

## Ferns of Bath: past and present

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The beautiful World Heritage City of Bath nestles on slopes of the valley of the River Avon, within the Cotswold Area of Outstanding Natural Beauty, surrounded on all sides by limestone hills. Within walking distance of the city centre are several small woods, steep hills with calcareous grassland and occasional rocky outcrops, and disused quarries. The river, canal and railway provide further habitats and there are numerous parks, churchyards and cemeteries within the city. Walls of different substrates add to the variety of habitats. Many of the tall elegant Georgian houses have a basement floor, fronted by a paved basement area far below street level, which provides a sheltered frost-free environment. Within and around Bath, this composite array of terrain presents a wide variety of habitats for ferns.

### Early Records

Perhaps the earliest fern record for Bath was made by Gerard (1597), who wrote: “Lunaria or small Moonewort groweth ... about Bathe in Somersetshire in manie places”. In 1834, Charles Babington’s *Flora Bathoniensis* was published, to provide “A catalogue of the plants indigenous to the vicinity of Bath”, with the geographical scope largely restricted to within four miles of the city. He listed thirteen species of fern to be found in and immediately around Bath, giving an indication of the distribution and abundance of each species. Seven (listed below, using current names) were considered so frequent or common that no location details were given:

- Common Polypody (*Polypodium vulgare* agg.)
- Wall-rue (*Asplenium ruta-muraria*)
- Maidenhair Spleenwort (*Asplenium trichomanes*)
- Hart’s-tongue (*Asplenium scolopendrium*)
- Rustyback (*Asplenium ceterach*)
- Bracken (*Pteridium aquilinum*)
- Common Male-fern (*Dryopteris filix-mas*)

For six rarer species, he gave details of sites:

- Moonwort (*Botrychium lunaria*)
- Common Adder’s-tongue (*Ophioglossum vulgatum*)
- Oak-fern (*Gymnocarpium dryopteris*)
- Black Spleenwort (*Asplenium adiantum-nigrum*)
- Broad Buckler-fern (*Dryopteris dilatata*)
- Brittle Bladder-fern (*Cystopteris fragilis*)

In his second edition, Babington (1839) suggested that his *Polypodium* (now *Gymnocarpium*) *dryopteris* had been an error for Limestone Fern (*Gymnocarpium robertianum*), introduced with stone to the garden steps of Widcombe House, but since lost. He noted two more sites for this species outside the city, at Friary Wood near Hinton Abbey, and at Box Quarries. Babington (1839) added four other woodland ferns to his flora, taking his total to seventeen native fern species in and around Bath.

The four species added to Babington's second edition were:

- Lady-fern (*Athyrium filix-femina*)
- Hard Fern (*Blechnum spicant*)
- Hard Shield-fern (*Polystichum aculeatum*)
- Soft Shield-fern (*Polystichum setiferum*)

Hard Fern was recorded at Wyck [Wick], in Gloucestershire, a rather more distant area included by Babington for the number and rarity of plants found there. White (1912) wrote that it was "Absent from the vicinity of Bath", but still noted it at Wyck. It was recorded there by Green *et al.* (2000), but Wick is beyond the area considered here.

### Changes to the Native Fern Flora



Fig. 1 Maidenhair Spleenwort (*Asplenium trichomanes*)

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The fern flora of Bath has changed over the last two centuries, yet all of the native species known to Babington can still be found, with the exception of Moonwort and Limestone Fern. The strange, diminutive Moonwort is a scarce and declining species in England and was last found in the Bath area in 1856, at Prior Park (White, 1912). The related Common Adder's -tongue, with its single green blade and



Fig. 2 Brittle Bladder-fern (*Cystopteris fragilis*) at Upper Langridge

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tongue-like fertile spike, has also apparently declined in recent years, but does still occur on hills north of the city, at Langridge, Monkwood Valley and St. Catherine. Wall-rue and Maidenhair Spleenwort (Fig. 1) were described by Babington as frequent on walls and rocks, Rustyback was frequent on walls, Black Spleenwort more rarely so: all can be seen on walls in the city today, as can Hart's-tongue and the common species of Polypody

(*Polypodium interjectum*). The delicate Brittle Bladder-fern (Fig. 2) was known to Babington in old stone quarries on Hampton Down, on rocks above Bathford, and on an old wall near the top of Widcombe Hill. It still occurs on rocks above Bathford (at Browne's Folly) and on rock outcrops at Upper Langridge, however there have been no recent records of this species on a wall. Bracken occurs in suitably acidic spots on the hills around the city, but also in the city itself, even in basements. Common Male-fern (Fig. 3), Broad Buckler-fern, Lady-fern, Hard Shield-fern and Soft Shield-fern are all larger woodland ferns, forming typical shuttlecock shaped plants. These five species all occur in woods a short walk from the city, and with the exception of Broad Buckler-fern, they have all been found recently in streets or basements within the city. Between the publication of *Flora Bathoniensis* and the present, however, it is likely that many of these species of fern were (temporarily) lost from the city of Bath.



Fig. 3 Common Male-fern (*Dryopteris filix-mas*)

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When Babington lived in Bath, the city was an inland port, connected to Bristol in the west by the Avon Navigation, and to towns in the east by the Kennet and Avon Canal, which opened in 1810. The hey-day of canals was short-lived: in 1840 Brunel's Great Western Railway arrived. Although both canal and railway provided potential transport routes for plants, and added new habitats for several fern species, the railway in particular accelerated the development of industry in the south and west of the city. The massive rise in pollution from intensification of industry powered by fossil fuels, the use of coal for domestic fires, and the ever-increasing transport in the city, is likely to have caused a catastrophic decline in the distribution of ferns in Bath, as elsewhere, during the nineteenth and early twentieth centuries (Crouch & Rumsey, 2010). In addition, many habitats were lost due to urban expansion.

A further factor undoubtedly contributing to the decline of ferns in the nineteenth century was the Victorian Fern Craze. Just after *Flora Bathoniensis* was published, the first fern books were beginning to appear, the Wardian Case was invented, and ferns, with their lack of gaudy colours well-suited to the spirit of the Victorian age, gained popularity almost exponentially. The craze of collecting native ferns swept across Britain, nursery catalogues began to include a wide variety of native British ferns, and professional fern-collectors stripped ferns from the countryside to sell to





Fig. 4 A monstrous Hart's-tongue (*Asplenium scolopendrium*) in Bath

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collectors. More books fuelled the fern fever, fern motifs appeared on household objects and serious collectors turned to searching for unusual variants, or "monstrosities". Innumerable varieties were described for many species, for example Hart's-tongue (Fig. 4), and this resulted in even more fanatical fern-hunting. White (1912), in his *Flora of Bristol*, blamed the obsessive collecting habits of gardeners for the disappearance of Hart's-tongue in Bristol; this is likely to have been the case in Bath as well. Today, however, Hart's-tongue is one of the most regularly encountered species in Bath and other urban areas (Edgington, 2008; Payne, 2005; Middleton, 2005). Ironically some of the ferns found in and around urban areas today are likely to be the result of natural colonisation of sites from garden sources!

As a result of pollution, destruction of habitat and collection, the fern flora of Bath is likely to have been drastically depleted by the beginning of the twentieth century. Thankfully, changes in horticultural fashion and the Clean Air Act of 1956, which resulted in a decline in atmospheric sulphur dioxide in urban areas, have reversed the trend. In Bath, cleaning of buildings has revealed a substrate suitable for colonisation by ferns. In addition, the climatic limitation to plant survival is reduced in city centres, due to a "heat island" effect, whilst in Bath, as in London, such limitations are further reduced by the distinctive architecture: the deep sheltered basement areas provide a warmer, damper microenvironment for ferns.

As explained, fourteen of the native ferns listed by Babington can be found in, or immediately around, Bath today. Three other native fern species have since been found here as introductions. In 1853, Maidenhair Fern (*Adiantum capillus-veneris*) was discovered by E.J. Lowe, growing in the airshaft of a stone quarry at Combe Down, some thirty feet below the ground. It has since been found at more than a dozen other sites in Bath and persists at some long-known locations, for example at Batheaston churchyard (Fig. 5), where it was first recorded in 1930. Although Maidenhair Fern is native on wet calcareous cliffs in some western coastal sites in Britain, when found inland in urban areas it has almost certainly arisen from the spores of cultivated plants, which are not of native origin (Pryor *et al.*, 2001).



Fig. 5 Maidenhair Fern (*Adiantum capillus-veneris*) at

Batheaston church

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Although Maidenhair Fern is native on wet calcareous cliffs in some western coastal sites in Britain, when found inland in urban areas it has almost certainly arisen from the spores of cultivated plants, which are not of native origin (Pryor *et al.*, 2001).

Another rare native fern was also found nearby in 1853. Rigid Buckler-fern (*Dryopteris submontana*) is largely restricted to karstic limestones in north-west England; in 1853 J.E. Vize discovered a single plant in a quarry on Hampton Down. In a letter attached to a specimen, now in the Natural History Museum, Vize wrote that he found but four fronds: he enclosed one, another was sent to Mr. Harrison of the Botanic Gardens, Liverpool, the others he retained! Within weeks, another correspondent suggested "the possibility, if not probability, that it had been planted there by Potter, a well-known fern-collector". White (1912) also believed it to be "doubtless planted" and Roe (1981) more cautiously wrote "probably planted". Whether planted or not, this species was not seen again. Jenyns (1867) quoted T.B. Flower as having written: "I fear the locality has been destroyed by the numerous fern collectors."

White (1912) included a record for Limestone Fern on "Walls below the canal between Bath and Batheaston", found by S.T. Dunn. Babington's earlier record for this species, on the garden steps of Widcombe House, had been considered an introduction. It is possible that the plants found by Dunn had arisen naturally, as a result of long-distance spore dispersal, and could thus be considered a native fern of Bath: Limestone Fern has its Somerset stronghold in Cheddar Gorge and Goblin Combe but has colonised stonework elsewhere (Crouch, 2017).

In 1982, D.E. Green discovered two clumps of Royal Fern (*Osmunda regalis*) growing against the church wall at St Catherine, to the northeast of Bath, but they were short-lived (Green *et al.*, 2000). Like Maidenhair Fern, this species is a British native, but was probably growing here as an escape from cultivation, or was deliberately planted.

As a result of taxonomic revisions, three species of *Polypodium* are now recognised in Britain. Babington listed "*Polypodium vulgare*. Common Polypody",





Fig. 6 Sea Spleenwort (*Asplenium marinum*) at the Guildhall, Bath

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which today would be denoted as *Polypodium vulgare* agg. The plants known to Babington are likely to have been what is now Intermediate Polypody (*P. interjectum*), since Polypody (*P. vulgare*) is a plant of acidic substrates. The revision of *Dryopteris*, however, has added new native species to the list of ferns of Bath. In the nineteenth century, Scaly Male-ferns were treated as varieties of *Dryopteris filix-mas*, now they are best recognised as several different apomictic species. Two of these, Golden-scaled Male-fern (*Dryopteris affinis*) and Borrer's Male-fern (*Dryopteris borreii*) occur in woodlands and shady sites around Bath; neither has yet been found in a street or basement. There is no reason to believe that these two species were not present when Babington wrote his flora: they were just not recognised and understood at that time.

Two other native fern species, which were not included for Bath in the former floras of Murray (1896), White (1912) or Green *et al.* (2000), have been discovered recently. Narrow Buckler-fern (*Dryopteris carthusiana*) was found in 2015 in a gully in Bathwick Wood. This species differs from the widespread Broad Buckler-fern by having narrow upright fronds, forming creeping clumps, rather than having spreading fronds arising from a discreet shuttlecock. The scales on the stipe (leaf stalk) are pale and uniformly straw-coloured, with no dark stripe. It is a fern of damp acidic woodlands or heaths and is perhaps a little over-looked.

Perhaps the most unexpected native fern ever to be found in Bath though was Sea Spleenwort (*Asplenium marinum*), discovered by C. and M.A.R. Kitchen in 2018. At least fifteen plants, some quite large, were growing on the outer wall of the basement of the Guildhall, below the stone balustrade (Fig. 6). This was believed to have arrived as a result of long-distance spore dispersal, although the nearest sites are on the North Somerset coast, over 30km away. The variously-sized plants suggested that *in situ* propagation had occurred following the arrival and growth of the first spore (Crouch, 2019). Tragically, the basement wall was blasted clean of ferns and no plants could be found in 2020, but there is the possibility that spores may remain to germinate again.

### The Arrival of Aliens

During the last century, the fern flora of Bath has been augmented by the arrival of aliens. The first exotic fern to be found was Water Fern (*Azolla filiculoides*), discovered in 1939 by J.P.M. Brennan in the Kennet and Avon Canal, between Bathampton and the Dundas Aqueduct. This interesting floating fern (Fig. 7), native to western North America, was first recorded in the wild in Britain in 1883 and is now widely distributed (Preston *et al.*, 2002).

Until the 1970s it was observed to be increasing in the canal, but it has not been seen since the restoration of the canal. This pattern of expansion then rapid loss is mirrored over much of the British Isles, few sites showing any extended continuity. Recently, however, it has been recorded in the River Avon near Pultney Weir, and just outside Bath in the Mill Pond by Claverton Pumping Station and in the Ox-bow Lake at Bathampton Meadows.



Fig. 7 Water Fern (*Azolla filiculoides*) Helena Crouch

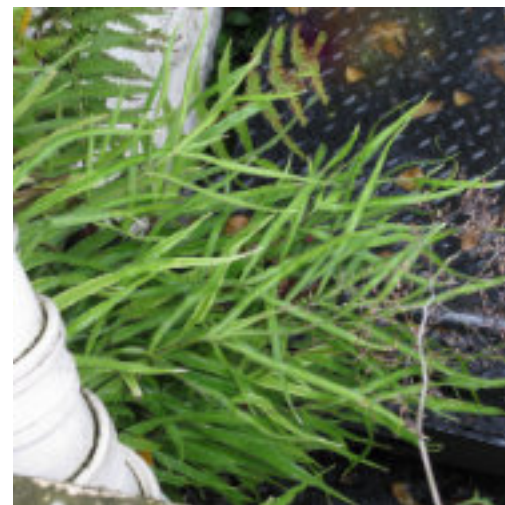


Fig. 8 Ribbon Fern (*Pteris cretica*) at Catharine Place,

In 1978 R.M. Payne found a single plant of Ribbon Fern (*Pteris cretica*) growing on the stonework of a deserted basement in New King Street. By 1979, it was gone, but several more plants were found that year on an old basement wall in Beauford Square: it did not persist here either (Green *et al.*, 2000). Ribbon Fern, a native of Europe, Asia and Africa, is frequently grown as a houseplant. It has since been found in basements at four further locations: Sydney Buildings in 2006 (the cultivar 'Wimsettii'), Laura Place in 2007, St James' Parade in 2008 and Catharine Place in 2009 (Fig. 8). These are still the only records for Somerset.

Four other species of *Pteris* have been found in Bath; all have probably arisen from the spores of houseplants. *Pteris* plants had been known under a grille on Lansdown Road since 2002, and on the stonework of a basement in Pierrepont Street for ten years longer (Randall, 2003). It was only in 2006 that these were both identified by F.J. Rumsey as Spider Brake (*P. multifida*), a native of Japan and China, grown in this country as a houseplant and first recorded in a naturalised situation in



Devon in 1935 (Crouch & Rumsey, 2007). Plants in Pierrepont Street were removed during refurbishment of the basement area, which is often the fate of urban ferns. The related species, Variegated Ribbon-fern (*Pteris nipponica*), was found in 2008, in a deep basement area on St James' Parade, but was short-lived. A *Pteris* plant found in a disused basement in Rivers Street by C. and M.A.R. Kitchen in 2009 is believed to be Jungle Brake (*Pteris umbrosa*), a native of Australia. This is the first record of this species becoming naturalised in Britain. Remarkably, it has persisted for over ten years and is now a huge plant, over 1m across, but no doubt the basement will be renovated one day and it will be lost. In 2010 a fifth species, Tender Brake (*Pteris tremula*), was spotted on steps and stonework of a basement area in the Royal Crescent (Fig. 9); it was last seen in 2017.



Fig. 9 Tender Brake (*Pteris tremula*) at the Royal Crescent, Bath

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In 1997, a single *Adiantum* plant was recorded by I.P. Green in a basement at Marlborough Buildings, near the Royal Crescent; it was seen again in 2008 by M.A. Spencer and identified as Delta Maidenhair (*Adiantum raddianum*), the identity confirmed by F.J. Rumsey (Crouch, 2008). It was last seen in the basement in 2012, but may yet persist. This South American fern, widely grown as a houseplant, was first reported as an escapee on a wall in London in 1997 (Rumsey, 1998). It has since been found in several sites in and around London, but elsewhere there has only been one other record for this species, in a street in Leamington Spa.

In recent years, the popularity of exotic ferns for the garden has increased; as a result, more species have become naturalised outside gardens, particularly in the sheltered basements of Bath. In the same derelict basement as the Jungle Brake, a single plant of Korean Rock-fern (*Polystichum tsus-simense*) was also found in 2009. That plant was last seen in 2012 and is thought to have been swamped by the *Pteris*. This species is now widely grown: in 2020 another plant was found by R.D. Randall, growing from stonework in a basement in Abbey Green.

Another fern now offered by most garden centres and nurseries is Fortune's Holly-fern (*Cyrtomium fortunei*), a native of Japan and Southeast Asia. A small plant of this species was seen growing from the stonework of a basement in St James' Parade in 2009, but did not persist. In 2017 a plant was found in a basement in Brock Street; that disappeared, but another, first spotted in 2019, persists in a different basement in that street. In 2020 this species was found at the edge of a footpath in Lambridge. Whilst none of the exotic species grown as houseplants has been recorded in Somerset outside Bath, or indeed beyond a sheltered basement, Fortune's Holly-fern (Fig. 10) has been found at Ashton Court, Portishead, Chew Magna, Wells, Midsomer Norton and Rode.

### The Future for Ferns in Bath

Many native plant species in and around Bath have declined since the time of Babington. In contrast, most of the native fern species ever recorded can still be found; indeed, many have increased in recent years, exploiting new habitats. Successful colonisation depends on the availability of propagules, habitat, and



Fig. 10 Fortune's Holly-fern (*Cyrtomium fortunei*)

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suitable conditions for germination and establishment. Mature ferns can produce over a million spores per plant each year and these can sometimes be carried long distances from the parent plant. The arrival in central London of Green Spleenwort (*Asplenium viride*), a species with its nearest strongholds in Wales and the Peak District, is good evidence of long-distance spore dispersal (Rumsey, 1997), as is the above-mentioned discovery of Sea Spleenwort in Bath. In addition, ferns have soared in popularity as garden plants, resulting in a great increase in the quantities and variety of spores produced within the city. The availability of propagules is perhaps a less limiting factor than the availability of suitable habitat and conditions for germination.

The suitability of habitats for ferns within Bath, particularly for wall ferns, such as Wall-rue (Fig. 11), has improved during recent decades following reductions in pollution, cleaning of buildings, and maturity of substrates, particularly mortar. There are numerous small woodlands around Bath, and many small copses and shady corners within the city itself, all providing habitats for ferns.

Climate may be a limiting factor to establishment: it has been suggested that the bitter winters of the mid-twentieth century contributed to previous poor performance of both native and alien ferns in London (Edington, 2008). In Bath, as in London, the effect of climate as a factor limiting fern colonisation and survival is now lessened by a “heat island” effect, and further reduced by the distinctive architecture: the deep sheltered basement areas provide a warmer and, critically, damper microenvironment.

For most ferns, the availability of water during reproduction is essential. A spore germinates to form a prothallus, or gametophyte, on which are borne the separate sex organs. Antherozoids (sperm) must swim to reach an archegonium (female sex organ), where they fertilise the single egg cell. The sporophyte – the familiar fern plant – arises from this fertilisation event, a process which is totally dependent on the presence of water. Although some native ferns can produce a sporophyte plant from a single spore, through fertilisation of gametes on the same prothallus, an even greater limitation to success for many native ferns is the fact that they are outbreeding. This means they require the development of two separate gametophytes, from two separate spores, which must have landed within the range of sperm motility, generally only a few centimetres apart, thus rendering them even more dependent on water at the crucial moment of fertilisation.

Not all ferns need water for fertilisation, however: recent studies have shown that around 10% of species investigated so far are in fact apomictic. They produce chromosomally unreduced spores (diplospores) which germinate to form a prothallus, from which a sporophyte arises without the need for fertilisation (Grusz, 2016). The dependence on available moisture is thus reduced. Very few of our native ferns benefit from this strategy: of those recorded in Bath, only members of the *Dryopteris affinis* group are apomictic. In contrast, most of the exotic species which have been recorded in Bath are apomictic: Fortune’s Holly-fern (*Cyrtomium fortunei*), Korean Rock-fern (*Polystichum tsus-simense*), and all species of *Pteris*. Whilst the *Pteris* species are sold as houseplants and are not frost-hardy, Fortune’s Holly-fern and Korean Rock-fern are perfectly hardy and increasingly grown in gardens – we can expect more records for these two species.

A number of other commonly available and frequently cultivated ferns are also apomictic, with a good chance of establishment outside gardens, from spores. Black Wood-fern (*Dryopteris cycadina*), a robust wintergreen Japanese fern, is widely sold and has been recorded elsewhere as a garden escape. Japanese Buckler-fern (*Dryopteris erythrosora*), with fronds which flush bright red in the spring and remain evergreen through winter, is often planted in tubs for its winter colour; this too has been recorded elsewhere, away from gardens, including on the stonework of a church. Indeed, both have been recorded as garden escapes elsewhere in Somerset, as has Japanese Shield-fern (*Polystichum polyblepharum*), a smart glossy woodland fern, widely available and also apomictic. Although all escaped *Cyrtomium* plants found recently in Somerset have been Fortune’s Holly-fern, other species are grown and known to escape, particularly House Holly-fern (*Cyrtomium falcatum*), which is readily available in nurseries and garden centres. These exotic ferns, and others, may one day grace the hidden corners of Bath, but none is likely to be invasive or have any impact on our native species.

In conclusion, ferns are apparently thriving in Bath, with more native and alien species to be found now than a century ago. This is due to the greater availability of suitable habitat, particularly the cleaned, less toxic walls and stonework; reductions in air pollution; and the cessation of the frenzied collecting which occurred at the height of Pteridomania. Thankfully the resurgence of interest in ferns is nowadays focused on appreciation and cultivation, with plants bought from nurseries and garden centres, rather than from collectors who have ravaged the countryside.



Fig. 11 Wall-rue (*Asplenium ruta-muraria*). Common in the Bath area

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**Appendix: Fern species recorded in Bath by different authors**

(✓) = repeated earlier record

C = simply listed as common

Column1	Babington	Babington 2	Jenyns	White	Green <i>et al</i>	Recent
<b>Native species</b>	1834	1839	1867	1912	2000	2000+
<i>Athyrium filix-femina</i>		✓	(✓)	✓	✓	✓
<i>Asplenium adiantum-nigrum</i>	✓	✓		✓	✓	✓
<i>Asplenium ceterach</i>	✓	✓	(✓)	✓	✓	✓
<i>Asplenium marinum</i>						✓
<i>Asplenium ruta-muraria</i>	✓	✓		C	✓	✓
<i>Asplenium trichomanes</i>	✓	✓		C	✓	✓
<i>Asplenium scolopendrium</i>	✓	✓		C	✓	✓
<i>Botrychium lunaria</i>	✓	✓	(✓)	✓	-	-
<i>Cystopteris fragilis</i>	✓	✓	(✓)	✓	✓	✓
<i>Dryopteris affinis</i> agg.					✓	✓
<i>Dryopteris affinis</i>						✓
<i>Dryopteris borrieri</i>						✓
<i>Dryopteris carthusiana</i>						✓
<i>Dryopteris dilatata</i>	✓	✓		✓	✓	✓
<i>Dryopteris filix-mas</i>	✓	✓		C	✓	✓
<i>Gymnocarpium dryopteris</i>	error	-	-	-	-	-
<i>Gymnocarpium robertianum</i>		✓	(✓)	✓	-	-
<i>Ophioglossum vulgatum</i>	✓	✓		(✓)	✓	✓
<i>Polypodium interjectum</i>						✓
<i>Polypodium vulgare</i> agg.	✓	✓		C	✓	✓
<i>Polystichum aculeatum</i>		✓		(✓)	✓	✓
<i>Polystichum setiferum</i>		✓		(✓)	✓	✓
<i>Pteridium aquilinum</i>	✓	✓		C	✓	
<b>Species native elsewhere in Britain</b>						
<i>Adiantum capillus-veneris</i>				✓	✓	✓
<i>Dryopteris submontana</i>			✓	(✓)	-	-
<i>Osmunda regalis</i>					✓	-
<b>Exotic species</b>						
<i>Adiantum raddianum</i>						✓
<i>Azolla filiculoides</i>					✓	✓
<i>Cyrtomium fortunei</i>						✓
<i>Pteris cretica</i>					✓	✓
<i>Pteris multifida</i>						✓
<i>Pteris nipponica</i>						✓
<i>Pteris tremula</i>						✓
<i>Pteris umbrosa</i>						✓
<i>Polystichum tsus-simense</i>						✓