Mosses in gardens: a case study from Norfolk

Before embarking on a survey of bryophytes in domestic gardens, it is necessary to define precisely what constitutes a 'garden'. However, as **Robin Stevenson** highlights in this article, despite the fact that gardens do not form a single type of habitat, it is nevertheless interesting to study the range of species that do occur in the immediate environment around our homes.

In the last issue of *Field Bryology*, Des Callaghan (Callaghan, 2007) issued an appeal for records of mosses from gardens and rooftops, something I had also been working towards; my approach is sufficiently different, I hope, to justify another article on the same topic, so soon after his.

In a study of the bryoflora of King's Lynn (Stevenson & Hill, 2008) I had looked at mosses in a number of gardens, so I was interested in the treatment of the topic in two recent books, *Mosses & Liverworts* (Porley & Hodgetts, 2005), and *Garden Natural History* (Buczacki, 2007).

Porley & Hodgetts did not define what they meant by a garden; Buczacki, however, does. His definition, taken from the OED, and subject to various qualifiers, does not fully take account of the complexity of gardens, even though this topic was explored, in some depth, by Gilbert (1989). It also excludes many areas, such as public parks, which, except for the absence of associated dwellings, are managed in virtually the same way as gardens. Nor does he mention the (often extensive) gardens associated with larger rural properties, which may grade off into semi-natural habitats. The 'gardens' surrounding buildings such as hospitals and factories have also been excluded, as have parks, yet in essence there is nothing to separate them from purely domestic gardens. In view of these uncertainties, it would seem wise to define very precisely what is to be studied, lest one get bogged down in semantic quagmires of one sort or another. I would suggest a garden is: any area enclosed within the curtilages of a private domestic dwelling which may be cultivated either for aesthetic or culinary purposes, or, at the whim or discretion of the owner, be devoted either in whole or in part, to uses other than horticultural, e.g. hard-standing for motor vehicles.

In my study of the bryoflora of King's Lynn, I tried to sample as many gardens as possible, but quickly realized that there were huge differences between them, mainly resulting from socio-economic and cultural factors – none of which are discussed either by Buczacki or by Porley & Hodgetts. Table 1 attempts to list those factors that are likely to have an affect on potential bryofloras. For all of these factors, the relative size/abundance is potentially significant, as are the management levels, which may range from neglected to intensive.

The tiny gardens associated with Victorian inner-city housing, or the neglected wildernesses associated with some areas of public housing, offer far fewer possibilities for bryophyte colonization than the larger grounds of middle-class suburbia, whilst the extensive gardens of the the rural gentry offer even greater opportunities. Buckingham Palace Garden (Wiltshire, 1999) has produced 60 species.

However, size is not everything: a large area of pure lawn may yield far fewer species than a

◁ Mosses growing on an old rhubarb forcer. *Ian Atherton*

Table 1. Factors of possible significance in determining the bryophytes present in gardens

House style	Detached/semi-detached/terraced/private estate/public estate/ historical urban complex
House age	Pre-Victorian/Victorian/Edwardian/Interwar/Modern
Size	
Soil type	Sandy/loam/clay/calcareous – pH?
Planting styles and management	Lawns Trees: size, number, bark chemistry Shrubs: size, number, bark chemistry Perennial beds: low levels of soil disturbance? Annual beds: higher levels of soil disturbance? Rockeries: geology of stones used, i.e. acid / basic (to include sinks, pots, ornaments and edgings) Shingle paths Concrete paths/patios/hard standings Rotting wood, including sheds and pergolas? Ponds & surrounds Boundaries: hedges/walls/lap fencing/porous wood/wire Neighbours: shading by trees/weed invasion/waste ground/rural Herbicides: used/not used Greenhouses: distinguish between hot and cool?

smaller, but more varied, area. Old lawns, based on mature soils may, however, yield surprises such as *Thuidium philibertii* (Preston & Hill, 2005). Varied habitats such as rockeries, ponds, etc., created by keen gardeners, offer more possibilities than gardens designed purely for ease of management. Planting preferences might also play a part in controlling bryofloras; beds of perennials and shrubs will, presumably, be less affected by regular soil disturbance than regularly weeded annuals or vegetables, and it should also be borne in mind that many bryophytes are quite transient in appearance. What is actually present may be less than the full potential bryoflora.

Other factors not discussed in the two general accounts of Buczacki and Porley & Hodgetts are soil type and climatic differences. Presumably gardens in the wet west will host a rather different suite of plants than gardens in the dry east – assuming that they are managed in similar ways, and have a similar range of micro-habitats present.

Similarly, no distinction has been made between urban and rural gardens. I have not examined any rural gardens, but common sense would dictate that they should differ, even if only subtly, from urban gardens. A greater proximity to potential propagules seems likely, if nothing else.

Curiously, none of these authors make any reference to the specific cultivation of mosses. However, even in Britain various attempts at the cultivation of mosses for decorative purposes have taken place. Pearman (1982) has given an account of a 19th century cryptogamic garden at Chatsworth House, whilst Hunt (1964) provides more details about the creation of 'moss houses', and Smee (1878) discusses the difficulties he experienced in establishing a 'mossery'.

Smee provides what must be one of the earliest lists of specifically garden bryophytes (14 mosses and 1 liverwort), whilst Chinery (1977), discussing gardens in general, lists 9 moss and 2 liverwort species. Buczacki lists some 26 species of mosses and 9 species of liverworts as occurring in gardens. Porley & Hodgetts suggest a 'fairly ordinary suburban garden might … support 20–30 species'. However, they do not discuss these in any detail, preferring to concentrate on alien introductions in gardens.

Buczacki lists a series of micro-habitats within gardens, but only names and discusses bryophytes for some of these, viz. lawns, paths and paving, walls, open soil, cloches and greenhouses, and 'orchards'. They are neither listed nor discussed in relation to mulched soil (one of his listed micro-habitats), rockeries, specimen trees (other than apples), or ponds – habitats which occur relatively frequently in gardens.

Results of the Norfolk study

Appendix 1 shows the results of sampling 26 gardens in Norfolk. Twenty of these were in or around King's Lynn itself; four from Watlington, one from Downham Market and one from Norwich. The majority of these were medium- to large-sized gardens. The levels of maintenance varied, though none were very neglected. A few had ponds and/or rockeries.

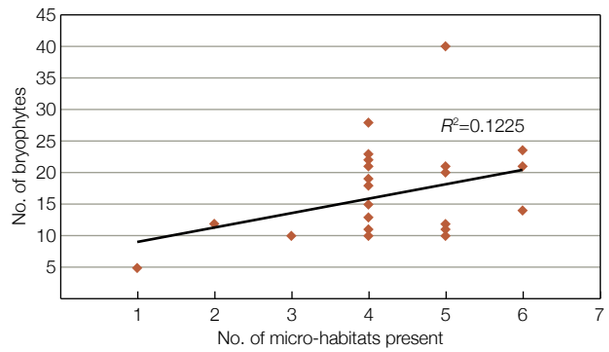
The average number of species per garden (including the Plantation Gardens in Norwich) is 16 – distinctly fewer than the 20–30 species suggested by Porley & Hodgetts. However, this low figure may simply reflect conditions in the relatively dry east of the country, though it would be interesting to have real figures for other parts of the country.

Common sense dictates that there ought to be a relationship between the number of micro-habitats available, and the number of bryophytes. A rather crude attempt to investigate this relationship is shown in Fig. 1.

As can be seen, the relationship between bryophyte numbers and the number of micro-habitats is not very strong (Fig. 1). However, the micro-habitats used were limited and crude. Trees and shrubs, for instance, were lumped together when it might be more appropriate to have used a scale which took into account the number, size, and bark chemistry of the species involved. A more sophisticated approach to the recording, and to the data analysis, might well prove more illuminating.

Examination of the data in Appendix 1 reveals some interesting features. First, they suggest that garden bryofloras are rather richer in species than indicated by Buczacki, although not, perhaps, as rich as suggested by Porley & Hodgetts. There is, however, considerable variation.

Size, and the richness of micro-habitats present, is clearly significant – as the high total for the Plantation Gardens in Norwich shows. The



△ Fig. 1. The relationship between the number of micro-habitats, and the number of species present, in the Norfolk gardens sampled. For this exercise the number of micro-habitats was simplified to just 6 (lawns; trees & shrubs; cultivated beds; rockeries and other hard surfaces; ponds; rotting wood) each of which was given a value of one.

lowest totals are associated with gardens managed for convenience, rather than as temples to flora.

The number of species which are virtually ubiquitous, e.g. *Brachythecium rutabulum*, *Bryum capillare*, *Eurhynchium praelongum* and *Tortula muralis* (Fig. 2) is fairly small, though there are a larger number of widely distributed species, e.g. *Amblystegium serpens*, *Bryum argenteum* and *Ceratodon purpureus*.

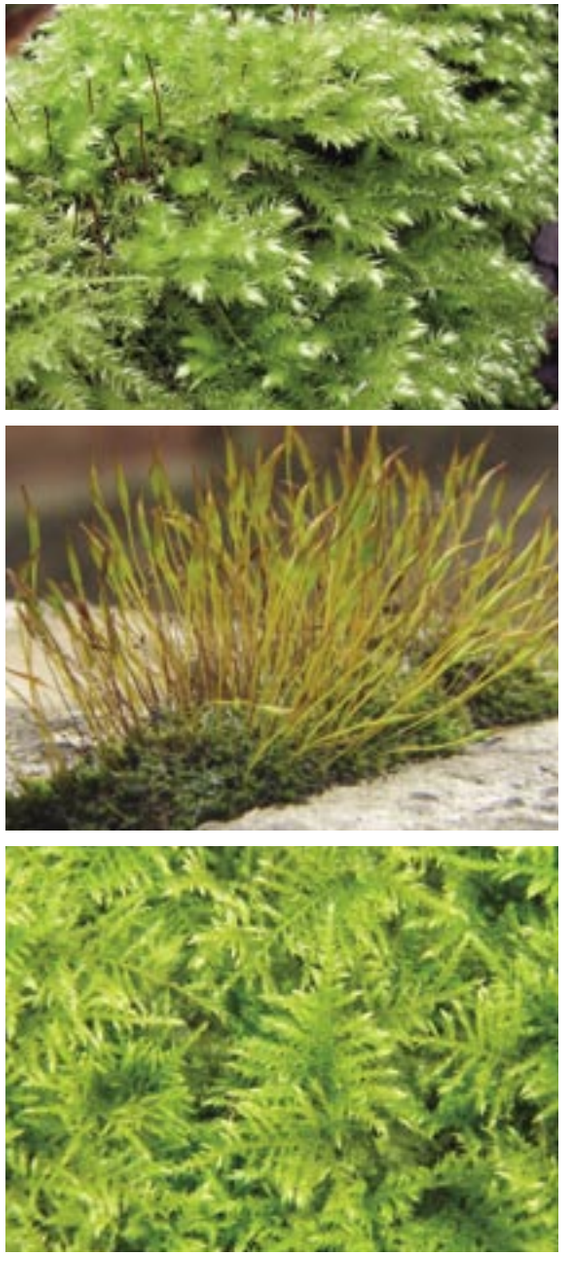
Notably, and inexplicably, many of the common weedy species which one associates with bare or disturbed ground in urban settings are rare. Why so few Didymodons for instance? The relative absence (or rarity) of typically arable species such as *Dicranella staphylina* and *Tortula acaulon* is also curious, but may reflect an inability to cope with the higher levels of disturbance found in gardens, as opposed to arable fields.

Soil chemistry is also clearly important, as in the distribution of *Atrichum undulatum* which is restricted to gardens based on acid sandy soils occurring in the northern suburbs of King's Lynn. In these gardens it occurs in lawns, rather than the 'open soil' that Buczacki lists. This presumably reflects his personal experience, rather than anything else, as does his inclusion of *Anthoceros punctatus* in his list of (neglected) lawn species.

The presence of specialist garden features such as rockeries and ponds is also important, the types of rock present in the former being particularly significant. Limestone in Norwich has enabled plants to survive, long after their original importation on the particular stone, whilst acidic local sandstone has enabled species such as *Polytrichum juniperinum* to penetrate deep into King's Lynn itself, where the soils are dominantly neutral. *Drepanocladus aduncus* is clearly a pond-side plant.

Some of the species listed by Buczacki seem, in the context of East Anglian gardens, to be rather unlikely. *Anthoceros punctatus* has already been remarked upon, whilst *Conocephalum conicum* occurs mainly in semi-natural habitats, usually close to water. *Hypnum jutlandicum* seems unlikely to occur at all regularly as a lawn moss whilst *Lepidozia reptans* seems a curious candidate for open soil – stabilized peaty banks, perhaps, but open disturbed soil, no.

Leptodictyum riparium may well occur in some damp greenhouses, but I would doubt that it occurs regularly, and the same is true for *Metzgeria furcata* and *Plagiochila asplenioides* on walls – surely these are very atypical occurrences?



△ Fig. 2. Three ubiquitous species of gardens – *Brachythecium rutabulum* (top), *Tortula muralis* (middle) and *Eurhynchium praelongum* (bottom). *Des Callaghan (top) and Ian Atherton*

Proposal

Although domestic gardens constitute a highly variable 'habitat', and one which is not subject to easy analysis, it would still seem like a good idea to collect some hard data about what actually occurs in them. Other biologists (e.g. Owen, 1991) have established that gardens are valuable refuges for the taxa they are particularly interested in, and there is currently much interest in exploring this habitat, e.g. Gaston *et al.* (2004) who describe the BUGS project, the website for which was given by Des Callaghan. His proposal in the last issue of *Field Bryology* is a valuable one, which I commend. I would only suggest that any lists submitted to him be accompanied by as much of the data I have listed in Table 1 as possible.

I would also add that the easiest way to sample rooftop floras is often immediately after a heavy rainstorm, when things get flushed down the drain pipes, or when birds have been rootling about on the roof; far safer than messing about on ladders! I would also note that recording the aspect of a roof is significant.

C. Robin Stevenson
111 Wootton Road, King's Lynn, Norfolk PE30 4DJ
(e crs1942@tiscali.co.uk)

Acknowledgements

I am grateful to those former colleagues at The College of West Anglia in King's Lynn who allowed me access to their gardens, also to Frances Schumann, who, in addition to helping with the fieldwork, arranged access to many gardens. My thanks are also due to Ron Payne who arranged visits in Watlington and Downham Market, and to Bob Ellis, John Mott and James Goodwin who helped with the recording of the Plantation Gardens in Norwich. Chris Preston read and made valuable comments on an earlier draft; to him too, thanks are due.

References

Buczacki, S. (2007). *Garden Natural History*. London: HarperCollins.

Callaghan, D. (2007). The bryophyte flora of our roof-tops and gardens. *Field Bryology* **93**, 48.

Chinery, M. (1977). *The Natural History of the Garden*. Glasgow: Collins.

Gaston, K.J., Smith, R.M., Thompson, K. & Warren, P.H. (2004). Gardens and wildlife – the BUGS project. *British Wildlife* **16**, 1–9.

Gilbert, O.L. (1989). *The Ecology of Urban Habitats*. London: Chapman & Hall.

Hunt, P. (ed.) (1964). *The Shell Gardens Book*. London: Phoenix Rainbird.

Owen, J. (1991). *The Ecology of a Garden*. Cambridge: Cambridge University Press.

Pearman, M.A. (1982). A nineteenth century cryptogam garden at Chatsworth. *Bulletin of the British Bryological Society* **39**, 33–38.

Porley, R. & Hodgetts, N. (2005). *Mosses and Liverworts*. London: HarperCollins.

Preston, C.D. & Hill, M.O. (2005). Bryophyte records. *Nature in Cambridgeshire* **47**, 92–95.

Smee, A. (1872). *My Garden – its Plan and Culture*. London: Bell & Daldy.

Stevenson, C.R. & Hill, M.O. (2008). Urban myths exploded: results of a bryological survey of King's Lynn (Norfolk, UK). *Journal of Bryology* (in press).

Wiltshire, E. (1999). Bryophytes in Buckingham Palace Garden 1995–1998. In *The Natural History of Buckingham Palace Garden, London*. Edited by C.W. Plant. *The London Naturalist (Supplement)* **78**, 23–26.

Appendix 1. Bryophytes in some Norfolk gardens

Abbreviations: Dow, Downham Market; KL, King's Lynn; Nor, Norwich Plantation Gardens; Wat, Watlington.

Species	Dow (TF60.04)	KL A (TF64.22)	KL B (TF64.22)	KL C (64.22)	KL D (TF64.22)	KL E (64.22)	KL F (TF61.19)	KL G (TF61.19)	KL H (TF61.19)	KL I (TF61.19)	KL J (TF61.19)	KL K (TF61.20)	KL L (TF61.20)	KL M (TF64.22)	KL N (TF64.22)	KL O (TF62.19)	KL P (TF62.19)	KL Q (TF63.22)	KL R (TF63.20)	KL S (TF64.20)	KL T (TF64.20)	Nor (TG23.08)	Wat A (TF62.10)	Wat B (TF61.10)	Wat C (TF61.11)	Wat D (TF61.10)	Total
Amblystegium serpens	1	1	1	1	1	1	1						1		1	1		1	1		1	1		1	1	1	17
Atrichum undulatum			1	1											1												3
Barbula convoluta	1	1	1	1	1	1										1	1	1	1			1				1	12
Barbula unguiculata	1						1		1		1	1						1				1					6
Brachythecium albicans	1			1								1			1								1		1		6
Brachythecium rutabulum	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	24
Brachythecium velutinum		1		1		1	1	1						1				1				1					8
Bryum argenteum	1	1	1		1			1			1									1	1	1	1	1	1	1	13
Bryum dichotomum		1															1	1					1		1	1	6
Bryum capillare	1	1		1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	23
Bryum radiculosum									1													1	1	1			4
Bryum rubens																			1	1				1	1	1	5
Calliergonella cuspidata	1		1	1				1						1		1	1			1	1	1					9
Ceratodon purpureus	1	1		1		1					1						1			1		1	1	1	1	1	12
Dicranoweisia cirrata			1			1									1											1	4
Didymodon insulanus	1			1																1		1				1	5
Didymodon luridus						1									1							1			1		4
Didymodon rigidulus															1						1	1					3
Eurhynchium hians	1	1					1		1		1				1	1						1		1			8
Eurhynchium praelongum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26
Funaria hygrometrica	1	1			1		1	1			1						1	1						1	1	1	11
Grimmia pulvinata	1	1	1	1	1	1						1	1	1			1				1	1	1	1	1	1	16
Homalothecium sericeum						1		1									1					1			1		5
Hypnum cupressiforme				1	1	1	1						1		1	1						1	1	1	1	1	12
Hypnum resupinatum		1	1		1	1		1														1		1		1	8
Lophoclea bidentata			1						1						1	1			1								5
Lunularia cruciata	1	1		1	1	1			1		1				1	1			1	1		1					11
Marchantia polymorpha				1													1							1			3
Orthotrichum affine			1																			1		1	1		4
Orthotrichum anomalum			1	1										1										1	1		5
Orthotrichum diaphanum		1	1			1		1	1			1		1					1	1		1	1	1	1	1	14
Plagiomnium affine				1											1							1					3
Plagiomnium undulatum			1	1		1							1									1					5
Pseudocrossidium hornschuchianum			1											1										1		3	
Rhynchostegium confertum		1			1		1	1			1	1	1		1	1		1		1	1	1		1	1	1	16
Rhynchostegium murale					1										1							1					3
Rhytidiadelphus squarrosus	1	1	1	1		1				1		1	1	1	1	1			1	1	1	1	1	1	1	1	19
Schistisium crassipilum					1	1									1								1				4
Syntrichia intermedia		1	1	1	1												1						1	1	1		8
Tortula acaulon	1							1																	1	1	4
Tortula muralis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26
Totals (including data below*)	21	21	18	22	18	19	12	13	10	5	11	10	10	10	20	14	13	12	10	14	11	40	15	21	28	23	

*The following were present in only 1–2 gardens: *Bryoerythrophyllum recurvirostrum* (Nor); *Bryum caespiticium* (KL L, Q); *Bryum gemmilucens* (Wat D); *Bryum ruderale* (Dow; Wat D); *Bryum* sp. (KL F); *Campylopus introflexus* (Wat D); *Cratoneuron filicinum* (KL A, D); *Dicranella heteromalla* (Nor); *Dicranella staphylina* (Wat C); *Didymodon fallax* (KL S); *Didymodon sinuosus* (Dow; Nor); *Didymodon vinealis* (Nor; Dow C); *Drepanocladus aduncus* (KL D); *Eurhynchium pumilum* (Nor); *Fissidens bryoides* (Nor); *Fissidens taxifolius* (KL O; Nor); *Gyroweisia tenuis* (Nor); *Hygrohypnum luridum* (Nor); *Leptobryum pyriforme* (KL G; Wat C); *Polytrichum juniperinum* (KL N); *Rhynchostegiella tenella* (Nor); *Sphagnum palustre* (KL A); *Syntrichia ruraliformis* (Wat C); *Syntrichia ruralis* (Dow; Wat C); *Thamnobryum alopecurum* (Nor); *Zygodon viridissimus* (Nor).