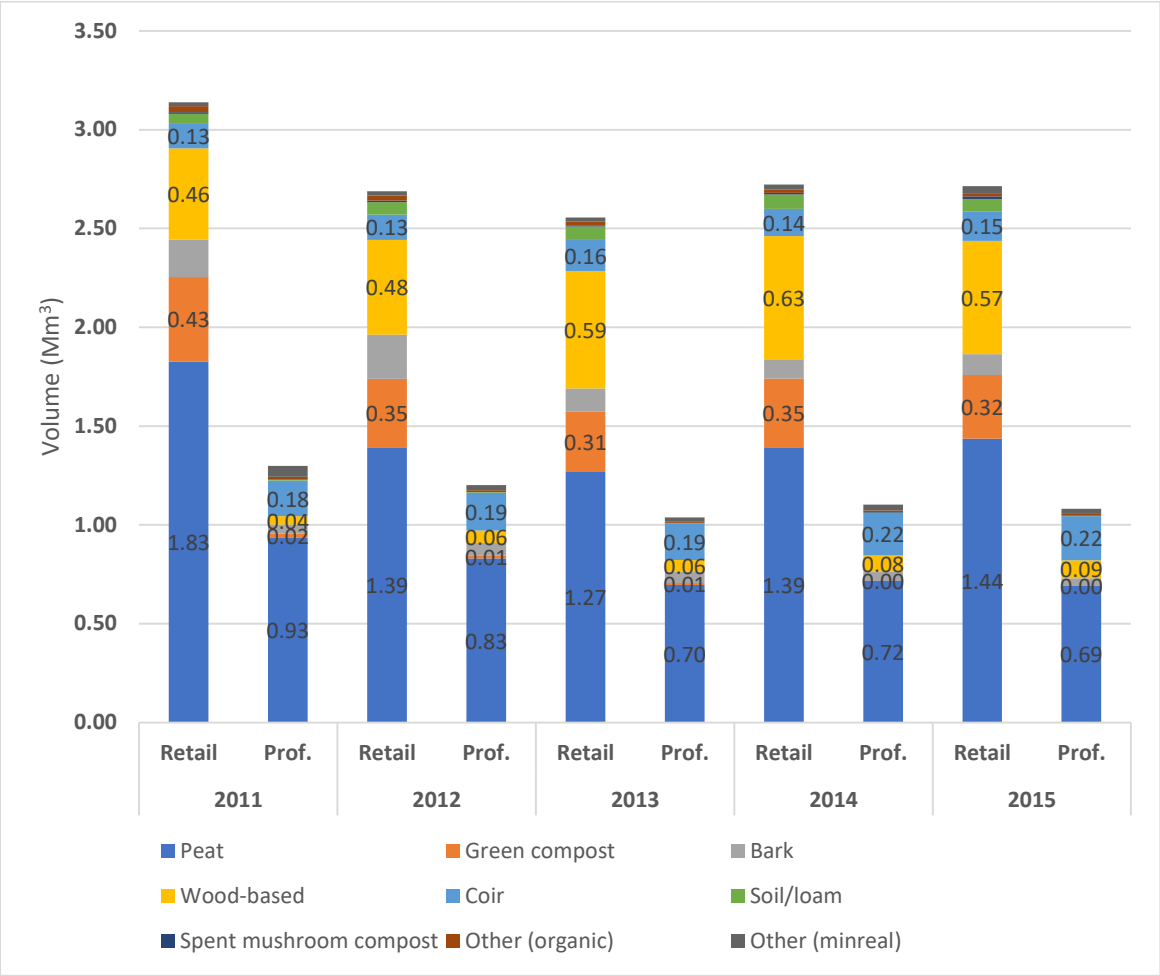
Based on the data from the two reports (Defra 2010; AHDB 2016), Figure 26 shows the trend in the use of peat alternatives in growing media in the UK over the period 1999-2015, with the values of all peat alternatives combined and relating to the overall sector (retail and professional sector combined). For the years 2011-2015 (AHDB 2016), the trends in use of peat alternatives were also recorded separately for the different types of materials, and the volumes of the most commonly used alternatives in media supplied to the retail sector and to the professional sector are shown in Figure 27.

Figure 26: Percentage use of peat alternatives in growing media 1999-2015



N.B. Values relate to the overall growing media supply.

Figure 27: Volumes of ingredients used in growing media in the UK between 2011-2015



- During this period, the volumes and proportion of the different peat alternatives used for growing media in the retail sector were in the range:
    - Green compost - 0.31-0.43 Mm^3 (12-13.6%)
    - Bark - 0.09-0.22 Mm^3 (3.4-6.0%)
    - Wood-based - 0.46-0.63 Mm^3 (15-23%)
    - Coir – 0.13-0.16 Mm^3 (4.1-6.1%)
- For growing media in the professional sector, coir was the most commonly used alterative to peat with volumes fluctuating between 0.18 Mm^3 – 0.22 Mm^3 and the proportion increasing from 14% to 21 % between 2011 – 2015.

Trends between 2016-2019

The latest publicly available data available on the use of peat and alternatives in the UK horticulture sector are those for 2015 (AHDB 2016). Some data was collected for 2017 but as the sampling and methodology used at that time was different, this data was not directly comparable and have therefore not been included. However, a new project to collect data for 2018 and 2019 using similar methodology to the AHDB 2016 project, has recently been

commissioned, and data for 2018 and 2019 has been collated. However, at the time of publication this data is not publicly available. It is understood that the data shows that the proportion of peat content in growing media has dropped to around 50%, although it is as yet unclear whether overall volumes of peat being used have declined.

Concern has been expressed by environmentalists that data on peat extraction levels in England and Scotland is not recorded by government and that there is no publicly available data on sales volumes from garden centres. 'Charlie Nathan, head of planning and development at the Royal Society for the Protection of Birds in Scotland, thought it was "incredible" that the Scottish Government does not have comprehensive data on commercial peat extraction and called for an end to the industry', (in Briggs 2019). As this quote illustrates, a lack of available data is a reputational risk for the industry as it leads to red flags being raised by environmental lobbyists who will point to a lack of transparency.

In summary:

- There was a steady decline in the **total volume of peat** used in growing media between 1999-2013, from approximately 3.29 Mm^3 to 1.96 Mm^3. However, there was a slight increase to 2.13Mm^3 in 2015.

- The **overall volumes of growing media** supplied in UK increased from 3.5 Mm^3 in 1999 to 4.5 Mm^3 in 2011, but have since then fluctuated between 3.6 – 3.9 Mm^3 for the period 2012-2015.

- Overall (retail and professional sector combined) the **proportion of peat** in growing media was reduced from 94% in 1999 to 62% in 2011, 57 % in 2012 and has, since then remained at 55-56% (56% in 2015).

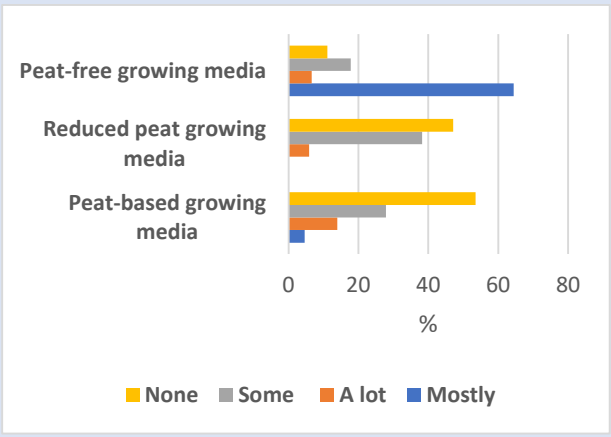
- Overall (retail and professional sector combined) **the proportion of peat alternatives** in growing media has been increased from 6% in 1999 to 38% in 2011 and to 45% in 2013 and 2014.

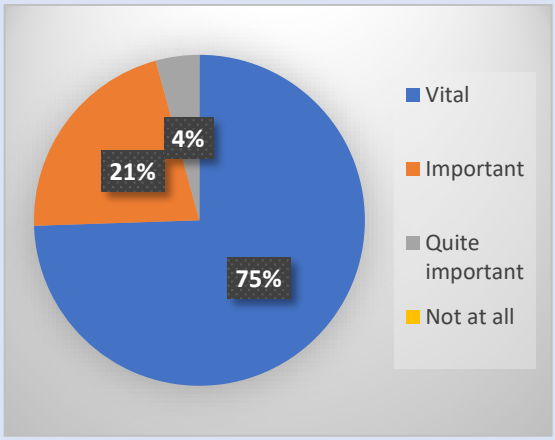
- In 2011, when the Government targets were set for phasing out the use of peat in horticulture, the growing media industry committed to a transition to a reduced use of peat and to sourcing growing media materials sustainably. The transition, in terms of volumes of peat and alternatives, was tracked between 2011 -2015, but since 2015 no data is currently available. In the absence of data from the recent years (2016-2019), it is difficult to demonstrate the extent of progress the has been made over the last seven years in terms of reducing the reliance of peat for growing media. The volumes and proportions of peat used were remained largely unchanged between 2013 and 2015 and no data has been published subsequently.

22.3 Appendix 3: Attitudes to Growing Media- 'Flowers from the Farm'

In February 2020 we conducted a survey about sustainability at the Flowers from the Farm Annual Conference in Maidenhead. Flowers from the Farm is a membership organisation which represents the interests of small-scale British commercial flower growers. Three of the questions in the survey were about attitudes to, and usage of, growing media. The results are striking in that respondents were very aware of the sustainability issues surrounding peat and most were seeking to use as little peat as possible. Seventy-five percent consider that it is 'Vital' to reduce peat usage, whilst over 60% 'Mostly' use peat-free growing media and only 14% used peat-based growing media 'a lot'. These results indicate that reducing or avoiding peat-based products is a practice reaching increasingly into the mainstream, even within commercial settings. For these growers reducing usage of peat is part of a set of sustainability practices which are important for their brand and reputation.

Figure 28): Usage of different types of growing media How important is it to reduce peat usage





22.4 Appendix 4: Reflections on the implementation of the Roadmap

(n.b. this initial overview is based upon information provided by articles in Hortweek between 2010 and 2019. These provide interesting insights into the evolution of debates and also progress made in achieving the roadmap to date)

OVERVIEW

2010 and 2011 were characterised by heated peat debates as DEFRA published its proposals to phase out peat through a voluntary approach. The discussions remained top news until about 2012/13, after the task force finalised its work (see below for details). There then seems to be a lull in the debate. There was a lot of focus on finding and trialling alternatives and continuing with peat-reduced products. At the same time, certification schemes for growing media start to become a topic. In 2019, one year before the initially planned complete phase-out of peat in amateur gardens, the debate became more dynamic again.

'How peat is shaping up to become the next big issue' is a very good summary article of the peat debate over time → (Appleby 2019a).

DEFRA/POLICY

In December 2010, DEFRA published a consultation outlining a proposal for **peat to be phased out in England by amateur gardeners by 2020, extending to producers and growers by 2030** (Mackenzie 2010). Earlier targets to reduce peat use by 90% by 2010 were missed by 30%. In 2010, the industry was roughly 60% peat reduced (Appleby 2011a).

The introduction of the targets in 2010 led to different reactions, including **worries** about cost, impact on the economy and job loss, discussions about a peat tax or levy, the effect on propagators, the evidence base of the policy, and an apparent lack of viable alternatives (Appleby 2011a, Mcewan 2011, Appleby 2011b, Mackenzie 2011). There was also a fear that English growers would be **disadvantaged** if there is not an EU-wide policy around peat usage (Appleby 2011c). Others simply called it '**foolish'** (Seabrook 2011). Several of these articles do focus on cost and the negative effects this would have for consumers, particularly as the early 2010s were characterised by stringent **austerity** measures.

To help meet these goals, Defra established a **task force**, bringing together representatives from 35 organisations across the supply chain to advise on how best to overcome the barriers to reducing peat use. Initially set up to look at peat, the task force had its remit broadened to that of **ensuring all the growing media and substrate used in the industry is sustainable** (Drury 2012, Appleby 2012). This was followed by the establishment of a £1 M research fund by DEFRA. The fund would support the research into peat alternatives over 5 years from 2013 onwards (Appleby 2013).

Most industry representatives seemed to acknowledge that the **phasing out of peat was inevitable** and that, in fact, it was good to have a target (Horticulture Week 2011). The question then became how this should be achieved: on a voluntary basis and led by industry (as before 2010) or guided by legislation. The industry seemed split over the best road to take (Appleby 2011d). DEFRA ended up going with voluntary targets for the phasing out of peat in their White Paper – this particularly worried production horticulture who had supported a

legislative approach, while retailers were pleased (Appleby and Tilley 2011). The option of legislation is retained if the voluntary targets are not being reached by 2015, however, EU law seems to prevent the UK from outlawing peat outright.

By 2018, peat use had not significantly decreased in amateur gardening and the Government threatened further measures to cut peat use if there was not sufficient movement to peat-free by 2020, as part of its comprehensive new environment plan (Appleby 2018a).

In early 2019, DEFRA started renewed consultations with industry and other stakeholders. Opinions within the industry were still split on whether a complete peat phase-out is at all possible or even necessary (Appleby 2019b, 2019c). Some argued that a **voluntary ban by 2020 would not happen**, and that DEFRA needed to look into other options together with industry, including: peat alternative consumer education; peat tax; peat minimum price; peat limited percentage in bags reduced year-in-year, e.g. 50% 2020, 40% 2021 to force the market; peat ban (Appleby 2019d). Involved NGOs, for example, have welcomed the idea of a peat ban, especially since the industry has had 10 years notice (Appleby 2019e, 2019f). The UK Government will probably launch a peat strategy in early 2020. DEFRA stated that the 2010 targets remained intact.

INDUSTRY/ALTERNATIVES

Viable **peat alternatives** are a concern but the phase-out also stimulated the search for alternatives (Lovelidge 2011). Peat alternatives were helped with an exceptionally bad **peat harvest** in 2012 and 2013, leading to a **peat shortage and price increases of peat-based products,** putting it on equal footing, pricewise, with alternatives**.** It emphasised the overreliance on peat by gardeners (Appleby 2013).

Popular alternatives are **coir and wood fibre. Coir** has been particularly successful with soft fruit producers in raised structures (Mcewan 2012)**.** However, the **coir supply chain** has its own environmental and economic sustainability challenges that affect security of supply in particular (Mcewan 2015a). Increasingly, variations of wood fibre preparations were also showing promise as an alternative (Mcewan 2015b, Drury 2015). Other trials included blends of coir, bark, wood fibre and green waste, sometimes in combination with peat (Appleby 2014).

Some people were worried about **how to market peat alternatives** to consumers. **Marketing** does play an important role and **'choice editing'** by retailers and garden centres can help (Appleby 2011e). Publicity plays an important role in raising consumer awareness about going 'peat-free', for example the RHS Chelsea explicitly stated it favoured peat-free plants and this has helped to increase sales for retailers (Clarke 2012). However, others have complained that **peat-free choices are not clearly labelled** and therefore it is difficult for consumers to make an informed choice, while others think labels might lead to more consumer confusion (Appleby 2017a, 2017b).

Meanwhile, the European peat industry developed a **standard to certify 'responsibly produced peat'**, which is audited by independent certification body MPS-ECAS (Appleby 2016). In 2018, the first types of growing media were certified (Appleby 2018b). In the UK,

the **Responsible Sourcing & Manufacturing of Growing Media Scheme** was launched in 2016. The scheme seeks to score growing media across a range of criteria and as such all materials are given equal scrutiny, unlike in the past when peat was singled out for what was not always favourable attention (Drury 2017). It wants to steadily introduce and increase an awareness of manufacturers' impact upon the environment as a result of choices made regarding the components used in growing media. The first full trial audits were conducted in 2019 (Appleby 2019c). In September 2019, the Growing Media Association announced a timeline for the implementation of the Responsible Sourcing Guide, which uses seven criteria for indicating environmental performance for growing media. Bags will be labelled with a traffic light system to communicate environmental credentials of the product (Appleby 2019g).

2019 saw the introduction of **several peat-free launches** at the Garden trade show Glee ahead of the Government's 2020 date for ending retail sales (Appleby 2019h). Public pressure on retailers and the industry also increased with broadcasting of **ITV's current affairs programme Tonight** examination of garden centre peat sales ahead of the looming 2020 Defra deadline for ending peat sales to amateur gardeners (Appleby 2019i).

The UK industry faced several upheavals: first, **Sinclair** went into administration in summer 2015 and was then bought by Westland, changing the market landscape; and second, **Brexit** led to new concerns regarding exchange rates and the cost of importing peat from Ireland and continental Europe (Appleby 2017c).

22.5 Appendix 5: Briefing document from HTA and GMA

Socio-Economic Briefing on the effects of changes in use of GM for UK Horticulture

June 2019

Introduction

The UK Growing Media Association (GMA) is a specialist group of the Horticultural Trades Association made up of manufacturers and suppliers covering 90% of the sales of growing media in the UK into the domestic and professional sectors of the UK ornamental horticulture industry. It is committed to reducing the amount of peat used in growing media.

The GMA is keen to work with Government to demonstrate peat reduction over a manageable time frame, whilst ensuring a sustainable future for the UK growing media industry - through maximising the opportunity for growth within the wider UK ornamental horticulture sector and positively contributing to measures to tackle biosecurity, climate change and health & wellbeing.

The GMA requires the support of an experienced research body to assist with the development of a socio-economic briefing that demonstrates the effects on the whole horticultural industry of moving away from a peat dominated growing media regime and the possible socio economic impact of using alternatives to peat

The body chosen to produce the briefing should have demonstrable experience in similar or same type of research projects, be able to work independently while regularly checking in with those who commission them and have experience of research being used in a public policy-making context.

There are several facets to the debate around peat use:

- The threat to peat lands as a natural habitat and impact on biodiversity
- Peat as one of the world's most significant carbon sinks.
- The role of UK ornamental horticulture's in the extraction and use of peat globally and within the UK.
- The alternative materials and their sourcing,
- The impact in terms of carbon footprint of using all materials in GM

Objective of the briefing

To assist the horticultural industry to produce a 'roadmap' detailing how the use of peat in growing media can be reduced to zero within a manageable timescale.
This project will need to:

- Outline patterns/trends in growing media consumption usage in the UK since 2000.
- Outline the sources of peat use in UK horticulture – from UK and overseas sources.
- Show how UK ornamental horticulture fits into global context of peat use.
- Outline strategies and policies to reduce peat usage in the UK.
- Evaluate the effectiveness of the Roadmap towards peat reduction in growing media in the UK.
- Outline an analytical framework (3Ps based Sustainability Model) for evaluating the appropriateness of individual growing media.
- Evaluate each category of Growing Media against the Sustainability Model. Components of the framework will include, but not be limited to the following:

    - Environmental credentials e.g. transport; energy cost; pollution; biodiversity impacts; carbon footprint; ecosystem services.
    - Availability of peat alternatives - demands from other sources
    - Cost of peat alternatives – affects both consumers & professionals
    - Infrastructure needed to move to peat alternatives – not currently in place
    - Risks to biosecurity and human health with alternative production

- Detail the barriers and opportunities (policy, market, infrastructure, technical, consumer etc) to delivering the roadmap and suggestions for action, such as
    - Subsidies? Effect of introduction – diversion of subsidies from CHP?
    - Green waste collection – Government regulation to create high quality media?
    - Incentivise separation of green waste (domestic v municipal)
    - Investment in collection & production infrastructure for green waste
    - International comparisons – what has worked, where & why?
    - Alternative materials – their sourcing and barriers to their use,
    - Competitive use of materials,
- Assess the viability of the current Government peat reduction targets.
- Make recommendations for further research.

Current and past voluntary industry initiatives

- DEFRA Growing Media Task Force – 12 Projects launched
    - Project 4 - Responsible Sourcing Scheme for Growing Media (started 201*, projected launch 2019) including the Responsible Sourcing Calculator
- Voluntary collaboration with NGOs in peatland restoration in the UK
- Voluntary reductions in both bagged and professional media made by both gm manufacturers and growers so far
- Contribution of the growing media industry to the UK economy
- Potential for carbon release process to be mitigated by planting plants potted in peat

Data Collection

- CP 100 – Tracking peat usage in growing media production
- SP1206 – DEFRA Review of growing media use and dominant materials for growing media in other countries (European & International) – 2010

(Please note, this list is not exhaustive)

Research so far – current and in progress

- CP138. AHDB "Transition to Responsibly Sourced Growing Media Use within UK Horticulture" 5 year project ends Dec 2019
- HNS182. NIAB "Developing optimum irrigation guidelines for reduced peat, peat-free and industry standard substrates" completed March 2013
- CP095. AHDB "sustainable resource Use in horticulture" 2017

(Please note, this list is not exhaustive)

Political Context

As part of the Government's approach to tackling climate change, it set targets within its 25 Year Environmental Plan of relevance to this project:

- 2015 – zero peat use in public procurement contracts. However, there has been no review of whether this target has been met.
- 2020 – zero peat in bagged growing media (consumer). As part of this pledge Government reserved the right to consider policy interventions to meet this target. For example, a ban on UK peat extraction for bagged consumer-use for has been proposed, but the GMA believes this offers an unfair advantage to imports. Defra plan to launch a consultation late Summer 2019 into policy interventions and levers to deliver the Government's commitments on peat reduction.
- 2030 – zero use of peat in professional growing media

22.6 Appendix 6: Underpinning concepts: What do we mean by 'Sustainability'?

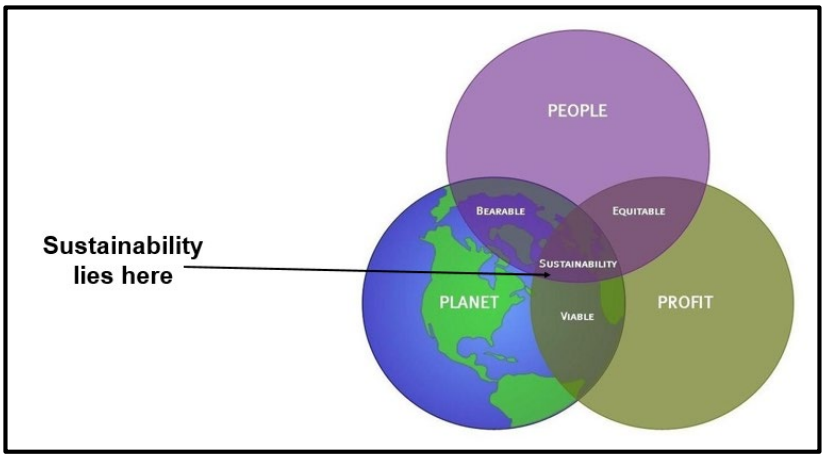
Sustainability has shifted from being a widely used but often misunderstood word to being a powerful concept that underpins policies emanating from global multi-lateral organisations, national governments, local government, NGOs and businesses of all shapes and sizes. The potency of the term is evident in its deployment by the United Nations in their Sustainable Development Goals which are routinely used as objectives by all manner of organisations. In its original incarnation sustainability was widely interpreted as being primarily focused upon environmental issues. However, the dominant definition centres on the 3 Ps – People, Profit and Planet (see Figure 29 below). Thus, an activity is only truly sustainable when it provides for the needs of people, ensures that firms can stay in business and at the very least does not degrade the natural environment. Focusing on just one or two of these criteria at the expense of the other(s) is ultimately not going to be sustainable, in other words there will be problems that will undermine the future. Awareness of the far-reaching consequences of the climate crisis is growing rapidly and it is evident that humans lack of concern for the natural environment is creating significant social and financial costs. A long-term lack of attention to these issues is starting to cause very real problems which can only be tackled by framing our choices (as governments, citizens and investors) through a 3Ps sustainability lens.

The horticulture industry is uniquely placed to be a leader in sustainability. After all, its core business focuses upon the sale of products which contribute heavily to sustainability goals –

plants that sequester carbon and provide a habitat for biodiversity. However, it can be argued that the industry is overly associated with products and consumer habits which are not sustainable – widespread use of chemicals, the promotion of homogenous gardens and the use of peat-based growing media. Therefore, a concerted effort to promote sustainability throughout the horticulture industry would be welcome.

In this review we use a 3Ps sustainability lens to focus upon the issue growing media. Growing media is an essential component of the industry, so the question is: what are the most sustainable ways forward for producing growing media? In this study we examine the different options using the best available data in order to assess the viability of each going forward.

Figure 29: The 3Ps of Sustainability



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