Saying one thing, doing another: Are you peat-free?

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Amongst the most important roles botanic gardens offer is the conservation of plant life and education on environmental threats. If this statement is true, then the use of peat in compost mixes is counter-intuitive. Peatlands represent one of our most threatened habitats and contain some of our rarest species. Botanic gardens can play a major role in preserving this ecosystem by educating commercial and hobby gardeners that effective peat alternatives exist.

Coconut products are the preferred alternative at the National Botanic Garden of Belgium (NBGB). It is made of the waste material from the coconut shelling industry and is a superb alternative to peat. We have successfully utilised this product as the major constituent of compost mixes over the past seven years. During this period, mixes have been carefully adapted to suit the needs of particular taxa while our horticultural staff adapted to cultivating plants in this medium. We successfully grow over 10,000 taxa in coconut-based media, the only exceptions being carnivorous plants and rhododendrons. We present the case that all gardens should be peat-free.

One of the major roles any botanic garden can play is in educating the public about the perils facing plants and their habitats. Education results in peoples' increased awareness of issues but can also lead to direct action. Strong media campaigns and peer pressure are ideally required, with these two elements significant advances can be accomplished. A good example where this can be achieved is by campaigning against the continued use of peat by the horticultural industry. However, institutes must be aware that in promoting this notion they themselves need to act responsibly rather than *saying one thing, doing another*. This manuscript sets out the argument against using peat, shares the experiences of the NBGB's endeavour to remain peat-free, and offers a sample press release to enable other gardens to spread the word.

Peat in horticulture

Peat has been used for over 40 years in horticulture. The nature of this material makes it in many ways an ideal resource to exploit commercially. It is easily extracted (once a peat bog has been drained), provides a lot of material from a relatively small area and when dry has a very small weight to volume ratio, thus reducing transportation costs. The material is also generally uniform in nature and relatively free from pests and diseases. It has the additional bonus of being nutrient-poor that makes it possible, by adding fertilizer, to produce a wide-range of standardised mixes. It is also a clean and pleasant material to work with, relatively cheap and has the advantage that people have had over 40 years to learn how to grow plants in this medium. Without doubt, peat is valuable to horticulture. Therefore it is worth revisiting why the use of this important and reliable horticultural commodity should be discontinued.

A globally threatened habitat

Peatlands (*senso lato*) are found on every continent except Antarctica. It covers an estimated 3% of the global landmass (Peatlands, 2007a). Yet this percentage represents a fraction of its former extent. The area of this habitat has declined dramatically over the last few centuries. Humans have, and continue to exploit peat (and the land it occupies) for fuel, agriculture, afforestation, and in recent times commercial horticulture. In many Western European countries only a fraction of its former extent remains. In the Netherlands, pristine peatland habitat has all but disappeared (Alfons *et al.* 2002) a similar situation occurs in Britain and Ireland (Tallis 1998), Switzerland (Grunig 1994), Finland (Schilstra 2001) and in Belgium (*pers. comm.* Leo Vanhecke, NBGB). The peatlands of Eastern Europe currently face considerable threats by the eastward

expansion by Western European peat mining companies (Peatlands 2007b). Unfortunately, the over exploitation of this habitat is not confined to these regions.

In Asia, China has a considerable wealth of internationally important peatlands with an estimated three million hectares. Current estimates however, suggest that only 25% remain undisturbed (Annotated Ramsar List). In Malaysia and Indonesia changes in land use has resulted in large areas of peatlands being converted into palm oil plantations (Inubushi et al. 1998) while fires that burn for years destroy other areas (Hirano *et al*. 2007). In the continent of Australia this habitat is relatively rare, but still suffers from peat mining for horticulture (Bilney 1997). The same situation is true in North America (United States Environmental Protection Agency) whereas the disappearing high peatlands of the tropical Andes in South America are being carefully monitored in a program initiated by the IUCN (IUCN 2003).

The harvest of peat is unsustainable. The formation of many of today's peatlands began around 10,000 years ago. Its rates of accumulation vary considerably depending on the age and type of peatland along with the prevailing climate. Figures of growth ranging between 0.7 – 12cm *per* century are not uncommon (Chambers 1984). This literally means that once this habitat is gone, it is lost forever. One study demonstrated the unsustainability of peat exploitation in Finland and concluded that peatland 'growth' was 85 times slower than its harvest (Schilstra 2001). The International Mire Conservation Group (IMCG) in co-operation with the International Peat Society (IPS) has developed a number of guidelines for the better use of peatlands. However, real improvements are not expected until guidelines are written in statute. Despite this realisation, in December 2006 the European Parliament adopted a last minute amendment resolution that defined peat as a long-term renewable energy source (EU Resolution on a Strategy for Biomass and Biofuels (2006/2082, INI)). This amendment if left unchallenged will legitimise the wholesale exploitation of some of the last remaining examples of this habitat in Europe.

The destruction of peatlands has implications far beyond this habitat type. The slow decomposition of organic matter means that peatlands are carbon stores (Inubushi *et al*. 2003) retaining this element from thousands of years of plant life.

Fig. 1 Peat exploitation in the nature conservation area of Ewiges Meer, East Frisia, NW Germany.

Once damaged, peatlands leak carbon dioxide (CO^2) into the atmosphere contributing to the causes of global warming. It is estimated that these habitats contain 30% of the world's soil (550 gigatons) carbon (UNEP-GEF Assessment on Peatlands, Biodiversity and Climate Change, *in press*). Furthermore, the amount of this element stored in the peatlands of Europe, Siberia and North America is equivalent to 70 years of current global industrial emissions (Pearce 2004). If the rates of damage to peatlands continue it is postulated that by the middle of the twenty-first century Co^2 emissions from this habitat will become one of the major contributors to atmospheric carbon (Freeman *et al.* 2004). Therefore, it is up to the horticultural sector to do its bit and act responsibly.

Curtailing the use of peat in horticulture

Despite the arguments against using peat, industries that 'promote' plant life continue to embrace its use. Worldwide peat forms around 85 - 90% of growing media (Joosten 2005) which amounts to around 38 million m^3 (*pers. comm*. Hein Boon, RHP Foundation). Peat is essentially a filler material, which nutrients must be added to promote plant growth. In order to be a realistic alternative, substrates must process the same good qualities as peat. Essentially these are;

- good aeration
- good water-holding capacities
- an acceptable degree of maturity that avoids microbial growth resulting in an anaerobic root zone (Abad et al. 2001; Fitzpatrick et al. 1998).

There are a number of peat-free alternatives that can fulfil these criteria, such as composts based on pine bark, dried sewage sludge, composted garden waste, rice hulls (*Oryza* sp.) and fibres from the husks of coconuts (*Cocos nucifera* L.). Generally alternatives are not well promoted, and as a consequence consumer demand is generally low.

Coir the realistic alternative to peat

Coconut products are the leading competitor to peat and the material of choice at the NBGB. Until its merits as a peat alternative was realised in the 1980s, coconut husks were a waste material from the coconut shelling industry and caused major disposal problems in Sri Lanka, India, Philippines, and Indonesia. The product suitable to horticulture is called coir. Coir refers to the fibre that constitutes the thick mesocarp or husk of the coconut fruit. It is composed of pithy tissue particles and short and medium length fibres (Thompson 1990). In order to make the fibres easier to separate fruits are often soaked in brine. This means that the excess salinity needs to be removed from the product before being suitable for horticulture (Evans et al. 1996; Handreck 1993). Some studies have shown that high salt levels can be problematic for the cultivation of some species (Ma & Nichols 2004). This has been due to the leaching of calcium and magnesium and high concentrations of potassium and sodium (de Kreij & Leeuwen 2001). As a consequence coir products require buffering with calcium and magnesium and other elements. Further, the coir should also be washed, to remove salt concentrations along with sodium and potassium ions (the latter a consequence of the buffering process). When obtaining a supplier for coir-based compost it is important to first ask if the medium has been washed and buffered, otherwise plants will not grow well.

Coir can absorb water 1000 percent its own weight yet is able to maintain a high air content, of the two types of coir available from coconut husks fibres are most suited to short-term cultivation (one or two years). Pith is more suited to long-term use (five years). The reason for the difference is that pith contains high lignin contents and decomposes slowly, whereas the fibres are high in cellulose that degrades more readily.

Another material that can be derived from coconut husks is coco chips. These are produced by cutting husks into small pieces. They can be purchased in three different grades according to size and are suitable for soil conditioning or adding to pith and fibres to improve the drainage of compost mixes. It is also suitable for epiphytic plants such as orchids. Currently, coconut derived products are under-utilised in horticulture with only one million m^3 is sold annually, despite the amount of material that is potentially available to be estimated at 65 million m^3 (*pers. comm*. Hein Boon, RHP Foundation).

Peat-free gardens

There are a number of European initiatives that certify potting composts for their green credentials. In the UK, the 'John Innes Foundation' decided that 'John Innes Composts' (a commonly used standard mix in UK horticulture) needed to be redeveloped to reflect the needs of both gardeners and the environment. They subsequently launched the brand 'Genie Composts' that contains no peat, loam or synthetic chemicals. All the constituents of the compost are natural and organic and sourced from within the UK. There are similar

movements in the Netherlands with the RHP Foundation (a national institute for certifying potting soils) are planning to ratify new growing materials. The project called 'Basiq Green' is under development, but intends to evaluate the influence of the substrate on the environment by comparing life cycle analysis on raw materials, the major parameters are greenhouse gasses and human toxicants (*pers. comm.* H. Boon, RHS Foundation).

With genuine concerns about the environment and conservation a number of botanic gardens have already adopted a peat-free policy, e.g. The Royal Botanic Gardens, Kew and the Mount Annan Botanic Garden (Coghlan 1992; Offord *et al*. 1998, respectively), while the Royal Botanic Garden Edinburgh is mainly peat-free (Rachel O'Conner, *pers.comm*.).

The NBGB has never used peat as a main constituent to compost except for certain difficult-to-grow Ericaceae and carnivorous plants. Historically, the bulk of compost mixes were comprised of leaf mould, composted manure, composted turf and Rhine sand with a base fertilizer. However, in the late 1990s some of these products became difficult to source and their variable quality meant that standardised composts were not always achievable. In 1998, alternatives were investigated for their suitability. The simplest solution would have been to utilise peat composts which were readily available from a number of suppliers. However, it was decided that the use of this material would be counter-intuitive to our institute's ethics and in contrast to our mission statement. After an intensive search a single supplier was found that could provide a coir-based compost, although this was only achievable *via* the Netherlands.

The first consignment of coir was utilised in the planting beds of the glasshouses as part of our ongoing restorations program. Subsequently, a range of potting mixes were developed and now all former composts have been replaced with those based on coir. This translates to around 10,000 species growing in this media with the only exceptions being rhododendrons, heathers, carnivorous plants and orchids.

The change in compost mix also meant a change in plant husbandry for the garden staff. The main difference was getting used to a new watering regime as coir has a much greater water-holding capacity compared to the former substrate. Another problem arose concerning the type of clay initially used which separated out from the mix and formed a layer at the bottom of the pot impeding drainage. Subsequently, a granular clay was selected (Swedish Bara clay) and up until now this has proved satisfactory.

In total, five main mixtures (see Table 1) have been produced that provide different properties for different groups of plants and situations (i.e. glasshouse beds or pots). Broadly speaking, the standard mix is used for the majority of plants in containers, but with slight modifications depending on the specific requirements of certain plants. For example, a small amount of leaf mould, perlite, charcoal and moss peat is added to plants such as begonias, gesneriads, bromeliads, Araceae and epiphytic ferns. Whereas succulents receive the standard mix plus washed sand, quartz sand, argex and grit. The Mediterranean compost mix was designed specifically for plants that come from areas with low phosphate and calcium. The three planting bed mixes have done well; however, with experience changes are necessary, for example, a new tropical planting bed mix will probably resemble our sub-tropical mix with a higher fraction of bark when next ordered. This highlights that gardeners must be vigilant when using new compost mixes and that an ideal mix can take a while to achieve.

	Potting mixes		**Planting bed mixes**		
Material	**Std. mix**	**Med. mix**	**Succ. mix**	**Sub-trop. mix**	**Trop. mix**
coco pith	45%	50%	25%	40%	25%
coco fibre	35%			25%	
coarse clay*			30%*		30%
granular clay	80kg/m³	10kg/m³		10kg/m³	
volcanic grit	20%	15%	25%	15%	
washed sand			20%		20%
coarse grade bark 1-5cm					25%
fine grade bark				20%	
bark litter		35%			
Fertilizer					
base fertilizer 1kg/m³ Pgmix 15-10-20	✓		✓	✓	✓
slow release fertilizer					
4,5 kg/m³ 15-9-9-3 12/14 months	✓				
Trace elements 0,2 kg/m³				✓	
MED fertilizer		✓			
pH	6 - 6.5	5.5	5.9	5.5	5.7

Table 1. The five most used coir-based compost mixes developed at the NBGB. 'Std. mix' = standard mix; 'Succ. mix' = succulent mix; 'Trop. mix' = tropical mix; Sub-trop. mix = subtropical mix; 'Med. mix' Mediterranean mix. '✓' signifies its use in the compost mix. The percentage refers to the quantity by volume. '' = course clay is no longer used at NBGB because it tended to get washed to the bottom of the pot causing drainage problems.*

Mixes based on coir products have been successfully used at the NBGB. This has only been possible with close cooperation with our supplier and vigilance from gardeners. We believe that other gardens should follow and reframe from using peat products whenever possible. In a relatively small country like Belgium it has been a struggle to find sources for coir. However, we now feel empowered to extend our success story beyond our garden and into the amateur arena in an attempt to increase the availability of peat-free alternatives in retail outlets. Currently, only a few Belgian companies offer coir based growing media. Two provides peat-free compost whereas the other offers it only as a component to their peat mixes.

Spreading the word

Because of the huge disparity in the availability of peat and peat-free alternatives, the NBGB launched a campaign to try and create more demand, and hence better availability of peat-free products in Belgium.

Consequently, a press release was written and sent to all news agencies in the country. We believe this initiative should be adopted by other gardens. In order to help facilitate this we have prepared a standardised press release that we hope might aid other gardens (Box 1). In preparation of this press release we consulted with two different media agencies, the British Broadcasting Corporation (BBC) and the international trade journal Horticulture Week. These agencies were selected for three reasons, firstly because the UK media has a proven track record in promoting peat-free products; secondly, the two types of media appeal to different audiences, namely hobby gardeners (BBC) and professionals (Horticulture Week) and finally because one of the authors of this manuscript has good contacts with both organisations.

The main features highlighted by the press authorities were as follows:

- Press releases should be short and concise (around 250 words is ideal).
- Grab the attention of your audience by explaining the main aim of the press release in the first sentence or two.
- Place associated information as bullet points after than weave it into the main body of text.
- Focus on items that most people would have heard of, e.g. use the Venus fly trap as a plant from peatland habitats.

With these criteria in mind, the following release was written, for which we are happy to share and allow other institutes to adapt to their own needs.

What's all the fuss about peat-free products?

Gardeners are contributing to the destruction of natural habitats through ignorance of the effects of the destruction of peat bogs. Nine out of ten bags of compost bought from garden centres this year will be peat-based. Many plant lovers fail to realise that buying this kind of product contributes to the loss of plant life in nature.

The …….. Botanic Garden is spearheading a campaign to enlighten gardeners to the damage peat extraction causes on the environment. Peatlands are one of the world's most endangered habitats. They provide homes for unique plants that entrap and digest insects to supplement their diet, such as the Venus fly trap and sundews. If extraction continues plants like these will be lost forever from the wild.

"Every bag of peat sold directly represents the loss of habitat that will never be replaced; its use in gardening is dreadful, especially as excellent alternatives exist. The fact that plant-lovers use this product is counter-intuitive, pushing plants and animals further towards extinction. Further, the damage caused by peat extraction releases Co^2 into the atmosphere increasing our carbon footprint. " said ……..

Peat alternatives exist. Composts based on coconut fibres are one of the leading alternatives. This product is derived from the waste material of the coconut shelling industry and is ideal for almost all plants.

However, it is not always easy to find in the shops, therefore the ……..Botanic Garden is requesting "gardeners to act responsibly and demand peat-free alternatives, and if they are not available, request it. This is the only way to create its demand and regular position on the shelves of garden shops." says ……...

notes for editors

1) Peatlands are a unique and highly endangered natural habitat.

2) Many of our peatlands are over 10,000 years old, formed by slowly rotting plant material.

3) Peatlands are dried prior to commercial extraction. This allows carbon (locked in the ground over thousands of years) to be released as Co^2, the gas responsible for climate change.

4) Co^2 emissions from dried peatlands will become one of the major contributors to atmospheric carbon.

5) The amount of carbon locked in peatlands is the equivalent to 70 years of current global industrial emissions.

6) Some countries have lost 100% of their pristine peatlands.

Box 1 Standardised press release

Concluding remarks

Peat is almost an integral material to modern horticulture, for good reason, it is an excellent material to base a compost. However, its extraction from one of the world's most endangered ecosystems is unsustainable and contributes dramatically to the causes of climate change. It is therefore up to botanic gardens to lead the way, go peat-free and communicate this message to the wider public. Botanic gardens are in a strong position to do this and must act in this responsible way. Environmental education is one of the main ways our institutes can contribute to conservation. Let's say and do in unison.

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References:

Abad, M. Noguera, P, Bures, S. 2001, National inventory of organic wastes or use as growing media for ornamental potted plant production: case study in Spain *Bioresource Technology, 77,* 197-200.

Annotated RAMSAR List, 06/04/2007, www.ramsar.org/profile/profiles_china.htm

Bilney, E. 1997, Australian Peatlands, *Wetlands Australia, 6,* 6-7.

Chambers, F.M. 1984, *Studies on the initiation, growth-rate and humification of 'blanket peats' in South Wales.* Occasional paper 9, Department of Geography, Keele University.

Coghlan, A. 1992, Britain backs coconut composts. *New Scientist 28*, 18.

de Kreij C & Van Leeuwen G. J. L. 2001, Growth of pot plants in treated coir dust as compared to peat. *Communication of Soil Science Plant Anals. 32*(13&14), 2255–2265.

Evans, M.R. Konduru, S. Stamps, R.H. 1996, Source variation in physical and chemical properties of coconut coir dust. *HortScience, 31*, 965–967.

Freeman, C. Fenner, N. Ostle, H. Kang, N. J. Dowrick, D. J. Reynolds, B. Lock, M. A. Sleep, D. Hughes, S. & Hudson, J. 2004, Export of dissolved organic carbon from peatlands under elevated carbon dioxide levels. *Nature 430*, 195.

Fitzpatrick, G.E, Duke, E.R., Klock-Moore, K.A. 1998, Use of compost products for ornamental crop production: research and growers experiences. *HortScience, 33*, 941-944.

Handreck, K.A. 1993, Properties of coir dust, and its use in the formulation of soilless potting media. *Communications in Soil Science and Plant Analysis. 24*, 349–363.

Hirano, T., Segah, H., Harada, T., June, S., Hirata, R., Suruosaki, M. 2007, Carbon dioxide balance of a tropical peat swamp forest in Kalimantan, Indonesia, *Global Change Biology 13*, 412–425.

Inubushi, K. Furukawa Y., Hadi A., Purnomo E., Tsuruta H. 2003, Seasonal changes of Co^2, CH^4 and N_2O fluxes in relation to land-use change in tropical peatlands located in coastal area of South Kalimantan, *Chemosphere 52*, 603–608

Inubushi, K., Hadi, A., Okazaki, M., Yonebayashi, K., 1998, Effect of converting wetland forest to sago palm plantations on methane flux and organic carbon dynamics in tropical peat soil. *Hydrological Processes, 12*, 2073–2080.

IUCN 2003, Peatlands in the Tropical Andes, towards an international socio-environmental monitoring system *05/04/2007*: *www.iucn.org/en/news/archive/2001_2005/press/peatlands.pdf*

Joosten, H. 2005, And what about peat? EU eco-labels under revision. *International Mire Conservation Group Newsletter, March, 12-17.*

Ma Y. B. & Nichols D. G. 2004, Phytotoxicity and Detoxification of Fresh Coir Dust and Coconut Shell, *Communications in soil science and plant analysis, 35,* 1 & 2, 205–218.

Offord, C. A. Muir S. & Tyler J. L. 1998, Growth of selected Australian plants in soilless media using coir as a substitute for peat *Australian Journal of Experimental Agriculture, 38*, 879–87.

Pearce, F. 2004, Peat bogs harbour carbon time bomb*, New Scientist,* 07 July.

Peatlands, 2007a, 05/04/2007. *www.peatlandsni.gov.uk/formation/global.htm*

Peatlands, 2007b, 05/04/2007. *www.peatlandsni.gov.uk/formation/euro.htm*

Resolution on a Strategy for Biomass and Biofuels (2006/2082, INI).

Schilstra, A.J. 2001, How sustainable is the use of peat for commercial energy production? *Ecological Economics, 39* - 2 – 285.

Tallis, J.H. 1995, *Blanket mires in the upland landscape. In Restoration of temperte wetlands*. Edited by B.D. Wheeler, S.C. Shaw, W.J. Fojt, and R.A. Robertson. Wiley, Chichester. 495-508.

Thompson, P.B. 1990, *The structural Biology of Palms*. Clarenden Press, Oxford.

UNEP-GEF in press, *Assessment on Peatlands, Biodiversity and Climate Change*.