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Growing Media in Balance

Environmental Footprints

Sphagnum Biomass and its Use

Peat in Swedish Horticulture

Peatlands for Education

IPS Annual Report 2012

The magazine for members and friends of the International Peat Society

100

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Potting Bromelia in a substrate based on white Sphagnum peat and coco fibre. Photo: Klasmann-Deilmann GmbH

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Riga, Latvia in August 2014

Editorial

Jaakko Silpola

Maintaining transparency means also that actors introduce their activities openly to all stakeholders. Photo: Jaakko Silpola

Transparency is needed when using natural resources

The use of natural resources must become more and more transparent. There are clear signals for that from several sectors.

For instance, discussion on the quality of meat and monitoring of related processes in the European food industry is ongoing. As you probably have noticed, it was discovered during past months that numerous products have contained horse meat, although the final products, such as burgers, were sold as beef. Another topic from the food industry is genetically modified (GM) food, for which different regulations and perceptions exist from country to country. Reliability, transparency and traceability are needed in both cases to ensure consumer trust.

Similarly, there is great public interest in other uses of natural resources, like forests. Timber, pulp and paper companies must show the origin of the wood they use in order to prove that they do not harvest forests illegally. Different forest certificates like FSC and PEFC are applied to show that wood is cut from responsibly managed areas. It is almost a must nowadays to use the adjacent logos if a company wants to enter the market of e.g. furniture or paper.

In addition, on a worldwide scale, ecological, social and economical sustainability of natural resources are continuously discussed and increasingly demanded by customers, as well as other stakeholders - at least in economies where people can afford to spend more money and thoughts on these values. International, national and local interests must be regarded by the economical actors as well as by national and regional authorities. What is the possible renewability of the resource? Is there enough of it available, can recycling and/or re-using be part of the process? What footprints do we leave? These are some of the ecological questions involved.

Social sustainability is sometimes less discussed even these days but it is still equally important. For instance the UN My World 2015 survey shows that jobs and secure incomes are still priority number one in many societies. However, which kind of income is safe and how can it be balanced between regions,

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and under which conditions? What kind of social responsibility would have been needed from the Western clothing business in order to prevent about 1,000 people from dying recently in Bangladesh when a textile factory collapsed? Industries can create jobs and welfare, but they also must carry much responsibility to people and local communities.

Another aspect concerns tax havens that are being discussed now very heavily when the economical crisis has hit many countries. On one hand, companies and private investors try to reduce costs, on the other hand, tax income is needed by governments in order to provide public services. Some companies are reported to have subsidiaries in low level taxation countries and use tax reliefs wherever possible. Other companies try to show their social and economical responsibility by counting how many jobs they provide locally and how much taxes they pay locally and to the state. Both are legal, and markets might have the chance to judge when there is enough competition.

How transparent and traceable is the use of peat and peatlands?

Transparency of the management and usage of natural resources include various aspects. We must know what is the total quantity and quality of a resource in order to guide and, if necessary, restrict its usage. The total quantity of peatlands is known quite well, partly also its quality, at least in several countries where peatlands are heavily used, for instance in agriculture, forestry and for peat extraction. The main peatland types are to some extent studied and documented. But how well do we know the biodiversity of individual peatlands, which strongly differs from country to country, mire type and region?

It can be said that the use of peat and peatlands is facing the same challenges as all other industries. There are always two options - to tell or not to tell. Luckily it seems that telling things, reporting, being as open as possible is becoming more common, for the benefit of the community and all involved.

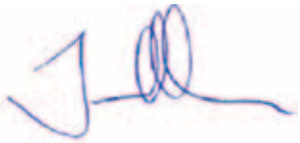
Some historical mile stones to mention from the field of peat and peatlands: The Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004. The RSPO deals with various issues under eight main principles, including the management of tropical peat swamp forests. Later on, the IPS took globally the initiative to introduce a Peatland Certification Scheme at the Tullamore Peat Congress 2008. That proposal was followed two years later, in 2010, by the Strategy for Responsible Peatland Management (SRPM), also coordinated by the IPS. In the meantime, Canadian stakeholders chose and applied the VeriFlora Certification for Responsible Peatland Management for their harvesting areas. And now in Europe, discussion is ongoing to establish a European Responsibly Produced Peat (RPP) initiative for horticultural peat.

All above mentioned examples show that the use of natural raw materials, the employment of skilled people, and being an active part of the local economy and society require more open and transparent actions every day - from individual companies to industrial sectors. Only that can provide true possibilities for long-term existence in today's open and transparent markets.

The IPS does its own share by making peatland management practices more transparent. We in the IPS carry on developing the Strategy for Responsible Peatland Management by content, but also keeping its practical application in mind. We definitely need to have national peatland strategies based on the global SRPM viewpoints in all IPS member countries. The Strategy can also act as an educational tool at schools and universities. However, to fully utilise its potential, the IPS as truly an international and neutral all-stakeholder organisation must create more content and give more examples on how to use that document in the field.

Based on the SRPM values and actions, the IPS also has several project ideas how to develop the management of peatlands for the years to come. Those projects will be introduced soon and you will hear from us.

Wishing you very best in your living,



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From the President's Desk

Björn Hånell

IPS Members at a meeting in Bad Zwischenahn, Germany in October 2012: Samu Valpola, Jaakko Silpola, Olaf Meiners, Valerijs Kozlovs, Lulie Melling, Björn Hånell, Marie Kofod-Hansen, Guus van Berckel, Susann Warnecke, Tanja Constabel, Gerald Schmilewski, Silke Kumar, Andre Daum, Jack Rieley, Paul Short and Johannes Welsch (left to right). Photo: Hotel Haus am Meer

Peat family reunion time!

Just before Midsummer in beautiful Leiden, the Netherlands. It is time for the Peat Family to gather and I would like to welcome you all to the Annual Convention of the International Peat Society (IPS).

The Executive Board (EB) and the Scientific Advisory Board (SAB) will meet jointly for two days. We have many important matters to discuss and decide on, following on from our brainstorming in January 2013 on a vision, mission and aims for the Society. The Chairs of our National Committees will have a Round Table discussion, and all members of the Society are welcome when its deciding body, the Annual Assembly, meets to approve or disapprove our accounts, budget, activity plans, and more. The Convention is also a forum for internal, but generally open Commissions meetings.

All this is however not all! The reunion offers an exclusive chance to get the most recent information on peat and its use in horticulture via the International Symposium on Growing Media and Soilless Cultivation. The symposium, closely linked to the Convention, is jointly organised by the International Society of Horticultural Science (ISHS) and the IPS. Enjoy!

With a new Strategic Plan 2013-16 in place, we now have a number of short-term and long-term commitments to address. One immediate task is improved involvement with other international agencies and conventions, including the United Nations Framework on Climate Change (UNFCC), the Convention on Biological Diversity (CBD), FAO, the International Union of Forest Research Organisations (IUFRO), the Society of Wetland Scientists (SWS), and the International Union of Soil Sciences (IUSS) – just to mention a few.

We have a need to update the IPS knowledge base and policy advice

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on climate change issues relevant to peatland under all uses. No doubt, Peatlands and Climate Change should feature as a major theme at our next World Congress (15th IPC) in Kuching, Malaysia in 2016.

At present, most IPS members are people directly involved in peatlands economically and/or scientifically. During the last two decades the ecological and biological aspects of peatlands have come to the fore, mainly in relation to climate change. So far we have given little attention to the involvement of local communities in peatlands, and to the social and cultural implications of industry and science. There are paragraphs in our Strategy for Responsible Peatland Management (SRPM) that deal with information dissemination and the engagement of local people regarding peatland management, but in addition to these a social chapter of the SRPM is much desired.

The first step to realize this wish will be to start filling the enormous gap in knowledge on social and cultural issues in relation to peatlands. In a new project, "Peatlands and Indigenous People", the aims are to deliver a paper on this topic at the Society, Culture and Traditions Symposium in Riga 2014, and to have the social chapter ready at the 15th IPC two years later. In line with our aim to promote peatland conservation globally, an IPS Task Force on this subject is under way, with special focus on developing, Southern Hemisphere and tropical countries.

The International Society for Horticultural Science (ISHS), represented by Bill Carlile, and the IPS with Donal Clarke and Gerald Schmilewski, confirmed their conference cooperation agreement in Stockholm in 2012. Photo: Susann Warnecke

Other commitments of highest relevance for the Society are to supplement the SRPM with practical guidelines, examine the feasibility of IPS meeting the research needs of its member organizations, and to develop a policy on peatland goods and services.

One prerequisite for accomplishing these engagements, and several more that are not mentioned here, is a closer cooperation with our National Committees. Use the expertise we have better – ask the experts to get more involved in our work! Moreover, we should improve our strength with a greater number of IPS office holders. We need more shoulders to share the workload. A modified structure of the Society has been suggested, and will be considered by the SAB and the EB during the Convention.

On a jogging tour (slow, staggering, I don't love it …) earlier today I had Status Quo plugged in my ears and one refrain went repeatedly: "Come on, come on, let's work together". Right on for the IPS! We need more collaboration. Perhaps more rock music to guide us as well?

Big challenges ahead - IPS will approach them with the skills and optimism of its members, here in Stockholm at IPC 2012. Photo: Susann Warnecke

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Growing media – they all have an environmental footprint !

Text: Gerald Schmilewski

There are many ways to look at growing media production and use, depending on interests. The problem is that many stakeholders do not generally understand or know of the viewpoints of others. All stakeholders must use a holistic approach when looking at the pros and cons of growing media constituents. We must accept that all growing media constituents have an environmental footprint – not just peat.

Points of view

The growing media manufacturer has to satisfy his customer's requirements and needs to sustain his own business without jeopardizing it by making insufficient mixes. For the grower the growing medium is an indispensable working material to cultivate his vegetables and ornamental crops at the lowest possible price. Environmentalists might insist on peat replacement, suggesting "alternatives" of which they know little of. Understandably, politicians avoid technical discussions on growing media constituents, but anyhow take decisive positions on CO_2 reduction. The public might be non-informed or indifferent towards sourcing of raw materials.

Growing media are materials, other than soil in situ, in which plants are grown (CEN, 1999). In the EU over

Fig. 1: Indicators to be assessed when selecting growing media and constituents thereof.

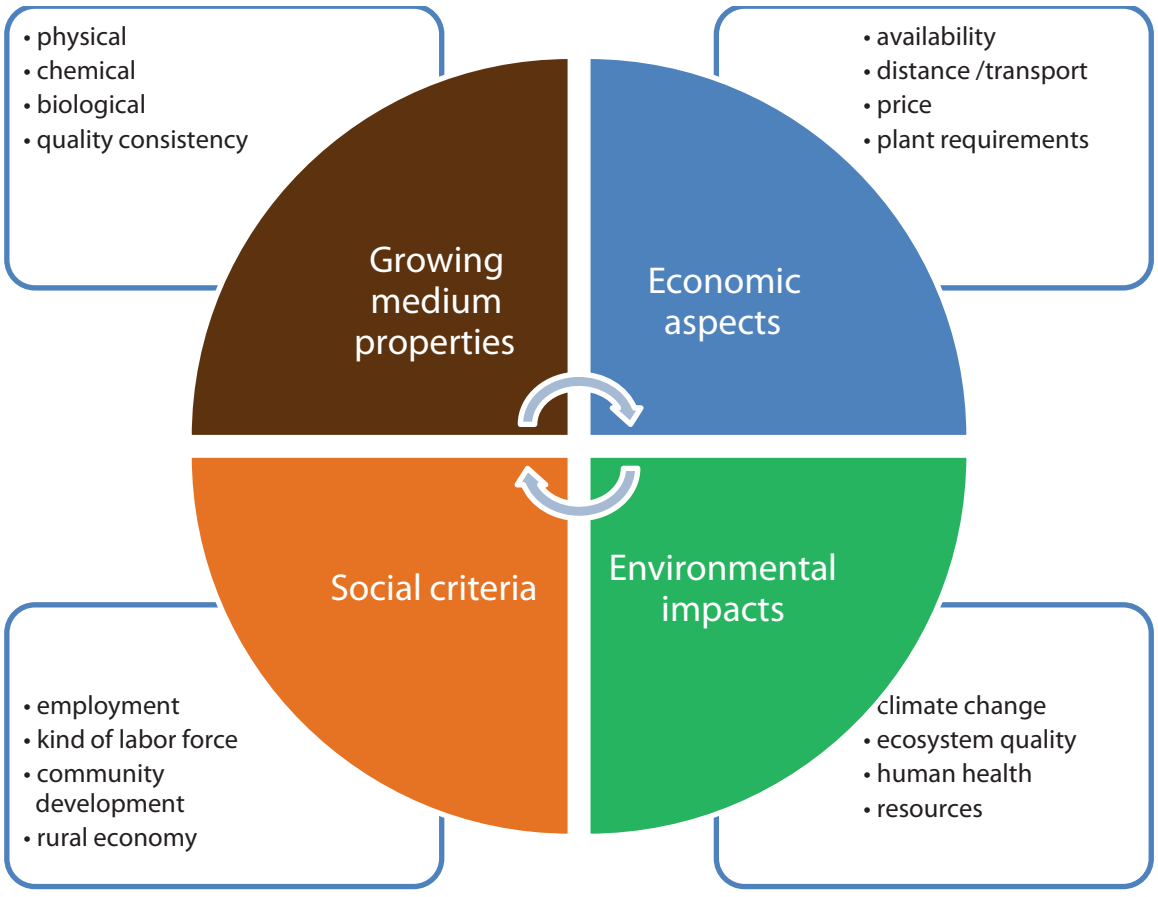

Photo 1: A transplanting robot in action. Photo: Klasmann-Deilmann GmbH

37 million m³ of growing media are produced annually by several hundred SMEs and a few large companies (Altmann, 2008). The growing media produced is the backbone of major segments of European horticulture. Peat – in most applications the favored growing media constituent – has gained reputation, due to its outstanding properties. But peat also features on the agenda of environmentalists, politicians, farmers, energy suppliers and forestry, who have made their claims for their favored "Wise Uses" of peat and peatlands.

Horticulture today is an intensive plant production industry. It deals with high-value crops which are cultivated with high capital inputs in terms of labor and technology per cropping area, either in protective structures (e.g. greenhouses) or in the field (e.g. container-grown nursery crops). Horticulture is highly sophisticated and the use of computer-controlled cultivation facilities, tailor-made fertilizers and crop specific growing media are essential to maintain business and to improve the products, yield and marketing of horticultural produce.

Horticultural requirements and growing media quality

The growing medium must function well under the grower's cultivation conditions. The quality of the medium must be measured against these conditions and the crop's requirements. A well balanced and holistic approach needs to be taken when choosing suitable growing media or constituents thereof. Not only must their physical, chemical and biological properties be evaluated, also economic aspects, environmental impacts as well as social criteria must be taken into account.

Peat has proven to be the best overall growing media constituent (Schmilewski, 2008). Materials other than peat have been analyzed and trial-tested to a great extent, and more research has been conducted on other materials than on peat in recent decades, but all have characteristic drawbacks that usually make their dilution essential. Also peat is not the best choice for every application! Coir pith, wood fiber, green composts and composted bark (and bark) have been used in growing media for many years, but seldom as the sole constituent. Wrongly composed growing media or use of less suitable constituents in too high proportion will restrict plant growth and can even jeopardize the very existence of a grower, because of diminishing yields and inferior product quality.

Disregarding the fact that these consequences contradict EU policy which aims "to encourage producers to improve (…) their product quality" (European Commission, 2003), it can weaken horticultural markets and the individual grower. The use of inferior growing media constituents or even peat free media is not an option for the vast majority of applications.

Are we being wise when using peat and materials other than peat? Peatlands and peat have been in the stranglehold of various interest groups for decades.

Environmentalists, politicians, NGOs, growers and growing media producers all want their say on this seemingly never-ending issue. Has the often quoted book on the "Wise use of mires and peatlands – Background and principles including a framework for decision-making" (Joosten and Clarke, 2002) or the EPAGMA (2009) "Code of Practice for Responsible Peatland Management" or the IPS (2010) "Strategy for Responsible Peatland Management" (SRPM) helped in these discussions?

Yes, they have. In particular the vision for responsible peatland management given in the SRPM sets a basis for a more holistic approach for decision-making: "Promoting the wise use of peatlands through safeguarding their environmental, social and economic functions and respecting their local, regional and global values". It is essential that all parties involved recognize that all three pillars of sustainability and sustainable development be well considered. One-sided, prejudiced assessments are useless to obtain wise decisions – this is also true for peat extraction, peat use and the use of any materials other than peat for the formulation of growing media.

Contrary to the highly ambitious UK governmental initiative of phasing out the horticultural use of peat by 2030 (HM Government, 2011) an ad hoc working group representing various stakeholder groups (incl. representatives from Wetlands International, IUCN, IPS, companies and EPAGMA) has developed a report on how to enhance the peat supply chain for

Table 1: Development of growing media from 1950.

1950-1975 **1st generation: Standardized growing media**	**1975-2000** **2nd generation: Tailor-made growing media**	**2000-2025** **3rd generation: Intelligent growing media**
	R & D	
Basic R&D on properties of peat Increased knowledge of plant requirements and GM characteristics Peat identified as the overall best constituent Analytical methods and national standards developed for peat-based GM	Increasing R&D on materials other than peat Modern cultivation techniques introduced (e.g. ebb and flood) First EU Standards for growing media	Increasing R&D into microbiological, biological, physical and chemical interactions in growing media Breakthroughs in biotechnology for defining growing media microbiologically Common use of biostimulants and biocontrol agents EU-harmonized regulation on GM based on EN standards
	Politics & economics	
Continued governmental ambition to drain and develop peatlands (mainly for agriculture) Industrialization of peat extraction Beginning of peatland protection activity	Political pressure to substitute peat in some countries Economic pressure on growers Dependence on peat-based growing media Diminishing peat resources in some countries Rehabilitation begins of peat extraction sites after use	Increased imports of peat to sustain growing media production Strong shift of peat and growing media production from western Europe to Baltic States Large and more sophisticated horticultural enterprises demanding more uniform growing media Peatland management for extraction leads to peat certification schemes Certification schemes for other constituents
	Growing media composition	
Increased use of peat-based growing media Some other constituents used	Peat clearly dominates as a growing media constituent Use of quality controlled composted materials, wood fibers and coir increases Strong product diversification	Peat remains crucial to sustainable plant production Further need to use peat due to inferior quality and availability of other constituents Increased use of materials other than peat depending on availability, quality and price

Dutch horticulture (Bos et al., 2011). This study was commissioned by the Dutch Government and is now the basis for developing a European certification system for 'Responsibly Produced Peat'. The reasoning behind this scheme is given in the report: "Growing media based on peat are very important for the Dutch horticulture sector. Peat is an excellent material and the sector has a long experience of how to achieve optimal results and to minimize risks using peat-based growing media." How different reasoning can be!

Young plant production.
Photo: Klasmann-Deilmann GmbH

A life cycle assessment (LCA) of growing media

The European Peat and Growing Media Association (EPAGMA) commissioned Quantis, a Swiss-based team of world-leading experts in the field of LCA studies to conduct a "Comparative Life Cycle Assessment of Horticultural Growing Media based on Peat and other Growing Media Constituents" (Quantis, 2012; full study: www.epagma.eu).
The four environmental impact categories were Climate Change, Ecosystem Quality, Human Health and Resources. The results of the study are most interesting and a few are reported here:

- All growing media and constituents thereof have an impact on the environment.
- It is not possible to clearly identify one growing medium as the least or the most impactful across the four impact categories.
- Growing media containing a relatively high proportion of peat show a higher impact in relation to the categories Climate Change and Resources.
- Growing media containing a large share of green compost have a relatively higher impact on Human Health.
- Growing media with a high share of coir pith have the highest impact relating to Ecosystem Quality.

The study concludes that "in general, it is not possible to clearly identify one growing medium constituent as having the least or the most impact across the four categories and the growing media application assessed. In this study".

In future life cycle assessments will be part of decision-making processes when formulating growing media. However, the given impact categories do not cover the performance characteristics of growing media, nor the economic criteria or social aspects that need to be considered (Fig. 1).

Future perspectives

No one can answer this with certainty. But considering the past, looking at the present and predicting the future as good as possible (Table 1), we can summarize as follows (Schmilewski, 2012):

- Horticulture will be increasingly demanding in respect to its requirements.
- Due to its outstanding properties and availability, peat will remain the dominating growing media constituent in the EU for decades to come.
- The use of peat as a soil improver will decline further, not for performance reasons, but because this application can be substituted by e.g. composts.
- Constituents other than peat (mainly local/regional sources) will be used increasingly in growing media; pre-conditions are their availability and assured quality.
- Phasing out peat in horticulture is not a realistic option.

Literature cited

Altmann, M. (2008): Socio-economic impact of the peat and growing media industry on horticulture in the EU. Study commissioned by EPAGMA.

Bos, M.G., Diemont, W.H. and Verhagen, A. (2011): Sustainable peat supply chain – Report of the ad hoc working group Enhancing the Sustainability of the Peat Supply Chain for the Dutch Horticulture. Alterra report 2167

European Commission Directorate General for Agriculture (2003): The horticulture sector in the EU –Fact sheet. Brussels.

European Peat and Growing Media Association (2009): Code of practice for responsible peatland management.

HM Government (2011): The natural choice: securing the value of nature. www.official-documents.gov.uk.

International Peat Society (IPS) (2010): Strategy for responsible peatland management. (eds.) D. Clarke and J. Rieley.

Joosten, H. and Clarke, D. (2002): Wise use of mires and peatlands – Background and principles including a framework for decision-making. 304 pp. Saarijärvi, Finland.

Quantis (2012): Comparative life cycle assessment of horticultural growing media based on peat and other growing media constituents. Study commissioned by EPAGMA. www.epagma.eu.

Schmilewski, G. (2008): The role of peat in assuring the quality of growing media. Mires and Peat; vol. 3, article 2. http://www.mires-and-peat.net/.

Schmilewski, G. (2012): The view from Europe. HDC News – Growing media review; pp. 5-7.

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Growing Media in Balance

Text: Hans Verhagen

Nowadays requirements for horticultural growing media are more strict when compared to past decades. Horticultural enterprises are large scale and have modern equippment. Markets demand delivery of specific qualityto a specific time table. Quality of plants must be uniform within large batches and on time. All this also effects growing media demands.

Whenever quality varies, or characteristics of a growing medium is not equal to previous deliveries, problems in cultivation can appear. Beside plant related requirements growing media must meet requirements in other fields such as logistics, economics and sustainability. Growing media must be balanced on many aspects.

Producing a growing medium with desired properties is one thing. Adapting it to the grower in such a way that its full potential comes to expression in a successful crop, is another thing. To achieve this, quality must be defined, for the growing medium as well as for the underlying constituents. Qualifiers for constituents do form a main factor. Qualifiers for constituents are a tool to manage production of Growing Media with the desired characteristics.

RHP searched for qualifiers for peat and a method to connect the growing medium with the grower. In this article a short overview.

What defines quality?

Principally the cultivation does set the primary requirements. Requirements which must be met by the growing medium. Further back in the chain this also sets requirements for the constituents, such as peat. Making a deliberate choice is not always easy, because useful qualifiers often are lacking.

Qualifiers for peat

Over the last years RHP-Research worked, together with participating companies, on qualifiers for peat. In this article three of these are described; fraction distribution, water uptake and structure stability. In various research projects, production techniques – sod/block production and milling – were examined on their effect on quality of the final peat fraction. Also the harvesting technique – mechanical and vacuum harvesting – were taken into account.

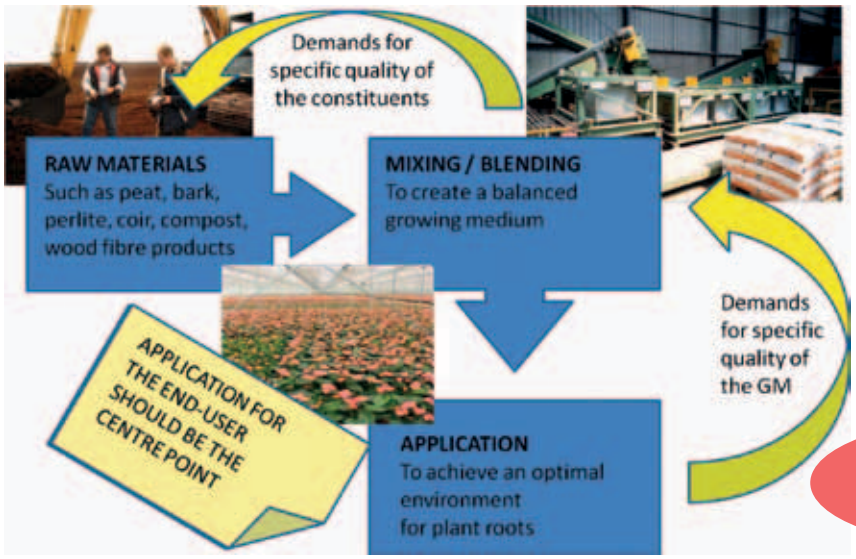
Refinement

Fine particles do influence the water/air ratio in growing media. The content of particles 0-1 mm – as determined in a sieve analysis – is of big influence on the air filled porosity (AFP). The higher the content of fine particles, the lower the AFP. Plants do need a minimum percentage of AFP for optimal growth.

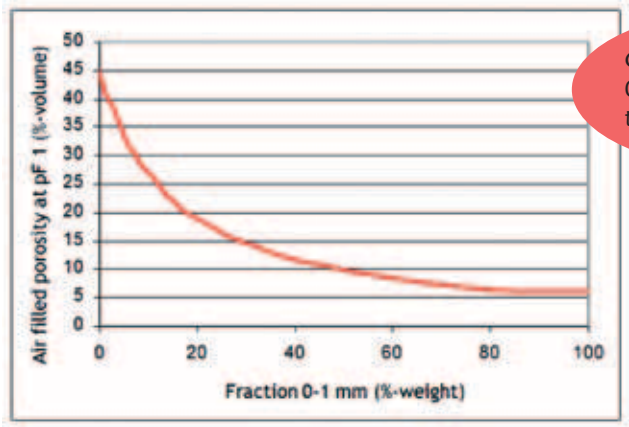
The share of fine particles in a peat material is severely influenced by the production techniques on the peat bog. By using vacuum harvesting the content of fine particles increased by 50% compared to mechanical harvesting. For mechanical harvesting refinement was marginal.

If the production of peat-fractions is the objective, then sod/block production is preferred. Research showed, whenever sods/blocks were properly dry, that less fine particles appear in the final produced fractions. Fractions produced from sods/blocks were significantly more effective in growing media.

The choice for a production technique is based on multiple aspects (e.g. financial, harvesting-speed and -capacity, etc). However, it is important to understand that fractions, produced with different techniques, visually seem the same, but perform differently.



Picture 1: What defines quality?



Graph: Fine particles 0-1 mm in peat in relation to AFP

Water repellency

Most peat materials do show water repellent behavior when strongly dried. Water repellency can cause major problems in growing media, leading to loss of plants. Production techniques showed to have major impact on the appearance of water repellency. Milled peat, when vacuum harvested, became more water repellent compared with mechanically harvested peat. When producing peat as sods or blocks, water repellency was much lower compared to milled peat in general.

Structure stability

Especially for larger pot plants stability of the growing medium is of major importance to maintain the desired structure during the cultivation period. A good structure provides optimal uptake of water, oxygen and nutrition by the plant roots. Stability is often incorporated in growing media by using peat fractions. RHP investigated the effect of production techniques on stability of growing media. Generally peat fractions produced from sods/ blocks were significantly more stable compared to fractions produced from milled peat. Stable fractions contribute to structure-stability in the pot!

Modeling with qualifiers

The research projects of RHP resulted into models which are used by participating companies. With these models the effects of constituents in mixtures can be predicted to a certain extent. Models do include

Photo: Anthurium in flooded bed system. Photo: RHP

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aspects such as fertilization, structure stability, water holding capacity and velocity of water uptake.

The RHP potting reference

In Europe a delivered volume of a growing medium is declared by a normalized European method (EN 12580). Physical and nutritional parameters also can be declared by EN methods. Based on these methods of analysis, growing media can be produced to fit the requirements of growers.

However, a well produced growing medium is not always a guarantee for successful cultivation. The application itself of the growing medium in the pot is of major importance. A growing medium with principally good aeration, can lose this due to tight potting by the grower. Whenever peat changes due to seasonal influences during production, the quality of the final growing medium also changes. Declaration by standard methods has no relation to the final application.

To achieve a good connection between the production of growing media and the use of them in horticulture, a new reference was developed by RHP. The RHP potting reference does show the standard compaction of a growing medium in practice. As such it provides clarity concerning the volume needed to fill a certain amount of pots. Based on the practical density of the growing medium, also physical characteristics (water holding capacity, air filled porosity), and fertilization can be set better in respect to the requirements of the grower.

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Measure it yourself!

The method for measuring the RHP Potting Reference is publicly available.

The method description can be obtained by sending a request to the author, verhagen@rhp.nl.

What is RHP?

RHP, established in 1963, aims to serve as the European expertise centre in the field of growing media, soil supplies and soil improvement.

RHP supports participating companies in technical development, which can result in a distinctive position in the market. This is to be achieved by means of innovative research, quality improvement and product certification.

Responsible Management of Peatlands – Implications for the Industrial Sector

19 - 20 February 2014
at Université Laval, Québec, Canada
Organized by the Peatland Ecology Research Group with Commission V of the IPS and the Canadian Chapter of the Society of Wetland Scientists.
More info: www.gret-perg.ulaval.ca.

Peat News

Are you receiving Peat News, the monthly email newsletter of the International Peat Society? If not, send your email address still today to susann.warnecke@peatsociety.org. (IPS members only!)

Peat as Constituent for Growing Media

Text: Hein Boon

A Message from the Netherlands

Peat is the major constituent for growing media. The socio-economic study of EPAGMA in 2008 showed that close to 30 million m³ of peat is used in growing media for horticultural and consumer purposes.

This volume of peat counts for almost 80% of the constituents used in these growing media (total volume 37 million m³). These figures relate to the use of peat in Europe. Although these amounts are not entirely up to date, we may assume that the current situation will be largely comparable. Consumption of growing media in Europe gradually changes.

New markets and phytosanitary requirements

In markets outside Europe the demand for growing media has grown in recent years. And the outlook is that the need for good and reliable growing media will further increase. The basis for this growth lies in a larger population and an improved standard of living. In other words, this is a prosperous outlook for the position of growing media and peat as a major constituent. These distant markets often apply strict phytosanitary requirements for the import of products in their

Unloading peat at Bol Peat, Schiedam, the Netherlands. Photo: Walter van Dijk

Table 1:
Survey: RHP-certified PEAT-products as constituent for growing media (x 1.000 m3*)

YEAR	black peat	white peat	total peat volume
2000	1291	1629	2920
2005	1613	2802	4415
2011	2888	4696	7584

* volume declared in m3 according EN-12580

Product types and application - RHP-certified -

in 2011	(x 1.000 m3)
peat for mushroom-casing	515
black peat	2373
milled peat	3546
sods/blocks	1150
total volume	7584

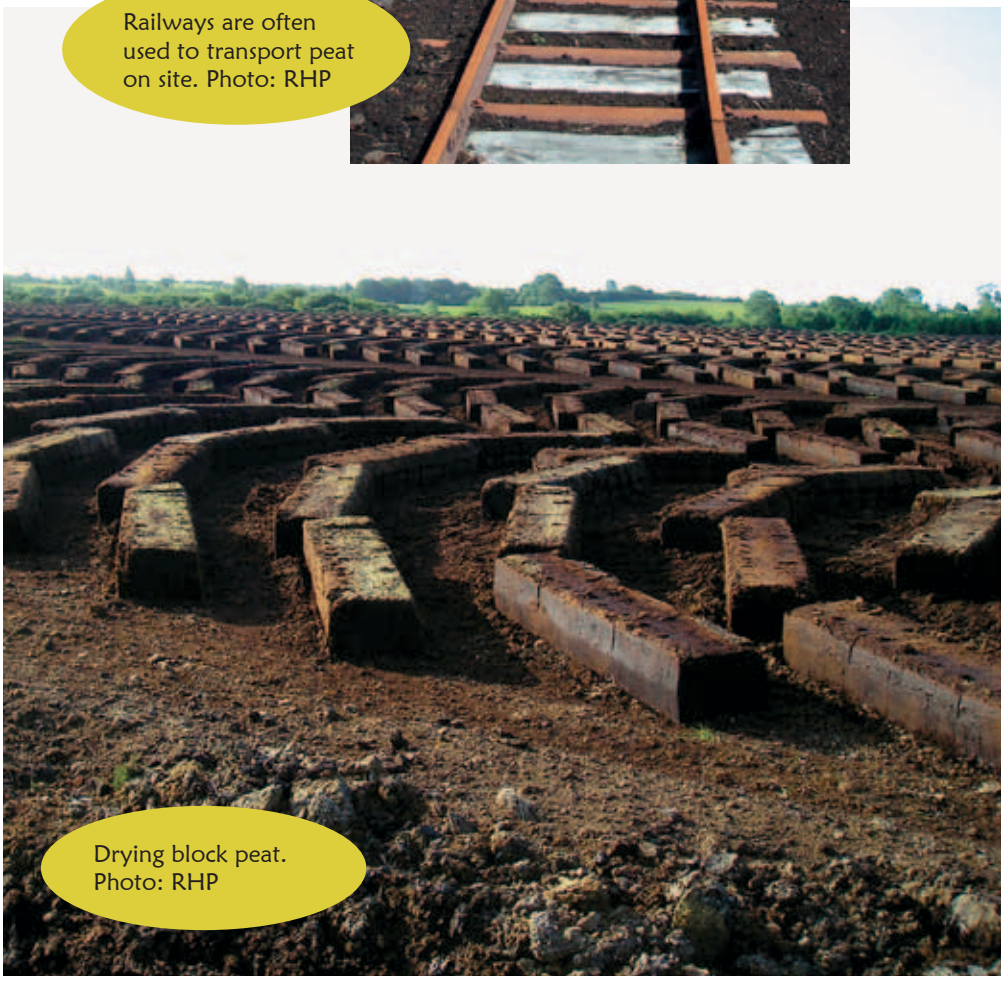
respective countries. And this is a great opportunity for peat as a phytosanitary clean product. Peat is by its nature, free from weeds, plant diseases, plant parasitic nematodes etc. Optimal control of production during peat extraction and logistics should prevent contamination.

Railways are often used to transport peat on site. Photo: RHP

Quality assurance tool for communication

Peat forms an important raw material for Dutch horticulture. In the Netherlands, however Sphagnum peat is no longer available. Already for decades large quantities of peat are transported from the Baltic countries, Scandinavia and Ireland to the Netherlands. These products are produced in accordance with the requirements of the RHP quality mark.

Sales of peat and growing media in the Netherlands (respectively 3,0 and 3,5 M m^3) has for some years been stable in volume. The supply of peat-products with the RHP quality mark however increases. Apparently, customers in broader Europe appreciate quality assured and phytosanitary virgin and clean sphagnum peat.



Drying block peat. Photo: RHP

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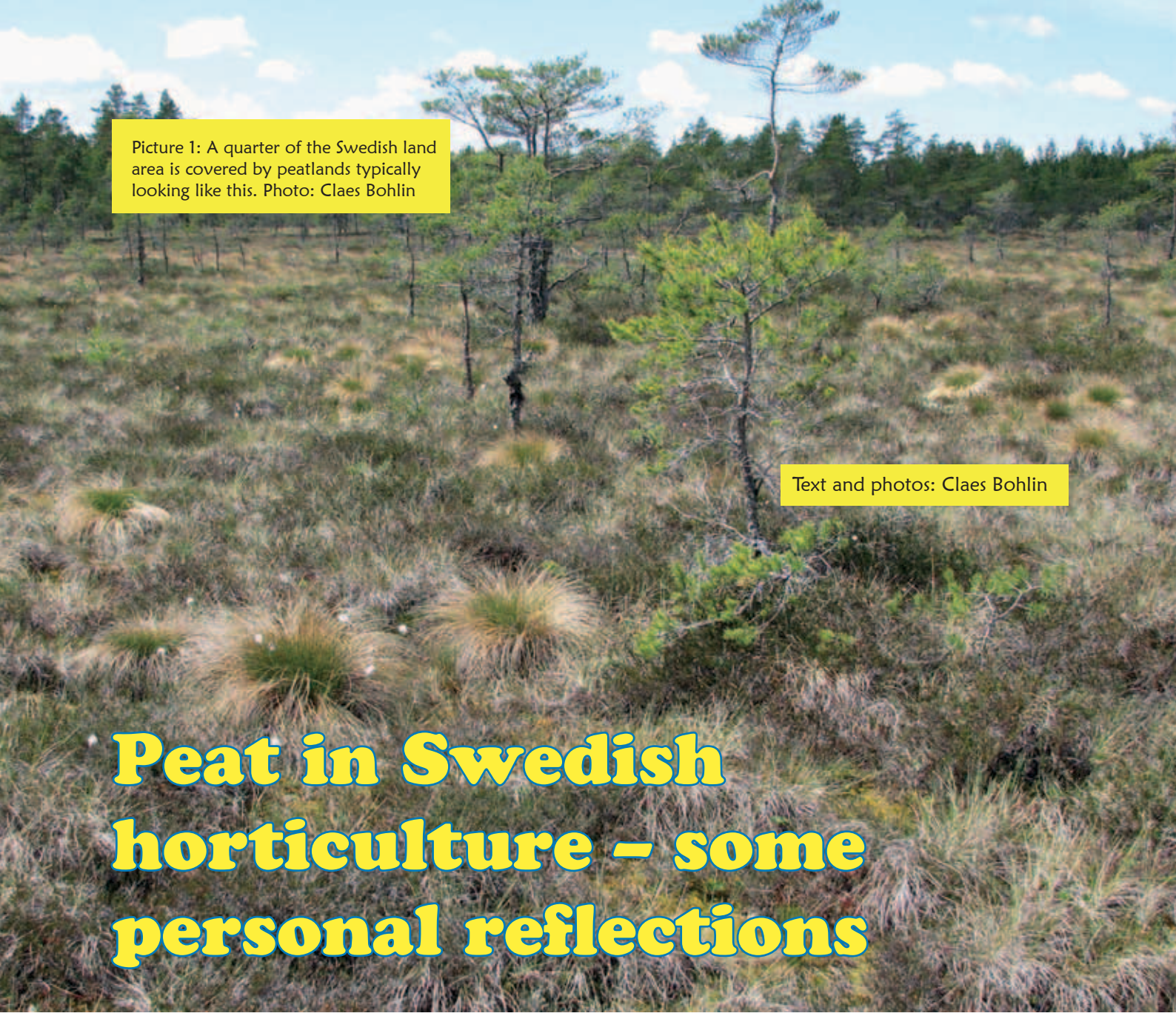

Picture 1: A quarter of the Swedish land area is covered by peatlands typically looking like this. Photo: Claes Bohlin

Peat in Swedish horticulture – some personal reflections

Text and photos: Claes Bohlin

The first encounter

My first memory of peat – peat in horticulture that is – goes back to when I was 9 -10 years old. That means we are back to one of the first years of the 1960ies. It was when the school had holidays in February and I had nothing to do since my two older brothers stayed at a cousin's place and only my 4 years younger sister was at home, so needless to say I really wanted a break… Therefore I asked my father if he had some job for me. He pondered a while and said I could come with him to work.

My father was a greenhouse grower and ran the company together with his two brothers. At this time of the year they prepared the growing beds for the cucumber crop. Earlier they used to improve the soil with horse manure bought from a cavalry stable in a nearby town, but now they had started using peat in big bales and added fertilisers and lime according to soil analysis from a lab, something that was high tech in those days.

The job I got was to break open and spread the peat on top of the bed so my father later could mix it in with a huge kerosene powered rotary cultivator which made an awful noise inside the greenhouse. I struggled on with the big peat bales and a digging fork. The bales came packed with wooden lattices and were bundled with steel wire. Each contained about half a cubic meter. The job was dusty and heavy and after all the irritation of getting my eyes full of this nasty stuff, I was pretty sure I would never be a greenhouse grower and definitely wouldn't work with that annoying material again.

Little did I know that I would spend most of my working life with peat in horticulture! And by the way, that day I earned my first true salary and was mighty proud when I came back home that evening.

A couple of years later they started growing the carnation crop in pure peat media. An advisor from a company called Hasselfors had spoken about the possibility to grow out of the ordinary soil to get rid of disease problems and to plant directly in enriched peat. This was

reported as a practice in Finland with very promising results and that of course had to be tested too.

The development of peat growing media

In Sweden the first compressed peat in bags were produced in 1961. It was raw peat for soil improvement and fertilised and limed peat also mainly used that way. This new way of packing the peat allowed selling the product to ordinary hobby consumers, since no one in their right mind would buy the old style baled peat and try to get it home from the garden centre in the trunk of their car.

This opened a totally new market in the hobby gardening segment. In the years to come a number of new peat based products saw the light; potting soil, planting soil, sowing media just to name a few. Also for professional use, the pure peat growing media was extended with various mixed products containing different peat types, bark, sand, clay etc. The "Einheitserde" concept was introduced from Germany and soon a wide array of products had entered the market. Standardised media with known composition and growing characteristics that were foreseeable for the grower.

Especially for the pot plant producers it was a small revolution getting considerably lighter media and much more even and predictable growing results. For the greenhouse vegetable crops, peat was the leading substrate for slightly more than a decade when rock wool entered the market.

Picture 2: Standardised, peat based substrates are a prerequisite for modern horticulture. Photo: Kekkilä Oy

More sophisticated fertigation techniques opened for the use of completely inert media. Those media, however have found their way out of the professional greenhouses only to very limited degree. Today, fifty years after their advent, the peat based growing media still totally dominate the market for both amateur gardeners and professional producers of plants that are sold on the retail market.

Why peat?

The reason why peat was to become such a success story lies in the material itself. Many articles and scientific papers have been produced on that issue and I will just briefly comment on this. There are a number of factors contributing to its popularity. Low weight, an enormous pore volume being able to hold water and exchange gases for the plant roots, purity and freedom from diseases giving room for easy adjustment of pH and balanced nutrition are some of the factors.

It is a material which, at least in part of the world, is extremely abundant and of a consistent and high quality. Growing techniques have been developed over the years fitted to this substrate and thus the modern horticultural industry would not look the same without peat.

Picture 3: Millions and millions of various horticultural plants start their lifes in peat based growing media. Photo: Kekkilä Oy

According to a socio-economic study performed by the European Peat and Growing Media Association (EPAGMA) a couple of years ago, much of the European horticultural industry is completely relying on peat and without it enormous values would be lost.

Picture 4: Not only for professionals, but also for hobby gardeners the peat contributes to reliable growing results. Photo: Hasselfors Garden AB

Swedish peat industry

Although one quarter of the Swedish land area is covered with peat and Sweden is the country within the EU which has the largest peatland area (about 38%), it is still not among the five biggest peat producers in Europe. Actually, the energy content of the total Swedish peat deposit of about 100 billion cubic meters correspond to approximately half the oil reserves in the North Sea.

As an average about 4 million cubic meters of peat is extracted from Swedish bogs annually, of this 2,5 M m^3 are energy peat and 1,5 M m^3 are horticultural peat and peat litter for animal bedding.

Most of the horticultural peat is harvested as harrowed or milled peat but one third is produced as block peat. Much of the latter is exported, mainly to the Netherlands.

The Swedish block peat has a very good reputation since it allows producing coarse material with almost no dust which guarantees high air content, a very good wettability and favourable physical conditions in general.

Of the horticultural peat approximately one third is exported; as raw material for professional substrates but also as growing media for hobby and professional growing, especially to Denmark and Norway.

The peat that stays in Sweden is used for amateur gardening (where Swedes at least have been the heaviest users in Europe, no recent data available though), professional plant production and landscaping. In addition, the use of peat as bedding for horses has seen a revival.

Given the abundance of peat in the country, it may seem strange that, since the beginning of this millennium, Sweden is a net importer of peat, an import that is steadily growing. It is energy peat that is used in larger volumes than we are able to produce domestically, since the process of getting extraction permits is very slow and difficult.

Peat and environment

How much peat can be produced in a responsible way in Sweden? This question has always been relevant and even more so today.

In Sweden we have started working with the concept of certification for the peat industry. We have a close contact with the Dutch initiative Responsibly Produced Peat and we see it as important for both the horticultural peat and the energy peat sector. What we know is that the regeneration of new peat is estimated to be in the region of 20 M m^3 annually. Thus considerably more carbon is sequestered than is released.

We also know that peat extraction will only be permitted on bogs with low conservation value, so only sites with a relatively low biodiversity will be extracted. The Swedish environmental legislation is quite strict, so site selection is closely controlled and environmental impact is assessed during the planning phase.

When the extraction goes on, a rather extensive monitoring programme has to be followed and reported annually. The legislation stipulates that rehabilitation is carried out as a dialogue between the peat extractor, landowner and environmental authorities. The most common after use is either forest planting or creation of shallow lakes as bird sanctuaries.

In a country where such a large part of the land is covered with growing Sphagnum plants it is sometimes difficult to convince people that this poor habitat would be the most relevant after-use, even if that happens to be the case closest to natural conditions. This issue is a bit of a philosophical question where people from Central Europe seem to have believes differing from many of the closest concerned:

Grow Sphagnum like it was before or choose a strategy for higher biodiversity? To what extent is man allowed to influence the direction?

To what stage of natural development should we go back - when the peat excavation started a few decades ago, or when the peat formation began, a couple of thousand years earlier?

Picture 5: The author Claes Bohlin has worked for over thirty years with horticultural peat, mainly for professional use. Claes represents the growing media industry in many roles, both nationally and internationally. Photo: Hasselfors Garden AB

Peat in the future

The importance of peat for horticulture is undisputable. It has become a necessary prerequisite for the intensive plant production we know today. Locally other growing media constituents may be more used but on a global scale, no other material is available in the quantities needed. Without peat the production would be less reliable and harvests smaller, resulting in higher prices and lower availability for many vegetable and small fruit crops as well as for ornamental and forest plants. Furthermore, for the continuously growing hobby market, peat secures successful results.

Peat can and must be produced in a responsible way, by companies with a vision of sustainability, and certification may be a good way to ensure this goal. It is also important to see that peat in many cases can be an extremely useful tool to make use of other growing media constituents that are not suitable on their own as pure media.

The European Ecolabel for Growing Media could easily have been a much more successful concept if a certain amount of peat had been allowed in these products.

I am convinced that peat will continue to play an important role for modern horticulture for a long time to come. Sound environmental strategies have to be adopted and followed but I have no doubt this can be done. Besides, Sweden has an abundance of this intriguing, slowly renewable material, which we will use responsibly for the benefit of our own and coming generations.

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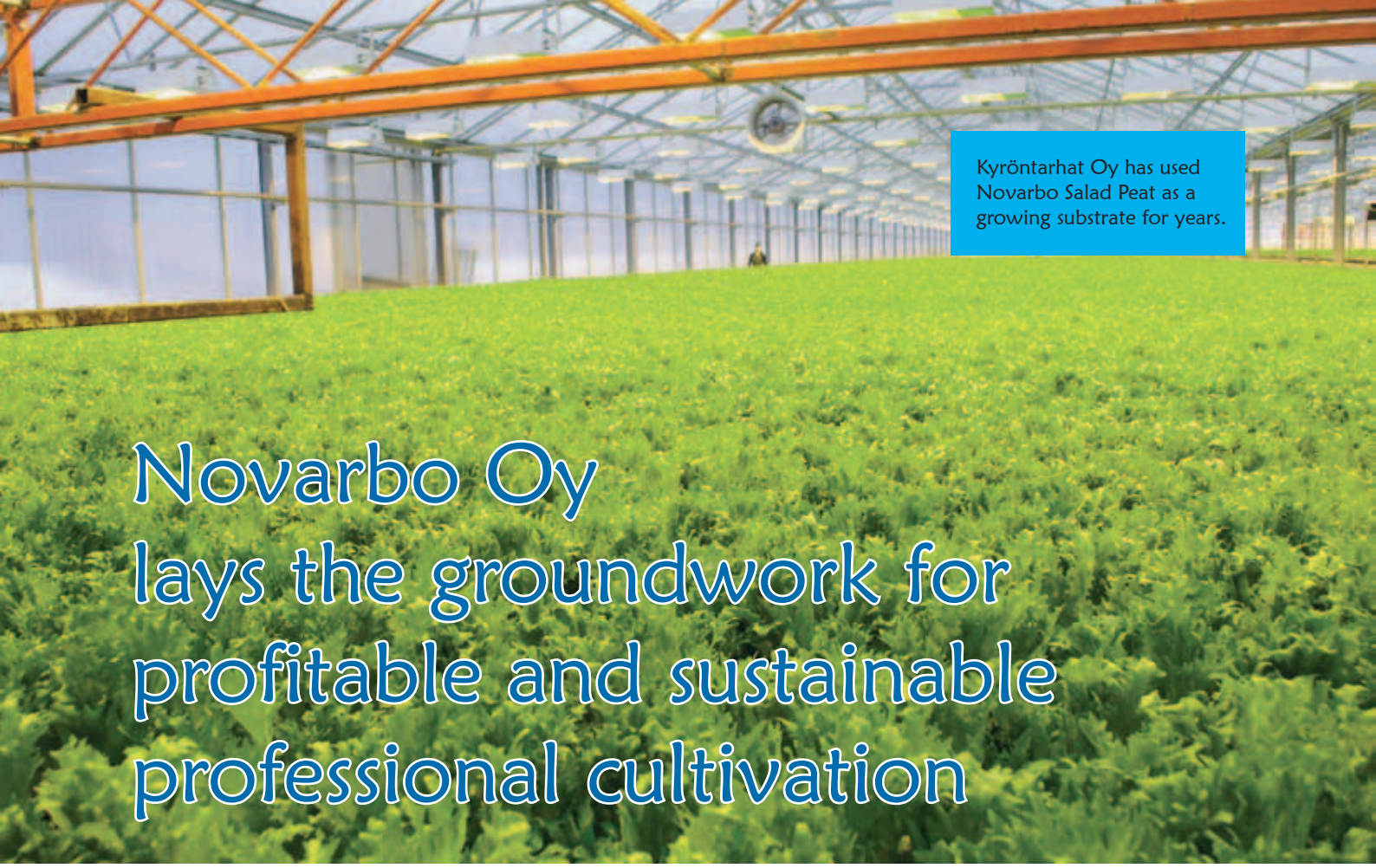


Kyröntarhat Oy has used Novarbo Salad Peat as a growing substrate for years.

Novarbo Oy lays the groundwork for profitable and sustainable professional cultivation

Text and photos: Merja Maansalo

Novarbo Oy provides growing substrates, fertilisers and state-of-the-art greenhouse technology for professional cultivation. All Novarbo fertilisers are intended for use in organic cultivation. Novarbo growing substrates are available for both traditional and organic greenhouse cultivation and plant production.

Growing substrates are typically pre-fertilised and limed according to the specific needs of each plant. Customers may also order special mixtures. One of the key raw materials used in growing substrates is peat.

Our customers are major players

"For us, multi-year delivery agreements are the best demonstration of the trust our customers place in our company and our products, states Managing Director Teppo Rantanen. Novarbo has long-term customers in, for example, Poland and Spain. In Poland, Novarbo growing substrates are used by, among others, the country's largest plant producer, Grupa Producentów Rozsad Krasoń. In 2012, Krasoń's total production was approximately 185 million seedlings and the company maintained a total 5 hectares of greenhouse space.

Spain's Semilleros Jaricio S.L. has been purchasing growing substrate peat from Novarbo for 15 years. Last year, its total production was approximately 200 million seedlings. The company maintains 7 hectares of greenhouse space.

Airy peat for lettuce cultivation

Novarbo Oy is a Finnish company. In Finland, two of its customers include lettuce producer Kyröntarhat Oy and seedling nursery specialist Mellanå Plant.

"We've enjoyed a successful co-operative relationship with Novarbo for many years. We mainly grow pot lettuce and iceberg lettuce. We

Novarbo growing substrates are shipped in pressed bales or big bales.

use Novarbo Salad Peat as a growing substrate", explains Sales Manager Teemu Kanasuo.

"This white sphagnum moss possesses balanced chemical properties. It keeps the structure of growing substrates properly aerated and is lightweight for easy carrying", says Managing Director Teppo Rantanen, listing the benefits of peat.

Peat also for forest seedlings

Mellanå Plant is Finland's largest private producer of forest seedlings. Each year, it produces approximately 18 million new seedlings for Finnish forests.

"We are very satisfied with the Novarbo Forest Seedling Peat we've been using. We're constantly developing our operations. Novarbo is an outstanding partner, because it's willing to hear what the customer has to say in product development matters", praises Salminen.

In-house peat production

Novarbo maintains its own peat production at three locations. There are over 300 hectares of peatland. "We extract some 200,000 cubic metres of peat each year. Most of the peat we use is white Sphagnum moss", explains Mauri Kariniemi, head of peat production.

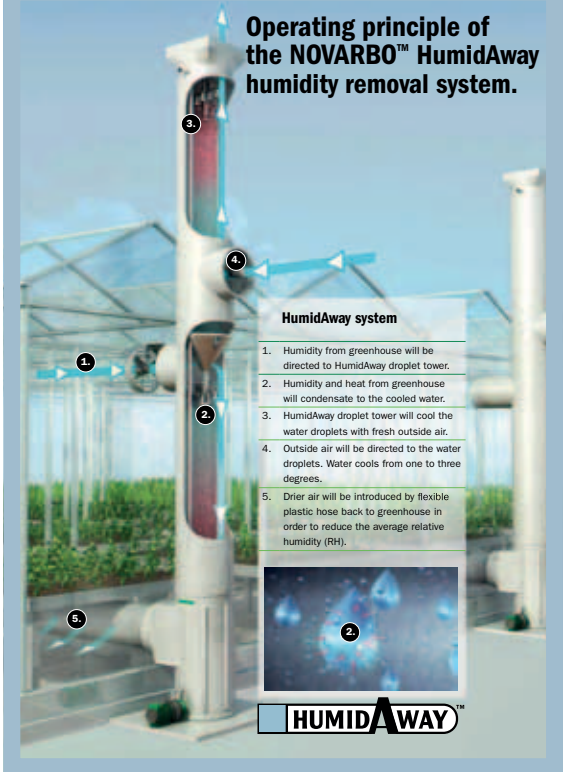
The majority of the peat is used for growing substrates and various animal beddings. The peat is also used as a raw material in Novarbo's Green Roof systems. Novarbo's peat is very rarely used in energy production.

Growing tests on test plantations

Novarbo products are tested regularly in its own test greenhouse. Quality control involves several different functions. In actual product development, Novarbo works continuously in co-operation with top experts in the field as well as with customers. One example of this is the dust-free Premium bedding, which is primarily intended for use in horse stables. Premium was developed in accordance with the cooperation received from stud farms.

Mellanå Plant Production Manager Metti Salminen presents healthy forest seedlings, which are growing in Novarbo Forest Seedling Peat.

In addition to peat and compost, Novarbo and its parent company Biolan Oy are also involved in several other business areas. The front loader works on a 15 hectare raw material and compost field.



Operating principle of the NOVARBO™ HumidAway humidity removal system.

Novarbo also offers groundbreaking greenhouse technology - HumidAway is a new, energy-saving equipment solution

Novarbo Oy's expertise is not limited to professional cultivation fertilisers and growing substrate products. The company also offers technical solutions for financially profitable and sustainable greenhouse cultivation. Novarbo Greenhouse Technology's latest application, the HumidAway, was introduced at the HortiFair 2012, which was held last autumn in Amsterdam.

"The energy-saving HumidAway is extremely well suited to, for example, greenhouse cultivation in Holland", explains Technical Director Anssi Jalava. He says that use of the HumidAway can regulate the microclimate of a greenhouse so that plants are given the optimal conditions for growth. The quality of plants is also enhanced.

"HumidAway can be used to remove excess humidity and heat without having to open any ventilation. It also makes it possible to regulate carbon dioxide levels.

Cost-effectiveness

HumidAway uses a patented technology. The system consists of integrated condenser units and evaporators. It can be installed in both existing and newly built greenhouses. The equipment is compact and can be installed on the greenhouse walls or walkways.

"Saving energy is absolutely vital to today's greenhouse operators, as it increases profitability considerably. Because the system can also be used to increase crop yields, the financial benefits are manyfold", states Jalava.

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Photos: Merja Maansalo
Novarbo Oy image bank

Novarbo Oy

- Novarbo Oy is an expert in professional cultivation, greenhouse technology and animal bedding products as well as green roofs and other green building technologies.
- The company maintains export operations in nearly 60 countries.
- Novarbo Oy is a subsidiary of the Biolan group.
- The parent company, Biolan manufactures and sells products for ecological farming and green area management as well as environmental products.
- Biolan manufactures natural products for amateur gardeners as well as products that help to reduce human impact on the environment.
- Biolan's environmental products include wastewater purifiers, composters and dry toilets.
- For more information, see www.novarbo.fi.

Impact of peat substrates with different concentrations of indole-3-acetic acid on ornamental plant cultivation

Text and photos: Lech Wojciech Szajdak and Jacek Nowak

Peat raw materials represent the main component of horticulture substrates. Depending on the origin and the depth of the peat layer, it reveals different physicochemical properties.

These are the decomposition degree, peat bulk and particle density, total porosity, water content, hydraulic conductivity, buffering capacity, total organic carbon, dissolved organic carbon, total nitrogen, the content of humic and fulvic acids of different maturity etc. The choice of substrate is the one parameter which results in the final effect of ornamental plant cultivation.

This is due not only to the requirements of the plant, but also the factors influencing the environment in which the root system is developing. However, the process of root forming sometimes takes a few months, therefore growing media should be sterile, airy, and well-permeable, of good moisture content and providing airation at the base of cuttings. Water-air properties have a significant effect on formation of the root system, growth of young roots and the content of biologically active compounds responsible for biochemical, chemical and physical processes.

White peat mixed in different proportions with permeable components like perlite and sand fulfills these conditions. However, coco fiber has also similar properties. Furthermore, use of plant growth regulators is very important for rooting in ornamental plant production. The shoot rooting

Photos 1 & 2. The effect of the commercial substrate "Klasmann Steck Medium" for rooting cuttings of poinsettia (*Euphorbia pulcherrima* 'Prestige Early Red'). Explanations: 1/1 - "Klasmann Steck Medium" - natural content of IAA 142,54 µg kg^{-1} d.m.); 1/2 - "Klasmann Steck Medium"- natural content of IAA + IAA in dose 200 µg kg^{-1} of fresh peat; 1/3 - "Klasmann Steck Medium" - natural content of IAA + IAA in dose 300 µg kg^{-1} of fresh peat; 1/4 - "Klasmann Steck Medium" - natural content of IAA + IAA in dose 400 µg kg^{-1} of fresh peat.

process consists of several phases: the formation of callus, root primordia and the root elongation. A decisive role in these processes is played by plant growth regulators.

Plant growth-regulating compounds called phytohormones represent a wide group of substances produced by plants and microorganisms in the rhizosphere that enhance seed germination and plant growth (Aeshad & Frankenburger 1991, Bandurski & Schulze 1977). These compounds are synthesized in one part of the plant and translocate to another part to influence a whole range of physiological and developmental processes at low concentrations. These substances stimulate plant growth, biofertilization (fixation of atmospheric N_2 or solubilization of nutrients) and may protect against plant pathogens. Numerous plant processes are known to be controlled by plant growth regulators, but the mechanisms of control have remained elusive (Chen et al., 2004, Cohen & Bandurski 1982, Dahm et al., 1977, Lebuhn et al., 1995).

Auxins belong to the plant growth regulators and play a critical role in plant cell growth. These compounds are involved in a wide variety of developmental processes, including initiation of leaf primordia, apical dominance, phototropism, fruit development, and lateral root production. Auxins chemically represent derivatives of indole ring (IAA – indole-3-acetic acid, IBA – indole butyric acid, NAA - naphthalene-1-acetic acid). Auxins are naturally produced in buds and leaves of plants, from where they are later transported to the base of shoots.

IAA belongs to phytohormones-auxin (Fig. 1). IAA is formed in mineral and organic soils (peat, moorsh and sapropels) from tryptophan by enzymatic conversion (Tena et al., 1986, Kennedy et al., 2004, Martens & Frankenberger 1993, Szajdak & Maryganova 2007).

This substance is also created during natural conditions in compost and in inorganic and organic soils under different cultivated plants (Muscolo et al., 1998, Sanderson et al., 1987, Sarwar et al., 1992, Strzelczyk et al., 1997). Thus, some kinds of peat and sapropels are commonly used for the preparation of for substrate and growing media for horticulture and pomology as well as organic fertilizers for agriculture. Therefore, the investigation of IAA is very important.

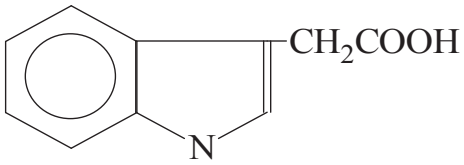

Fig. 1: Indole-3-acetic acid.

This compound seems to play an important role in nature as a result of its influence on regulation of plant growth and development (Kennedy et al., 2004, Lebuhn et al., 1995). A principal feature of IAA is its ability to affect growth, development and health of plants (Strzelczyk et al., 1997). This compound activates root morphology and metabolic changes in the host plant (Bandurski & Schulze 1977). The physiological impact of this substance is involved in cell elongation, apical dominance, root initiation, parthenocarpy, abscission, callus formation and the respiration (Goldsmith 1977, Kampert & Strzelczyk 1975).

Currently, ready-made substances containing auxins used for rooting of plant cuttings are available on the market. They are in powder form in which the base of the cutting is immersed before insertion. In order to determine the effect of the IAA content in the media for rooting cuttings of ornamental plants, studies were conducted as part of the grant (Grant N N310 310139) supported by the Polish Ministry of Education) in the Institute of Horticulture in Skierniewice, Poland.

In the experiment, the cuttings of chrysanthemum *Dendranthema grandiflora* "Zembla White", poinsettia *Euphorbia pulcherrima* "Prestige Early Red" and hydrangea *Hydrangea* L. were used. From April to August 2011 the rooting of cuttings was carried out in cell trays with the use of six rooting substrates (3 commercial substrates and 3 self-preparing based on Polish neutralized white peat mixed with perlite) containing four concentrations of IAA (natural concentration and 200, 300 and 400 µg kg^{-1} additionally). The natural content of IAA in the studied substrates was as follows:

- Commercial growing media for rooting of cuttings 'Klasmann Steck Medium' - 142,54 µg kg^{-1} d.m.
- Commercial growing media for rooting of cuttings "Substrate for rooting cuttings of ornamental plants AURA" - 114,82 µg kg^{-1} d.m.
- Commercial growing media for rooting of cuttings CERES - 158,36. µg kg^{-1} d.m.
- White peat (H3-H4) from the North-Western Polish regions - 133,63 µg kg^{-1} d.m.
- White peat (H3-H4) from the Northern Polish regions - 109,88 µg kg^{-1} d.m.
- White peat (H3-H4) from the North-Eastern Polish regions - 123,54 µg kg^{-1} d.m.

The experiments were conducted in accordance with EPPO norms (European and Mediterranean Plant Protection Organization - Guideline for the efficiency evaluation of plant growth regulators, Rooting of cuttings, PP 1/186(2)).

Studies have shown that commercial substrates and a mixture of different peat with perlite had a significant effect on the characteristics of cuttings. The weakest cuttings were obtained in peat-based substrate H3-H4 in North-Western Poland. Different IAA doses had no significant effect on the test characteristics of rooted cuttings, except for H3-H4 peat originated from the Northern

Polish regions, where the length of the roots of chrysanthemum and their fresh weight were higher when the IAA was additionally applied.

However, there was a positive effect of IAA added to the amount of rooted cuttings. In most of the substrates the largest rooted cuttings were obtained when IAA was added to the substrate. The natural content of IAA in peat and commercial substrates used also had a significant effect on the quality and rooting of cuttings of ornamental plants. The best rooted cuttings were obtained in commercial growing media for rooting of cuttings 'Klasmann Steck Medium' and 'Substrate for rooting cuttings of ornamental plants AURA' and using a peat originating from the Northern and North-Eastern Polish regions.

This data indicates that the source of peat had a significant impact on investigated parameters of rooted cuttings of ornamental plants. The differences result not only from IAA content in the media but also from the physical parameters of peat.

The studies were supported by the grant No. N N310 310139 founded by Polish Ministry of Education.

References

Aeshad M., Frankenburger W. T. Jr. Microbial production of plant hormones. Plant and Soil 1991. 133, pp. 1-8.

Bandurski R.S., Schulze A. Concentration of indole-3-acetic acid and its derivatives in plants. Plant Physiol. 1977. 60. pp. 211-213.

Chen Y., De Nobili M., Aviad T. Stimulatory effects of humic substances on plant growth. In: Soil organic matter in sustainable agriculture (Eds., F. Magdoff, and R.R. Weil), CRC Press, Boca Raton. 2004. pp. 103-129.

Cohen, J.D., Bandurski, R.S. Chemistry and physiology of the bound auxin. Ann. Rev. Plant Physiol. 1982. 33. pp. 403-430.

Dahm H., Sitek J.M., Strzelczyk E. Synthesis of auxins by bacteria isolated from roots pine seedlings inoculated with rusty forest soil. Pol. J. Soil Sci. 1997. 10. pp. 131-137.

Goldsmith M.H.M. The polar transport of auxin. Ann. Rev. Plant Physiol. 1977. 28. pp. 439-478.

Kampert M., Strzelczyk E. Synthesis by auxin by fungi isolated from the roots of pine seedlings (*Pinus silvestris* L.) and from soil. Acta Microbiol. Pol. 1975. 7. pp. 223-230.

Kennedy A.C., Stubbs T.L., Schillinger W.F. Soil and Crop Management Effect on Soil Microbiology. In: Soil organic matter in sustainable agriculture (Eds., F. Magdoff, and R.R. Weil), CRC Press, Boca Raton. 2004. pp. 295-326.

Lebuhn M. T., Heulin, T., Hartmann, A. Production of auxin and other indolic and phenolic compounds by Paenibacillus polymyxa strains isolated from different proximity to plant roots. FEMS Microb. Ecol. 1995. 22. pp. 325-334.

Martens D.A., Frankenberger W.T.Jr. Metabolism of tryptophane in soil. Soil Biol. Biochem. 1993. 25. pp. 1679-1687.

Muscolo L., Cutrupi S., Nardi S. IAA detection in humic substances. Soil Biol. Biochem. 1998. 30. pp. 1199-1201.

Sanderson, K.J., Jameson, P.E., Zabkiewicz J.A. Auxin in a seaweed extract: Identification and quantititation of indole-3-acetic acid by gas chromatography-mass spectrometry. J. Plant Physiol. 1987. 129. pp. 363-367.

Sarwar M., Arshad, M., Frankenberger W.T.Jr. Tryptophan-dependent biosynthesis of auxins in soil. Plant and Soil. 1992. 147. pp. 207-215.

Strzelczyk E., Dahm H., Pachlewski, R., Różycki R. Production of indole compounds by the ectomycorrizal fungus Cantharellus cibarius Fr. Pedobiologia 1997. 41. pp. 402-411.

Szajdak L., Maryganova M. Occurrence of auxin in some organic soils. Agron. Res. 2007. 5(2). pp. 175-187.

Szajdak L., Matuszewska T., Gawlik J. Effect of secondary transformation state of peat-muck soil on total amino acids content. Int. Peat J. 1998. 8. pp. 76-80.

Tena M., Pinilla J.A., Magallanes M. L-phenylalanine deaminating activity in soil. Soil Biol. and Biochem. 1986. 18/3. pp. 321-325.

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Peat-free growing media: Sphagnum biomass

Text: Hans Joosten, Greta Gaudig & Matthias Krebs

A future-oriented horticulture has to reduce its reliance on the finite and harmful resource 'peat'. Alternatives have to be found that are environmentally friendly, economically competitive, and ensure a steady supply of high quality raw material for growing media. Sphagnum biomass looks most promising to do the job.

The use of peat in horticulture has serious sustainability drawbacks. Peat extraction progressively destroys the ecosystem functions of raised bogs, including their carbon storage capacity, water regulation function, palaeo-environmental archive and typical biodiversity. Emissions from horticultural peat in Germany, for example, equal those of aviation. Living bogs have become so rare in most countries of the European Union that the few remnants are strictly protected as priority habitat under the EU Habitat Directive. Because of its environmental unsustainability, the United Kingdom and Switzerland have already decided to phase out the use of peat entirely. Economic and social sustainability of the growing media industry is not only at risk because of these environmental concerns and constraints. In fact the peat resources

Photo 1: Installation of a large-scale Sphagnum farming field in NW Germany by the peat company Moorkultur Ramsloh GmbH, Hankhausen, spring 2011. Photo: Sabine Wichmann

Photo 2: Sphagnum farming field in Hankhausen 1¼ years after installation. Photo: Sabine Wichmann

in the major peat consuming countries in Europe are virtually exhausted and supplies have to be secured from ever more remote sources. There is thus an urgent need for the growing media industry to find sustainable alternatives for peat.

The most promising emerging alternative is Sphagnum biomass, which – not surprisingly – has similar physical and chemical properties as white peat. The use of Sphagnum biomass as a raw material for growing media in modern professional horticulture has successfully been tested (see box and Blievernicht et al. 2013, this volume).

Cultivation of Sphagnum ("Sphagnum farming"), including diaspore recruitment, establishment, optimization of site conditions, productivity, and regeneration after harvest, has over the last decade extensively been studied by the University of Greifswald in cooperation with various research and industrial partners (see www.sphagnumfarming.com). Next to substantial industrial support (especially from Moorkultur Ramsloh GmbH and the Deutsche Torfgesellschaft mbH) research was funded by the German Peat Society (DGMT), the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) and the German Federal Ministry of Economy and Technology (BMWi).

After successful laboratory and field experiments, in spring 2011 an almost 5 ha large industry scale pilot site was established on agricultural bog grassland in Hankhausen, Lower Saxony (Northwestern Germany). Establishment comprised of soil preparation (various alternatives including sod removal, plowing, or herbicide application), optimizing hydrology and introducing Sphagnum diaspores (Photo 1). 1.5 years after initial establishment *Sphagnum palustre*, *S. papillosum* and *S. fallax* already covered 95% of the area with an average lawn height of 8.3 cm (maximum 22.4 cm).

Hankhausen has convincingly proven the feasibility of large scale Sphagnum farming already during the establishment phase (see Photo 2). The pilot site now allows developing methodologies and testing machines for further scaling up of cultivation and harvest of Sphagnum biomass.

In addition to land-based cultivation on bog soils (i.e. on bogs formerly used as pasture, meadow or arable field and on bogs after peat extraction) also water-based Sphagnum cultivation has been developed by installing artificial

Photo 3: External benefit of Sphagnum farming: new habitats for threatened bog species. Photo: Sabine Wichmann

floating mats on water bodies resulting from peat, sand and lignite extraction.

Substituting white peat consumed in German horticulture entirely (ca. 3 million m³ per year) would require Sphagnum farming on ca. 40,000 ha. This area seems within reach considering the 145,000 ha of bog grassland in Lower Saxony alone. Perspectives for continuing conventional cultivation of these lands are poor. Alternative drained land use practices (e.g. maize cultivation) are even more environmentally detrimental. These drained peatlands need urgent rewetting to reduce emissions and Sphagnum farming seems to offer the necessary perspective. Implementing wet uses (paludicultures) is furthermore topical, because the European Union has just (12 March 2013) decided that the gigantic carbon

Did you know?

Cultivation experiments in several research institutes in Germany, Finland, and Chile have successfully shown the suitability of growing media made from Sphagnum biomass for producing a wide variety of crops from seedling to saleable plant.

Vegetables, ornamental plants and shrubs grown in substrates consisting for up to 100% of Sphagnum biomass generally performed equally or better than in standard peat-based media. Industrial scale poinsettia cultivation not only satisfied the grower Rosengut Langerwisch near Berlin but also the customers who appreciated the alternative of a peat-free product.

Peat-based media have been optimized over many years. Therefore the first trials with Sphagnum biomass are more than promising. In future new and adjusted substrates based on Sphagnum will find more and more application in horticulture.

emissions from organic soils under agriculture have to be reported better and have to be accounted for from 2021 on. In its decision the EU explicitly mentions “incentivising sustainable paludicultural practices” as a measure to improve the management of peatlands.

Worldwide the idea of Sphagnum farming attracts interest and research into its implementation has started in various countries, including – next to pioneering Germany – in Canada, Finland, Ireland, Poland, Chile, and Estonia. Increasing commitment and efforts from the industry will accelerate developing this sustainable alternative for peat in growing media.

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Photo 4: Poinsettia grown in Sphagnum biomass by the grower Rosengut Langerwisch, Germany. Photo: Anja Prager

Sphagnum biomass - the next Generation of Growing Media

Text: Armin Blievernicht, Stefan Irrgang, Matthias Zander and Christian Ulrichs

Introduction

Centuries of peat extraction have damaged and dried out bogs, releasing carbon into the atmosphere. The replacement of peat could help to protect such vulnerable areas, reducing our CO_2 footprint. During the last decades, many constituents were tested for being a proper substitute for peat in horticultural growing media.

In the beginning, efforts aimed only at getting independent from vanishing peat resources. Nowadays, new ecological aspects became important concerning the use of peat in horticulture. Boon and Verhagen (2008) addressed the value of the natural environment of peat areas. The lower CO_2 impact of sustainable growing media compared to standard substrates containing peat became a major marketing factor. Additionally, governmental policies have changed over the last years in many countries and preservation of natural habitats has become an important aspect.

Wood fibre, bark and green-compost are available raw materials that might replace peat, and might allow a production of growing media and its usage for pot cultures. This could have a tremendous positive effect on the environment, e.g. by reducing transportation and CO_2 emission.

However, the availability of wood by-products is decreasing because of an increasing usage as energy resource (Meinken, 2010). Green-compost generates a higher yield when digested in biogas plants than used as a constituent of growing media.

Table 1: Properties of white peat and air-dried Sphagnum biomass. Author: Armin Blievernicht

Property	White peat	Sphagnum biomass
Physical		
total pore space (%)	95	99
water capacity (v/v, %)	66	32
plant available water (v/v, %)	28	16
air capacity (v/v, %)	29	66
bulk density (kg m^{-3})	84	23
wettability	difficult	easy
shrinkage (%)	29	20
Chemical		
pH-value	low (3-4)	
nutrient content	low	
salinity (EC)	low	
nitrogen immobilisation	not remarkable	
organic matter (w/w, %)	96	93
hazardous substances	none	
Biological		
content of weeds	negligible	depends on origin
Environmental		
renewability	arguable	yes
local availability	decreasing	to be built up
Impact on:		
local water balance	negative	positive
habitat ecology	destroying	neutral/positive
CO_2 - equivalents flux	negative	neutral
Economic		
price	unrivaled	depends on production system and quantity of units sold

Processing of coconut products – another potential replacement for peat in growing media – expends lots of freshwater. Taking into account the long-distance shipment of coconut products, their eco-balance may not be equalized.

Besides availability, other organic matter than peat does not have the potential to account for a major proportion in growing media. Several physical and chemical properties (i.e. N-immobilization, high salinity, structural stability) set a limit for the maximum proportion of the peat substituents in growing media. Depending on the constituent used, in most cases it is at a maximum 30% (v/v).

To date, peat has been indispensable for producing high-quality growing media. In the European Union, about 29 million m^3 peat are used for producing growing media every year. Peat combines many favorable physical, chemical and biological properties that no other material does; thus, it is still the main constituent in growing media production. The percentage of peat in all growing media produced in the EU accounts for approximately 80% (Altmann, 2008). Peat-free growing media play only a minor role in industrial production. Nevertheless, the market for peat-reduced media is growing (Schmilewski, 2009).

Sphagnum biomass and peat – it's all within the family

Looking into the genesis, we know that white peat mainly consists of slightly decomposed peat mosses (*Sphagnum* sp.). Even after hundreds of years of conservation under anaerobic conditions in a bog, the plant bodies are still visible. The fast renewability of Sphagnum (compared to the long-term genesis of peat) suggests non-decomposed Sphagnum biomass as a suitable and sustainable substitute for peat.

Thus, we addressed the question if decomposition of Sphagnum plants is necessary for providing a high-quality growing media constituent. Comparisons of physical and chemical properties showed several similarities between air-dried Sphagnum plants and peat. Low pH, content of nutrients, hardly nitrogen fixation, and a high structural stability are some of them.

Figure 1: Large-scale Sphagnum farming on artificial floating mats on an opencast mining lake in the southeast of Brandenburg, Germany. Photo: Armin Blievernicht

However, some differences were also found, including a considerable higher water capacity in peat than in Sphagnum, whereas the air capacity was more than twice as high in Sphagnum as in peat. The properties of air-dried Sphagnum biomass strongly support the testing of non-decomposed Sphagnum for the production of new peat-free horticultural growing media. In addition, the fast renewability of Sphagnum in comparison to the long-term genesis of peat might help to replace peat with sustainably produced Sphagnum biomass.

Implementing Sphagnum growing media in the market

Successful introduction of new products to the market necessitates concerted actions to overcome reservations and renitences. Concerning Sphagnum biomass, introduction to the market of horticultural growing media, one will also face players who will have a bearing on success or on failure of this attempt. For the peat-processing industry, non-decomposed Sphagnum could be a competitive constituent with a promising future.

However, professional horticultural enterprises have to be convinced that Sphagnum in growing media will work as well as peat does. Growing media are the basis for successful plant production and thus of the livelihood of countless small and medium-sized enterprises. Failure of the growing media can lead to an incalculable outcome.

Nevertheless, at the end of the commercialization chain, the consumer decides whether new products will stay in the market or not. The first step is the purchase decision. It mainly depends on personal preferences, background information about the product (e.g. environmental impact) and last but not least on the product's price. The second step is the performance after purchase, particularly the plant growth and development in the new growing media compared to peat-based media.

Production of Sphagnum biomass

Besides the development of Sphagnum-based growing media, our focus also lies on producing Sphagnum in an effective, economical way with a high-quality output. For successful Sphagnum production, the most important factor is a constant water supply.

Figure 2: Raw material used for growing media production – *Sphagnum palustre*. Photo: Stefan Irrgang

In Germany, we have several types of areas potentially suitable for Sphagnum production, e.g. rewetted abandoned bogs, water filled gravel-pits or agricultural bog grassland (see Joosten et al. 2013, this volume).

Five years ago we started cultivating Sphagnum on opencast mining lakes. The first challenge was to create an artificial floating vegetation mat. After five years of engineering and continuous modification, we now have a product that changed from a hand-crafted model to an industrial manufactured product. Our first results showed that producing Sphagnum on artificial floating mats on opencast mining lakes is generally possible. After one year of growing, we gained a net biomass accumulation of about 5.4 t ha^{-1} for *Sphagnum fimbriatum* (Blievernicht et al., 2011). Now, we are producing *Sphagnum palustre* on an overall area of 2,000 m^2 floating mats.

Trials with Sphagnum growing media

To create new horticultural growing media based on air-dried Sphagnum plants, non-decomposed Sphagnum was combined with other organic and mineral constituents in different proportions, according to the specific requirements of different plants on the properties of the growing medium, and tested in a large number of plant growth tests. At Humboldt-Universität zu Berlin, Germany, we started with three different proportions (25, 50, 75% [v/v]) of air-dried Sphagnum biomass in peat-based growing media and with a pure Sphagnum growing medium.

Nine different plant species were tested and plant growth evaluated. The results proved that non-decomposed Sphagnum biomass can be used as a constituent with peat in growing media and that pure *Sphagnum palustre* can act a suitable growing medium in which the majority of tested plants grew as well as in the peat-based control (Blievernicht et al. 2011, 2012).

The next step in creating a new growing medium was to find out how the properties of a Sphagnum-based growing medium could be more precisely adjusted to plant-specific requirements. For this, other organic materials (i.e. composted digestate) were used as additives. Plant experiments were performed under greenhouse conditions. At the same time the implementation of Sphagnum as a growing media constituent in professional horticultural production systems was started in 2010.

Our project partner, Rosengut Langerwisch, runs a horticultural enterprise where Sphagnum/peat mix (1:1) was tested on a large-scale. Around 4,000 poinsettias (*Euphorbia pulcherrima*) were produced under normal conditions in a greenhouse. No differences were found between plants grown in the Sphagnum/peat mix and plants grown in the standard peat-based medium. All poinsettias were successfully sold to the customer.

In 2011, for the latest cultivation cycle of poinsettias under production conditions, the Sphagnum-based growing medium was adjusted to an almost peat-free growing medium, containing only 10% peat. Above-ground growth of poinsettias produced in the Sphagnum-based medium was at least as good as of plants produced in the standard peat-based medium. Actually, one cultivar grew even better in Sphagnum-based than in peat-based growing medium. More convincing than statistical results was the producers' and customers' feedback. Both requested more Sphagnum products – a new and sustainable constituent on the growing media market!

Outlook

Currently we are working on the establishment of standards for producing Sphagnum based growing media. We thank our project partners for accompanying and supporting our joint goals. This research was funded by the German Federal Ministry of Economy and Technology, project nr 16INO5353 and VP2167803.

References

Altmann, M. (2008). Socio-economic impact of the peat and growing media industry on horticulture in the EU. Study commissioned by EPAGMA.

Blievernicht, A., Irrgang, S., Kumar, S. (2011): The potential of Sphagnum as a compound of growing media: International Symposium on responsible

peatland management and growing media production. Quebec, Canada 13.-17. June 2011, Book of Abstracts p. 40.
Blievernicht, A., Irrgang, S., Zander, M., Ulrichs, Ch. (2011): Produktion von Torfmoosen (Sphagnum sp.) als Torfersatz im Erwerbsgartenbau (Production of peat mosses (Sphagnum sp.) as an alternative for peat in professional horticulture). Gesunde Pflanzen, Volume 62, Issue 3-4, pp 125-131.
Blievernicht, A., Irrgang, S., Zander, M. & Ulrichs, C. (2012): Kultivierung von *Calluna vulgaris* in torfreduzierten Sphagnum-Substraten. DGG. DGG-Proceedings, Vol. 2. (2012), No. 1, 1-5.
Boon, H.T.M. and Verhagen, J.B.G.M. (2008). Growing media for the future. In: C. Farrell and J. Feehan (eds.), After Wise Use – The Future of Peatlands. Proceedings of the International Peat Symposium, Tullamore, Ireland, 8-13 June, 2008, Vol. 1, Oral Presentations, pp. 142-143. International Peat Society.
Meinken, E. (2010). Vorstellung weiterer Ausgangsstoffe: Qualitätsanforderungen und Verfügbarkeit. Fachtagung – Verwendung und Substitution von Torf – Verantwortliche Nutzung von Rohstoffen im Klimawandel, Fulda, Germany, 9-10 November, 2010, German Peat Society (DGMT). www.dgmtev.de
Schmilewski, G. (2009). Growing medium constituents used in the EU. Acta Horticulturae 819, pp. 33-46, ISHS.

Figure 3, this photo: Professional production of poinsettias in Sphagnum growing medium at horticultural plant Rosengut Langerwisch, Germany. Photo: Armin Blievernicht

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Figure 4, below: Comparison of selected growth parameters of three different poinsettias cultivars (Euphorbia pulcherrima) grown in Sphagnum growing medium under normal production conditions. Sphagnum growing medium consisted of 80% *Sphagnum palustre*, 10% peat and 10% composted digestate. Author: Armin Blievernicht

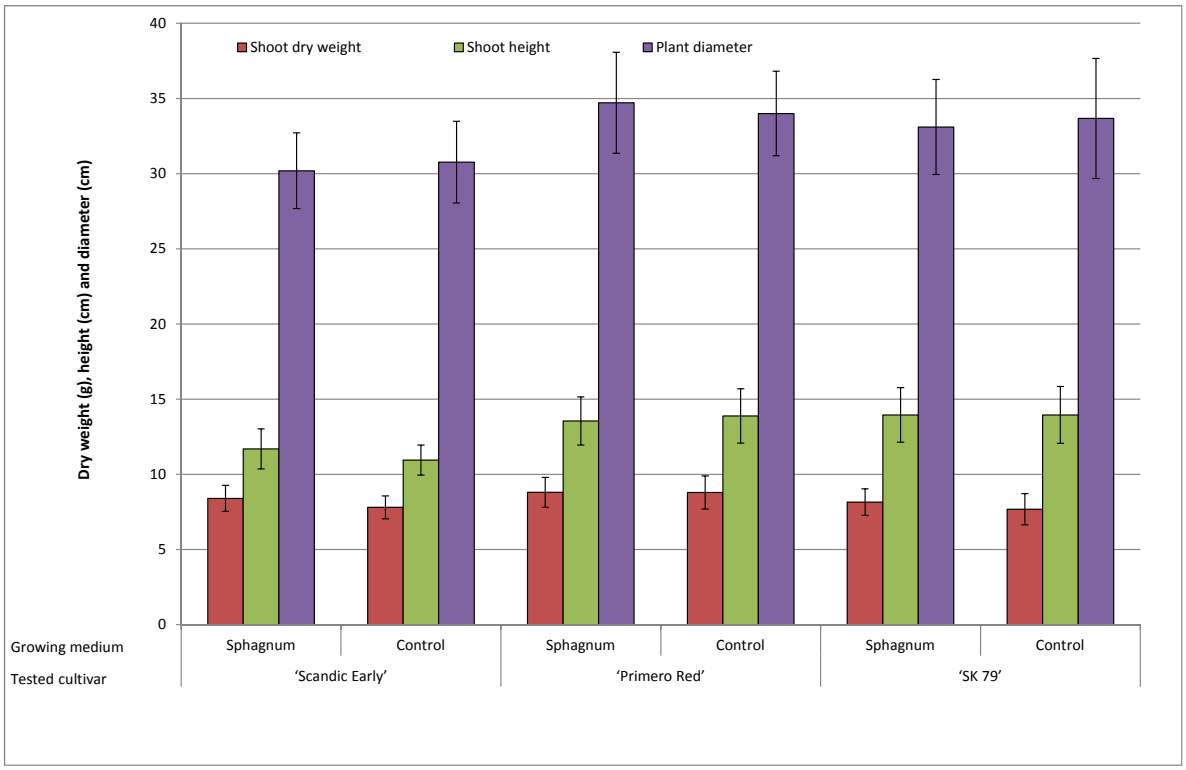

Figure 1: Researchers peat probing at a test line close to Bundoran, County Donegal. Photo: Antoinette Keaney

Tellus Border – Soil Carbon and Peat Depth Assessment Using Airborne Geophysical Data

Text: Antoinette Keaney, Jennifer McKinley, Alastair Ruffell, Martin Robinson, Conor Graham, Jim Hodgson and Mohammednur Desissa

Tellus Border is an EU INTERREG IVA-funded survey project that maps the rocks, soils and streams of the six border counties of the Republic of Ireland – Donegal, Sligo, Leitrim, Cavan, Monaghan and Louth using geochemical and geophysical techniques.

The project is a cross border initiative between the Geological Survey of Northern Ireland, the Geological Survey of Ireland, Queen's University Belfast and Dundalk Institute of Technology. Research undertaken by the School of Geography, Archaeology and Palaeoecology at Queen's University Belfast is investigating whether peat thickness can be estimated using data from airborne geophysics.

Background to the Tellus and Tellus Border Projects

The project was originaly conceived in the 1990's by the two Geological Surveys of Ireland, with the intention of mapping the whole island of Ireland using the most up-to-date geoscience techniques. The first phase of the work, the Tellus Project over Northern Ireland was completed between 2004 and 2007. The Tellus Border project was publically launched on 4th July 2011 and its geochemical and geophysical surveys are now completed. The Tellus and Tellus Border geochemical surveys provide a comprehensive data set from one period in time for some 60 elements and compounds, against which future environmental change and impacts on soil, sediment and water may be measured. The airborne geophysical survey measures three geophysical parameters that are used in geological mapping - the magnetic field of the earth, electrical conductivity and the natural radioactivity of the earth.

Cross border investigation on soil carbon and peat thickness

It has become increasingly important to measure and model carbon stocks to facilitate the management of carbon changes over time. The Irish and UK governments have signed the Kyoto Protocol, an agreement within the United Nations' (UN) Framework Convention on Climate Change that commits to reducing emissions of greenhouse gases by 12.5% between 1990 and 2012. Estimates of peat thickness and soil carbon stores are a key component of the

required annual returns made by the Irish and UK governments to the Intergovernmental Panel on Climate change.

The aim of the Tellus Border soil carbon research is to extend the soil carbon and peat volume assessment of Northern Ireland (based on existing Tellus airborne data) to the border counties of Ireland (based on the newly acquired Tellus Border data). The results will support the requirements of the Convention in providing information and knowledge of the effective capacity of soil carbon sources and sinks. The research represents the first cross border investigation and integration of data on soil carbon and peat thickness.

How the survey was carried out – airborne capture of data

Terrestrial radiation was measured at 1 second intervals during the airborne survey using an Exploranium GR820 gamma-ray spectrometer which resolves radiation emitted from the natural radioisotopes of potassium, uranium and thorium. These radioisotopes, due to their relative abundance and half-lives are the main contributors of gamma radioactivity from rocks.

Previous work by the Geological Survey of Finland and the Tellus Project has demonstrated that saturated peat attenuates gamma-radiation from underlying rocks (Hyvönen et al., 2005 and Robinson et al., 2010). This effect can be used to estimate the thickness of peat, within certain limits.

Ground truthing at field site locations

The soil carbon and peat volume assessment project involves using selected peat bog sites in Northern Ireland and the bordering counties to ground truth and evaluate the use of airborne geophysical (radiometric and electromagnetic) data and validate modelled estimates of soil carbon, peat volume and depth to bedrock. An example of the techniques used for ground truthing include Ground Penetrating Radar (GPR), peat depth probing (Figure 1), hand held spectrometry (a Scintrex GIS-5 portable gamma-ray spectrometer was used to asses terrestrial radiation) as well as magnetics, resistivity and analysis of moisture content.

Other ground based analysis techniques include rainfall, carbon/methane data monitoring, terrestrial laser scanning and recording surface topography. Historical maps and orthophotography are used to delimitate the extent of the bog surfa

using Arc GIS. Figure 2 shows the lines of radiometric data collected during the airborne survey at one of the field site locations, Ballynahone Bog, County Derry, Northern Ireland.

Figure 3 is an example of a surface of the historical peat depth data (1996/1997), the blue areas highlighting the deeper sections of the bog. This shows the variable nature of peat depths across the bog and how a single value for peat depth should not be used for the whole field site as it could greatly overestimate or underestimate peat volume and therefore effect carbon stock calculations.

Figure 4 is an example of the airborne radiometric data (22nd September 2005) for this site. Blue highlights areas where the radiometric signal is attenuated by thicker overlying peat while red highlights areas with a higher radiometric signal suggesting thinner areas of peat.

In order to investigate this

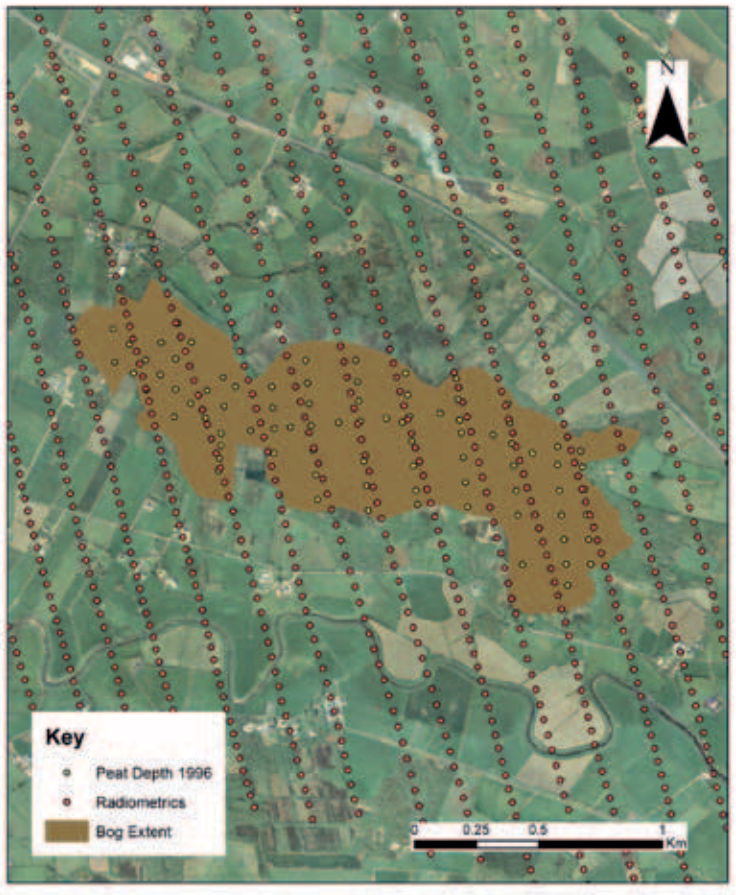

Figure 2: Orthophotography from 2010 of case study site Ballynahone Bog, County Derry, Northern Ireland. Bog extent, sampling scheme for the 1996 historical depth surveys with overlap of Tellus airborne survey radiometrics data obtained September 2005. Reproduced from Land and Property Services data with the permission of the Controller of Her Majesty's Stationery Office, (c) Crown copyright and database rights MOU203

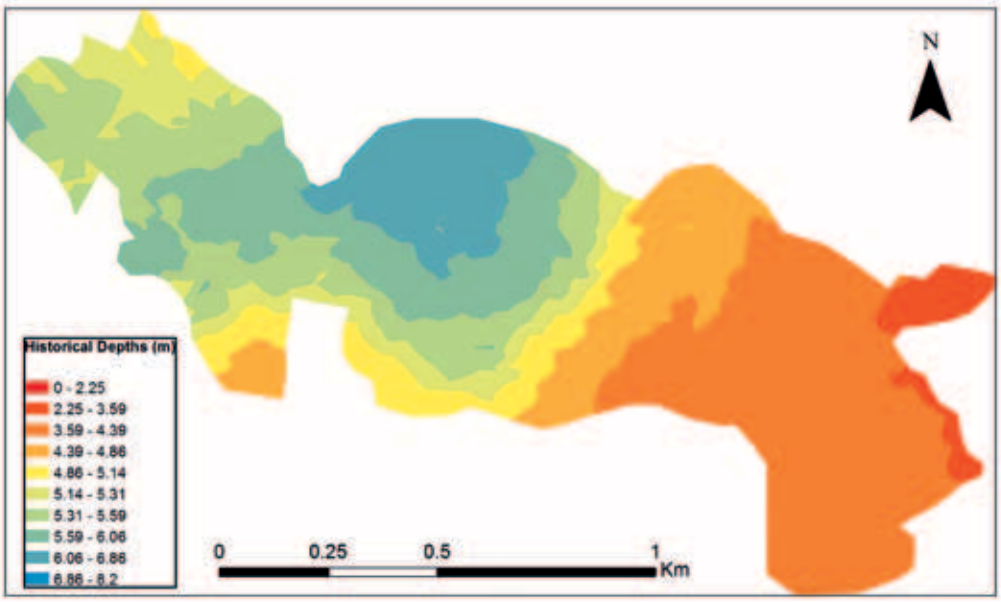

Figure 3: Output map for historical peat depth data (1996/1997) of Ballynahone Bog, County Derry, Northern Ireland.

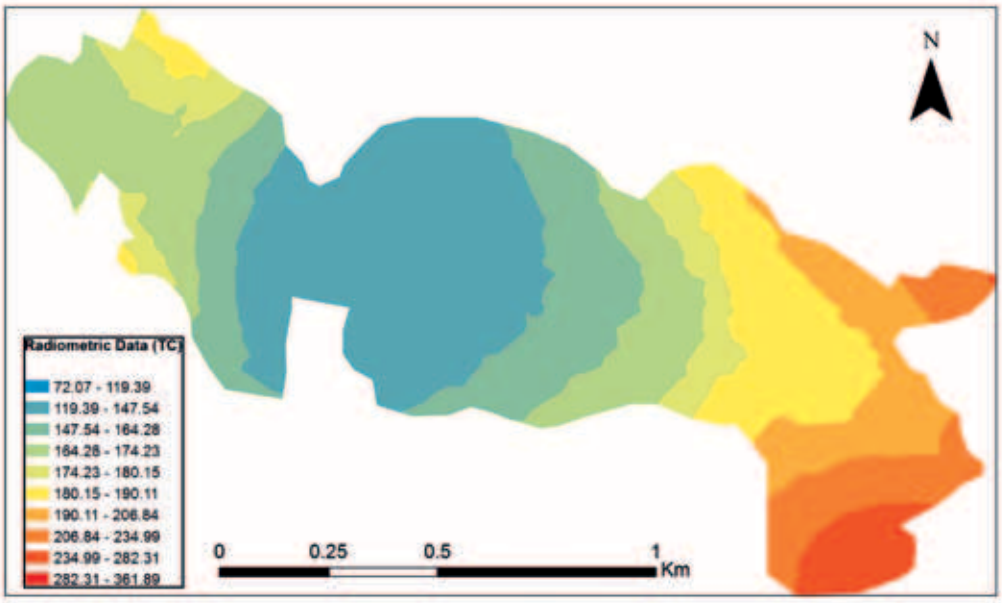

Figure 4: Output map of radiometric total count (cps) data (2005) of Ballynahone Bog, County Derry, Northern Ireland.

radiometrics and peat depths further two test lines have been chosen, one near Bundoran, County Donegal and the other at Sliabh Beagh, County Monaghan. On the ground these flight lines cover varying surface land use zones allowing extrapolation of data from these sites.

Importantly for this project these two flight lines were chosen because they fly over areas of varying geological structure and stretch across areas of peat allowing variation in the radiometric signal from peat covered and non-peat covered areas to be investigated and compared in relation to the underlying geology.

The airborne survey in these areas has been flown at a series of different elevations and different times throughout the year allowing the data to be assessed temporally with different saturation levels. Analysis of test line data aims to assist our understanding of bog dynamics and how seasonal conditions can affect the saturation levels of bogs and thus the effect this has on the attenuation of the radiometric signal which will help improve calculations of soil carbon stocks.

Bundoran, County Donegal

At the test line located close to Bundoran, County Donegal, airborne data was collected at five different times throughout the year 2011 – 2012 and at six different height elevations. This allowed the temporal variability of the data itself with regards to seasonal variation to be assessed. Ireland and the UK experience a temperate maritime climate which generally results in warm drier summers, cool wet winters and a variable spring and autumn period in between.

The Tellus data were collected predominantly during the summer months while the newly acquired Tellus Border data were collected during winter months. This provides a unique opportunity to assess the variability in data as a result of seasonal variation. Peat is predominantly composed of water and it is this water which results in the gamma radiation from underlying rocks being attenuated by the overlying peat. This attenuation of the radiometric signal will allow the mapping of boundaries and the

assessment of the thickness and saturation of the peat.

To reiterate, the radiometric survey measures the radiation emitted from the radioisotopes of potassium, uranium and thorium. The number of counts across the whole spectrum is also available and is referred to as the total count data. During the winter months it would be expected that the total count readings would be lower and during the summer months they would be higher as they are dependent on rainfall and saturation levels at different times of the year.

Sliabh Beagh, County Monaghan

The second test line is 7 km long and is located at Sliabh Beagh, County Monaghan. This line straddles the border and therefore contains data collected by the Tellus and Tellus Border surveys. Ground handheld spectrometry readings are obtained every 60 metres to be comparable with the airborne sample locations which encompass an area of approximately 100 m in the direction of the flight and 50 metres around it. Survey lines are 200 metres apart.

Results illustrate how the ground based spectrometer data provides more detail spatially while the airborne data smooths the radiometric signal due to the larger footprint of the measurement. Temporal variation is apparent at this site from analysis of the ground based survey. Higher total count radiometric values were obtained in June and lower values in August, and they are consistent with rainfall.

Analysis of the airborne and ground radiometrics illustrates two sections along the test line which experienced a reduction in total count data. GPR data for this test line illustrates that these two sections are over areas of increased peat thickness of 2.5 - 7.5 metres and 1 - 6.4 metres. This provides an example of where saturation levels have affected the data and illustrates the temporal and spatial aspect being investigated by the soil carbon project.

Project Outcomes

This project demonstrates that airborne radiometric data can be of value in determining the accuracy and limitations of monitoring soil and peat carbon by investigating the attenuation of gamma-radiation from underlying rocks. Airborne radiometric data show temporal and spatial variations in relation to saturation levels and underlying bedrock and superficial deposits. The results from this project will support the requirements of the UN Framework convention in providing information and knowledge of effective capacity of soil carbon sources and sinks.

The Tellus Border project is funded by the INTERREG IVA development programme of the European Regional Development Fund, which is managed by the Special EU Programmes Body in Northern Ireland, the border Region of Ireland and western Scotland.

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References

Hyvönen, E., Turunen, P, Vanhanen, E., Arkimaa, H. and Sutinen, R. (2005) Airborne gamma-ray surveys in Finland Aerogeophysics in Finland 1972 - 2004: Methods System Characteristics and Applications, Geological Survey of Finland, Special Paper 39: 119 - 134.

Robinson, M., McKinley, J., Ruffell, A. and Young, M. (2010) The improvement of peat depth models for Northern Ireland through the Investigation of Tellus data Presented at GeoENV 2010 Geostatistics for Environmental Applications, Gent, Belgium, 1st September 2010, Pages 36-38.

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Reed as a Renewable Resource

International conference on utilisation of wetland plants shows that reed is a worldwide relevant plant for providing many ecosystem services

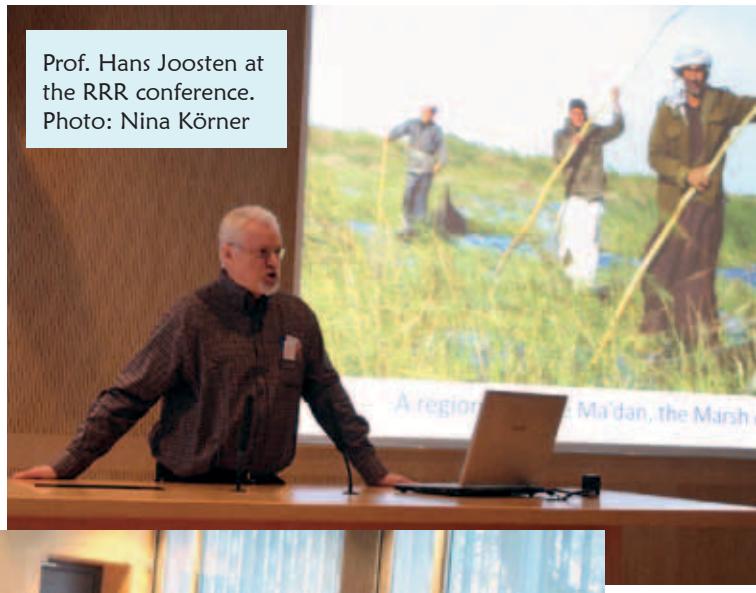
Text: Jan Felix Köbbing and Wendelin Wichtmann

The first international conference on utilisation of wetland plants from 14th-16th February in Greifswald hit the nerve of about 160 experts from all over the world.

Wetland biomass was shown to offer promising new potentials as a renewable raw material and fuel. Thus many participants perceived quite a "pioneering spirit" during the two days event titled "Reed as a Renewable Resource" (RRR) and following field excursions.

For the first time the conference - organised by the Department of Peatland Studies and Palaeoecology at the University of Greifswald, the Institute for Sustainable Development of Landscapes of the earth (DUENE e.V.) and the Michael Succow Foundation – covered multiple aspects concerning the utilisation of reeds such as biomass processing, ecosystem services, legal and economic frameworks, harvesting techniques and logistics. In the midst of the peatland-rich Vorpommern region it brought together participants from research, governance and practice ranging from the Baltic States to Bangladesh and from Canada to China.

The RRR-conference hosted more than fifty lectures and presentations at the "Alfried Krupp Scientific College" located at Greifswald city centre. Their contents made evident that there is more knowledge and experience on utilisation of wetland plants than presumed within single countries and important synergies became apparent. Reed offers many opportunities to address the increasing and diversifying demand for biomass. Changing from intensively used drained grasslands on peat soils to harvested reedbeds by rewetting improves the delivery of ecosystem services manifold: greenhouse gas emissions are decreased by reduced mineralisation



Prof. Hans Joosten at the RRR conference. Photo: Nina Körner

Participants at the RRR conference. Photo: Nina Körner

Briquettes and handicraft from reed. Photo: Nina Körner

of peat and replacement of fossil fuels by biomass; biodiversity benefits because sites are much more suitable for may specialised wetland species. The potential of biomass from wetlands as bioenergy crop, construction material or fodder is widely recognised. So are the possibilities to create and protect habitats of rare species, reduce greenhouse gas emissions or clean wastewater. Also, the cultivation and exploitation of reeds like common reed, sedges, reed canary grass, cattail etc. can combine sustainable land use for wet areas with demands for biomass and reduction of carbon dioxide emissions - while simultaneously reducing competition between biofuels and food production.

Keynote speaker Prof. Dr. Hans Joosten (University of Greifswald, Germany) lectured on benefits of reed. His Department of Peatland Studies and Palaeoecology has gathered remarkable expertise in research on utilization of wetland plants since 1994 in regional projects and abroad. Prof. Dr. Hans Brix (University of Aarhus, Denmark) held his key speech on ecological aspects of reed growth and cultivation. The public lecture of Prof. Emeritus Dr. Michael Succow, Right Livelihood Laureate (1997) and recognised peatland scientist, led through the history of fen peatland use in Central Europe.

Apart from the conference talks an open-air exhibition of large machinery for harvesting and processing reed brought "Reed as a Renewable Resource" to the public attention on the Greifswald market square. Thanks to their tracks or their balloon tires these vehicles do not sink into the soft ground despite a length of up to seven meters and a weight of up to six tonnes. Some of them already operate on rewetted peatlands in the federal state Mecklenburg-Vorpommern.

Such peatland restoration of the Nature Park Peene River Valley and the Trebel River Valley were the destination of an excursion on the conference's third day. The Peene River is one of the last not regulated and nearly natural river beds in Germany. It extends over 33,000 ha and hosts a large number of different species of birds (156) and fish (37), some of them included in the IUNC red list of threatened species. In both areas most former grassland polders have been rewetted within several projects and now show large stands of hyper to eutrophic vegetation with all kinds of reeds.

Several of these sites would benefit from regular vegetation management (paludiculture) as this would keep them open and preserve them as habitats for many key species of natural fen peatlands (see photo on page 7).

Another excursion took RRR-participants to several processing facilities where they were presented with the resulting products of raw biomass from wet peatlands including bio-coal, biogas and matting. This included a demonstration on producing bio-coal by hydrothermal carbonisation (see photo 8 on page 43).

Demand for biomass is growing as it is also increasingly used for biogas production. In addition, laboratory results of ensilage and biogas yield from fermentation of reed (*Phragmites australis*), sedges (*Carex* spec.) and reed canary grass (*Phalaris arundinacea*) were presented together with the successful use of summer mown reed biomass for biogas production. As bioenergy

Exhibition of machinery for harvesting and processing reed on the Greifswald market square during the "Reed as a Renewable Resource" Conference. Photo: Paul Schulze

is heavily promoted in Germany due to the Renewable Energy Law, biogas production from paludiculture biomass seems to be profitable. Thus the use of wetland biomass is an opportunity to tap into a new biomass resource.

The visit to a reed mat workshop offered insight on traditional use of reed. One of the last Pomeranian reed harvesters demonstrated the traditional manufacturing of reed. Reed harvesting in Pomerania has a long tradition. Some families have harvested reed for the last 400 years but increasing constrains imposed by nature conservation regulations and the lack of agricultural subsidies for this activity has resulted in the progressive abandonment of the traditional use of reed. The project

Construction material from reed. Photo: Nina Körner

Traditional reed mat. Photo: Christian Schröder

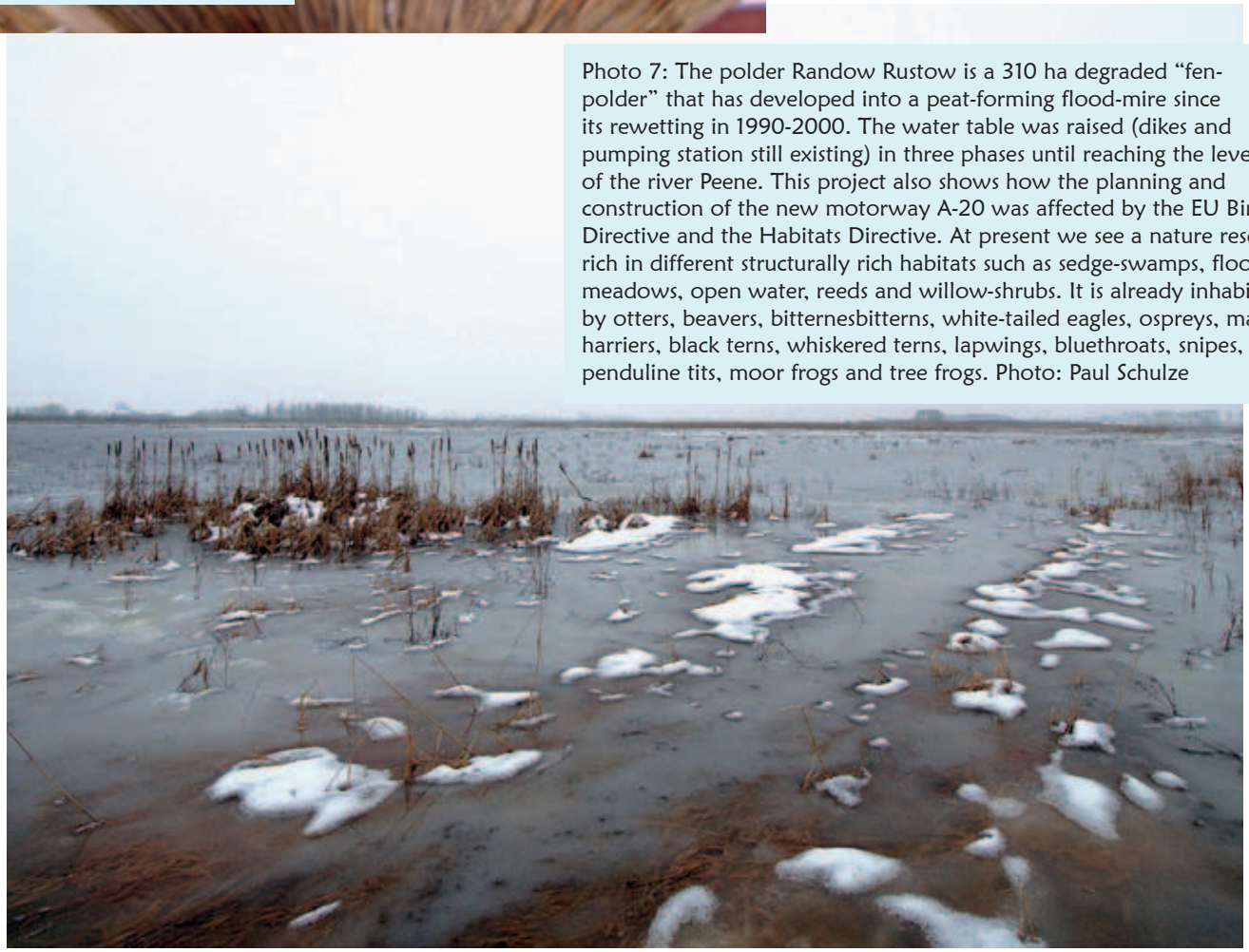
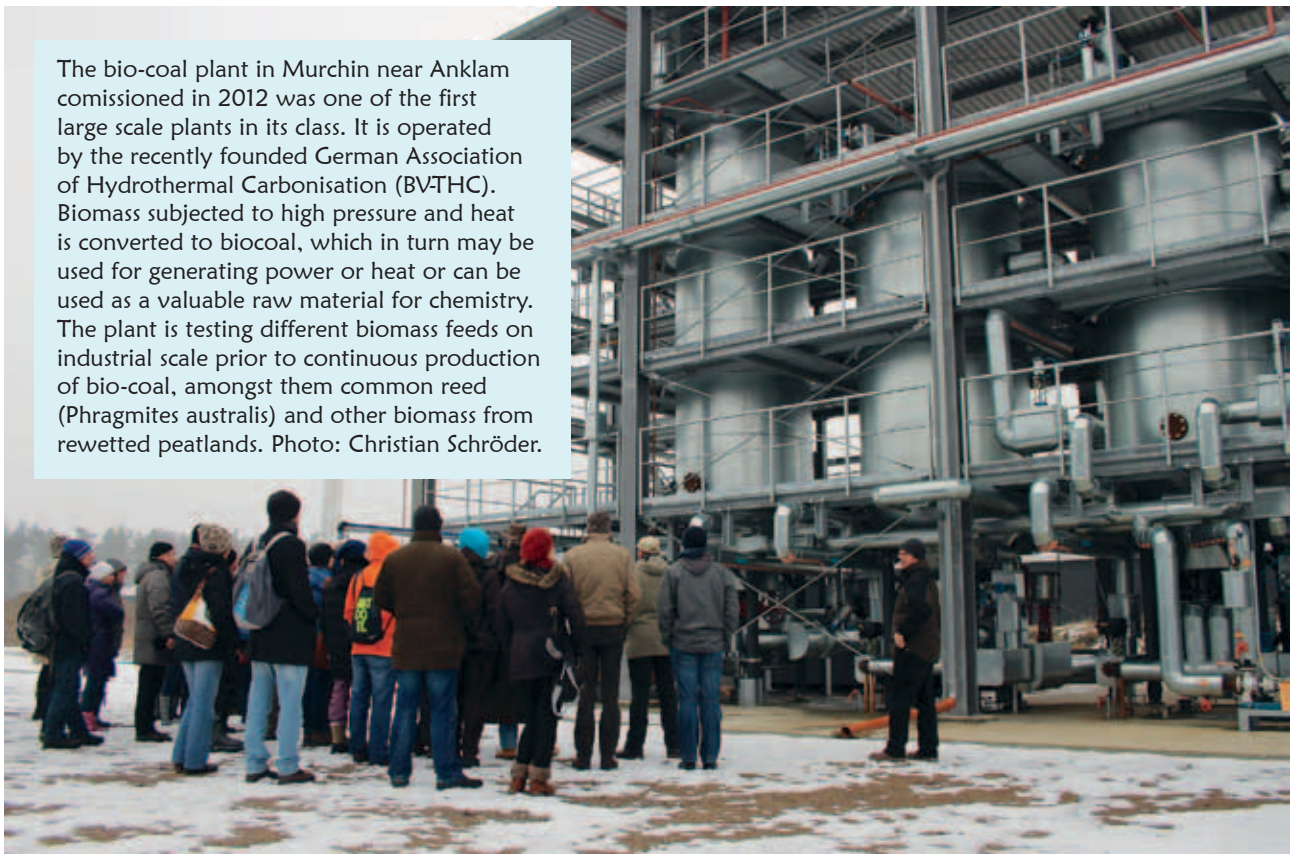


Photo 7: The polder Randow Rustow is a 310 ha degraded "fen-polder" that has developed into a peat-forming flood-mire since its rewetting in 1990-2000. The water table was raised (dikes and pumping station still existing) in three phases until reaching the level of the river Peene. This project also shows how the planning and construction of the new motorway A-20 was affected by the EU Birds Directive and the Habitats Directive. At present we see a nature reserve rich in different structurally rich habitats such as sedge-swamps, flood-meadows, open water, reeds and willow-shrubs. It is already inhabited by otters, beavers, bitternesbitterns, white-tailed eagles, ospreys, marsh harriers, black terns, whiskered terns, lapwings, bluethroats, snipes, penduline tits, moor frogs and tree frogs. Photo: Paul Schulze



The bio-coal plant in Murchin near Anklam comissioned in 2012 was one of the first large scale plants in its class. It is operated by the recently founded German Association of Hydrothermal Carbonisation (BV-THC). Biomass subjected to high pressure and heat is converted to biocoal, which in turn may be used for generating power or heat or can be used as a valuable raw material for chemistry. The plant is testing different biomass feeds on industrial scale prior to continuous production of bio-coal, amongst them common reed (Phragmites australis) and other biomass from rewetted peatlands. Photo: Christian Schröder.

"Vorpommer Initiative Paludiculture" is working on these problems and will provide solutions in near future (see www.paludiculture.de).

The conference aims seem quite accomplished: building networks, identifying research demands, exchanging experience and information thus encouraging progress on reed energy production and its large-scale implementation.

Encouraged by networking and exchange, the "reed-pioneers" now aim to promote the positive effects of peatland rewetting – especially the potential of wet land use and cultivation of reed biomass – to government, agriculture and industry.

Paving a new path to peatland rewetting and sustainable usage does require the adoption of favourable political and legal conditions , especially flexibility in the regulations that allow changes in land use on rewetted peatlands and the inclusion of wetland biomass as agricultural activity under the EU Common Agricultural Policy.

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Traditional manufacturing of reed mats on Usedom island, Germany. Photo: Christian Schröder

The Value and Use of Peatlands for Education

Text: Catherine O'Connell and Nuala Madigan

Figure 1: The Conamara Bog Week in County Galway has been running since the 1980's and is a multidisciplinary educational celebration of peatlands. Photo: CEEC

The recently published Strategy for Responsible Peatland Management of the IPS highlighted the importance of investing in education, training and information dissemination to realise the vision of the strategy.

How can education work to deliver the IPS vision of "promoting wise use of peatlands though safeguarding their environmental, social and economic functions and respecting their local, regional and global values"? The Irish Peatland Conservation Council (IPCC) is a leader in the field of peatland education and has a wealth of experience to share with IPS members and other stakeholders in this regard.

Since the 1990's there has been a growing interest in the value of peatlands for formal and informal education. Hand in hand with this has been a rapid growth in the range and availability of education resources and facilities focusing on peatlands, both in Ireland and internationally.

Educators working on behalf of private individuals, non-governmental organizations, industry and Government agencies have developed multi-media publications and web sites, organized exhibitions, provided training, developed techniques for the management of sites used in education and established visitor centres. As a result, peatlands are more visible today than ever before through education.

IPCC's educational role has been both formal and informal. Providing support, training and resources to schools is part of our formal commitment. Delivering life long education programmes and interpreting peatlands for visitors are elements in our informal work.

Peatland Education and Training in Schools

The scale and variety of peatland habitats and landscapes and their links to a country's history, culture and economy offer a tremendous educational resource for the teacher keen to undertake active, experiential education in, and about the peatland environment.

Peatland education is not just about gathering data and survey work on a school trip, it involves the development of attitudes, values, skills, creative and spiritual responses which are applied in all areas of a childs life. This philosophy

Figure 2: A selection of peatland education resources produced by the IPCC for use in schools. Photo: C. O'Connell

underpins IPCC's work in education and is the basis for over 25 years of our research and development work in this area. Our goal was to turn peatlands into a teaching tool delivering aspects of the school curriculum and at the same time raising awareness and understanding of the natural and cultural heritage of our peatlands, their importance in our economy and the need for their conservation and wise use. Working proactively with teachers IPCC have developed a whole series of curriculum linked resources – packs documentary and visual materials, on-line resources, activities and ideas, all of which promote IPCC's peatland education objectives.

For example IPCC's pioneering work in the creation of resources led to the publication of the Peatland Education Pack in 1992. This interdisciplinary resource aimed at 11-15 year old students is divided into six modules spanning science, history, geography, art, craft and design, English and Gaeilge, reflecting the breadth of subjects which peatland study can offer. Each subject area focuses on different aspects of peatland education. For example the science module focuses on the bog as a habitat for ecological studies, the history module explores archaeological artifacts and structures while the English is a broad based module examining the value of natural and cultural heritage.

Figure 3: Taking the peatlands to the people. The Dutch Irish Peatland Exhibition on tour in Dublin city allowed school children to experience peatlands and take bogs into their classroom. Photo: M. Kelly

Through the division of peatland education into subject areas this resource enables educators to promote the wise use of peatlands, safeguarding environmental, social and economic functions while at the same time respecting their local, regional and global values.

Producing peatland educational resources alone will not inspire teachers and educators. If the vision of the IPS strategy for responsible peatland management is to be achieved teacher and educator training for teachers in the use of the resources is necessary. In Ireland training courses are run annually by the Irish Peatland Conservation Council in liaison with education and visitor centres around the country. A typical day long course – entitled 'Wake up to Bogs' – includes a first-hand experience of a peatland on a field trip. On site, ecological field studies are undertaken to understand how the special environment of the bog

Figure 4: At the Bog of Allen Nature Centre in Co. Kildare, the IPCC are providing a hands-on experience of peatlands for visitors from all over the world and they love it. Photo: C. O'Connell

Figure 5: Boardwalks and seating areas are essential on peatlands used for education. Visitors experiencing the wind and the view across Lodge Bog in Co. Kildare, Ireland. Photo: C. O'Connell

works. Time is also given to a multi-sensory exploration of the bog. A follow-up session looking at man's influence on this environment is conducted indoors. We use board games to explore participant values and lifestyles audits to help target areas of personal behaviour that must change to support the goal of conservation and wise use of our peatlands (see information box on page 48 for typical course content).

The production of formal peatland education resources by the IPCC was recognised by the Department of Education and Science in Ireland. During a national curriculum review in the 1990's it was decided that all aspects of peatlands should be included for school students to study. The success of the Peatland Education Pack and Training programme led IPCC to develop many more resources for use by schools including the Cutover and Cutaway Bogs Education Pack (O'Connell 2000). IPCC's work to date has also inspired the production of education materials in the UK (Macartney 1994, Webster 1999, Telfer & Matthews 1999), France (Dalbavie & Solleliet 1994), Slovakia (Viceníková 2002) and Canada (Olsen et al 2011).

Life Long Education Programmes

Peatland education is a life long commitment and needs to be provided for the entire community, both individuals and groups independent of age. It is the responsibility of all government and non-governmental organisations with an interest in peatlands to have education programmes to engage people outside the formal education system. A diversity of approaches are being used by educators to help develop lifestyles that are harmonious with peatland wise use.

Travelling exhibitions have proven successful both in Ireland and internationally as a means of raising awareness. They bring the peatlands to people, for example in urban areas, who perhaps cannot experience peatlands otherwise. The IPCC and The Dutch Foundation for Conservation of Irish Bogs produced "The Wild Beauty of Bogs/De Venen Geturfd" Exhibition which toured through the Netherlands and Ireland from 1986-1888 and from 1990-1994 respectively to highlight the lessons in bog conservation and Wise Use that each country could learn from the other. The "Heartland" Exhibition 2009-2010 demonstrated how peatlands and the work of Bord na Móna influences development, innovation, work, environment, community, culture and heritage in Ireland. Further afield the National Science Foundation and Ocean Spray Cranberries developed an exhibition entitled "Mysteries of the Bog" which was launched in 1993 in the Boston Museum of Science and toured the United States for three years from 1996-1998. This extensive exhibition included the following experiential activities for visitors:

"Mysteries of the Bog, a rich weaving of science, history, archaeology, legend and economics, examines the curious landscape of the bog. Visitors can walk through a simulated quaking bog; meet the "Bogey Man", a replica of a 2,000 year old body preserved in a European bog: examine carnivorous plants that live in bogs, some growing live in a terrarium; and explore the geology of bog regions though an original computer programme. The exhibition is enhanced by a 10-minute multimedia presentation introducing the other-worldly quality of bogs, photos of typical bog landscapes on both sides of the Atlantic, and quotes from Shakespeare and other authors that emphasize our common misconceptions about bogs".

Art and peatlands have also inspired exhibitions. In 1990 an exhibition entitled "Bogland" organised by the Sculptor's Society of Ireland focused on the artistic response to the experience of the bog environment - its wildlife, history, landscape and use. Working in the blanket bog area of Co. Wicklow, sculptors fashioned

unique forms using materials and inspiration from the bog itself. A photographic exhibition of their work toured in Ireland from 1990-1991. An International Sculpture symposium in 2000 led to the establishment of the permanent exhibition of Sculpture in the Parklands at Lough Boora Parklands in Co. Offaly.

Other approaches used in outreach education involve designing year round action programmes to engage communities in caring for their peatland heritage. These include formal courses and open days on wetlands or in a peat landscape, with a series of planned awareness raising activities, usually a combination of talks, walks, art and music. One of the most successful of these is the annual Bog Week run by the Conamara Environmental Educational & Cultural Centre in Co Galway and which has been running since the 1980's.

Action days appeal to a different audience including people who wish to up-skill. They include work camps to restore wetland hydrology and species, collect litter, clean up pollution, remove invasive species or record biodiversity. In recent years in Ireland an annual focus for these kinds of educational activities has been World Wetlands Day in February, Biodiversity Week in May, International Bog Day in July and Heritage Week in September.

Social media and the internet have transformed ways of communicating at all levels. The IPCC's website, among others, at www.ipcc.ie is the centrepiece of our education programmes facilitating networking and dissemination of information within Ireland and throughout the world.

Peatland Education Sites

First hand experience of peatland wildlife, archaeology, utilisation and landscape is fundamental to the development of attitudes which are sympathetic to wise use idealism.

> "no one will care about what they have never experienced"
>
> Speech to Communicate Conference, November 2012

Every peatland site, whether intact or man-modified, is a potential educational resource. Ireland has a network of almost 30 peatland education sites in active use. They include sites of importance for biodiversity, demonstration sites for restoration or management techniques, archaeological sites, rehabilitated industrial sites, recreational national parks and a bog school (at Peatlands Park in Northern Ireland).

Even centres of learning such as museums, botanic gardens and zoos can offer peatland education programmes drawing on the extensive collections they house,

Figure 6: The Flytraps house at the Bog of Allen Nature Centre is a garden of insect eating plants which grow in peatlands throughout the world. Photo: E. O'Connell

Figure 7: The experience of squeezing the water from Sphagnum moss is a first step in ensuring that people begin to care about bogs. Photo: C. O'Connell

and through the peat-free management of their grounds and gardens they can give a positive example on lifestyles.

Obviously, in using peatlands as an educational resource, care must be taken not to damage a site significantly and to conduct safe visits. Access facilities, particularly boardwalks are clearly important in this respect, but management to reconcile site conservation with educational use is vital. The UK-based Field Studies Council recommend two strategies on such sites. The first is making conservation part of the educational agenda while also fulfilling formal educational expectations; and the second is zoning the different educational activities so that they are compatible with the robustness and value of the site (Trudgill 1996).

Without exception all sites, parks and centres provide an experience of the peatlands to children or adults, a vital element of education. Initiatives to open peatland educational sites both intact and man-modified need to be encouraged worldwide. It is only when you feel the ground quake beneath your feet that you truly appreciate how wet a bog is. With management, care and respect peatland education sites can be used to promote the wise use of peatlands.

Visitor Centres and Education

Visitor Centres are an important tool for delivering peatland education and providing access to the public to peatland sites and projects. The IPCC manage and run the Bog of Allen Nature Centre in Co. Kildare. The centre opened in 2004 and is being developed as a centre for excellence in peatland education, conservation and research. Lonely Planet (2008) ranked the centre as "one of the top 10 Eco Projects in Ireland".

The Centre is open all year round to school groups, special interest groups and casual visitors. Its facilities include: permanent exhibitions on all aspects of peatlands - social, economic and environmental; bog themed gardens including a lake and marshland garden, a fen garden and a bog garden; a carnivorous plants garden; field studies equipment and resources, research library, Lodge Bog and an eco-themed Nature Shop. Educational activities conducted at the centre include: guided walks, nature activities, children's camps, habitat studies, up-skilling courses, volunteering opportunities and open days.

Conclusion

Peatland education has a vital role to play in raising awareness of the importance of peatlands to the

Wake Up to Bogs Course Content

* Introduction
* Ice breaker: bog wood, turf sods and archaeological finds from the bog.
* Resource distribution.
* Discovering the Wild Boglands DVD workshop.
* Making bog flower and bog pool bug identification dials.
* Plant identification using flower dials, plant adaptations.
* Field Studies on a peatland site:
* Peatland formation: studying the layers visible in a turf bank to build a model of bog growth.
* Studying bog flora using square frame quadrats.
* Studying differences between wet and dry parts of a bog along a transect.
* Studying the effects of drainage on the peatland.
* Pond dipping to study the feeding relationships between the minibeasts in bog pools.

economy, heritage and biodiversity of a country. Peatland education needs to be made available to everyone as a life long activity. There are a variety of methods that can be used to realize the educational goals of the IPS Strategy for Responsible Peatland Management. A number of outstanding education programmes are in place in Ireland and around the world thanks to IPCC's pioneering peatland education programmes that are bringing about real change. If we fail to take advantage of the positive opportunities peatland education provides to securing the conservation and wise use of our peatlands globally, future generations may not forgive us.

References

Dalbavie, T. & Solleliet, J.P. (1994) Les Tourbières au Pays des Plantes Carnivores. WWF, France. 24pp

Macartney G. (1994) Peatlands Forever? An Education Resource Pack. Department of the Environment for Northern Ireland, Belfast. 58pp.

O'Connell, C. (2000) ed. Cutover and Cutaway Bogs Education Pack. Irish Peatland Conservation Council, Dublin. 120pp.

O'Connell, C. (1992) ed. Peatland Education Pack: Science, Geography, English, Gaeilge, Art, Craft & Design and History Modules. Irish Peatland Conservation Council, Dublin. 626pp.

Olsen, K., Issel, C. & Skutelnik, N. (2011) For Peat's Sake - A complete classroom study on Burns Bog and other Peatlands. Burns Bog Conservation Society, Delta, Canada. 205pp.

Telfer, M. & Matthews, T. (1999) The Peatlands of Caithness and Sutherland and their Inhabitants - A Teachers Pack for Primary Schools. LIFE Peatlands Project, Scotland.

Trudgill, S. (1996) Education, fieldwork and conservation: meeting different needs? Field Studies Council Magazine 11: 3-5.

Viceníková, A. (2002) ed. The World of Peatlands - Handbook for Primary School Teachers. DAPHNE - Institute of Applied Ecology, Bratislava, 211pp.

Webster, S. (1999) Wild, Wet and Wonderful A teaching Pack for Peat Bog Projects. Scottish Natural Heritage, Perth. 35pp.

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Welcome to the "peat family"!

New IPS Members

We welcome the following individual persons, institutes, companies, non-government organisations and/or their representatives as new IPS members. Updates in their membership lists are provided by our National Committees as soon as they occur, or at least at the end of each year on request of the IPS Secretariat (status 16 May 2013).

Individual Members

Finnish Peatland Society (Suoseura): Pirjo Ingerö, Erkki Raikamo
Irish Peat Society: Alan Gilmer
Dutch National Committee (Nederlands Veengenootschap): Kay Koster, Toine Schipper
Indonesian Peat Society: Supiandi Sabiham
Italy: Marco Valerio Del Grosso

Student Members

UK Peat Society: Grace Blackham

Please note that not all National Committees offer student membership yet. However, they often have reasonable membership fees for individual members - just ask.

Government organisations

Estonian Peat Association (Eesti Turbaliit): Aivar Pajupuu (OÜ Eesti Geoloogiakeskus)

Corporate Members

Estonian Peat Association (Eesti Turbaliit): Tiit Kangert (Vändra MP), Rli Kanter (AS Nurme Turvas), Anu Kitt (OÜ Stender Estonia), Vladimir Kozorev (AS Kruviks), Ly Lauringson (AS Kekkilä Eesti), Karmo Leemet (AS Jiffy Products Estonia), Rainer Rebane (OÜ Biolan Baltic)

Research institutes

Polish National Committee: Krystyna Balaga, Joanna Jarosz, Jaroslaw Pietruczuk (University of Marie-Curie Sklodowska in Lublin), Monika Gasowska (Warsaw Agricultural University)

Please also remember to update your address and email in the IPS website member database or with the IPS Secretariat, ips@peatsociety.org if you feel you are not receiving IPS publications.

You are very welcome to join us, too! Please visit www.peatsociety.org/join-us, contact the National Committee in your country (addresses at our website and in the Annual Report) or fill in the membership application form in this magazine.

Increase return - reduce processing costs with improved baling

Text: Janet Cass

Growing peat consumption

Good news for peat producers: Demand for peat by the horticulture industry remains strong. And no wonder—peat's unsurpassed capacity to retain nutrients and water makes it a valuable component in plant substrates, where it also helps to regulate air and moisture around roots.

Peat's value to the horticultural industry as a constituent of growing media is clear from the following statistics that show it's not only in demand, but that demand is rising in some areas. Sweden's harvest of peat for horticultural use was 1.61 million cubic meters in 2011, an increase of 28 percent compared with 2010. Overall peat production in Belarus rose 21 percent between 2011 and 2012, while Ukraine's overall peat production rose 32 percent during the same period. Thus the challenge to peat producers is to maximize the return available from this demand without losing profit to unnecessary processing costs.

Reduce processing costs

Improved packaging: One way to accomplish this is to replace traditional ready-made bags with tubular film, which saves up to 15 percent in packaging. In addition, tubular film saves the peat producer money because it avoids downtime caused by ready-made bags' inherent risks of sticking together due to electrostatic charge and improper placement in the equipment's bag magazine. Labor needed to fix downtime caused by ready-made bags is correspondingly minimized by the use of tubular film.

Tubular film further decreases labor costs and enhances production because it accommodates up to 2,000 bales per roll. To help peat producers increase uptime and profit margins by incorporating this film, Premier Tech designed the new, VP-400Tubular four-station compression baler. The VP-400Tubular baler's use of film supports operation 24/7 and completes Premier Tech Chronos' range of balers, which includes the vertical form-fill-seal model EA-450.

For peat producers whose customer base includes clients that require peat to be packaged in ready-made bags, the VP-400Hybrid can be operated with both tubular film and bags. Tubular film capability can be retrofitted onto Premier Tech Chronos' four-station compression balers, as well.

Improved feeding: All balers in the VP series of four-station compression balers from Premier Tech Chronos can be paired with the company's volumetric belt feeder and leveling device to overcome peat's tendency to bridge during the packaging process, which can cause downtime. The belt feeder reduces bridging during feeding by moving the material at a consistent rate through the baler's compression tube. In addition to maximizing feeding efficiency, this equipment promotes accurate packing because the leveler ensures that a consistent height of material is fed into the compression tube. Production is optimized too, since the height of the leveler adjusts to accommodate different bale sizes.
Reliable, innovative

Tubular film produces bales that are shaped as precisely as traditional bags, which is an important consideration for efficient stacking and transport. The reliability of bale geometry enhances the ability of all compression balers to get the maximum volume of peat in trucks and in containers for overseas delivery. Compression balers are the most money-saving way to prepare peat for transport—and using tubular film is the most efficient and cost-effective way to package it. Together,

VP-400 hybrid bag placer.
Photo: Premier Tech Chronos

compression balers and tubular film are powerful money-savers for the peat producer.

Adapting tubular film technology from the chemicals industry to peat handling is an innovation developed in collaboration with Premier Tech Horticulture, a North American peat and substrate producer with 90 years of peat processing experience.
Challenges drive innovation
In an environment of ever-increasing fuel and production costs, peat producers must reassess their operations and consider strategies for staying competitive. Cutting costs by baling with tubular film is an innovative strategy that peat producers cannot afford to overlook.

For more information, visit www.ptchronos.com.

VP400 hybride. Photo: Premier Tech Chronos

Janet Cass
email: janetkcass@gmail.com

VP-400 Tubular Film Automatic Four-Station Baler

Premier Tech's Industrial Equipment Group, the worldwide leader in packaging solutions, provides customized bulk processing, packaging, palletizing, and load securing solutions for a wide range of materials, such as peat moss.

The company's most recent innovation for the wood industry is its VP-400 Tubular Film Automatic Four-Station Baler (VP-400T), which uses tubular film instead of ready-made bags. This new machine, like its predecessor, the VP-400SE, is designed for 24/7, year-round operation with minimal downtime.

Inspired from the traditional VP-400

The VP-400 Baler is a unique four-station baler where the various stages of the bagging process are carried out simultaneously. It features four tubes mounted on an indexing table which allows the tubes to rotate so that the bag remains in the same tube throughout the bagging process. The first two stations are used for filling and compression operations, whereas the third station includes an automatic impulse sealer that forms the bag top, with gussets tucked in, and makes a trimmed seal just above the product line. At the fourth station, a bag placing module transfers the filled bag to an exit conveyor and places a new one onto the tube.

The VP-400T was designed to make you benefit from a significant reduction in packaging material costs through the use of tubular film instead of ready-made bags. The VP-400T can package a wide range of compressible materials and is suitable for small or large production volumes with its impressive flexibility. The use of tubular film also solves most of the problems encountered when using ready-made bags (dog ears, sticky film, etc.) and increases the machine's uptime thanks to an autonomy of up to 2000 bags/roll.

One of the options available on the VP-400T is the possibility of running both ready-made bags and tubular film on the same machine: the VP-400 Tubular Hybrid (VP-400TH). The VP-400T and VP-400TH are the only systems available on the market that can generate different bale sizes with the same equipment, using tubular film or ready-made bags.

Features:

- Low bag cost
- High speed
- High bag autonomy
- Ease of co-packing
- Less sensitive to bag quality
- Low height equipment

For more information, please see ptchronos.com.

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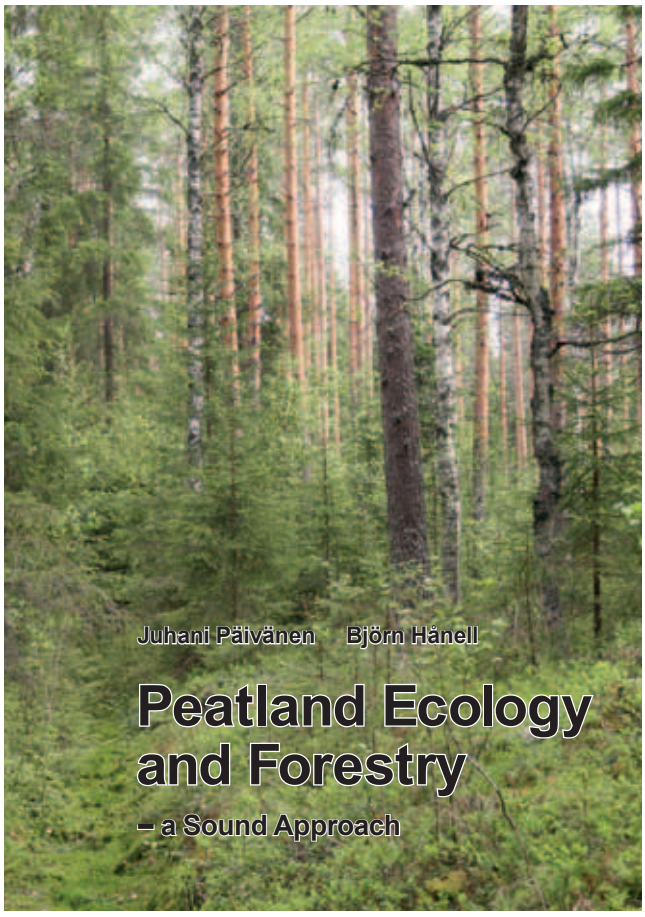
Peatland Ecology and Forestry – a Sound Approach

Another review for the new peatland forestry book

Juhani Päivänen and Bjorn Hånell 2012. University of Helsinki, Department of Forest Sciences Publications 3:1-267.

Every segment of science is born by a need to understand natural phenomenon. It progresses from observation to classification to detailed experimentation discerning cause and effect, then to application for practical use. The segment matures in the span of a century or more wrought with trial and error often with confusion in terms, classification and application misfires. As a neophyte to peatland ecology, hydrology and forestry in 1967, I sought to devour all the information available in the previous 70 years, and then struggled for many more to make sense of it all. I added my own experimentation, interpretation and application, but discussions at science or management meetings remained in a quagmire ending in "yes, but".

Rarely, a publication seeks to assimilate, weigh and recommend considering all viewpoints in the segment. At that point, the segment has reached the beginning of maturity. Peatland Ecology and Forestry has brought the mire ecosystem and boreal forestry segment to maturity in 2012, as Ven Te Chow's, Handbook of Applied Hydrology: a Compendium of Water-Resources brought hydrology to maturity in 1963.



The authors from the University of Helsinki and the Swedish University of Agricultural Sciences at Umeå, respectively, draw heavily from northern Europe for forestry topics, but survey and select literature from the world stage in the first section where terms and concepts are sorted, refined and nailed down as well as the quantity of mires, peatland and peat in the World - - - "a common language and terminology are absolutely necessary".

The second section, similarly, surveys the world literature. It explains the Mire Ecosystem (mire initiation and succession, ecosystem function in terms of water, plant communities, carbon dynamics and carbon accumulation and peat soil in terms of physical structure, water properties, thermal conditions and nutrient regimes) and Mire Hydrology (water balance terms, groundwater and soil, acrotelm and catotelm, mire regulation of floods (or not), soil water and tree growth, and the hydrology of peatlands drained for forestry).

The third section describes the similarities and differences of peatland classification in the Nordic countries, and suggests that a uniform classification in northern Europe or world-wide may not be desirable; rather, allow each to function best where it was developed. In Finland, site-specific plant communities deriving from the work of Wainio (1878) and Cajander (1909) are the foundation of classification. Far reaching historical perspective is an intentional part of many sections where early works in Finnish, Swedish and Norwegian restricted their distribution and

To order this book, please visit www.peatsociety.org/shop.

acceptance, but are here revealed in English.

A short fourth section on peatland forestry in Fennoscandia is historic, progressing to the status of peatland forestry in each country and ending with justification for wood production on mires. In the northern Lake States of the USA (47ºN), precipitation is 80cm, potential evapotranspiration 60cm and water yield 20cm, in central Finland (62ºN) precipitation is also 80cm, but potential evapotranspiration is only 40cm and water yield is double the value in the Lake State's at 40cm.; hence, drainage to produce a renewable forest resource is very much needed.

The first two-thirds of the textbook are broad in perspective, surveying the literature, sorting it out and recommending the essential. The last third of the text is specific to forests on peatlands considering conservation, exploitation, single tree selection and progressive management on drained peatlands.

Precise silviculture prescriptions for forests in the Nordic countries, Great Britain, Russia and Canada apply to spruce, pine, birch and their mixtures. It drills down with great depth and with care given to the interaction of species. The changing ecology and functions of forests on drained are detailed. In addition to the soil and hydrology specifics of drained mires in the first part of the book, the last section sets the book apart with a primary emphasis on peatland forestry compared to recent texts where mires, wetlands, or peatlands are treated generally.

A final, shorter chapter, deals with gathering products on peatlands (berries, mushrooms and fiber), game, agriculture (brief), peat harvesting, and finally, the restoration of managed peatlands.

Color photos, and figures (many in color) are crisp, stunning and illustrate concepts with clarity. About 1,000 references are included and the book is well made and error free. This is a textbook that will stand alone in Nordic countries as the basis of several college courses and paired with other monographs on mire, peatland and wetland ecosystems.

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In memoriam: Prof. Dr. Rouse S. Farnham

Prof. Dr. Rouse S. Farnham Rouse passed away peacefully on January 30, 2013, in St. Paul, Minnesota. He was born on January 29, 1918 in Evergreen, Alabama. He was preceded in death by his wife Virginia and is survived by children: Christopher, Nancy, Richard and Julie; two grandchildren; and two great grandchildren.

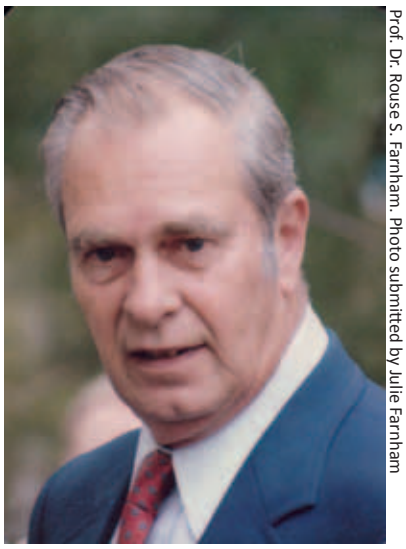
Rouse received a B.S. in Agriculture Science from Auburn University in 1941. He then served his country in the U.S. Air Force from 1942-1946, primarily stationed in China. Upon his return, he attended Ohio State University and was granted a PhD in Soil Science in 1951. In 1950, Rouse started working in the Soil Science Department at the University of Minnesota, St. Paul. This began his 50 year involvement with peat and peatlands. As an Assistant, Associate and Full Professor he became a national and international expert in mapping, classification and utilization of organic (peat) soils. Rouse was an advisor to many undergraduate and graduate students in Soil Science, of which three were granted a PhD. He retired as Professor Emeritus in 1985. In retirement he continued to be active as a peat consultant in the U.S. and Canada.

Dr. Farnham started his international peat involvement in 1963 at the 2nd Congress in Leningrad. Through 1986 he was an active participant in many IPS symposia and all Congresses; presenting papers, chairing sessions and enthusiastically meeting Presidium responsibilities. In 1979 he was elected Vice President of the IPS. He served in this position until he resigned in 1990, at which time he became an Honorary Member of the IPS. He was instrumental in hosting the 6th Congress (1980) in Duluth. Rouse was a charter member of the U.S. National Committee and served as Chairman for many years. Significant contributions that Dr. Farnham made to the peat world include several aspects:

In 1960 the Iron Range Resources and Rehabilitation Board (IRRRB), a State of Minnesota Agency, began conducting research on the potential of utilizing Northern Minnesota's vast, unmapped peat resources. Rouse and Donald Grubich (IRRRB) became a team in the major effort of inventorying and characterizing these peatlands. Many peat samples were analyzed under Rouse's tutorship, providing jobs to soil science students and introducing them to peat soils. Rouse and Don co-authored many inventory publications that were instrumental in the development of Minnesota's horticultural peat industry. Their friendship endured for over 50 years.

In 1964 the IRRRB was gifted a 200 hectare peatland to be used as a peat research facility. IRRRB and the University of Minnesota shared the facility. Rouse used the facility to conduct innovative and visionary research on the use of peatlands for agriculture, horticulture and biomass production. He also did baseline water quality studies for the Minnesota Department of Natural Resources at a time when peatlands were becoming recognized as a valuable natural resource. In later years, one of Rouse's students, Dr. Tom Malterer, used the facility to conduct research on specialty crops, short rotation forestry and peatland restoration (rewetting).

In 1969 Rouse realized the potential of using the properties of peat to treat sewage effluent. With graduate student Dr. Jim Brown, they developed and tested a laboratory prototype of a peat over sand filter. Successful large scale testing of



Prof. Dr. Rouse S. Farnham. Photo submitted by Julie Farnham

the filter was done using various loading rates. Subsequently, three large filters were installed for the U.S. Forest Service in campgrounds in Northern Minnesota. Rouse and Don Grubich were instrumental in building these filters and they are still operational today.

Rouse's final peat achievement started in 1994 as he helped form a startup company called Peat Technologies Corporation (PTC). PTC obtained a sole license to manufacture peat granules that effectively remove heavy metals from fluids. The technology was developed at the Natural Resources Research Institute (NRRI), at the University of Minnesota Duluth. PTC further refined the technology for use in the treatment of septic tank effluent and as a peat-based inoculant in agriculture.

Rouse's colleagues and students will long remember him as a man with a magnetic personality, who had a creative and inquiring mind, and whom they valued as a visionary, mentor and friend.

Donald Grubich and Tom Malterer

How do I use the special website for IPS members?

Text: Susann Warnecke

IPS is offering several website services for its members only. Here we are giving a few hints on how to use those pages.

Login

All IPS members, also those that have joined via a National Committee, have received their personal log in names and passwords for the IPS website by email. These are needed when you want to access the special information on the IPS website that is available for members only. Please click on “Login” on the left upper corner of www.peatsociety.org and enter your user name and password. In case you do not have this data anymore, press “Login” and then choose the sheet “Request new password” on top of the email field.

Member menu

When you are logged in as a member, you will see an additional menu below the usual IPS website sections. These are the list of members, the document database, add open position, add document, my account, and the peat dictionary on the left.

Your own profile

Each IPS member has his or her own profile stored within the IPS member list. This is based on the information from our member associations (National Committees) and visible to the IPS Secretariat only as long as you do not make them visible to other members yourself, by clicking a box at the end of your data sheet (note that there are several tabs). You can edit your email address, postal address and other information yourself and thereby make sure that all IPS publications reach you in time. You can even upload your own profile photo. However, for Peat News, please always announce changes in your email address also to susann.warnecke@peatsociety.org.

Member database

The button “list of members” opens a list of IPS members and their contact data for you. These are - for data protection reasons - only those members that have opened their contact information for this purpose in their own profile. Feel free to contact them for your projects and work. You can open your own contact data by checking a box in the address sheet of your member profile.

Document database

The document database contains all kind of publications for which IPS owns the copyrights. These are all recent issues of Peatlands International, Peat News, IPS brochures and posters and a couple of proceedings of IPS conferences. Further data is scanned and added continuously, so check back once in a while!

Peat Dictionary

The printed IPS Peat Dictionary has its application version at www.peatsociety.org/peat-dictionary. This contains 6373 terms in five languages; Finnish, Swedish, Russian, English and German. Have a try - you can also add terms if you like.

Open positions

All IPS members can share open positions and new research proposals themselves. Just click “add open position”, fill in all fields required and your text will show up even on the frontpage of the IPS website.

Sharing on social networks

All open content on the IPS website can be shared by email and via your favourite social networks. You can copy the link directly from your browser or use the social sharing buttons (Twitter, FB, Email, Stumbleupon etc.) on the upper right corner of each IPS page.

What if I loose my password?

In case you have lost your IPS user name and password, please go to www.peatsociety.org/user/password or (Login -> Request new password tab), type the email address to which we are sending Peat News and you will receive a new password within minutes. User names are in most cases firstname.lastname. In case this does not work, make sure via your National Committee that you are an IPS member and contact susann.warnecke@peatsociety.org.

IPS and related peat and peatland events

International Peat Society | IMTG MTC

IPS Convention 2013 at the ISHS-IPS "International Symposium on Growing Media and Soilless Cultivation"
17 - 21 June 2013 in Leiden, the Netherlands
www.peatsociety.org/events/leiden2013
www.grosci2013.wur.nl

Polish National Committee and Commission III
Workshop Fen Peatlands after Drainage for young scientists and PhD students
Solec, Warsaw, Poland, 9 - 11 July 2013
www.uwm.edu.pl/gleba/IPSC3/

INTECOL 2013: Into the next 100 years
London, United Kingdom, 18 - 23 August 2013
www.intecol.org

Lithuania Peat Association
Baltic Peat Producer Forum 2013
Vilnius, Lithuania, 4 - 6 September 2013
www.asocdurpes.lt/en

UK National Committee: War & Peat - The military heritage of moors, heaths, bogs and fens
Sheffield. UK, 4 - 6 September 2013
www.ukeconet.co.uk

Finnish National Committee (Suoseura)
Autumn excursion to Central Ostrobothnia
16 - 17 September 2013
www.suoseura.fi

German Peat Society (DGMT): Annual Assembly
Freising, Germany, 25 - 27 September 2013
www.dgmtev.de

Finnish National Committee (Suoseura)
Member meeting and Seminar
Finland, 15 October 2013
www.suoseura.fi

German Garden Industry Association (IVG)
48th German Peat Day
Bad Zwischenahn, 24 October 2013
www.ivg.org

IPS Excecutive Board Meeting
Tallinn, Estonia, 28 - 29 October 2013

Finnish National Committee (Suoseura)
Autumn meeting and Seminar
Finland, 19 November 2013
www.suoseura.fi

Responsible management of peatlands: implications of the industrial sector
Québec, Canada, 19 - 20 February 2014
www.gret-perg.ulaval.ca

German Peat Society (DGMT)
Peloid Congress
Bad Kohlgrub, Upper Bavaria, spring 2014
www.dgmtev.de

German Peat Society (DGMT)
Conservation and restoration of mires in Thuringia
Oberhof, Germany, 25 - 26 June 2014
www.dgmtev.de

International Peat Technology Conference
Riga, Latvia, 26 - 29 August, 2014

UK National Committee
'In The Bog' - peatlands as ecological and cultural landscapes
Sheffield, 1 - 3 September 2014
www.ukeconet.co.uk

German Peat Society (DGMT)
Utilisation of Peatlands for Tourism and Environmental Education
Bad Wurzach, Germany, 24 - 26 September 2014
www.dgmtev.de

15th International Peat Congress "Peatland in Harmony - Agriculture, Industry, Nature"
Kuching, Malaysia, 15 - 19 August 2016

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To inform us about future happenings of interest for IPS members, please contact ips@peatsociety.org.

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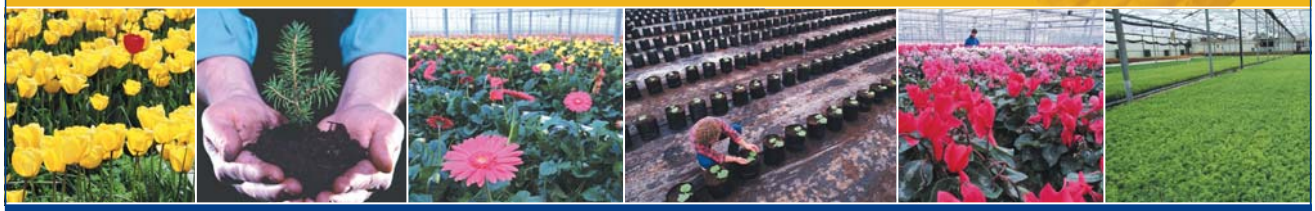

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