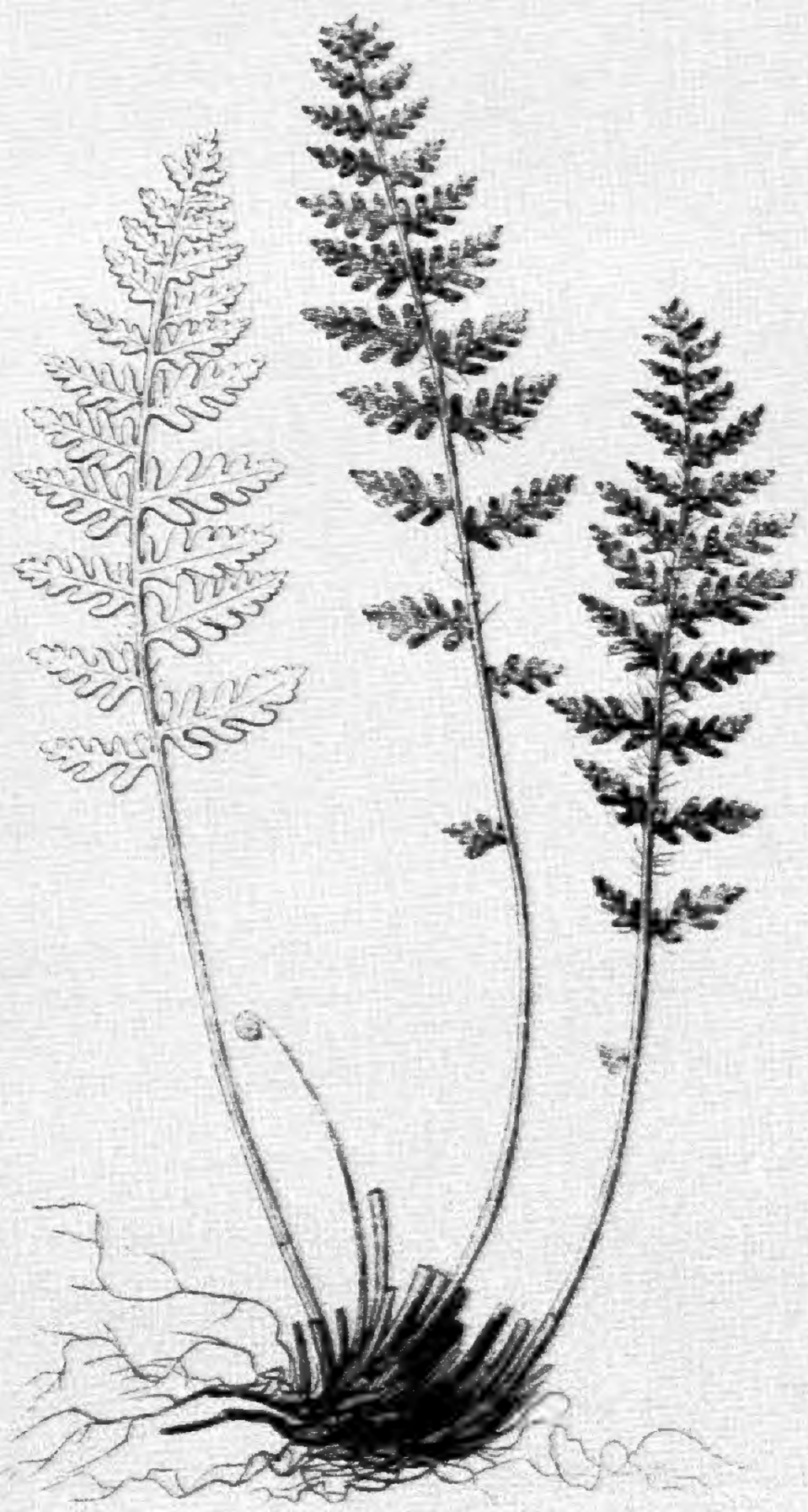
PTERIDOLOGIST

Edited by

Barry A. Thomas



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THE BRITISH PTERIDOLOGICAL SOCIETY

THE BRITISH PTERIDOLOGICAL SOCIETY

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The BRITISH PTERIDOLOGICAL SOCIETY was founded in 1891 and today continues as a focus for fern enthusiasts. It provides a wide range of information about ferns through the medium of its publications and other literature. It also organises formal talks, informal discussions, field meetings, garden visits, plant exchanges, a spore exchange scheme and fern book sales. The Society has a wide membership which includes gardeners, nurserymen and botanists, both amateur and professional. The Society's journals, the *Fern Gazette*, *Pteridologist* and *Bulletin*, are published annually. The *Fern Gazette* publishes matter chiefly of specialist interest on international pteridology, the *Pteridologist*, topics of more general appeal, and the *Bulletin*, Society business and meetings reports. **WWW site:** http://www.eBPS.org.uk

Membership is open to all interested in ferns and fern-allies. **SUBSCRIPTION RATES** (due on 1st January each year) are Full Personal Members £15, Personal Members not receiving the *Fern Gazette* £12, Student Members £9, Subscribing Institutions £25. Family membership in any category is an additional £2. Applications for membership should be sent to the Membership Secretary (address above) from whom further details can be obtained. (Remittances made in currencies other than Sterling are £5 extra to cover bank conversion charges.) **Airmail** postage for all journals is an extra £4, or for those not receiving the *Fern Gazette* £2.50. **Standing Order** forms are available from the Membership Secretary and the BPS web site.

Front cover: Woodsia ilvensis as illustrated in Edward Newman's *A History of British Ferns.*

Back numbers of the *Fern Gazette, Pteridologist* and *Bulletin* are available for purchase from P.J. Acock, 13 Star Lane, St Mary Cray, Kent BR5 3LJ; E-mail: BackNumbers@eBPS.org.uk.

STUMPERIES

Martin Rickard, Pear Tree Cottage, Kyre, Tenbury Wells, Worcs. WR15 8RN.

There are many ways of staging ferns in a garden. The most common is probably in a shady border with or without flowering plants. Certainly this has been my way of planting - usually without too many flowering plants! The ferns look good but some may argue they need that little something extra to set them off.

I have toyed with rockeries, or, more precisely, placed small rocks strategically amongst the ferns. The ferns have enjoyed the shelter provided by the stones and the damp root run underneath has been a godsend in droughts. There are problems though, rock is expensive, a ton does not go very far, and can be heavy and difficult to manouevre. Residents of the major population centres are usually a long way from good rock supplies and so generally make do without, or use old bricks and clinkers - rarely to pleasing effect. In rocky areas rock gardens can be stunning - the waterwashed limestone rockery at Linda and Jeremy Kaye`s nursery at Silverdale is a classic example of just how to use rocks. Here alpines and ferns live together in harmony. Their rockery was mainly built by Reg Kaye. Reg was a craftsman, he was fortunate to have the stone on site, but he did have to move it all into position. He did this with crowbars, he was still moving huge stones weighing several hundredweight well into his eighties!

For the rest of us, what other ideas are there for adding that rustic atmosphere to our fern areas? I think one answer is to make a stumpery.

I am not sure when the word stumpery was coined. Certainly all the Victorian books I have consulted refer to the use of roots, stumps and old wood but not specifically stumperies. Ferneries are referred to by name in the first half of the nineteenth century. Interestingly rockeries seem to be referred to as rock-work, which makes me wonder when the word rockery was coined, or when it came into common use?

The earliest reference I can find to roots and stumps being promoted as suitable for the garden is in the 1840s. Jane Loudon in *The ladies companion to the flower garden,* c.1844 says: `Two or three large stools of trees grouped together on a lawn with mould and plants placed in their interstices, form a striking contrast to the smoothness and high art displayed on the general surface of the lawn.` She makes no specific reference of ferns, but soon many books were suggesting roots and stumps as ideal for the fernery. Notably in 1848 Thomas Moore in *A handbook of the British ferns*, talks about using the 'stumps of old trees' for the culture of *Polypodium vulgare*. B S Williams says in *Ferns and lycopods,* 1852 - 'Stumps often look well laid down in different parts of the fernery with common ivy overrunning them, and the polypode (sic) planted on top.'

About this time Joseph Paxton built a large stumpery at Chatsworth in Derbyshire. William Adam describes it in *The gem of the Peak*: 'From the conservatory we pass through a rustic arch and find ourselves in a deep cutting of the shale, through which the carriage drive is made, the lofty sides of which are strewed with immense roots and trunks of decayed trees, as if they had been heaped for ages by some convulsion of nature, some of them erect, and the whole of the bank planted solely with British ferns.' Paxton famously designed the Crystal Palace building for the Great Exhibition in 1851 in Hyde Park. In about 1853 this was moved to its new site in south London. Paxton was still very much involved and was probably responsible for the stumpery in the adjoining park around the collection of dinosaurs built by Waterhouse Hawkins in 1853 - the earliest dinosaur theme park in the world! Today the park is being restored by Bromley Council, the dinosaurs are being given a face lift and a new fern planting is planned for the near future, when fresh stumps will be incorporated in the design.

One of the most famous stumperies, both in history and today, is the one at Biddulph Grange in Staffordshire. The garden belonged to James Bateman, whose designs were inspired by his friend Edward Cooke during the 1840s and 1850s. According to Peter Hayden in his book *Biddulph Grange a Victorian garden rediscovered*, 1989, Bateman made a notable stumpery by the approach to 'China' from the eastern terrace. Tree stumps were piled up and secured to a height of 10 or 12 feet on either side of the winding path, meeting overhead in places. 'Mr

Bateman has been singularly fortunate in procuring a quantity of the most gnarled, contorted, and varied masses of wood imaginable for this purpose; and they are joined together and disposed with exquisite art' (Kemp in *How to lay out a garden*, 1864.). Root work also featured on a steep bank. Here Kemp was impressed by the way Bateman,` with a judicious disregard for petty criticism`, had planted dead trees upside down in the ground, with their roots 8 to 10 feet in the air, and had trained ivies to grow over them. Possibly as a result of seeing the garden at Biddulph Kemp became quite an advocate of stumperies, suggesting in his book that 'In places where stone is not easily procured or where it abounds so much that some other material would be preferable, the rugged stumps or roots of old trees may be substituted and will yield quite as much picturesqueness'. As recently as 1953 in *Follies and grottoes* Barbara Jones admired the `twisted pieces of dead trees lining the stepped and winding descent ` into 'China'. Today the stumpery at Biddulph is still in remarkably good heart. I believe most of the original stumps have disintegrated but there is still an abundance of beautiful stumps on site adorning either side of the path down into 'China'. Unfortunately the original root arches have gone but there are plans to reinstate them and to add to the fern plantings in the near future.

Cooke was key to the design of these stumperies having already built one in his Kensington garden where it was complemented with tufa rockwork provided by James Pulham. After a few years Cooke moved to Hyde Park Gate where he built another much larger stumpery, this time associated with artificial rock structures installed by Pulham. His final move was to Glen Andred near Groombridge, Kent, where he again built a stumpery. There was abundant natural rock at Glen Andred which Cooke set about modifying to form large outcrops. I know of no record of *Hymenophyllum tunbrigense* from Glen Andred but within about one mile of the garden 5 distinct colonies were known until quite recently and may well still be there. Cooke`s outcrops were so realistic I wonder if today the filmy fern has colonised his artificially manipulated rocks! Cooke was active in quite a few gardens often incorporating stumperies in his designs.For example at Betteshanger near Deal, Kent in 1851, and another at Ashurst Park near Tunbridge Wells in 1857. He also designed stumperies for the gardens of his friends.

By the mid 1860s the fortune of stumperies seems to have been in decline. Their suitability in the garden was assaulted by virtually all fern authorities from then to the end of the century and beyond. The principal objection was the pests and diseases they harboured. Right back in 1863, *The fern manual*, said: 'We deprecate wood (tree stumps) for such work (rockeries) under glass, although some people say they are first rate materials for the purpose, but we have not found them to be such. They may be very well where a collection of Fungi is desired, or to suit the fancy of those who like to do a thing one day and alter it the next. Wood rots, and the stones that are above or on it fall, and the work has to be done over again at a time when the plants are about their best. Moreover the plants do not thrive on them as they will do without them, which no doubt is owing to the venomous threads of the various Fungi that harbour there destroying their roots...' Shirley Hibberd in *The fern garden,* 1869, agreed: 'Outdoor ferneries are usually formed of tree roots and banks of earth, picturesquely disposed and planted with ferns severally adapted to the sites and positions the scheme affords. Where there are living trees on or near the spot (and the shade of large trees is desirable), the use of roots is objectionable, because of the quantities of fungi which are sure to be produced, the mycelium from which may find its way among the living plants and commit vast havoc. But even this danger is worth risking sometimes in cases where roots and butts are plentiful on the spot, and it is undesirable to incur any great expense.'

Much later in *Ferns and fern culture*, 1892, J Birkenhead, the leading nurseryman of the time joined the chorus: '(Making rockeries) Sometimes tree roots are used , but they soon commence to decay, so they are not at all suitable for a fernery which is to be of a lasting character. Not only so but the rotten wood encourages the growth of fungus which spreads through the soil and not infrequently destroys the ferns planted therein.' That other popular writer F G Heath was similarly critical in *Garden rockery, how to make, plant and manage it*, 1908: 'Rockery is not .... a mixture of tree stumps and miscellaneous pieces of stone. Where stumps of wood are employed a warm and sheltered asylum is at once formed for myriads of small insects which, naturally, look upon the plants immediately surrounding them as placed

there for their use and enjoyment; as, in fact, an easily accessible store house of food.'

So what is the situation? Are stumperies bad for your ferns? I find it difficult not to take the warnings of great growers like Birkenhead seriously but my feeling is that stumperies do have a place in modern gardens, albeit gardens trying not to look modern! The criticism in *The fern manual* is referring to ferneries under glass - not relevant to most of us today. The idea of supporting rock on wood is obviously a non-starter, so we are left with the multiplication of pests in the shelter under the wood and in the rotting tissues. I am surprised this is a problem. Ferns grow abundantly on woodland floors as long as light levels are not too low, and as long as it is neither too wet nor too dry. Woodland floors are surely littered with rotting wood? I can see the introduction of parasitic fungi like *Armillaria mellea* would be a problem to other woody plants - but surely not to ferns? In addition what about leaf mold? It has proved a great soil improver in ferneries, and leaf mold I have collected is often full of fungal mycelia so how can stumps be any more harmful? The durability of stumps is cited as a problem by Birkenhead but this is no problem, in practice it is a simple matter to add new stumps on top of the old ones as they rot down.

Stumperies have recently been given a huge boost. Probably the best one ever constructed now stands triumphantly in the garden of His Royal Highness the Prince of Wales near Tetbury in Gloucestershire. It was built about 1995 by Julian and Isobel Bannerman. It is well illustrated in the recently published *The garden at Highgrove* by The Prince of Wales and Candida Lycett Green (2000). Here stumps are piled up to form banks and one walk-through arch. The gothic mood of the stumpery is very effectively enhanced by two temples made of rough wood with their pediments filled with small roots - somewhat reminiscent of antler horn. A wide range of ferns grow amongst the stumps but most are larger woodland species and cultivars, clearly choice alpines are not suitable. To complement the ferns the Prince has planted quite a few hostas and miscellaneous woodland plants but ferns predominate - I am pleased to say!

Some of you may know I have exhibited ferns for my nursery at many shows since 1991. At every show I use old roots and stumps liberally, to try and add interest to the display. At least that might appear to be the reason, but the truth is the stumps were initially used to hide pots - the fact that the wood added to the appeal of the display was really a fortunate accident! It is unthinkable not to use wood today!

Obviously I think stumps are wonderful when used to set off ferns. If there is a downside from pests and fungi, I for one am prepared to put up with it! My advice therefore is why not try a stumpery in your garden? Anticipate possible problems, only use woodland ferns that are likely to be tolerant of fungi and insects, do not pile rock on top of stumps and be prepared to add new stumps as old ones shrink with age. Add a little bit of flair and skill in the arrangement of the wood and stumps and you will have your own intriguing garden feature. Ground Force eat your heart out!!

APPENDIX:

Some suggested ferns for planting in your stumpery with some notes on their use:

Asplenium scolopendrium cultivars - best near the front as they are not very tall.

Polystichum setiferum cultivars - ideal throughout.

Dryopteris filix-mas and *D.affinis*, cultivars of both - excellent towards the back.

Other *Dryopteris* species - *D.goldiana, D.erythrosora, D.wallichiana* or most other large species, excellent towards the back.

Cyrtomium fortunei. - excellent contrast.

Adiantum aleuticum or *A.venustum* - leaning towards the alpine end of the spectrum but I think both should do well.

Polypodium vulgare and *P.x mantoniae* (and possibly *P.interjectum*?) and cultivars - perfect in hollowed out stumps.

Onoclea sensibilis - perfect in wet areas, if a little invasive.

Osmunda regalis and cultivars - perfect in wet areas.

Matteuccia struthiopteris - perfect in wet areas but like *Onoclea* a little invasive.

Athyrium filix-femina and cultivars - perfect in damp areas.

Blechnum spicant - on acid soils, best near front.

Gymnocarpium dryopteris and the cultivar `Plumosum` - excellent, will be invasive but so attractive!
Dicksonia antarctica, D.fibrosa and *Cyathea australis* - tree ferns make excellent accent plants, remember they will need some winter protection.
Woodwardia fimbriata - good tall fern, ideal for planting between large logs.

Ferns that might be best avoided:
Woodsia species - all.
Asplenium species - all dwarf rock species.
Smaller polystichums.
Cheilanthes species.
Cystopteris - some species may be worth trying but not one to start with.
Polypodium australe and cultivars - likes lime and free drainage, may not like the acid conditions created by rotting wood.
Athyrium niponicum - perhaps a bit too prone to slug attack.

BOOK REVIEW

The Garden at Highgrove. by H.R.H. The Prince of Wales and C.Lyett Green. Weidenfeld and Nicholson, London (2000), 176pp. ISBN 0-297-82544-5. £25.00.

While not specifically a fern book, I hope members will agree with me that this update on our Patron's garden near Tetbury deserves a mention in our journal. In 1993 the Prince co-authored *Highgrove An Experiment in Organic Gardening and Farming*, which was a general account of the Highgrove estate with no significant mention of ferns. This new volume is an account of the garden alone with ferns now featuring quite strongly. There are several areas with a fern content and all are beautifully illustrated. Top of the list is the wonderful stumpery (or Temple Grove). This is shown from many angles giving the reader a taste of its gothic, somewhat sinister, atmosphere. I love the two temples and the swards of ferns emerging through the massed stumps. Other innovative features shown include the Wall of Gifts, which has been planted with ferns at its top and bottom and the 12 foot high Fern Pyramid covered with woodland ferns from top to bottom. These three show-stopping features were all designed by Julian and Isobel Bannerman.

Other ferny sites are illustrated. There is the Southern Hemisphere Garden with three species of tree-fern: *Dicksonia antarctica, D.fibrosa* and *Cyathea australis* in the lee of the walled garden and the Laurel Tunnel with various woodland ferns lining the path. Some of the tree ferns are amongst those plants given to the Prince by members of the British Pteridological Society in 1999 to commemorate his fiftieth birthday the year before. I was particularly pleased to see the Society getting a mention in three places in the book. Unfortunately the Prince is described as our President whereas we are a proud to have him as our Patron.

In the book the excellent photographs do most of the talking. It is a beautiful book – and ferny! It would not surprise me if quite a few members find it irresistible. The price is fair, especially when you consider that most of its royalties go to The Prince of Walesís Charitable Foundation.

Martin Rickard

WOODSIA ILVENSIS IN BRITAIN - LAST CHANCE OR LOST CAUSE?

Adrian Dyer, Stuart Lindsay and Phil Lusby, Royal Botanic Garden, 20A Inverleith Row, Edinburgh EH3 5LR.

The Oblong Woodsia (*Woodsia ilvensis* (L.) R.Br.) is Britain's rarest fern with fewer than 100 clumps known in natural populations. At some sites, only a single plant remains. Already rare when first discovered, it was severely depleted by Victorian collectors throughout the 19th Century, and surveys during the latter half of the 20th Century showed that numbers have continued to fall at several sites. Research has not yet provided a full explanation of the continuing decline and it is not clear whether it is due to a factor over which we have some control or a consequence of changing climate. If the former, we may have a last chance to take action to ensure that this attractive small mountain fern (fig. 1) remains in the British flora, but if the latter, its continued survival in Britain is probably a lost cause. Because of the critically low and declining numbers of plants and the possibility that its extinction is not inevitable, the Oblong Woodsia has been identified as a priority species in the UK Biodiversity Action Plan, and Recovery Programmes have been initiated in England, Scotland and Wales. An outline of the action being taken and the background to it is given below. A more detailed account is presented in the *Botanical Journal of Scotland* (Dyer, Lindsay & Lusby, 2001)

THE HISTORY OF *WOODSIA ILVENSIS* IN BRITAIN

W. ilvensis was probably widespread in the tundra flora of Britain during and immediately after the last Ice Age. It will have moved north as the ice retreated and been eliminated in the south as tall herbs and trees became established. As the temperature continued to rise and the forest expanded, it will have become restricted to rocky sites in northern mountains. The distribution of *W. ilvensis* outside Britain indicates that it is a species of cool continental climates, and Britain is on the oceanic fringe of its ecological and geographical range in Europe. Within the mountains, it appears to be restricted to species-poor sites where competition from other plants is slight. In south-west Norway, the nearest place where the species is vigorous and relatively common, the associated species include several that are characteristic of dry habitats (fig. 3) and *Woodsia* behaves as a "resurrection plant", becoming dry and shrivelled during summer drought but recovering fully within a short time after rain (fig. 6). In Britain, the exposed and well-drained sites for *W. ilvensis* are not only periodically very dry, but there are indications that at some the soil contains unusually high levels of copper or other metals. Tolerance of these two factors, summer drought and toxic metals, may at least partly explain why this fern can grow at sites where other vegetation is sparse. Although forest clearance by man over the last 5000 years or so might have created new suitably exposed habitats, increased grazing pressure, particularly from sheep and deer over the last few hundred years, might explain why *W. ilvensis* in Britain became restricted to relatively inaccessible sites on rock faces and steep unstable scree. Because of this combination of climate changes, soil requirements and grazing pressure, *W. ilvensis* was already rare when Bolton first identified it as distinct from *W. alpina* in the late 18th Century. At that time it was known only from one site in Snowdonia (Wales).

It was this rarity that appealed to the Victorian pteridologists and during the period of "pteridomania" during the mid-19th century, it was much sought and enthusiastically collected. Access to the mountains was much improved by the expanding railway network and the search for new populations intensified. Although it is difficult to identify most of the locations with certainty, herbarium sheets and excursion accounts reveal that by the end of the century, at least 20 and perhaps as many as 30 populations had been found in northern England, Snowdonia and the mountains of Scotland. Some of these populations were of considerable size when found; more than 100 plants occurred at several sites. However, not only were whole plants, and not just fronds with spores, collected by enthusiasts for their private herbaria and gardens but they were removed from the wild in bulk for sale by the horticultural trade. A nursery in York offered plants at half-a-guinea (equivalent to about £22 today) each in 1857. As a consequence, at some sites *W. ilvensis* was eradicated in a few years, and at others by the end of the century. The

remaining plants were probably saved by changing fashions resulting in little interest in ferns, or any other Victorian obsession, during much of the first half of the 20th Century. Only two sites are represented in herbarium collections over this period, and the precise location of most other populations, extant or extinct, were forgotten until two of them were re-discovered in the mid-1950's. Other surviving populations have been found since, one of them by Martin Rickard during a BPS field excursion to the Moffat Hills (Scotland) in 1972. A plant was found in 1950 at a site in Teesdale (England) known since 1821 (fig. 2) and thought to have been eliminated by 1895, but recent searches indicate that this population is now extinct. There was also a report in 1971 of a site at Ben Lawers (Scotland) confirming an early record from that area, but the continued survival of *W. ilvensis* at Ben Lawers has not been confirmed. Remarkably, in 1983 a new population (fig. 5) was discovered in the Cairngorms (Scotland) by David Mann, then of the University of Edinburgh, now at the Royal Botanic Garden Edinburgh (RBGE). This population does not appear to have been known to the Victorians.

The renewed interest in British *Woodsia* in recent years has allowed the populations to be surveyed intermittently. This has revealed a continuing decline that is not apparently due to collecting. The largest population (now the only population in England) has declined from about 100 plants to about 70 clumps since 1954 while another population in the Moffat Hills has been reduced from about 25 clumps to 3 over the same period. The Cairngorm population has declined from 8 to 3 plants since it was discovered in 1983. In recent years it has been observed that mature plants are lost from scree populations as a consequence of disturbance by grazing animals although serious grazing damage is rarely seen.

THE CURRENT STATUS OF *WOODSIA ILVENSIS* IN BRITAIN.

W. ilvensis is now Britain's rarest fern. Of the 98 clumps recorded in 1999, 71 occur at one site in the English Lake District, a total of 15 at 3 widely separated localities in Scotland (Moffat Hills, Glen Clova and the Cairngorms), and a total of 12 occur at two separate localities in Snowdonia (fig. 4). At most of the Scottish and Welsh localities, the plants are distributed over two or more distinct sites. No site has more than 4 plants and two have only one plant. Searches in the vicinity of surviving and extinct populations have not yet revealed any additional plants but the cliff and scree habitats favoured by *W. ilvensis* are difficult to survey and the possibility of other surviving plants cannot be discounted. It is also possible that some of the recorded clumps consist of two or more genetically distinct individuals. Isozyme analysis revealed this to be true of one of the large clumps tested at Glen Clova.

No regeneration of young plants has been seen in British populations, although gametophytes and young sporelings have been found in Norwegian populations. Recruitment in British populations either fails altogether or it is a very rare event, perhaps occurring only in certain years at long intervals. Research at RBGE has revealed that this failure to regenerate is not due to sterility; spore samples from several localities had over 90% germination in laboratory culture. Germination tests at different temperatures revealed that *W. ilvensis* spores respond to temperature in a way similar to those of several other British fern species from a wide range of habitats. There is nothing in these results to explain either the rarity of *W. ilvensis* or its failure to regenerate, but inability to germinate at 5°C suggests that establishment can not begin during the winter months. Other possible causes of the inability to regenerate are still to be investigated. They include the failure to produce mature spores or the failure of mature spores to produce sporelings in years with adverse weather conditions, and the failure to colonise the rare microhabitats suitable for gametophyte development because of the low number of spores produced by small populations.

Another hypothesis is that enforced inbreeding in very small populations of a normally outbreeding species with accumulated recessive lethal alleles has resulted in embryo failure. Investigations that will indicate whether this is a likely explanation are currently underway using isozyme analysis. The results will reveal whether the surviving plants are the heterozygous products of outbreeding that have survived since the populations were larger, or the homozygous products of selfing that may have been imposed by the reduced population size. If the plants are heterozygous, inbreeding in the next generation of gametophytes might cause

Fig. 1 *W. ilvensis* growing in loose scree, Lake District.
Photo: S. Lindsay

Fig. 2. An 1821 herbarium specimen (large central plant labelled "1") of *W. ilvensis* from a Teesdale population now extinct. Photo: A.F. Dyer

Fig. 3. *W. ilvensis* among moss cushions (including *Racomitrium*) and xerophytic angiosperms (including *Sedum album*) on the surface of flat sloping rocks near Aurland, Norway. (August). Photo: A.F. Dyer

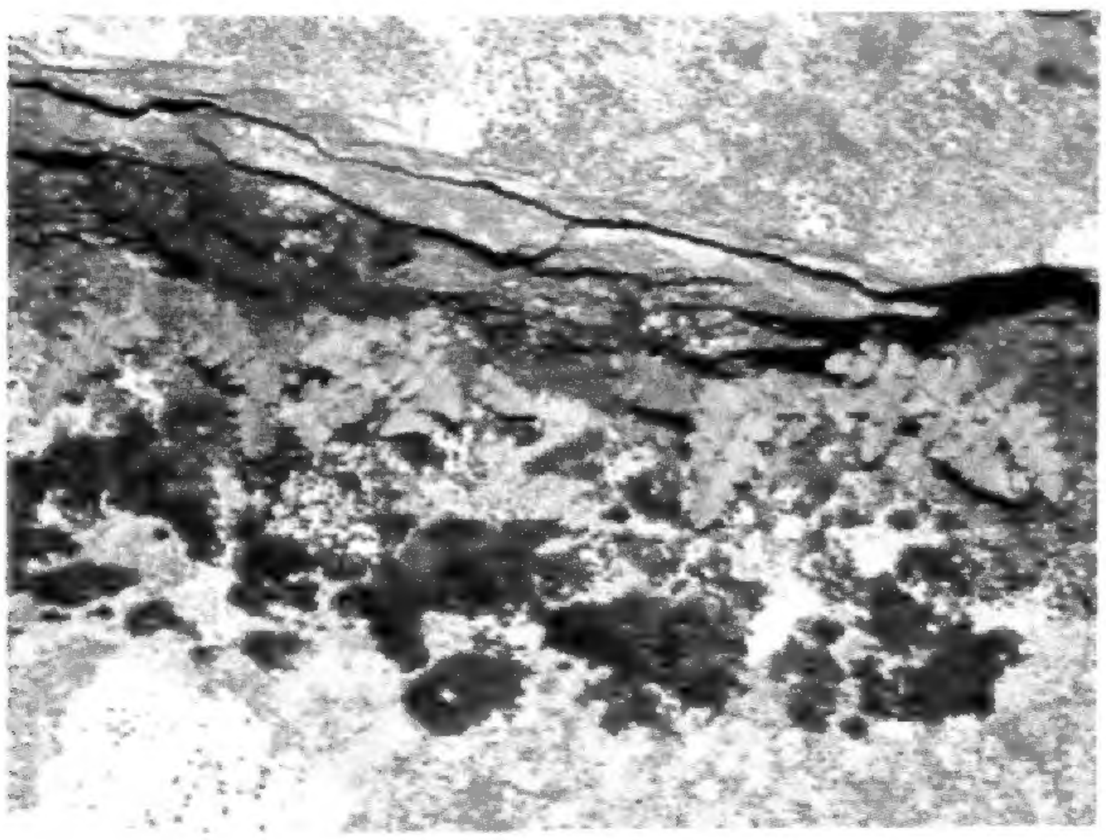

Fig. 4. *W. ilvensis* in a rock crevice, Snowdonia (August). Photo: S. Lindsay.

Fig. 5. *W. ilvensis* among boulder scree at a site in the Cairngorms, discovered in 1983. (August). Photo: S. Lindsay

Fig. 6. *W. ilvensis* at the same site as Fig. 5 showing the response to summer drought. The fronds curl inwards to expose the hairy lower surface. After rain, the fronds return to their fully expanded green state within a day or two. *W. ilvensis* is a "resurrection fern". Photo: S. Lindsay.

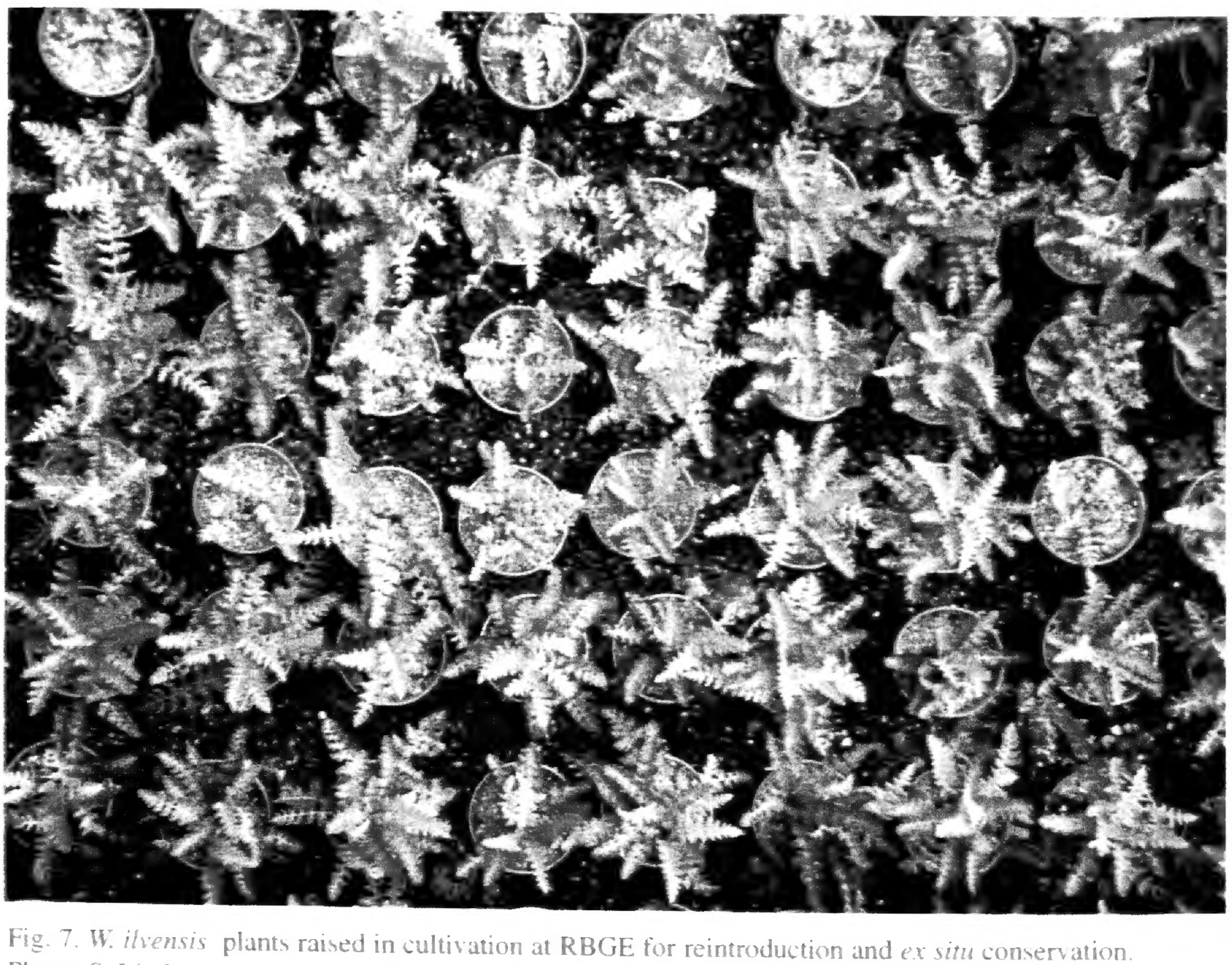

Fig. 7. *W. ilvensis* plants raised in cultivation at RBGE for reintroduction and *ex situ* conservation. Photo: S. Lindsay.

embryo failure; if they are homozygous, successful sporeling formation by isolated gametophytes is likely to be possible, and failure of regeneration in the wild must be caused by some other factor. The capacity for successful self-fertilisation can be tested by *in vitro* breeding experiments. Meanwhile, the isozyme results to date have shown that no genotypes are unique to a single population and all the variation detected in Britain is found in Wales. This is consistent with the suggestion that the existing plants are survivors of a single, once widespread, breeding population. Some of the British isozyme genotypes are also found in Norwegian populations.

CONSERVATION OF *WOODSIA ILVENSIS* IN BRITAIN

Even though *W. ilvensis* is not globally endangered, its continued existence in the British flora is sufficiently precarious for it to have become one of the priority species for the UK Biodiversity Action Plan. Because the decline to the present very low numbers can be attributed at least in major part to the effects of human activity in the past, a case can be made for active intervention to try to reverse the trend, at least until it can be demonstrated that future climate changes make this either ineffective or unnecessary. The case is strengthened when, as here, the species concerned is not a pioneer of an ephemeral habitat but a long-lived occupant of an essentially stable habitat in which there has been no drastic and irreversible change. The species features in the Species Recovery Programmes of English Nature (EN), Scottish Natural Heritage (SNH) and Countryside Council for Wales (CCW). These Recovery Programmes for *W. ilvensis* have benefited from research on the species funded in the mid-1990's by the Leverhulme Trust and conducted by Adrian Dyer and Stuart Lindsay at RBGE. For this reason, the UK Species Action Plan for *W. ilvensis* (under which the national Recovery Programmes are now being implemented) is based at RBGE, and RBGE is the "lead partner", providing the focus and co-ordination for the conservation efforts. The UK Species Action Plan for *W. ilvensis* is managed by a Steering Group consisting of representatives of RBGE, SNH, EN, CCW, National Trust for Scotland (NTS), National Trust (NT), Natural History Museum (London) (NHM), Heather McHaffie on behalf of the British Pteridological Society (BPS), and several other individuals with specially relevant expert knowledge.

In April, 1999, the Steering Group met to consider the conservation steps to be taken. During the preceding Leverhulme-funded project, spores had been collected under licence from at least half the plants at 5 of the 6 localities (a small solitary Welsh plant has failed to form spores over a period of several years) and stored under refrigeration at RBGE. In addition, mature plants of all provenances had been raised by Andrew Ensoll at RBGE (fig. 7). It is planned to maintain a representative collection of all provenances at RBGE and arrangements are being made to disperse plants of single provenances to other gardens throughout Britain to provide reserve material. With a representative gene bank already assured and material available for planting if required, the attention of the Steering Group turned to the wild populations. The options were: to take no action, to manage the habitat at the site to improve the chances of survival and regeneration, or to undertake translocations.

There was general agreement that action should be taken but decisions about what should be done were hampered (and still are) by the lack of understanding of the causes of the failure to regenerate. CCW has decided not to undertake translocations until habitat restoration has been attempted. There is no evidence of significant changes in the habitat at these isolated sites but it remains a possibility that grazing is a factor in the continuing decline after collecting all but ceased. Consequently, CCW has negotiated reductions in the numbers of livestock in the vicinity of the known Welsh sites and is waiting to see whether the populations recover before deciding on further action.

EN and SNH have decided that grazing control may not be enough to ensure the future of the species in England and Scotland and have combined it with translocation into the wild of plants raised at RBGE. Replacement of plants by man appears to be an appropriate response where, as in the case of *W. ilvensis*, populations have been endangered by the removal of plants by man. The translocation options are *introduction* of plants to an apparently suitable site where the species has never been recorded, *re-introduction* of plants to a site where the species has been recorded but is now extinct, or *augmentation* by adding plants to the few left in an

endangered population. Although re-introductions suffer from the disadvantage that genotypes native to the site no longer exist and the translocated plants inevitably have "foreign" genotypes from other sites, in most other ways the re-instatement of a previous population is a less intrusive process than creating a new population or interfering with an existing one. The decision was taken that reintroductions would be undertaken in 1999 at two sites, one in England and one in Scotland, where Victorian records of collecting provided good indications of the precise locality of *W. ilvensis* populations that had subsequently become extinct. Funding by EN and SNH, practical assistance by staff of RBGE, EN, SNH and NTS, and permission by landowners was provided as appropriate at each site. At both sites, agreements had been previously obtained to reduce the number of sheep grazing in the area.

At one site in Teesdale, 26 plants were re-introduced in June, 1999, and a further 38 in September the same year. As no live Teesdale material now exists and there are no other sites in the Pennines, cultivated plants from spores collected at all five main British localities were used to provide the widest possible genetic base in the hope of increasing the chances of establishment and the vigour of any offspring. Also in September, 1999, 129 plants were re-introduced to a site in the Moffat Hills. All the plants were raised from spores collected at the only known locality for wild plants in the Moffat Hills, in another valley about 6km distant. These plants are likely to be the best adapted to the re-introduction site, and if there should be any spore dispersal to the natural population, no genetic contamination will result. At both locations, plants were placed in crevices in rock-faces and also among scree, a common habitat in Norway. In September 2000, another 50 plants of all provenances were re-introduced at a second Teesdale site at a location recorded once in the 19th Century. In this case, the record refers to a large area, within which we selected a small site for the reintroductions on the basis of accessibility and similarity to the first site. A further re-introduction as part of the project to restore the natural vegetation in the Carrifran valley in the Moffat Hills is currently under consideration.

A crucial feature of the re-introduction programme is the subsequent long-term monitoring. Without it, little will be learned. While there is interest in whether the translocated plants can re-establish, survive and release spores, of even greater significance is whether the spores can give rise to new plants so that the population becomes self-maintaining. Until we know what has prevented regeneration in the recent past, it is impossible to predict whether this can occur. Only regular recording of the condition of the planted individuals and a diligent search for juveniles will reveal whether this species is now secure in Britain. If establishment is a rare event, this may take many years. The early signs are promising. The most recent surveys (August and September, 2000) revealed that more than 90% of the 193 previously translocated plants at both sites were alive, few showed serious grazing damage and many were growing vigorously and producing spores, although it was not determined whether plants at the Moffat site released mature spores before the season ended. Detailed records of the plantings and subsequent monitoring are kept at RBGE.

It is intended that monitoring will continue at least once a year (in September) for at least 5-10 years. Currently, no augmentations or additional re-introductions are planned but the Steering Group meets every year to review the UK Species Action Plan for *W. ilvensis*. Further research into the cause of the failure to regenerate in the wild might indicate additional measures that would encourage sporeling establishment. Regular monitoring will also be undertaken of the natural populations to record any further decline in numbers of mature plants and to search for regenerating sporelings. Until we observe newly established juveniles among the surviving wild plants or at the translocation sites, the future of this species in Britain must remain uncertain.

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THE EFFECT OF HEAT AND DROUGHT STRESS ON NATIVE FERNS DURING THE GROWTH CYCLE OF THE FOLLOWING YEAR[1]

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A previous article (The Hardy Fern Foundation Quarterly: Vol. 10, No. 1 Winter 2000) discussed the condition of locally native ferns grown in Louisville, KY U.S.A. during the drought and heat wave of the summer of 1999. This report discusses the condition and growth of these ferns during the current year (2000) and compares them to the growth of locally non-native ferns.

Winter and early spring rain was ample and the weather turned warm in late February and early March. As a result, many ferns started early growth, particularly a number of Asian species. A hard freeze occurred during the third week of April which killed growth on most ferns. The late spring and summer weather had adequate rainfall except for several two week dry periods.

1. *Adiantum pedatum, Osmunda cinnamomea* and *O. claytoniana.*
Established plants in a bed under a large burr oak *(Quercus macrocarpa)* on one side and a large white oak *(Quercus alba)* on the other showed signs of severe stress and frond damage during 1999. Three of four *A. pedatum*, one of two *O. cinnamomea* and the one *O. claytoniana* did not reappear this year. *Dryopteris filix-mas cultivars* in this bed showed mixed performance, apparently as a result of the spring freeze. Those that had significantly broken dormancy were killed back to the ground and took several weeks to resume growth. These specific ferns did not have the vigor nor the frond length during this year's growing season compared to others that had not emerged to any extent. *A. pedatum* in other beds, which did not have such significant competition for water, not only survived but showed almost normal growth. They also showed little damage from the freeze.

2. *Asplenium platyneuron* and *Asplenium rhizophyllum*
Only the two oldest *A. platyneuron* had good growth this year. All started growth early and were damaged by the frost. The *A. rhizophyllum* did not survive the freeze and the youngest *A. platyneuron* is barely alive.

3. *Athyrium asplenioides* and *Athyrium thelypterioides*
These two ferns performed the best of the lady ferns during 1999, and along with *A. cyclosorum* performed the best this year with no difference from normal growth. Next in performance would be *A. angustum* and then the European *A. filix-femina* species and cultivars. The native lady ferns showed little frost damage compared to the Asian ferns. The fronds of Asian ferns lady ferns (*A. japonicum, A. niponicum* cultivars and hybrids and *A. otophorum*) were killed to the ground and took three to four weeks to resume growth. *A Cyrtomium fortunei*, in this area of the garden, did not show any new growth until mid July after being killed back by the freeze.

4. *Cystopteris bulbifera*
These plants started vigorous growth very early and were badly damaged by the frost. When they resumed growth, it was sparse and dormancy is starting earlier than normal. They did seem to have a higher percentage of fronds with bulblets than normal. They had supplemental water and showed little stress last year. It is probable that the poor performance is due to the freeze. A number of *Asplenium scolopendrium* in the same area also received added water last year. They did not break dormancy until after the freeze and had a normal year.

Footnote:
[1] Reprinted with permission from the *Hardy Fern Foundation Quarterly,* Vol. 10, No.3.

5. *Dryopteris species*

D. carthusiana, D. goldiana, D. intermedia and *D. marginalis* are native to this area. *D. goldiana* and *D. intermedia* appear to have performed the best of the locally native *Dryopteris*. They show no signs of any stress from the previous year and made good growth. *D. carthusiana* does not appear to have increased in plant size but shows no sign of stress this year. Three *D. marginalis* sited in morning sun performed very badly. Two started growth which was damaged by the freeze. Both never recovered. One of these plants did not receive adequate water last year but the other two did. The third plant has shorter than normal fronds and looks stressed. By contrast, a newer plant of *D. marginalis* in full shade with good water the previous year looks normal.

There are several exotic *Dryopteris* in the same location as were the three *D. marginalis*. The *D. pseudo-filix-mas* (Mexican male) thrived this year, along with *D. filix-mas* and assorted cultivars and *D. erythrosora*. Next in performance would be the *D. affinis* varieties and lastly most of the Asian varieties just holding their own or struggling

The North American *D.* x *boottii, D. celsa, D. clintoniana, D. cristata* and *D. goldiana* in various beds are showing good growth this year. They do not show effects from either the freeze or the hot and dry weather of last year. One *D. clintoniana* that went dormant early last year apparently due to lack of water, reappeared this spring, was killed back by the freeze and has now reappeared with vigorous growth.

6. *Onoclea sensibilis*

These were in the shade in a bed of *Pachysandra* ground cover. They went dormant in the middle of last summer regardless of the water they received. Only one plant showed new growth this spring and then died. It appears that the combination of location, last years dry, hot weather and the spring freeze were a lethal combination. For what it is worth, the *Pachysandra* is still growing although somewhat the worse for wear.

7. *Polystichum acrostichoides*

These plants were damaged by the spring freeze, but started new growth more rapidly than most of the other damaged ferns. They are noticeably thinner and shorter than in other years, although they did have a good number of fertile fronds.

8. *Matteuccia struthiopteris*

Two established beds showed significant damage from the dry, hot weather of last year in spite of some supplemental water. A number of ferns died in one bed. The other bed is next to a new planting of perennials which received a large amount of additional water. The effect on the ferns of the additional water for the perennials was very noticeable. They showed a consistent increase in the number of live crowns and in frond height the nearer they were to the perennials. The freeze did significant damage to both beds as additional plants died after the freeze. In both beds, the plant number and vigor has been significantly reduced. Few plants sent out stolons and none have fertile fronds. By contrast, a new planting that received some additional water, in the high water flood area next to a creek, had normal growth this year and no damage from the frost. It appears that the water in the creek prevented the freeze from having any effect in the immediate vicinity of the creek. It is clear that this fern is very sensitive to both drought and late spring freezes.. The combination seems to aggravate the damage more for this fern than any other native North American species. This fern is not listed as native to Jefferson County, but is included due to discussion in previous articles.

9. *Osmunda regalis* and *Polypodium virginianum*

These were planted last spring, and received ample water. They appeared to have normal growth until the fall freeze. The O. regalis showed normal growth and the P. virginianum did not appear this year.

CONCLUSIONS

The freeze adds a variable that adversely affected the performance of many ferns in the current year. This factor makes conclusions regarding the effect of drought and heat questionable. However, it is a fact of garden life in the central United States, that both moderate droughts and late spring hard freezes occur on a regular basis.

In contrasting the performance of various groups of ferns, it is clear that in general the Asian ferns do not grow as well as others in the Louisville area. The ferns which seemed to suffer the most freeze damage were *Athyrium japonicum, A. otophorum, Dryopteris crassirhizoma, D. sieboldii* and *Polystichum polyblepharum.* No established ferns were killed but several newly planted ones were. All of these ferns had stunted and slow growth for the entire summer. *D. sieboldii* appeared to suffer the most harm. It put up only one frond replacing five that were frozen and it did not resume further growth until early August. The rest resumed growth after three to six weeks, but none reached more than half to two thirds of the frond height of the previous spring. *Athyrium niponicum* varieties are an exception. They have been hardy here on a long term basis. Some in my garden are more than ten years old and have survived lower than minus 15°F winter temperatures as well as several late freezes. It appears that many Asian ferns react to periods of warm weather prior to a freeze by starting growth and then suffer serious damage. It may be that the large number of growing points on the rhizome of A. niponicum offsets significant loss of early fronds.

Martin Rickard (2000) in an article on the time of frond unfurling found that, in general, the Asian ferns in England started growth earlier than the European or New World ferns. He listed several factors which may cause early growth. I would like to suggest that avoiding early growth may be a survival adaptation for plants in areas like Louisville, Kentucky, in the U.S.A. It could be that native species have adapted to periods of early warmth followed by hard freezes. Avoiding premature growth could be one factor affecting survival, as the Asian ferns clearly showed less vigor as a result of the freeze. It would be interesting to see if the Asian ferns are native to areas where late spring freezes are rare or non-existent after first periods of warmth. The only fern listed by Martin Rickard native to this area and grown by me is *Osmunda cinnamomea*. It was found only in a large swamp area which has since been drained. However, growing near standing water provided *Matteuccia struthiopteris* with protection from the freeze in my yard and it is possible that the swamp provided the same for *O. cinnamomea*.

The events of the previous year's drought and the current year's freeze clearly demonstrate that locally native plants are more likely to survive adverse conditions than many of those imported from other areas. However, there are a number of exotic ferns which performed very well indeed. The performance of *D. pseudo-filix-mas, D. filix-mas* and cultivars, *D. erythrosora,* the European *A. filix-femina* and cultivars, and *A. cyclosorum* was excellent, but all required regular supplemental water to thrive. The events of the past eighteen months have served to separate the truly hardy ferns from the rest as far as this area is concerned.

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Rickard, M. 2000. Frond unfurling. *Pteridologist:* **3**(5), 115-6.

BOOK REVIEWS

FERN GROWER'S MANUAL (revised and expanded edition) by Barbara Joe Hoshizaki & Robbin C. Moran. 2001. Timber Press, Portland, Oregon, USA. ISBN 0-881924-495-4. 604pp. Price £45.00 (hard cover with dust jacket).

New editions can be difficult to review if you have had the previous one since it came out 25 years ago. The easiest way would be to compare the new with the old, but that is hardly fair to the majority of would-be purchases who might never have seen the original. So I shall pretend that I have never seen the original edition either.

This book is exactly what the title says it is – a manual for people who want to grow ferns. All the necessary details are there. Starting with some basic information on ferns, it moves on to chapters on *Cultivating Ferns, Soils and Fertilizers, Through the Year with Ferns, Planting, Propagating,* and *Landscaping*. Within these 88 pages there is a wealth of information, backed up with clear line drawings, explaining everything you need to know, and maybe some things you didn't even know you wanted to know, about growing ferns.

The section on *Troubles with Growing Ferns* is a little more problematical because it is written for the American grower. The accompanying Appendix IV on *Names of Pest and Disease Control Substances* is also a not as useful as it may appear for non-American readers because there are a number of products that are certainly not approved for use in the 2000 UK Pesticides Guide (e.g. acephate, bendiocarb, dienochlor, mexacarbate, potassium permanganate, and streptomycin to mention just a few). This problem is further complicated by the fact that common chemical names may differ between the USA and the UK (e.g. oxydemetron-methyl in the USA is referred to as Demetron-methyl in the UK). I have no idea what the situation is in other countries.

The following chapter on *How Ferns Get Their Names* I found rather laboured at times as the authors seem to assume that the reader knows nothing at all about the subject, which is not generally the case these days.

The bulk of the book is devoted to *Ferns and Fern Allies in Cultivation* in describing those commonly cultivated in the USA. Here, in 390 pages, are well-written descriptions, good figures, photographs and silhouettes of 700 species in 24 genera. Useful indications of hardiness are given for most of the species, which are linked to the USA Plant Hardiness Zones (illustrated here in colour). An accompanying 49 colour pictures illustrate some of the range of plants in cultivation. It is, however, an alphabetical compendiums requiring an inquisitive reader, attempting to identify a fern, to either have some prior knowledge or to scan through the pages looking for something similar. There are no keys and, if pushed, I would argue over a few of the Latin names. Those of us who are interested in fern varieties will be disappointed, because the references to them are very few and far between and the illustrations are mainly copies from British books.

The book is completed by a number of appendices: *Measuring Light* is probably too academic for most readers, and then there is *Fern Societies* that merely directs the reader to the American Fern Society (although the web site of the British Pteridological Society is included together with that for the San Diego Fern Society), *Importing Ferns* is aimed at the American Reader although there a few cautions relevant to most readers and *Family Classification* is basic. A *Glossary, Literature Cited,* and *Subject* and *Plant Name Indices* complete the book.

Without doubt this is a very useful addition to fern literature and anyone interested in growing ferns should have it. Timber Press should also be applauded for adding this fourth fern book to their list (look on www.timberpress.com). My only reservation is that the book has, of course, an almost complete North American (no I mean American) bias that at times verges on being parochial. There are some telling remarks such as the fact that British Isles have many new floras, but those for continental Europe in English [I had thought that at least Spanish may have had a chance these days] are not updated, and an annual list offered by a fern society [not named - but I guess the BPS] listed 775 packets of spores free of charge.

But the pros certainly outweigh the cons for this book. Jimmy Dyce recommended the first edition, I recommend the second. Go out and buy it, you will not be disappointed.

Barry A. Thomas

THE SPORE PATCH

Anne and Barry Wright
(Spore exchange organisers)

Welcome to the spore patch. We hope this might become a regular forum for all things to do with the spore exchange, from requests for specific taxa to feedback on germination successes etc. So far we have, thankfully, had few adverse comments and a pleasing number of positive ones. The only comments we have had about the glassine spore packets seem to have been from people peeling the flap open rather than cutting it off. The spores stick to the gum on the flap, so cutting off the gummed section avoids the problem. The other worrying comment was from an Australian recipient who found no spores in the packets after travelling half way round the world. Must be because they arrive upside down! We now put some spores in kitchen foil to make them extra spore-proof and for when we need to be miserly with taxa in short supply.

Last year we had requests for 467 taxa and sent out 2,397 packets of spores to 136 members. 29 members donated spores during 2000.

Donations are always a worry to us. Will we get enough to replenish stocks, and will there be any spores worth having in the carefully packeted envelopes? It is sad to report that we do get some donations that are totally unusable. The worst case was a large donation which comprised carefully packed frond tips which were either devoid of sori, or had been collected far too late and all of the spores had been shed before being collected. Late collection is probably the main problem of many of these fruitless donations. The worst group are the tree-ferns, notably *Cyathea* spp. We frequently get what seems to be a large donation of spores only to spend a considerable time looking under a microscope to finally realise that there are too few spores among the chaff to be worth including in the list. It is very hard for us to tactfully report back to these donors that their efforts have been in vain. All we can suggest is that anyone donating spores should please check the packets or envelopes to see if there is anything spore-like in the bottom before wasting expensive postage sending something we cannot extract spores from. We can cope with cleaning spores from fronds and chaff, but anyone prepared to go one step further and do that bit for us will earn our undying gratitude!

One final problem we sometimes have is the labelling of donations. We are getting to know a large variety of species names, but we do sometimes get donations where the species name is unfamiliar and hard to read. This involves us in a fair amount of time trying to decipher the words and search our books and the Internet to try to match hieroglyphics with a name.

But enough of the problems. Very many thanks to all our donors. Most donations are well presented and most welcome. Keep up the good work.

The new species numbering system does not seem to be posing any problems. The germination information has been sent in by many members. Thanks to all those who have taken time to return their forms. This will be useful for the future as we are concerned that we may be discarding spores which may have viability beyond the three year cut-off we currently use. The plan from this year is to keep all spores indefinitely and to give members the option to test some of the older spores. More details with the next spore list.

The decoding sheet with each request gives us the opportunity to keep track of who requested what and when, and also which donor provided the spores. This means we can track backwards and forwards if necessary as in the case of a donation which turns out to have been the wrong taxon. Some donors send in spores, in all innocence, which are wrongly named. If we can isolate these cases we can let members know to correct their records and stop them propagating the mistake by sending in spores with the same wrong name on them. One example we are trying to track down resulted in several reports of *Woodsia alpina* being sown and *Cystopteris dickieana* coming up.

Speaking of wrong names. The 17 people who had spores from us – donor no. 13 – of *Athyrium filix-femina* 'Clarissima Bevis Superbum' with the taxon number 1567, please note that this is not the correct name. We bought the parent plant under this name in good faith, but now believe it to be *Athyrium filix-femina* 'Plumosum Divaricatum', as featured in Martin Rickard's new book *The Plantfinders Guide to Garden Ferns*. This is a very beautiful fern but is not as finely cut as 'Clarissima'. We hope that they germinated and you are not disappointed.

WANTED

DEAD OR ALIVE

The Australian Fern Weevil

This pest of fern collections was first found in the fern house at Glasnevin, Dublin in 1902 where it ravaged the collection. It has subsequently appeared in widely scattered sites in England, Wales and the Channel Islands, sometimes in fern collections but also on bracken and male fern in the wild. Any kind of fern can be attacked. The main damage is caused by the grubs which live in the stems and rhizomes.

Description: 5-7 mm long, black, dull, warty, with a long slender curved beak. Grubs: White, legless, with brown head.

Action: Send specimens to: Richard Thompson, Coleoptera Section, Department of Entomology, The Natural History Museum, London SW7 5BD.

Residents in the British Isles and the Channel Islands should keep a lookout for these Weevils and report to Richard Thompson if any are found.

FRACTAL FERNS

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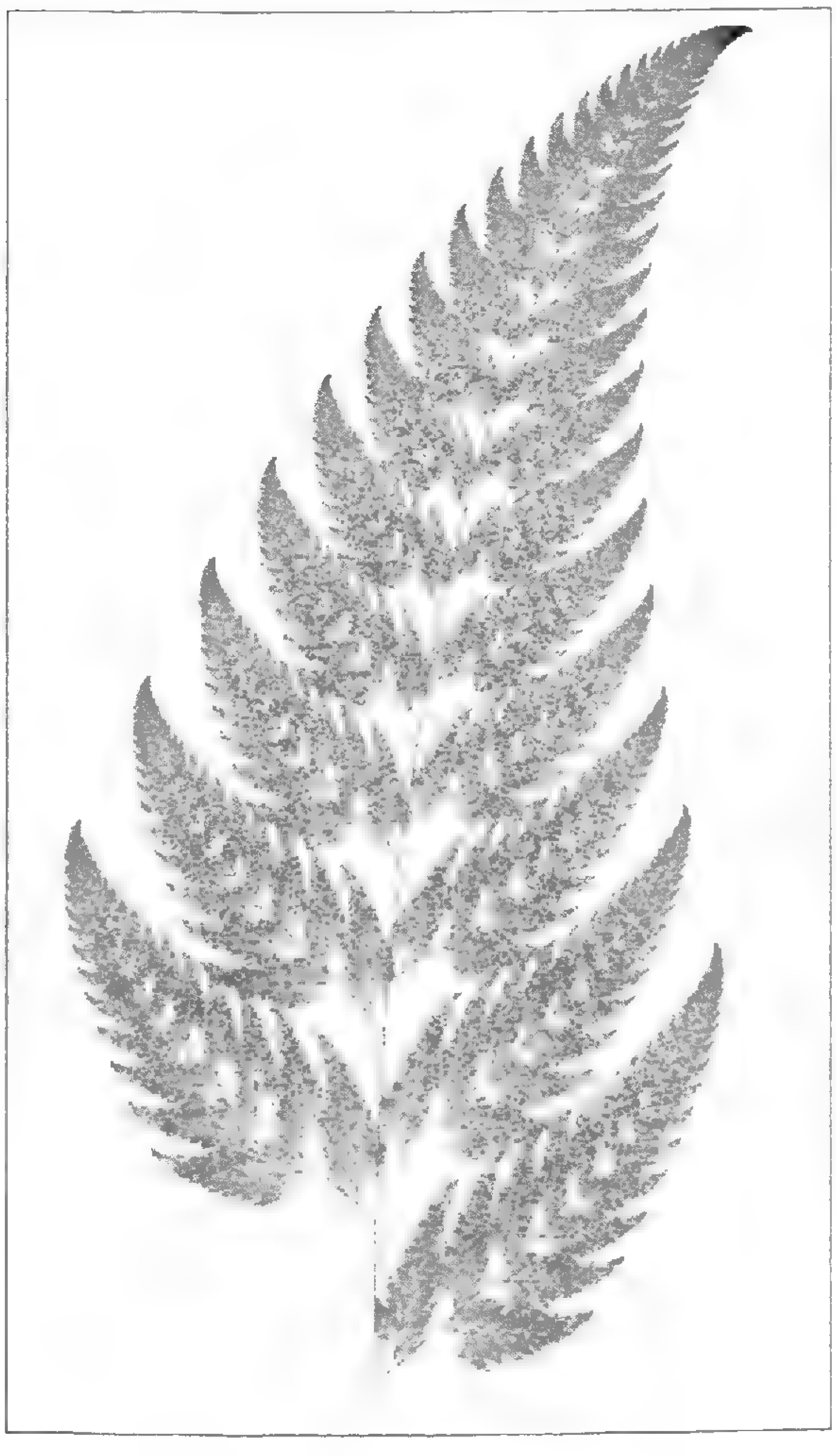
Abstract

Using simple PC software and suitable starting conditions, it is possible to generate fractal images that bear a striking resemblance to real pteridophytes. This paper presents a brief exploration of generating fractal images resembling fern fronds, using simple Iterated Function System (IFS) software on a PC. It illustrates some of the morphologies that can be obtained through simple variation of image iteration parameters. A possible link between the IFS fractal and the patterns of ferns in nature is discussed in passing. The paper is based on a page prepared in 1997 as part of the Website 'Ferns of the Canberra Region' (http://www.home.aone.net.au/byzantium/ferns)

What are fractals? Put simply, fractal mathematics can be used to generate points on a graph that are the result of iterated calculations: The answer from one calculation is the input value to the next calculation. The resulting graph of points generated by the mathematics is usually loosely referred to as a 'fractal image'. The iconic Mandelbrot image is generated by a process that assigns a colour to each point on a two-dimensional graph, according to how that point behaves when its coordinates are used as a starting point for calculations using the Mandelbrot formula (Mandelbrot, 1988).

Another method of generating fractal images is the Iterated Function System, or IFS. This method was first explored by Michael Barnsley at the Georgia Institute of Technology in the 1980s (Barnsley, 1993). Starting with simple graphical shapes, the process iteratively transforms them into more complex shapes.

The IFS process for a 'fractal fern' starts with four polygonal shapes specified by a list of 28 numerical values. One of these shapes corresponds to a line segment (this becomes the fern's rachis or stalk). The iteration process starts with these shapes and uses them to generate new shapes, gradually building up a detailed array of black or white points on the graph. With appropriate starting parameters, after dozens or hundreds of iterations, a pattern emerges that bears a startling resemblance to a fern. The larger the number of steps in the iteration, the more intricate the detail in the pattern becomes.



A characteristic of this and other fractals is that the pattern repeats itself in the finer and finer detail. In other words, taken to the limit, the detail displayed does not depend on the level of magnification of the image. Swift anticipated this in 1733:

Big fleas have little fleas
on their backs to bite them,
and little fleas have lesser fleas,
and so ad infinitum.

Barnsley is credited with discovering the IFS fractal pattern now known as *Barnsley's Fern*. It is supposed to resemble the Black Spleenwort, *Asplenium adiantum-nigrum*. There are numerous references to Barnsley's Fern on the Internet. It is usually depicted as in Figure 1.

Figure 1: Barnsley's Fern - standard image

The starting shapes for Barnsley's Fern are specified by a series of 28 numbers used as input to the calculation process, as follows:

0	0	0	.16	0	0	.01
.85	.04	-.04	.85	0	1.6	.85
.2	-.26	.23	.22	0	1.6	.07
-.15	.28	.26	.24	0	.44	.07

What do these numbers mean? The four lines correspond in general terms to the rachis of the fern (first row), the overall form of the frond (second row), the left hand first pinna (third row) and the right hand first pinna (final row). The first four columns correspond (roughly) to characteristics like the length of the pinna, the sparseness and width of the pinnae, the curve of the frond and pinnae etc. The exact relationships are complex and non-orthogonal. The final column is a list of probabilities that tell the calculation process how often to use the particular rows. It gives the balance to the final picture. Transforming these iteratively is straight forward but labor intensive, and dramatically simplified using a PC and appropriate software.

The software used in this brief exploration is a freeware program known as Fractint. It runs on a PC and allows one to calculate and plot IFS fractals, including fern-like fractals. It is available in the Internet at http://spanky.triumf.ca//www/fractint/fractint.html, in DOS and Windows versions.

In this exercise, I have used the Windows version to explore some of the fern-like images that can be generated. As the results of the iterations, the program creates black and white images as raw screen output.

A useful way to create more life-like images is to accept the raw monochrome output from Fractint and process it in a graphics program such as Adobe Photoshop. The best technique is to convert the black pixels to green and filter the image to create the appearance of a continuous tone. The result of such image processing – which involves no redrawing of the computer generated image, just filtering and colouring – is shown in Figure 2.

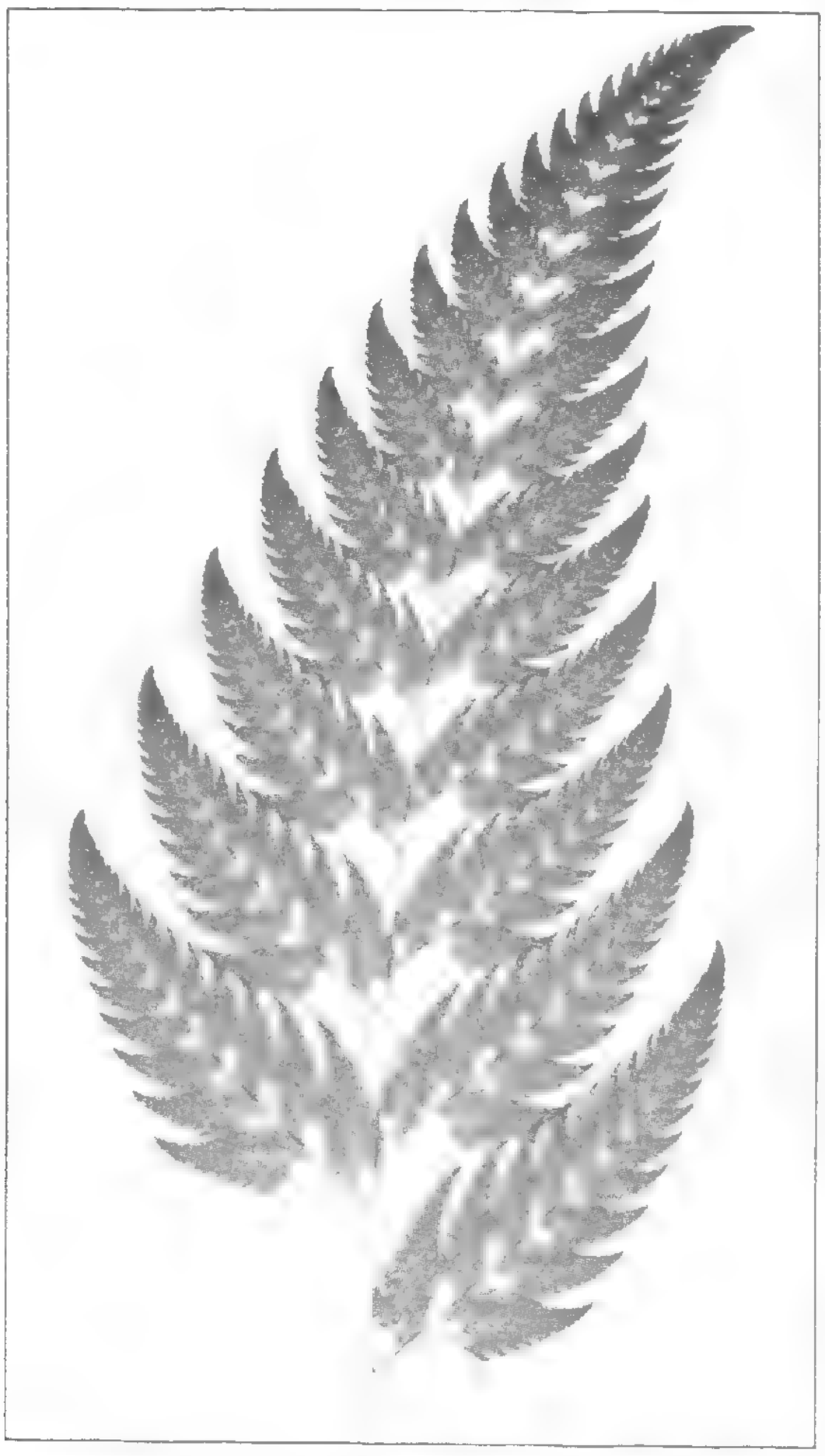


Figure 2. Barnsley's Fern – Photoshop enhanced image

This image is reasonably fern-like, though it includes certain morphology that is unnatural, such as the pinnule nearest to the rachis being the first to occur on the pinna, instead of the second. However, the IFS system allows one to change this.

By changing the starting parameters, one can change many of the characteristics of the "frond" shape. My first experiment with this process was to modify the parameters for Barnsley's Fern to adjust the pinnule sequence arrangements. This was fully successful, and warranted additional processing in Photoshop to rotate the image into a more natural position. The resulting image looks remarkably natural. The results of this are shown in Figure 3.

Figure 3. Barnsley's Fern - modified pinnule sequence

There are strong similarities between the two, but notice the different pinnule arrangement next to the rachis. This difference is the result of the changes in the parameter list.

The parameters for this image (found through trial and error) are:

0	0	0	.2	0	-0.12	.01
.845	.035	-.035	.82	0	1.6	.85
.2	-.31	.255	.245	0	.29	.07
-.15	.24	.25	.20	0	.68	.07

The numbers are roughly the same as the first set, in most places. The main difference is in the third and fourth rows in the seventh column, where the numbers are substantially different, both relative to each other and in absolute terms. The other changes are minor "tweaks".

Note that the image consists only of computer generated points, with filtering, colouring and rotation.

This success led me to ask if it might be possible to generate fern-like images substantially different from the Barnsley Fern.

The first step was to identify the role of each element in the array of numbers. By trial and error, I worked out what happened when each array element was changed. To follow this step, note that the Fractint software accepts as input different arrays of numbers from a file called fractint.ifs, which you can edit with a text editor.

This file includes many different IFS arrays, including one titled 'fern'. I edited each element in the "fern" section of the file, and processed it through Fractint to determine the result.

Many of the results were most un-fernlike. One or two looked like palm fronds, but others were strange mutants. The main problem is that the array parameters are not orthogonal (independent of each other), so when one parameter is changed, it is necessary to compensate a little through changes to other parameters (for example, to re-attach pinnae to the rachis!) This is a slow and painstaking process.

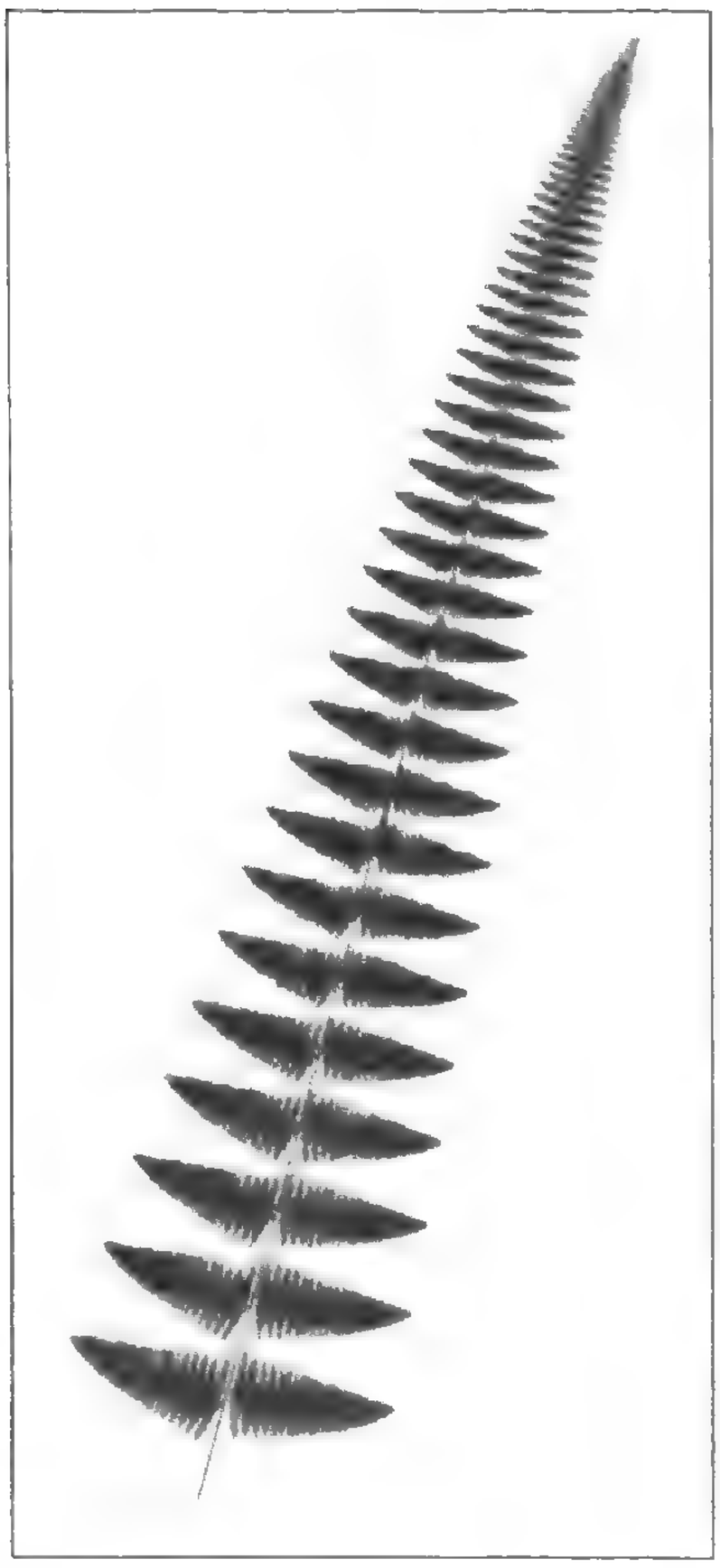
When I'd established the role of each of the parameters and how sensitive it was to changes, I was able to create totally new fern-like images.

The first and most visually pleasing looks vaguely like *Calochlaenia dubia*, as shown in Figure 4.

Figure 4. A new fractal fern - '*Calochlaenia*' sp.

The parameters for this image are:

0	0	0	.25	0	-.14	.02
.85	.02	-.02	.83	0	1	.84
.09	-.28	.3	.11	0	.6	.07
-.09	.28	.3	.09	0	.7	.07



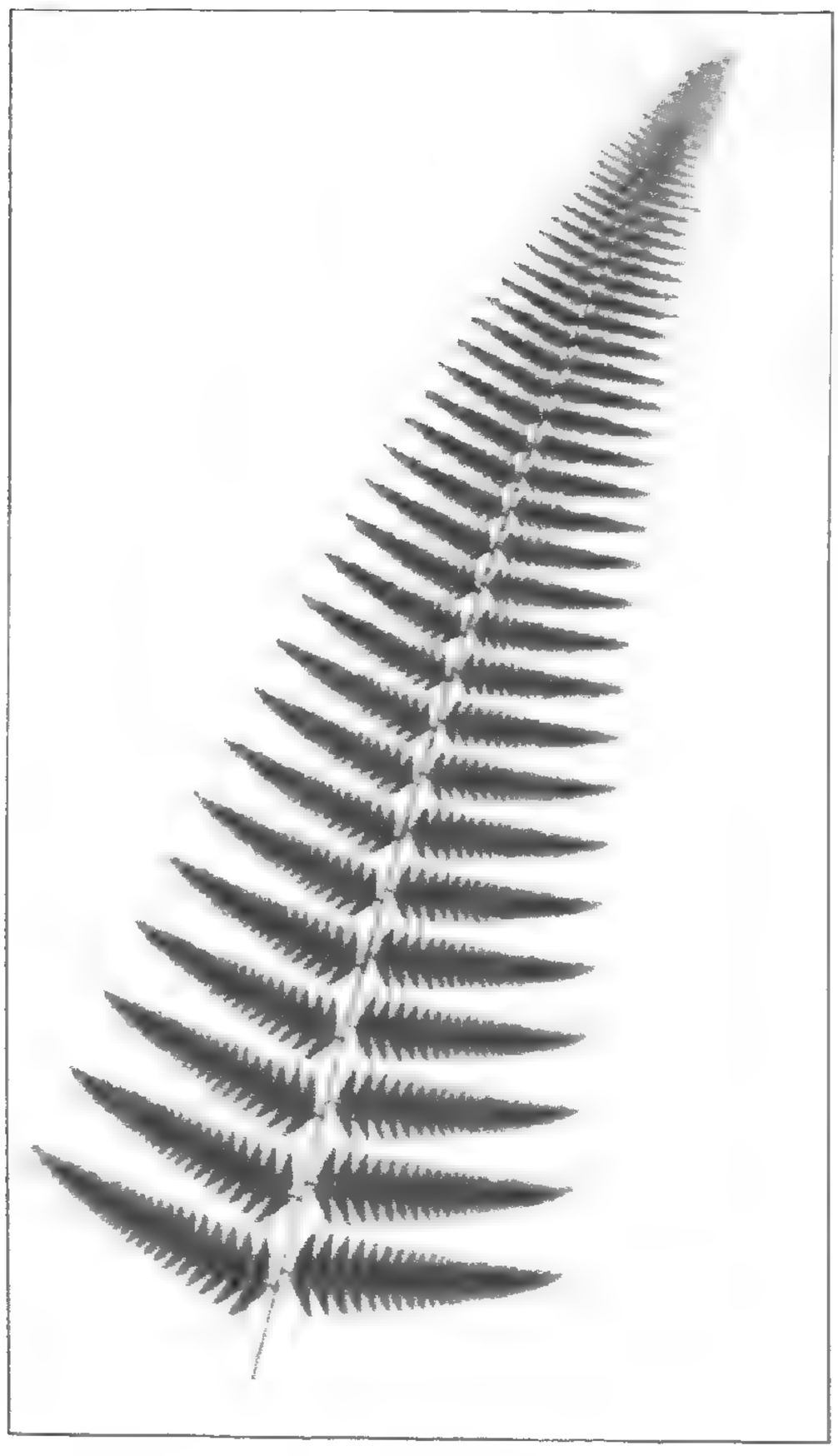
The next question that occurred was to ask if it were possible to generate fronds of the "fishbone fern" kind. This must necessarily be an approximation, as fractal ferns have (*in extremis*) pinnules on pinnules on pinnules etc, while real ferns stop the division at some point. Fishbone ferns usually stop at the first set of pinnae, which is difficult to achieve using the IFS system.

However, the infinite detail possible in fractals is only reached if the calculations are continued indefinitely. Stopping after a certain number of iterations limits the level of detail in the image. (Between 150 and 2000 iterations were used for all of these images). Further, the screen pixel size and the graphics plot resolution also cuts out detail below a certain point. If one uses this by creating detail so fine it cannot show up in the screen image, and filtering the result in a graphics program, the result looks a bit like a cross between a *Pellaea* and a *Nephrolepis*, as shown in Figure 5.

Figure 5. "Fishbone" Fern

The parameters for this image are:

0	0	0	.25	0	-.4	.02
.95	.002	-.002	.93	-.002	.5	.84
.035	-.11	.27	.01	-.05	.005	.07
-.04	.11	.27	.01	.047	.06	.07



While attempting to create the 'fishbone' fern image, I found a set of parameters for an image reminiscent of the *Cyclosorus* species. The result is shown in Figure 6.

Figure 6. *Cyclosorus*-like fern

The parameters for this image are:

0	0	0	.25	0	-.4	.02
.95	.005	-.005	.93	-.002	.5	.84
.035	-.2	.16	.04	-.09	.02	.07
-.04	.2	.16	.04	.083	.12	.07

SHORTCOMINGS

The IFS fractal system as used here (and perhaps under all circumstances) is not able to generate fully realistic fern images. For example, the pinna length always decreases toward the frond tip: it never grows and contracts again. The structure of the pinna is always fully detailed (i.e. fully fractal). It doesn't simplify as you approach the tip. The pinna angle doesn't vary along the frond. And so on.

These are, most likely, limitations of the very simple IFS process. But if one notes that the images are specified by minor variations in only 28 numbers, the results are remarkable.

The Fractint software also allows three dimensional modeling, but this is beyond the scope of the present exercise. The process is similar to the 2D images, but more complex. I leave this to others to explore.

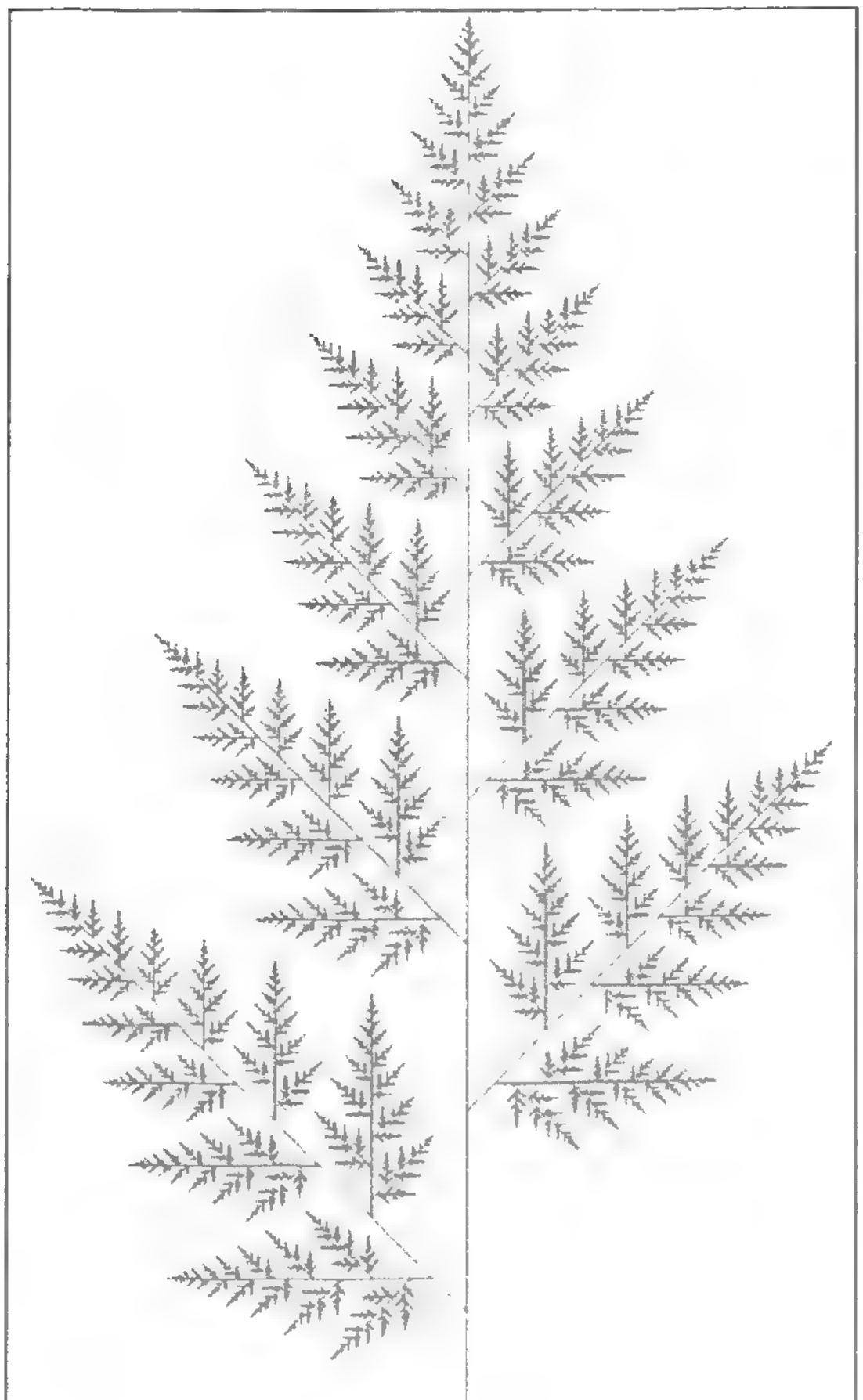
Fractals and fern genetics

The success of this crude modeling process does not imply that an identical process is implemented in fern genomes. However, it illustrates that quite different but complex shapes can be generated by varying a small number of parameters. Given the ubiquity of fractals in nature (Mandelbrot,1988), it is possible that an equivalent process may be embedded in the genome, giving rise to the diverse morphology of the pteridophytes.

Other types of fractal ferns

There are other ways of plotting fern-like images from simple formulae. Another method that can be explored using the Fractint software is known as the L-System.

This is a set of instructions that tells the computer to plot a short line, turn a corner (of a prescribed angle), plot another line, turn again, and so on, until a given point is reached, then go back and draw another set of connected lines, starting back near the beginning of the first line series, and so on. Depending on what angles, line lengths and re-start conditions one chooses, one can create images that are somewhat fern-like.



One of the L-system routines available in the Fractint file plants.l, available from the Fractint Website, is called "Leaf1". If you set the "order" to 34 (which tells it how far to go down the line segment series) you get the result shown in Figure 7:

Figure 7. L-System leaf, Order=34

The formula for Leaf1 is:

```
Leaf1 {
angle 8
axiom x
a=n
n=o
o=p
p=x
b=e
e=h
h=j
j=y
x=F[+A(4)]Fy
y=F[-B(4)]Fx
F=@1.18F@i1.18}
```

For further information, see the tutorial on L-Systems on the Fractint Website (http://spanky.triumf.ca/www/fractint/lsys/tutor.html).

FURTHER READING

There is much information on the Internet about fractals, though not much dedicated to fractal ferns. A good place to start is the Fractint homepage: (http://spanky.triumf.ca/www/fractint/fractint.html).

Another Website with useful information, especially on three dimensional L-Systems fractals, is Laurens Lapré's Lparser page (http://www.xs4all.nl/%7Eljlapre/index.html) I've not used this software but the images are beautiful and include a number of fern fractals (see the Gallery page).

REFERENCES

Michael F. Barnsley. 1993, Fractals Everywhere (2nd edition). Morgan Kaufmann Publishers; ISBN: 0120790696

Benoit B. Mandelbrot, 1988, The Fractal Geometry of Nature. W H Freeman & Co.; ISBN: 0716711869

MORE ON FRACTALS

If this article has given you interest in fern fractals you might like to see: Heggie, M. and Zodrow, E.L. Fractal lobatopterid frond (Upper Carboniferous) Marattialean Tree Fern). Palaeontographica B 232: 35-57, 1994.

TWO FERNS FROM ONE MANHOLE!

Mike G Taylor, 30 Beatrice Street, Kempston, Bedford MK42 8AE.

In a garage block off of Conniston Close, Bunyan Road, Kempston there are three manholes (350 x 500 x 1100 mm deep). Four years ago I first noticed the fronds of a Male-fern poking up through the grid of one of the covers unfortunately it could not grow any further as passing vehicles broke the tips of the fronds. Each year I take a look to see if it is still there and this year (2000) to my surprise and delight not only was the Male Fern present but also the fronds of a Hart's Tongue Fern. Examination of the other two manholes revealed a small Male-fern in one of them while in the third two small Hart's Tongue Ferns, about 200 mm apart, were growing about 300 mm down. There was still water present in all three manholes at the end of July. I would have liked to take a photograph down into the first manhole as it is wonderful mixture of the fronds of the two species but unfortunately it proved to be impossible to remove the cover.

OPHIOGLOSSUM ON THE ISLE OF RAASAY

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The Isle of Raasay lies between Skye and the Scottish mainland and has a good variety of ferns. As a self-inflicted task, I have been mapping all vascular plants on Raasay on a 1 km square basis for the past nine years and offer here the results so far for one small genus.

Despite extensive botanical work on Raasay in the 1930's, the first record of *Ophioglossum* from the island was in 1960. This record 'among boulders in grassland at Oskaig' on the west coast of Raasay has never been found again and remains in some doubt as other records made by this recorder during his 1960 visit are also in doubt. However in 1984, *O. vulgatum* was found above the path from Fearns to Leac on the east coast where I was able to re-find it in 1997 and where it can be seen today.

Indeed, it is not only to be seen scattered over some distance at the original site towards the top of a grassy bank below basic cliffs, it is also quite common just above but more especially below the same path for several hundred metres. In all these places it is under *Pteridium aquilinum*. Keen to add *O. vulgatum* to the list for the next 10 km square to the north, I was able to find it again at the first attempt in 1998 in similar land - a basic slope on the east coast about 6 km north of the original site, again under bracken. More recently (May 2000 and May 2001) I found more in this 10 km square, well away from the basic soils of the east coast but still under bracken. So all *O. vulgatum* known on Raasay today is under bracken and this seems to be more important than the underlying rock type.

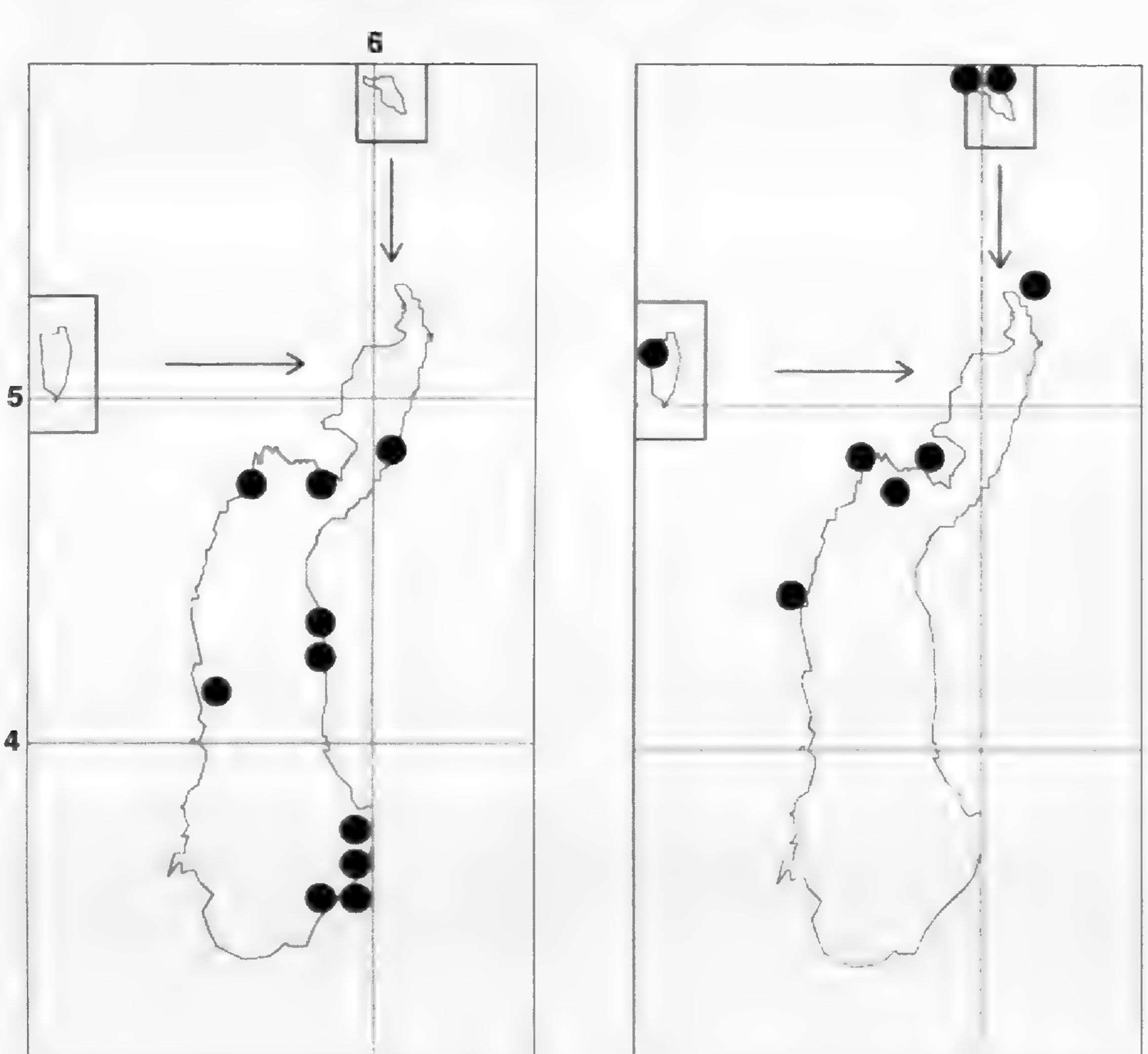
In 1996, the year before finding *O. vulgatum* at the previously known site, I came across some *Ophioglossum* near the extreme north-western tip of Eilean Tigh, a tidal island off the north end of Raasay. The site is 2 1/2 hours brisk walk from the end of the road on Raasay and requires good timing if one is to cross to Eilean Tigh and not be marooned. Photographs and a specimen sent to Alison Paul confirmed my identification as *O. azoricum*. There are several hundred plants on these bleak exposed shortly cropped peaty banks. Other plants to be found with it include *Aira praecox* (Early Hair-grass), *Plantago coronopus* (Buck's-horn Plantain) and *Sedum anglicum* (English Stonecrop).

Subsequent searches have shown that *O. azoricum* occurs at other sites on Raasay and its associated tidal islands, Eilean Fladday and Eilean Tigh, and also on the island of Rona to the north of Raasay, but this small fern remains unknown on Skye. Most of the sites are similar to the first in being exposed coastal peaty banks but two discovered in 2000 are rather different. These are flat areas that flood in winter from, in one case a lochan, and in the other a small burn. The associated flora is also different. These are areas of partly bare peat but also present are species such as *Filipendula ulmaria* (Meadowsweet), *Leontodon autumnalis* (Autumn Hawkbit), *Potentilla erecta* (Tormentil), *Ranunculus repens* (Creeping Butercup), and *Ranunculus flammula* ssp *flammula* (Lesser Spearwort).

It seems unlikely that all Raasay sites for these two ferns have been found and there remains the challenge of finding *O. azoricum* on the much larger adjacent Isle of Skye.

The maps show 1 km square distributions for the two species and were produced using Alan Morton's DMAP programme.

Ophioglossum azoricum



Ophioglossum vulgatum

Ophioglossum azoricum

THE BAKER COLLECTION: BRODSWORTH HALL

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THE SITE.

In the eighteenth century the first BrodsworthHall was built using stone from a limestone quarry only a few hundred yards from the actual site of the building. The building and the estate were in the ownership of the Thellusson family, made famous through one of them leaving a rather controversial will which resulted in a court case and the passing in 1800 of the Accumulations Act (often called the Thellusson Act.)

In 1859 it was decided to demolish this hall and rebuild on the same site, so from 1861 to 1863 the new hall was built and refurnished. Much of the old stone from the original building was used in the reconstruction. This Hall still stands, majestically looking out over this lovely part of Yorkshire which is north west of Doncaster.

THE QUARRY

This quarry is within the boundary of the 15 acre beautifully laid out gardens. It really is an enchanting part of ground and it covers several acres and is set among tall sheltering trees. Although this area is called The Grove it was essentially a quarry garden even in the days of the first hall. Little is known about the type of plants which grew in this place but one hundred and ninety years between 1800 & 1990 saw the whole area become grossly neglected. The house and the gardens were handed over to British Heritage in 1990 who have been carrying out extensive restoration and recovery works. During this time the most dramatic part of the Grove was revealed uncovering a beautiful ampitheatre about thirty yards long and about twenty feet deep with one side laid out as a tremendous rockery. It is truly amazing, but even more amazing is the fact that this is destined to be a fern garden. David Avery, the head gardener, contacted me in July 2000 to tell me of the intentions of English Heritage and to seek some advise on obtaining the plants.

THE FERNS

Wing Commander Eric Baker O.B.E. and his wife Rita went to live in a picturesque little village of Wiswell, near Clitheroe, where there was a very attractive piece of land which had to be cultivated and planted. Rita made a suggestion that some ferns would be appropriate but Eric did not seem to fancy the idea, so she decided to buy one and present it to her partner. What a good idea that was. A *Polystichum setiferum* variety was purchased and handed over. He was amazed at the delicacy and architecture of the fronds. It could be planted in the garden. Eric was hooked. During the coming years they searched all over the country for the more unusual species and varieties, travelling many thousands of miles, spending many hours seaching for and exchanging plants. They became members of the BPS in 1992 and remained very active members until sadly Eric died on 12th August 2000. Rita was left with the impossible task of maintaining the bungalow, garden and all of the plants, a task with which she could not cope. I mentioned to her about the conversation I had had with David Avery and a meeting was arranged between them with a view to the collection being taken over. Terms and conditions were arranged and some of the garden staff from Brodsworth, armed with spades, forks, wheelbarrows and other tools went over to Wiswell to collect all of the plants. It took them five days to complete the task even though the weather was atrocious. They even took boards with them to lay on the lawns in order to avoid doing any damage. Apart from the Baker Collection of ferns Martin Rickard has also supplied a number of Tree Ferns (I think there are seventeen of these very large plants) for planting in a different part of the Grove. I estimate that some of them are in the region of ten fect in height. I was at Brodsworth on 9th Dec with Rita and we were overjoyed to see that many of the ferns are already planted in this massive rockery. They really are a joy to behold, especially as they are such mature and well grown specimen.

THE FUTURE.

When the remainder of the plants are in their permanent positions, which will be about the end of 2000, an irrigation system will be ready to ensure that these lovely ferns never go dry. In addition, the base of the quarry will be covered with some stone chippings which will make it appear that there is a stream running through this wonderfull fairyland. One plant which will look particularly spectacular is a very large *Polystichum setiferum pulcherimum* 'Bevis' . I watched the excavation of this from Wiswell and it took two hefty men to carry it to the van. Visitors will be able to see some very unusual Polypodiums, some very good scollies, excellent *Polystichum*, *Osmunda*, in fact a truly wonderful collection of ferns. Look for the 'filmies' growing on the trunks of the tree ferns.

THE CONCLUSION.

When all the planting is finished a plaque will be erected in the quarry stating that this is the Eric Baker Collection. One little, but important, point is that David Avery has found a Scollie in the limestone cliff, out of reach of human hands, which must have been there for some years as it has multiplied. He showed this to Martin and this resulted in a ladder being provided which Martin climbed to get a close look at this unusual fern. Neither he nor myself have ever seen one like this before. It is to be called '*Asplenium scolopendrium laceratum* 'David Avery' The house and gardens are open to the public during spring, summer and autumn and I can thoroughly recommend a visit. The ferns should be very good in 2001, but absolutely excellent in 2002 and thereafter.

The entrance to the hall is:
From Al (M) turn westwards at junction 37.
Take A635 towards Barnsley.
After a couple of miles turn northwards at signposted lane.
The entrance is about two miles onward on the left.

Brodsworth Hall is open 31 March - 4 Nov., 1-6pm Tue. - Sun. and bank Holidays. Gardens, tearooms and shop: 31 March - 4 Nov., noon - 6pm. Gardens only 1 Nov. - 26 March 2001, 11am - 4 pm weekends only. Ring for details on 01302 722598. Pre-booked guided tours for house in mornings April - Oct. Entry House and garden £5/£3.80/£2.50. Gardens: £2.60/£2/£1.30 (summer) £1.60/£1.20/80p (winter)

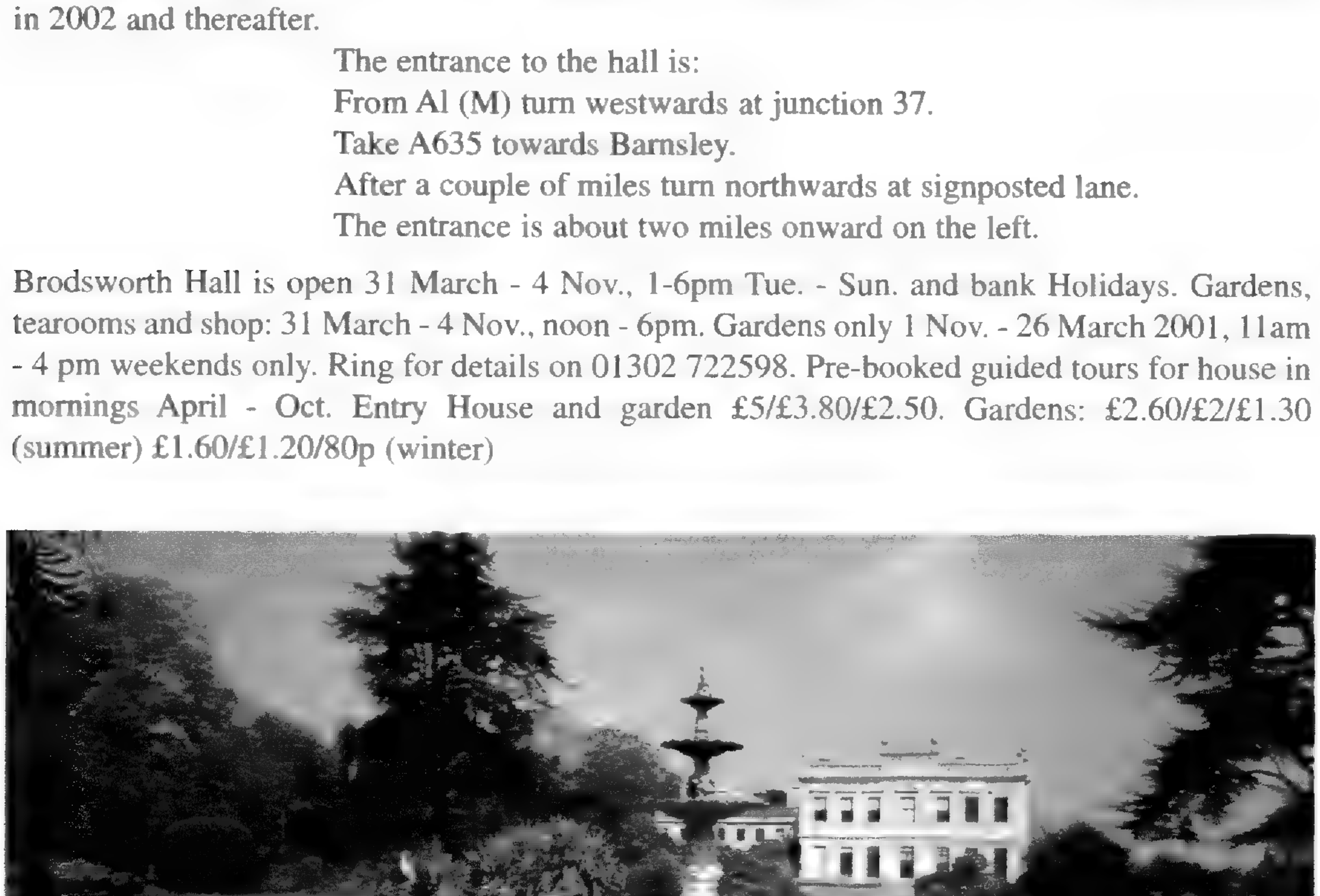

Fig. 1 Brodsworth Hall (©English Heritage Photo Library)

Fig. 2 *Asplenium scolopendrium* laceratum "David Avery".

Fig. 3 Way out to tree ferns (©English Heritage Photo Library)

Fig. 4. The Rockery December 2000

Fig. 5 Rita Baker

SURVIVALS

Ted Wright[1], Littleworth House, Amberly, Stroud, Gloucestershire[2].

When I acquired Littleworth House at the end of 1994, I soon learned that it had been built by Stanley S. Marling, a member of a dynasty once prominent in the neighbourhood, and still remembered in the village. He died , aged 99, in 1963 and some of the house looks as if had been built before 1914. Stanley Marling, of Stanley Park and Littleworth house, was the youngest of three brothers and had been vicar's warden of the family church, All saints, Selsey from 1916-1922. His nephew, J.S.V.Marling inherited the baronetcy and property of Stanley Park after World War I and I assume moved to Littleworth House in 1922 or thereabouts. He had become church warden at Amberley by 1929. It seems that he may have brought some of his collection of ferns when he moved house.

One of my first activities was to prepare accommodation in the garden for my collection of ferns, which have moved house with me half a dozen times in the last sixty years. I soon found out, however, that there were a number already in residence: plentiful male ferns and hart's tongues especially, but among them were quite a few interesting cultivars suggesting that one of my predecessors may have taken an interest in the subject.

The first that caught my eye were polypodies: a nice spread of about a yard round of *Polypodium australe* 'Macrostachyon' in the shade under a sycamore and a plant of a crested cultivar growing in a limestone wall, probably *Polypodium interjectum* 'Bifido-grandiceps'. If my soil; were less limy I would have ascribed it to *Polypodium vulgare*! The next find was a fine plant of *Polystichum setiferum* with a tendency for the pinnae to adopt a cruciform form - on the way towards 'Wakleyanum'. Unfortunately it is no rival to the true P. setiferum 'Wakleyanumî which my brother and I had in the family garden before World War II, but which alas died after an injudicious move to a drier situation in the late 1930's. The final discovery was of an *Asplenium scolopendrium* 'Marginatum' a couple of years later growing at the foot of another limestone wall in an obscure corner.

I showed Martin Rickard these on various calls and this sparked his antiquarian interest. When I mentioned Stanley Marling he realised there was a connection with the BPS as there had been a Marling on the membership list back around 1911! It would appear that the garden has gone full circle from BPS member to BPS member in around 80 years. This suggested that the few survivors may have been only the tip of the iceberg and that Marling may have had many more attractive specimens growing there in the heyday of the garden when, according to reports, he used to employ seven gardeners at one time. This has now come down to one elderly owner and a jobbing 'tidier' for three hours a week, but I am still keeping my eyes open in case there may be treasures lurking somewhere about the place. Little chance, I fear; but it is satisfying to know that there are a few survivors from oldendays to go with the ones that have travelled the country with my from East Yorkshire, some of which I have known for over sixty years.

Footnote

[1] Since this article was written Ted Wright has died. We publish this article in the belief that he would have wished us to do so.

[2] see also Ted's article *On Curlies* in the *Pteridologist* 2, 4, 173-174, 1993.

THE MARLING CONNECTION

Martin Rickard, Pear Tree Cottage, Kyre, Tenbury Wells, Worcs. WR15 8RP.

Ted Wright refers to my recognition of the name Marling. It was quite extraordinary really. When Ted showed me the old established fern cultivars in his new garden at Littleworth House I only mused out loud that I wonder who used to live then. When he told me it was a Stanley Marling I was flabbergasted. It was a name that I had come across several years earlier when I was working through the membership list for possible sites of old fern collections in the Cotswolds. As a result of my enquiries at the time I gave an account of some of my successes in an article published in the *Bulletin* 2, 4, 196-197, 1982 entitled *On the track of old varities*.

Marling, recorded as S.S.Marling of Stanley Park, Stroud in the Society membership lists, never seems to have been an active member, but he was a keen fern grower. The Reverent Hawkins (later Cannon Hawkins) of Stroud wrote in our *British Fern Gazette* Vol. 1, p.130 (1910):

"My friend S.S. Marling, of Stanley Park, Stroud, has already a splendid collection, through yet young in years. They revel in their ideal surrounding, sheltered by the trees and nourished by the moisture from the lake."

"There is seen the *Athyrium* in its manifold variety, but beyond all there is Polystichum divisilobum plumosum [today known as *P. setiferum* 'Plumosum-divisilobum'] in all its glorius shades and shapes of colour and form. No 'withered cheek nor tresses grey' among them, the rusty tips are happily absent, for it is a plant which revels in the fresh air."

According to my information, Marling joined the Society in 1911, a year after Rev. Hawkins wrote these words. He was still on the list in 1918, but was gone by 1921. In those days the Society was quite small with 149 members.

Archival research by Ted Wright has shown that Samuel Marling lived from 1864 to 1963. He is therefore almost certainly the S.S. Marling of our membership list as well as Ted's Stanley at Littleworth House. It is perhaps significant that he resigned from the Society so early even though his friend Cannon Hawkins continued as a member until his death around 1935.

Stanley Park was a prestigious country house near a village outside Stroud, about three miles from Littleworth. Sadly progress has seen its demise as a country house and it is now divided into flats and the grounds have been partly built on. There is therefore little prospect of uncovering old fern cultivars in there original site. There is still a lake that is quite remote from the house but I was unable to find any cultivars when I explored there in 1982. The existence of the few surviving cultivars makes it appear likely that Marling moved his ferns to Littleworth although I am tempted to think that he might has distributed them when he moved. I suggest this because no lady ferns or plumose polystichums survive in the garden at Littleworth. Lady ferns would probably have struggled as the garden is sunny and well drained but the plumose polystichums should have thrived. Where are they now? They are certainly not amongst the bread and butter cultivars discovered by Ted, I suspect the best were creamed off long ago, possibly by Cannon Hawkins, among others.

In my 1982 article, I described the existing ferns at Overcourt in Bisley, about 4 miles north of Stroud. These I deduced were from the collections of Cannon Hawkins. This collection included one or two fine polystichums including *Polystichum setiferum* 'Plumoso-divisilobum Baldwinii'. Perhaps the Cannon acquired this from S.S. Marling?

Our Society has always been small so I wonder what the odds are of two Society members living in the same house. It is certainly a happy coincidence that once again fern flourish at Littleworth. Ted's collection is small but choice - curiously featuring several forms of *Polystichum setiferum* 'Plumoso-divisilobum.'

AN INTERESTING HARTSTONGUE FERN

A.R. Busby, 16 Kirby Corner Road, Canley, Coventry CV4 8GD

At the Southport Flower show in August 2000 Lawrence Kirby exhibited on the Society's stand a rhododendron log planted with several ferns. One of the ferns was a perfectly normal Hartstongue, *Asplenium scolopendrium*. During the show I noticed that this fern was exhibiting fronds with a neat continuous dark margin around the entire frond. This feature was apparent on all the plant's fronds, which suggested that it is a constant and very attractive feature. It was difficult to ascribe a colour to it but, to my eye, it appeared like a dark maroon line. Others considered it to be nearly black.

For some unaccountable reason, this feature rang bells in my brain. I was vaguely aware that I had seen an account of this feature in a Society publication several years ago and at the risk of being considered a very sad case who can get excited at something that most might consider a very trivial pursuit, I decided to see if I could track it down.

One of the great joys of being involved with this Society is being able to spend time browsing though its journals. Having looked through the old BPS newsletters without any luck, I turned my attention to the early volumes of the *British Fen Gazette* and there it was in a report on the Society's annual excursion to north Somerset in 1957 (vol. 7, p. 207). J.W. Dyce reporting on a visit to a 'deep valley' in the Brendon Hills relates: ìThe scolopendriums were magnificent and one wooded slope was covered with large specimens among which we discovered several with their fronds outlined with narrow dark margins. The suggestion of mourning in this peculiar development inspired our editor to name them *Asplenium scolopendrium* 'Maerens'. The editor at the time was of course the Reverent E.A. Elliot.

In the same volume, there was an article under the heading 'Fern Gossip' on page 21 by my good friend, the T.A. Dyer. He reported that he too had noticed this condition, which apparently begins to show as the frond unrolls as a thin pallid white line slowly becoming brown and eventually maturing as a black line. Various guesses at an explanation were made on the spot. One was that the soil in coniferous woodland had some sort of chemical effect, possibly resinous. Another, by Dr. Warberg, in mentioning that similar specimens had been seen in Kent suggested that it was a nutritional cause and that an element in the soil was responsible.

So there it is. Have other members noticed this feature? Does it come true from spores? Does anyone care? I look forward to correspondence on this matter.

CORRIGENDA

Corrections to FERN COLLECTING IN S.TOME (GULF OF GUINEA), *Pteridologist* **3**(5).

p.118. Line 17: *Dryopteris pentheri*, line 19: *Huperzia warneckei, Selaginella molleri*;
line 25: *Athyrium newtonii*; line 26: *Grammitis molleri*; line 40: *A. megalura var. molleri*;
line 42: *Pteris pteridioides*.
p. 119. Line 5: *molleri*; line 9: *Dryopteris pentheri*; line 11; *Trichomanes rigidum,*
Pneumatopteris venulosa; line 42: *Vittaria, V. owariensis*, *Asplenium barteri*;
line 43: *Microsorum punctatum*.
p. 120. Fig. 5: (...) *Begonia crateris*
p. 122. Line 14: *Platycerium stemaria*.

BOOK REVIEWS

PTERIDOPHYTES IN THAILAND by Thaweesakdi Boonkerd and Rossarin Pollawatn. Published by Office of Environmental Policy and Planning (OEPP), Bangkok Thailand. August 2000. Paperback, 312 pages, 248 colour plates, 671 distribution maps. ISBN: 974-7580-55-1. Price: Free (except for post and packaging). Order from Biological Resources Section, Natural Resources and Environmental Management Division, Office of Environmental Policy and Planning (OEPP), Ministry of Science Technology and Environment, 60/1 Rama VI Road, Bangkok 10400, Thailand. Tel: (662) 2713251, 2797180, 2797186-9 ext. 226, 227. Fax: (662) 2798088, 2713251.

This book (which forms volume 11 in Thailand's OEPP Biodiversity Series) is little more than an illustrated list of the 671 pteridophyte taxa currently known from Thailand but it is well researched and beautifully produced. The general format for the presentation of data on each species is simple and brief consisting of a 5 line textual entry (family, scientific name, synonym, Thai name and data source) and a small distribution map. For most species there is no additional information but for 151 species there is a beautiful selection of 248 high quality colour photographs. Most of these photographs are the same as those that were used to create the image library of *Noteworthy Ferns of Thailand* [the 'electronic book' produced by Boonkerd and Pollawatn (and others) in 1996 and reviewed by the Pteridologist in 1999 (vol. 3, p 104)] but there are a few new photographs here including 22 that are used to illustrate 17 of the 46 fern allies found in Thailand. Unlike *Noteworthy Ferns of Thailand, Pteridophytes in Thailand* contains no information on species morphology, ecology, economic uses or conservation status.

It is worth noting that despite the simple and standard format adopted for the presentation of data on each species only 16 have a complete entry; 542 species are portrayed as having no Thai name and 598 species are portrayed as having no synonymn. I am not qualified to challenge the implication that most Thai pteridophytes have no local name (I could imagine that this is true) but I know for certain that most Thai pteridophytes have at least one synonym which could have been included in this book. It is also worth noting that none of the 73 synonyms that do receive a mention in the book can be located via the index. *Pteridophytes in Thailand* also suffers, in places, from poor English, inconsistent use of author abbreviations and double-imaging of maps but these are relatively minor faults that are unlikely to trouble the majority of readers.

Pteridophytes in Thailand is undeniably a useful and attractive little book that will be of most interest and value to those who are actively involved in plant biodiversity studies and conservation in Thailand or the neighbouring countries. For anyone with a more casual interest in the fern flora of Thailand (and who is not particularly interested in finding information on fern allies) I would still recommend *Noteworthy Ferns of Thailand.*

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