



**THE FRIENDS OF TREBORTH
BOTANIC GARDEN**

**CYFEILLION GARDD
FOTANEG TREBORTH**



NEWSLETTER

CYLCHLYTHYR

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Fig. 1. Digitised images of specimens from the Herbarium [p. 19]

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Cover Photos:

Front: Xi Long and Shore planting orchid seed on a tea tree (*Camellia sinensis*) [p. 25]

Back: Skeins of wool drying (with Pat Denne). Yarns dyed with plant dyes at the Gwynedd Guild of Weavers, Spinners & Dyers dyeing day, September 2014, Treborth Botanic Garden. [p. 15]

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Chair's Report May 2015

This newsletter is filled with the usual fascinating and eclectic mix of articles, from an update on the herbarium project (the oldest specimen is from 1778!) to an interesting piece on plant fibres, and another on projects taking place in the Anglesey AONB.

One of Angela's articles is a biography of Nigel. He retires in July and so this newsletter includes his last regular contribution as Curator. I'm sure I'm not the only reader who, when the newsletter arrives, turns first of all to his Weather and Wildlife report, partly because of the information they contain, but mainly because of the joy of reading his eloquent and measured prose. He writes as he speaks: with sharp observations, little known facts, and questions to inspire an enquiring mind. This report first appeared in the second newsletter in March 1998, when Nigel wrote that "in the early, Venus-bright hours of St. Valentines Day the Song Thrush's strident call breaks the pre-dawn silence of the garden, awakening the roosting Jackdaws which flurry from the wood in untidy, tree-top hugging gangs". In September 2001, he noted that "Cockchafers, also known as Maybugs, were noticeably less numerous – a total of 115 compared with 278 last year – perhaps evidence of a cyclical fluctuation in their numbers or perhaps the hibernating stages had perished in the waterlogged winter soils?" I urge you to turn to his report in this newsletter where he writes about the garden in winter and the "majesty in the quiet dormancy of an old Oak"; he gives a scientific exposition of the physiology of the blackbird which creates its song; and he also describes the astronomical delights of the night sky in the late winter. Nigel is a true natural historian in the Victorian tradition, a Gilbert White for Treborth, who has observed and recorded the flora, fauna, weather and natural features of the site and its surroundings for all of the last 39 years. He has delighted in sharing this information through the newsletter, as well as with students, Friends and other visitors to the Garden.

Nigel's Curator's report mentions the changes taking place at Treborth with the new staffing proposals and the links with the Wales Environment Hub. The Two Dragons project is also making excellent progress, and received a great boost in March when the Duke of Cambridge visited Xishuangbanna Tropical Botanic Gardens in China, and met Bangor students Sam Herniman, who designed the Chinese Garden at Treborth, Faith Jones and Katie Brenieol. They talked about Treborth and suggested he might like to visit (watch this space!).

This is all very exciting and takes Treborth into a new era. The biggest change, though, will be Nigel's departure in the summer, and many of us will find it

hard to imagine the Garden without him. Treborth will, of course, continue to grow and develop as all gardens do, but he will be much missed. We will see his legacy always in the plantings and features around the Garden, as well as in the career progression of the many students who have been taught, enthused and influenced by him over the years. 2015 has been a momentous year for Nigel and Caroline: as I write this in early April, Caroline has just retired and they are away meeting their newborn grandchild, and, in a few months, they will be packing up their house to move on to a well-deserved, and doubtless a happy and fulfilling, retirement. We wish them both well.

Sarah Edgar

News in brief

Donations:

We are delighted to report on several substantial donations. In February, we received a cheque from Mary Iliff, the widow of James Iliff, who left a bequest of £500 to the Friends in his will. Mr Iliff had visited the Garden some years ago and was very impressed with what he saw and began making regular donations, as well as this bequest.

Mrs Dorothy Owen of Felinheli has given £100 to the Friends - she's leaving the area and wanted to acknowledge the enjoyment that the Friends have given her over the years.

Greenwood Forest Park has been giving us an annual donation of £300 for some years which is much appreciated.

Mr Huw Thomas is very fond of the Lucombe Oak and has generously donated £2600 to pay for management and interpretation of this very special tree. A formal agreement between the Friends and Mr Thomas is being drawn up, and we will give you more details in the next newsletter. This is the first time that the Friends have entered into such an adoption arrangement; we hope that other members might like to consider this way of supporting the Garden.

Other donations have been received from Mr and Mrs David Jones, Mrs Saville, Mrs Hanson and Dr Shaun Russell.

Plant Sale, 11 April:

We raised more than £2000 at this event, despite the cold morning and unexpected snow on the mountains! As usual, there was a very good selection of shrubs, vegetables, and indoor and outdoor plants. The cakes were amazing, including a deliciously chocolaty one appropriately called 'Devil's Food'. Thanks go to everyone who brought in plants to sell and to those who bought them. The next sale, at which there will be more vegetables such as tomatoes and other more tender plants, will be held on Saturday 16 May. There'll be an opportunity then to see inside the rhizotron as part of the International Year of Soils.



Curator's Report: December 2014 – March 2015

What a difference a few months make! When I penned the last curator's report 4 months ago I was uncertain whether Treborth would have any university staff to look after it after August 2015. Now I can confidently announce that it will. Happily, Rosie Kressman's post as Horticultural Technician has been made permanent – congratulations to her! The curator's post will be advertised in April with a view to my successor commencing in August. He or she will have a more horticultural role than I have undertaken, with less teaching at University level. Additionally, we are very fortunate to be having a part-time Director (50%), our first, in the shape of Dr Shaun Russell, who will be accompanied by his PA, Jane Smith, who will work 50% of her time as Treborth's Administrator. Shaun and Jane will be based on-site at Treborth, in Rivendell, from the end of May.

These are extremely encouraging developments for Treborth. Shaun is Director of the Wales Environment Research Hub, until recently based in the Environment Centre for Wales building on the Science site of Bangor University. He will continue with some of those responsibilities part-time while committing the rest of his energies to securing better outside funding for the full range of activities currently undertaken or planned for Treborth. Shaun's botanical background (he is a bryologist) will ensure that traditional botany remains high on the list of priorities for Treborth while his wide experience in the environmental field with the Welsh Assembly, NGOs and International agencies will create new opportunities to develop and sustain Treborth's wider educational and research remit.

Jane is very experienced in organising diverse events in support of environmental research and education and has also offered to put her practical skills and enthusiasm to good use by helping in the Garden as and when circumstances demand.

Sophie Williams will develop her research in plant conservation (especially through her continuing links with China) as well as expanding her botanical teaching role. As Chair of a new Treborth Advisory Board and Course Director for the MSc in Plant Conservation, Sophie will ensure that the Garden plays a key role in both teaching and research within the College of Natural Resources.

This new structure offers so much for Treborth. I predict a major surge in activity and influence both within the University, locally throughout North Wales, and nationally and internationally through increased work towards the Global Strategy for Plant Conservation. On the ground, it is hoped that ageing glasshouses can be replaced and buildings upgraded as well as there being further investment in people – an outside horticulturist for example, and additional educators so that perhaps sooner rather than later we can confidently invite all potential user groups to Treborth and offer first class botanical and environmental insight in a well-resourced and unique setting.

The role of the Friends will remain as important as ever but perhaps modified to reflect the changing University investment. In future I would hope that the Friends will be able to slowly reduce their physical input to the Garden and increase their advisory, awareness and fund-raising activities. Wednesdays and Fridays should provide the icing on the cake rather than the very matrix of the mix.

And as for STAG, well I am sure that it will have an equally significant future, still needed for those achingly demanding tasks in the woodland, arboretum and elsewhere in the Garden, those fun events when it's all hands on deck but to great reward, and the ongoing cross-fertilisation effect between student and Friend in a hugely fertile setting where academic interest rubs shoulder with practical learning and achievement and life-time experience.

Nigel Brown



Weather and Wildlife: December 2014 – March 2015

Month	Rainfall		Temperature		Number of Days			
	mm	inches	Max.	Min.	Rain	>10 deg	ground frost	air frost
Dec	121.0	4.8	12.5	0.75	26	11	2	0
Jan	111.9	4.4	14.0	-0.5	25	10	7	5
Feb	49.5	1.9	11.5	-2.0	16	4	7	2
Mar	73.5	2.9	13.0	0.5	20	15	4	0

December's mild, damp progress took 2014's rainfall total to 1179 mm (46.4 inches), 12% above the annual mean. January continued in similar vein culminating in powerful southerly winds reaching strong gale force on 14th resulting in damage. There followed a colder spell with a few air frosts and intermittent showers of hail and snow which continued into February. Calm, rather dull conditions prevailed during the first half of February followed by milder, more changeable weather during the second half of the month continuing into the first half of March. Mid-March saw a welcome dose of settled sunny weather, later cancelled out by an unsettled period of showers that continued until the end of the month. With a mean daily maximum of 9.6 degrees March was not a particularly mild month and spring seemed sluggish.

Winter can sometimes seem interminable even though unextreme. It often felt like that these last four months when actually it really was no different to many winters that have gone before and indeed produced little by way of extreme cold or wind. And anyway, we live in a cool temperate climate with plants and animals accustomed to and indeed requiring such seasonal closure. Who knows what metabolic 'relief' winter brings to organisms that function at such a fast pace during the 'growing season'. And indeed, how little we understand about the innate functioning of the seasonal rhythms that our wildlife and garden life dance to. There is a majesty in the quiet dormancy of an old Oak which has shut down its complex canopy many, many past winters, withstood wind and frost with its layered, lignified trunk and close-wrapped winter buds, and left its survival in the hands of nature. The individual, of course, is more vulnerable than the species and may perish while other congeners and conspecifics survive, but their inherited strategy for survival lives on in the genes of every oak tree in the woodland and if it didn't, then the strategy would be different from what we observe.

What do **Red Squirrels** (*Sciurus vulgaris*) do in winter? I don't know the answer but I know a man who does, Craig Shuttleworth, and he has continued to

provide Treborth with tremendous help and support in ridding the Garden of **Grey Squirrels** (*S. carolinensis*) and encouraging further research by students. Through regular trapping by Tony Dyda, we can claim that for a season at least Treborth is Grey Squirrel-free and in the process much has been learnt about the numbers and habits of perhaps up to 8 Reds in the area. Now visitors have a very real chance of seeing Reds especially in the coastal woodland before 10 am. They have been captured on camera at several supplementary feeders established as part of two research projects. One recent concern is that in addition to the lethal squirrel pox virus, Reds are susceptible to adenovirus which is inherent to an unknown extent in populations of native small mammals such as **Wood Mice** (*Apodemus sylvaticus*). Clearly, if the levels of infection of adenovirus are high in Treborth's mice then any conservation action on behalf of Reds should avoid artificially increasing contact between Reds and mice. Supplementary feeding might unwittingly increase the risk of cross infection and efforts are now in hand to assess the level of risk.

Though the overall impression of the arrival of spring seems slow, when you analyse individual components then it isn't so disappointing – for example bird song. By early February there were 10 species in song and most welcome of all, **Blackbird** (*Turdus merula*) singing softly at dusk in the cherry tree in front of the lab, its rich, rounded notes floating gently across the evening of 9th February. What prompted this first song of blackbird? Can we say? Can we interrogate the circumstance and measure every parameter until we claim to know what prompts a blackbird's first spring utterance? We should in theory be able to do that since like all behaviour it has purpose and its mechanisms are switched on and off by parameters reaching threshold values which trigger changes. Temperature is a good starting point, but far too simple and variable a device upon its own – it was 5 degrees at that time and the day had reached a modest 5.75 degrees – no real clue there then. It was calm, and had been all day and every day for a week. Influential? Well perhaps, as sound must travel through air and in so doing is apt to be attenuated and diverted by every movement of molecules. Calm conditions allow for the even spread of sound across the greatest volume and area, and dusk often witnesses the cessation of temperature differentials which may restrict sound transmission. Acoustically then, evening time might convey some advantage to the individual with something to say, as indeed does dawn.

Day length is often implicated in behavioural ecology and provides a fail-safe way for nature to control major life processes. With built-in clocks and light sensors, a bird's brain is an accurate time piece and is hard-wired throughout to the celestial rhythm. The blackbird knows exactly where it lies on a year's time line. Its organs respond instinctively. Hormones seep their chemical cues throughout the living entity we call blackbird, subtly co-ordinating growth and change. One such change lies in the two forebrain nuclei known as HVC and RA where neurons

responsible for song syllables not activated since the previous summer begin to fire off signals to complex muscle tissue surrounding the trachea and the paired bronchi. Contraction of muscle in these areas causes the windpipe to lengthen and contract and influences the rigidity of membranes and pads which extend into the airstream just below the junction of the two bronchii and the trachea, a region known as the syrinx. Whether the membranes and pads are tightened or relaxed alters their impedance of the airflow and moderates sound production through the vocal region, which is also influenced by the action of co-ordinated respiratory muscles affecting air volume, and by beak action which further modulates the sounds produced from within. In gifted songsters such as blackbird, each half of the syrinx may act independently of the other, creating unique notes in tandem with its neighbour, in effect creating an internal duet, often only appreciated when projected electronically in the form of a sonogram. Sometimes one half of the syrinx is responsible for the higher frequency sounds (above 5 kHz) while the other half produces low frequency notes. A blackbird is a vocal gymnast!

While much bird song is instinctively delivered, much is learnt and can be influenced by nurture and surroundings. The learning process commences in the egg as unhatched nestlings hear their parent's song and calls. It continues throughout the first few weeks of life and in some species finishes there with no further capacity to learn. **Chaffinch** (*Fringilla coelebs*) song is learnt within the first year and very little more is developed after that. But in other species the ability to learn and develop new songs continues throughout life eg in **Starling** (*Sturnus vulgaris*) and **Canary** (*Serinus canaria*). The capacity of a bird to learn song is directly related to the volume of the two forebrain nuclei mentioned earlier, one neuron per syllable. The young bird forms a template in the brain for each song and there follows an extended period of attempts to match its own at first unpractised vocal efforts with the stored acoustic template. And so in turn, unrecognisable 'sub-song' improves through 'practice song' to finally emerge as 'adult song' which, when achieved, remains unchanged for life.

Local dialects are detectable in many species and reflect the amount of competition among breeding males as well as particular characteristics of the habitat; for example, forests encourage low frequency song, the higher pitches being attenuated by foliage more easily than the lower pitched sounds. In recent times urban birds have been shown to develop higher pitched songs in response to their noisy environments, and widespread species such as **Great tit** (*Parus major*) utter higher pitched song in urban populations than great tits in rural areas.

Song is well known as an overt expression of sexual selection and is generally regarded as an honest signal of health and heterozygosity, positively associated with mate acquisition and territorial success. Research has

demonstrated that in some species, such as canary, females respond to special 'sexy' syllables embedded within the overall song of the male. Such phrases incite hormonal responses in the female including the production of larger eggs. Of course such cues are often expressed in conjunction with visual stimuli such as a vivid plumage. In **Blue tit** (*Cyanistes caeruleus*) it is the ultraviolet reflectance of the crown stripe which acts as a trigger for the female to select a mate and the greater the UV reflectance the greater the proportion of male offspring in the resulting brood.

I've taken a break from writing and stepped outside to put the moth trap on. It's still windy and there's a casualty – a recently completed nest lies upturned on the ground, no sign of any occupants and no sign of violent intent. This is the wind's work and the blackbird's effort on this nest has come to nothing – the one consolation is that egg laying does not appear to have commenced.

The nest is oval, 18 cm long axis, 16cm short axis. It tapers neatly beneath to form a cone, in all, 12cm deep and weighing 313 grams. The outer layer is decorated with a fairly loose weft of pleurocarpous moss, *Eurhynchium* I think, inserted among fine twiglets of **Lawson Cypress** (*Cupressus lawsoniana*) and **Japanese Pencil Cedar** (*Cryptomeria japonica*) (the two closest trees), and here and there thin straps of cypress bark are woven through the matrix. There's a thin, discrete mud layer before finer herbaceous stems and leaves appear, mainly grasses but occasionally broad-leaves, some present in skeletal form. The density of the herbage increases as the cup-like inner layer is approached. A single body feather within the nest cup suggests that the final comfort zone was being prepared when disaster struck.

All the materials for the nest are available within 10 metres of the site where it fell. What template did the blackbird use for such elaborate design? What part of its brain holds the blue-print? What triggers the deployment of such information? How much 'learning' is involved? How adaptable to circumstance and material supply is the average blackbird? Many of the answers to such questions will overlap with those posed for bird song and indeed involve positive feedback systems of sequential neural and metabolic programming. A nest is a quite wonderful object born out of natural dexterity and immediate design needs and bird song is the auditory expression of a beautifully synchronised set of neural and physiological processes set in train by the passage of the earth around the sun. Blackbird, you have so much to teach us about our world!

Brambling (*Fringilla montifringilla*) has rarely been recorded at Treborth so two perched briefly in the top of the *Abies concolor* by the Welcome Area on 31 December was notable, their nasal calls drawing attention. A few days later and

Woodcock (*Scolopax rusticola*) flew over the Bog Garden at dusk, a time when for at least ten years now we have enjoyed the noisy, entertaining arrival of up to 1000 **Jackdaws** (*Corvus monedula*) flying in to their habitual roost in the Donkey Field Wood. Indeed, so regular has this been and the behaviour so intriguing that it has spawned several undergraduate projects over the years.

This year, undergraduate students Ciaran Bradshaw and Jake Meates set up automatic sound recording equipment in the jackdaw roost but just before Christmas the roost inexplicably moved 2 km NW to a copse on the outskirts of Llanfair PG where they amalgamated with a similar sized gathering of jackdaws which had been using this Anglesey site for a few years. The resulting flock of 2000 birds makes a fine sight, and sound, and analysis of the acoustic ecology of the enlarged roost is proving very interesting. Incidental sounds such as ambulance sirens on the nearby A55 trunk road have an immediate effect on the roost, prompting calling whatever the time of night. Pre-roost assemblies take place every evening just before dusk and involve dramatic, dynamic clouds of hundreds of birds, frequently alighting in prominent hedgerow trees, most commonly **Ash** (*Fraxinus excelsior*). Whether this large assembly of jackdaws benefits the individuals involved in reduced risk of predation, enhanced thermoregulation, mate selection or information transfer (as thought to be the case with **Raven** (*C. corax*) at Newborough Forest), we do not yet know. But certainly the roost represents a complex theatre of social behaviour which is likely to have multiple benefits for birds of the Corvid family, renowned for their intelligence.

Talking of Raven, there is a pair at Treborth this spring but I have not worked out quite what is going on and have no proof that they are nesting. **Grey Heron** (*Ardea cinerea*) seems very thin on the ground with just one occupied nest. Fortunately there are several pairs breeding on Ynys Welltrog in the Swellies. A female **Blackcap** (*Sylvia atricapilla*) appeared at the feeding station by the curator's house in early February. Rather unusually, there has been no **Chiffchaff** (*Phylloscopus collybita*) heard singing at Treborth this March – usually they can be heard from mid-month onwards. Similarly I have not yet noted the lekking of **Jay** (*Garrulus glandarius*) this spring, whereas last year they could be heard performing their strange, mechanical-sounding routines from mid-February.

And this sluggish start to the wildlife year is mirrored in the relatively low numbers of insects recorded during the first three months. Only single specimens of **Peacock** (*Inachis io*) and **Red Admiral** (*Vanessa atalanta*) butterflies have been seen, and moth catches have been quite depressed. Exceptionally, we had zero catches of moths for over a month from early January to mid-February. 62 nights of trapping in January and February produced just 21 moths of 7 species. March, traditionally quite productive for moths, this year has delivered 478 moths (well

below average) of 17 species (just below average). Interestingly, a fine specimen of **Great Diving Beetle** (*Dytiscus marginalis*) appeared in the moth trap on 25/26th January. Bumble bees did not appear until the last week of March and then in only small numbers. The first frog spawn was recorded on February 24th but quantities have been disappointing. By March 19th **Purple Toothwort** (*Lathraea clandestina*) made a welcome re-appearance, flowering beneath the **Italian Alder** (*Alnus cordata*,) on whose roots it feeds. Disappointingly, by the end of March, we still await the welcome flowers of **Wood Anemone** (*Anemone nemorosa*).

Luckily our little Eclipse Party just avoided an on-coming cloud bank on the morning of March 20th and nice images of the partial solar eclipse were transmitted through my bird-watching scope onto a whiteboard on top of the rock garden. Throughout the period there have been fine celestial objects and events to observe, weather permitting. One memorable evening I watched Comet Lovejoy skirting the Andromeda Galaxy, their close juxtaposition and similarity of size in the night sky grossly misleading. The comet has a nucleus probably no bigger than the Botanic Garden and lies just 44 million miles from Earth while the galaxy stretches 220,000 light years across and lies 2.5 million light years away. Both appear as fuzzy patches from Earth, the comet moving between the stars more rapidly as it is flung away from its recent close encounter with the Sun, out along an extreme ellipse that will take it to the furthest reaches of the Solar System, known as the Oort Cloud, before it is retrieved in 8,000 years time and once more returns to Earth's quarters. Lower in the south western sky hangs a crescent moon flanked by a brighter Venus, dim Mars and gently through my binoculars, the greenish-blue hue of Uranus. Further east, Jupiter dominates an otherwise dark patch of sky between Leo and Gemini, its four Galilean moons easily visible. These planets and their satellites literally bring us back down to Earth and our world and its singular place in time and space.

Nigel Brown





Fig. 2. Popcorn Cassia in Ethiopia [p. 39]



Fig. 3. Colobus Monkey in Ethiopia [p. 39]



Fig. 4. Balls of yarn. Wool dyed with homegrown dyes. Back row (L-R) Onion skin; madder; woad. Front row (L-R) Red onion skin; Coreopsis; weld; green (weld & woad). [p. 15]



Fig. 5. Clumps of blue toothwort on *Metasequoia* [p. 22]



Fig. 6. Orchid seeds sown behind clingfilm [p. 25]

Dye Plants

For thousands of years, plants were the major source of dyes for fibres and textiles. Textiles do not survive well in the archaeological record, but cloth patterned with dyed yarns has been excavated from sites dating to around 3,000 BC in central Europe.

After the first synthetic dye was created in 1856, the use of plant dyes declined fairly rapidly though they are still used in some parts of the world, and there has been a resurgence of interest in them by craftspeople. Throughout the world a wide range of dye plants are available, the most important of which were traded widely until the late 19th century. Some dye plants were produced as crops, but a large number were collected from the wild and used locally. In botanical nomenclature the specific name '*tinctoria*' or '*tinctorium*' signifies that the plant was a known dye source, though by no means all dye plants are identified in this way.

To assist the dye to attach to fibres, a fixative (or mordant) is usually required, though a number of dyes are 'substantive' and don't need such assistants. The most usual mordant used by craft dyers today is alum (potassium aluminium sulphate) for protein fibres (eg wool and silk) or a combination of alum and tannin for cellulose fibres (such as cotton or flax). Other mordants such as iron, tin, chrome and copper sulphate are useful in modifying the colours obtained; however, these metal salts are toxic and many craftspeople prefer not to use them. Some plants can be used as mordants, such as Rhubarb (*Rheum rhaponticum*) as the leaves and roots contain oxalic acid.

Most dyes are extracted from the plant material by soaking and boiling and the mordanted fabric or yarn is then simmered in the dye. Some dyes, such as madder, are heat sensitive and better reds are said to be produced if the dyebath temperature does not exceed 60°C.

The dye plants described below are ones that have been widely used and most can be cultivated in Britain.

Madder (*Rubia tinctoria*) is native of south-central Asia but has been widely cultivated. It is a source of red dye found in the fleshy roots which are harvested from established plants every two or three years. It is a sprawling plant related to goosegrass (*Galium aparine*) and ladies bedstraw (*Galium verum*), both of which produce red dye, though their fine roots suggest that a large quantities would have been needed to yield dye. Madder was the source of Turkey red, a notable

dye used on calico cotton and carpets from Turkey and the Middle East; it required a complex dye process to yield such a strong red.

Coreopsis provides a rich golden yellow. Dyers coreopsis (*Coreopsis tinctoria*) is an annual from prairie habitats in America, though garden cultivars of *C. grandiflora* such as Early Sunrise also yield dye and are perennial. The dye is in the flowerhead and it can be harvested as the flower is dying back. Flowers can be used fresh or dried.

Weld (*Reseda lutea*) is thought to have been introduced to Britain during the Roman period. It is a biennial (or short-lived perennial) which can be seen growing in gravel or railway ballast. It produces a rosette of leaves in the first year and a tall flowering spike in the second. The whole of the above-ground plant is used in dyeing when in flower and beginning to set seed. It gives a very bright yellow and was traditionally combined with a blue dye to provide bright greens. Dyers greenweed (*Genista tinctoria*) also produces a strong yellow, and, like weld, was a base for Lincoln green or Kendal green. A number of other plants will produce olive greens, especially if dyes are modified with copper sulphate or iron, but a clear green isn't available other than by over dyeing yellow and blue.

Onion skins (*Allium cepa*) produce yellows and oranges, with red onion skins giving a deeper colour with a greenish shade.

Walnut (*Juglans nigra*) gives rich browns from young leaves and the hull of the nut. This is a substantive dye, not requiring a mordant.

Several tropical tree species have heartwoods which yield strong dyes. Logwood (*Haematoxylon campetchianum*) gives purples and greys. It was imported into Britain and logs retrieved from historic wrecks around the coast still give dye even after being submerged in the sea for several hundred years. Brazilwood (*Caesalpinia echinata*) heartwood gives reds and pinks.

The sole source of blue from plants is indigo. Amazingly indigo occurs in chemically identical form in a wide range of plants from different families across the world. Indigo molecules bond with fibres only in soluble form, which is achieved in a very alkaline environment and in the absence of oxygen. It is termed a vat dye and traditional recipes depended on some kind of fermentation to drive off the oxygen. Methods of extracting indigo and dyeing with it must have evolved independently in several continents. However, the universal principle is that achieving the soluble form of indigo is essential for the dye to attach to the fibre. When fabric or yarn is withdrawn from the dye vat it is exposed to air, the indigo oxidises and turns back to its insoluble form, which turns the dyed material from greenish to blue.

In Britain and western Europe, the source of indigo was woad (*Isatis tinctoria*), a biennial crucifer. It is not native to Britain but was cultivated in southern England in the Anglo-Saxon period and from the medieval period woad production centred on Somerset and the Lincolnshire fens. The dye is extracted from the leaves of the first year rosette. In the traditional industry, the leaves were crushed, fermented and then formed into balls which were dried and sold on to dyers. The processing was smelly which made it unpopular with the neighbours.

Today, most indigo dye is synthetic, though it is chemically identical to natural indigo. Some craft dyers consider that natural indigo has greater subtlety, perhaps from other 'impurities' present in the plants compared to the uniformity of the synthetic indigo.

The best known source of indigo is *Indigofera tinctoria*, a legume. The genus is widely distributed across central and south America, Africa, India and south-east Asia. *Indigofera* was widely cultivated in India and during British rule was a major export. *Persicaria tinctorium* (Japanese or Chinese indigo) is a knotweed and is the main source of indigo in China and Japan. It is an annual plant and not frost hardy. In parts of China, *Strobilanthes flaccidifolius*, a sub-shrub, was a source of indigo in mountainous regions. In West Africa, another legume, *Lonchocarpus cyanescens*, a climber, was also used. Many of these sources continue to be used in their local area, albeit on a reduced scale compared to the past as commercially produced textiles tend to be favoured.

Lichens and fungi are also sources of dye. In Britain, the lichen crottle (*Parmelia saxatilis*) was widely used, especially in the Scottish Highlands for dyeing wool and gives a reddish brown. The lichen was harvested by scraping it off rocks. Fermenting certain lichen species with ammonia can give very different colours compared to the conventional boiling technique.

In recent times, a number of projects have been established using plant dyes and there are small scale businesses providing specialist markets and several active groups preserving and developing the craft of using plant dyes. A key principle is sustainability, in terms of collection of wild material, in dye processes and prevention of pollution and in energy conservation.

Careful mordanting and dyeing can produce strong bright colours reasonably fast to light and washing. Plant sources are variable, so that the strength and colour of dyes can vary with soil type, or amount of sunshine the plant has received, but the colours produced are admired. Dyeing with plant materials is rewarding and dyeing with indigo is magical.

There is a good dye garden at Trefriw Mill in the Conwy valley, and Helen Melvin's dye garden in the Vale of Clwyd is often open during the Helfa Gelf / Art Trail event in September. (see Figures 4 and 188)

Hilary Miller

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Helen Melvin / Helfa Gelf: <http://www.helfagelf.co.uk/en/about/>



Fig. 7. Blue toothwort (*Lathraea clandestina*) Spring growth. [p. 22]

The Herbarium Digitisation Project - a brief update

It's been over a year since the project began and, a few minor delays notwithstanding, I am making good progress. When we applied for the funding, we based our estimates on the 10,000 specimens that were reported in a condition survey report produced by the National Museum of Wales. It turns out that this figure was an estimate, as we have since counted at least 30,000 specimens. Despite having now scanned over 10,000 specimens, I am nowhere near finishing! (Figure 1).

As you might imagine, there is a significant focus on the flora of north Wales, including some lovely specimens of the Snowdon Lily (*Gagea serotina*, syn. *Lloydia serotina*) and an excellent representation of the flora of Bardsey Island. But the collection does not end in north Wales - far from it. We have specimens from a huge number of international locations and across a broad range of biomes. Locations as diverse as Greenland and South Africa, Samoa and Jamaica, as well many locations in mainland Europe are all represented. Until I complete the database, however, I am unable to give you exact statistics.

There have also been some excellent discoveries. Up until recently, the oldest specimen I had found was one of a marine alga - *Rhodomela subfusca* - happily labelled with 'Royal Botanic Gardens Kew' and stamped '*Herbarium Hookerianum*'. Quite how we ended up with specimens from the Hooker collections at Kew has not yet been established, but I am sure our ownership is entirely legitimate! However, our oldest specimen appears to be a *Cercis siliquastrum* (Judas Tree) from Jamaica, collected in 1778.

Of additional note is a rather large collection of specimens from Yunnan, collected by none other than the Edinburgh-based plant hunter George Forrest (1873-1932) between 1917 and 1919. Forrest is noted as being one of the first Europeans to explore the flora of South West China and is responsible for introducing many well-loved garden plants in the genera *Gentiana*, *Rhododendron*, *Pieris*, *Primula* and *Iris* amongst many others. We have well over 50 specimens from his expeditions and this link with China is especially interesting given the current development of the Chinese Garden at Treborth.

Thankfully, I am not entirely alone in the Herbarium. With the help of the Bangor Employability Award, I now have the help of an intern called Becca Claxton, a second year student studying towards the BSc Applied Terrestrial and Marine Ecology, who has a particular interest in botany. Becca is helping me make progress through the rather large number of loose and/or unaccessioned specimens that as yet do not have a home in either a folder or a cabinet.

We are currently looking for more funding and hope to have some success in the not-too-distant future, but if any readers have suggestions as to possible sources of funding, please do get in touch. In the mean time, I am continuing with the project and enjoying every minute! If you would like to visit the Herbarium, please email me at j.balfour@bangor.ac.uk or telephoning on 01248 382453.

James Balfour



The Arboretum: Further developments and Sponsorship Possibilities

Over the past few years a lot of effort has gone into clearing invasive undergrowth and weed trees from the Treborth Arboretum: bamboo, rhododendron and cherry laurel have been taken out, some dangerous trees removed, together with other small trees and shrubs to free up existing specimens. Some trees and saplings still need removing, especially along the railway line fence, either because they are potentially dangerous, or they are in poor condition and their removal will allow more space and light to plant new specimens.

In the FTBG Newsletter of May 2014, the theme of “The changing tree-scape of Wales: when and why did each tree species arrive?” was outlined for the Arboretum. With much of the initial clearance phase achieved, new plantings and interpretation can begin. Initially, the Plant Collection Committee aims to plant several small specimen trees in the space behind the coastal footpath car park, in line with the theme: during 2015, we hope to plant specimens of trees introduced in Roman or mediaeval times, including *Juglans regia* (walnut), and fruit trees such as species of *Malus* (apple), *Pyrus* (pear), and *Morus* (mulberry).

We also aim to label one or more specimen trees of each species in the Arboretum, showing Welsh and English common names as well as the scientific ones, together with a brief comment about the origin of the species, whether it is native or introduced, and when it arrived in Wales. These labels will be backed up with more detailed information on the Treborth website.

Of course, these developments do cost money for the new specimen trees and for the labels. We have already had the generous gift of three young *Tilia cordata* trees, planted in the Arboretum last year, which appear to have established very well. Would anyone feel they would like to sponsor any further trees, or perhaps some of the labelling?

Pat Denne (Plant Collections Committee)

Some Thoughts on Plant Fibres, old and new

Before the Romans came, what plant fibres did the ancient inhabitants of the British Isles use to make string or textiles? There seem to be remarkably few plants that are truly native which have fibres sufficiently long, strong and abundant enough to produce string or serviceable cloth: the only ones that I can think of are stinging nettles (*Urtica dioica*) and lime (*Tilia* spp). Stinging nettles are remarkably useful plants, not only do they have fine fibres (suitable for string, sails and clothing), but young nettle shoots are edible when boiled (with a high mineral content, tasting like hairy spinach), and also produce a good yellow or olive green dye for cloth. The bark of lime twigs is easily stripped off, and its abundant bast fibres are traditionally used for string and rope. Arguably other fibrous twigs, such as osier (*Salix* spp), could have been used for binding bundles, but can you think of any other native plants producing usable amounts of spinable fibre?

Linen (*Linum utilissatum*) and hemp (*Cannabis sativa*) were introduced into Britain in mediaeval times and grown as crops for their fibre content. It has never been possible to grow cotton (*Gossypium* spp) commercially in Britain, and before the 17th Century (when shipping routes from the Far East became increasingly established) cotton clothing was highly prized and extremely expensive.

Today an immense range of plants is available for textiles, string or ropes. As well as cotton, linen and hemp, there is ramie (*Boehmeria nivea*, a member of the nettle family), sisal (*Agave sisalana*), banana (with beautifully silky fibres which are extracted from the fruit stalk), jute (*Corchorus* spp, used to make hessian), kenaf (*Hibiscus cannabinus*), coir from coconut husks, kapok (*Ceiba pentandra*) and New Zealand flax (*Phormium tenax*). Most of these are harvested from stem or leaves, except for cotton and kapok which are fibres attached to seeds. Almost all of them are imported into the UK rather than being home grown. It has been estimated that cotton accounts for over 30% of all fibres used for textiles world-wide (including animal fibres), and unfortunately commercially produced cotton requires environmentally unfriendly quantities of irrigation and fertilisation.

As well as these natural plant fibres, many others commonly used for textile production are man-made. Rayon and lyocel (tencel) are both derived from wood pulp, needing chemical treatment to dissolve the cellulose before being extruded into fibres. Similarly, the beautiful silky bamboo and soya fibres have also been chemically extracted before extrusion. Polyester fibres (such as nylon and terylene), are synthetic polymers, not directly derived from plant sources.

So, manufacturers and crafters of today have an enormous choice, some fibres (such as cotton, linen and banana) are fine and soft enough for clothing worn next to the skin, others (such as sisal, jute and kenaf) too hairy for clothing but strong enough for rope. Some plant fibres come in a range of natural colours (wild-type cotton fibres can be brown or green as well as white), some need bleaching or other chemical treatment before taking dyes. If you want to be environmentally friendly, it is not always an easy choice.

Pat Denne



Blue Toothwort (*Lathraea clandestina*)

Lathraea clandestina is a parasitic plant, growing principally on willow, alder, maple and other woody plants, and also on *Gunnera manicata*. It was introduced from the near continent, and is now established in various parts of Britain and Ireland. Botanical details are described in various writings which are covered elsewhere; this article describes only my own experience with it in our garden. (Figures 5 and 7).

I saw it first in the RHS gardens at Wisley many years ago, and was completely fascinated. Books recommended propagation by lifting a piece of the plant and placing it on the bared root of the intended host. The addition of some seed was also suggested. Obtaining material is not easy though, and I hunted it for many years. I found it at last advertised by Chiltern Seeds. Several times I sowed this but without success. My conclusion was that it may need fresh seed, and after another long search I was eventually able to obtain some. I placed this on the roots of a willow. After a year nothing appeared, but a year after that, great excitement - my wife Patricia had spotted a great mound of beautiful purple flowers, the size of a dinner plate. When seen like this, it could be mistaken for a clump of purple crocus. It seems that we were lucky, as it can take as much as ten years to flower. The hooded flowers may vary from plant to plant, from an intense purple to a rather paler shade. It shows early in the year, perhaps even in December, as small white scale leaves. The purple flowers may show in February, and it will go on flowering sporadically well into the summer. Pollination is by bumble bees. The seeds are contained in small pods, four or five seeds to a pod. When ripe, the pods burst, throwing the seeds around within a small area. They can be collected by squeezing the pod, causing it to discharge the seeds into one's hand - a messy business though as the seeds are moist and sticky. This may be a factor in their

dispersal: too heavy to be wind borne, they may adhere to animals. It is probably best to sow them before they dry.

I sowed more fresh seed on field maple and several other trees, but since then it has popped up other parts of the garden. It has subsequently appeared at the base of *Metasequoia glyptostroboides*, a recognized host, where at the moment it thrives. A stream four or five feet wide runs through our garden. Recently it has flowered on the other side of the stream, at the base of a hazel and a wingnut tree (*Pterocarya fraxinifolia*). There are some pollarded willows about three yards away so it is hard to confirm the host. In fact in many sites this is hard, as we have a large number of potential hosts around the garden. It seems not to harm the hosts. It prefers moist shade, and will survive some water-logging. Lacking the ability to transpire moisture through true leaves, it apparently excretes surplus water directly into the soil, making it damp (a feature noted by Charles Darwin).

It is not a plant for the tidy garden. Its performance is by no means consistent, forming sometimes a large mound of flowers, and perhaps the next year, showing only a few scattered small bunches of flowers. It may spread around, under paving or in gravel paths, showing often as small clumps of fewer than a dozen flowers, but sometimes as a larger mound. It grows where it will, quite out of control, appearing now in seven sites around our large garden. On the credit side, however, I know of no pests, but some of our cats have bitten off flowers, which are then spat out. They will also take great delight in rolling on the flowers.

Perhaps people think that there is something a little sinister in its being a parasite, but it is a shame that in gardens we do not see more of this self-willed yet beautiful plant.

David Saunders



Feedback on the article 'Natural Resources Wales - a Personal View' (Newsletter number 52, January 2015)

As expected, there were responses to this article and all of them, whether emails (3), conversations (4) or one hand-written paper, were supportive of the opinions expressed.

The great majority of these came from people with professional backgrounds in environmental and biological science, and the others from very concerned amateurs (in the truest meaning of the term). Some of these were former employees of the three former bodies who could be relied upon to know a thing or two, and some were active in conservation. All of them expressed a great deal of uncertainty that Natural Resources Wales (NRW) will adequately protect nature and the environment in the face of strong economic pressures.

The most detailed personal response came from one of Treborth's long-serving volunteers who lives near Newborough Forest on Anglesey. She raises "concerns about the future 'protection' of our wildlife habitats under the stewardship of NRW ... Here at Newborough, I see the forest being developed primarily as a recreation area for people where nature takes a back seat", and states:

"I first came to Newborough in the early 1960s when public access was on foot only, as tracks were little more than footpaths frequently with blown sand. There was no car park: there were fewer cars on the roads. The wildlife of the forest was closely guarded by the Nature Conservancy Council warden when even to be seen carrying a seed head was a criminal offence. I have witnessed over the years the building of the present road and a small car park and noted the increased use of forest and beach, but developments were always low-key. No commercial vehicles were ever permitted. Since NRW took over in 2013, change has been dramatic."

Our volunteer gives details of the enlargement and surfacing of the car park, permits to commercial ice cream etc outlets, and way-marked footpaths and tracks, making it "no longer a wild place". But her overriding concern is the increase in the number of dogs, especially their mess and those not on leads, and inconsiderate cyclists. To be fair, NRW's remit does include the promotion of leisure activities, better health and well-being, and increased access for all sections of society. However these aspects should not override the primary function of preserving wildlife and the environment. As our volunteer rightly points out:

"There is little information concerning why the area is a special place. Together, the Warren, Forest and Llanddwyn Island have been recognised as one of the country's very best wildlife and geological sites. It is designated as a Site of Special Scientific Interest, a National Nature Reserve, a European Special Area of Conservation and a part of the Isle of Anglesey Area of Outstanding Natural Beauty [and] most of the public ... are unaware of its scientific importance."

Any more viewpoints?

Angela Thompson

Xishuangbanna Tropical Botanic Garden: Language on the Mountain

Having the confidence to start using an unfamiliar language can be daunting. But when the only conversation available to you at the top of a mountain is Chinese, there is little to do but jump right in!

In my second or third week of residence in Xishuangbanna Tropical Botanic Garden (XTBG), I started helping the orchid group (Cover photograph). The Green Stone Forest is one of the farthest reaches of XTBG. It consists of a few jagged limestone hills, covered in native tree species, protruding out of a sea of rubber plantation enshrouded by mist. The landscape is divided by a series of boardwalks that extend from the valley to the highest point.

Dendrobium species are in the family Orchidaceae and are important in Chinese culture for their medicinal use. But because of their usefulness they are sometimes over-harvested, resulting in a decline in the species. In this area of Xishuangbanna, there has also been a huge loss of forest to rubber plantations, leaving orchids far less forest to inhabit. Our mission is to try to reintroduce *Dendrobium* species into the remaining limestone forests - a process which involves sticking sphagnum moss on tree trunks with cling film, then injecting the orchid seed into the moss with a hypodermic syringe (Figure 6). The seeds are microscopic and the most important part of this delicate operation is that the seeds have been inoculated with a fungus which forms a symbiotic relationship with the seed and enables it to germinate.

It is a two-person job, with one holding the moss in place and the other wrapping the trunk with cling film and one person injecting while the other fills the syringes. This is all done while making sure not to let the glass jar which holds the seed roll down the slope – a crime which ends the day of fieldwork. There are two main seasons in Xishuangbanna: hot and wet, and warm and dry. The moss is only used in the dry season so that moisture is retained under the cling film for long enough for the seeds to germinate. A germinating seed results in an attractive sight for tourists as well as a success for the conservation of orchids.

The team carrying out this project is all Chinese, making it an excellent opportunity to try out my meager Mandarin. The number of words I actually learnt was relatively low; however my confidence in communication felt a significant boost. My mum used to tell me I was unable to multitask but learning a language while learning to plant orchids was not as frightening as I first thought.

Sam Herniman, trainee funded by British Council

The Open Air Laboratories (OPAL) project

The Open Air Laboratories (OPAL) network is a National Lottery funded, UK-wide citizen science initiative that allows you to get hands-on with nature, whatever your age, background or level of ability. OPAL in Wales is being run by a partnership between the North Wales Wildlife Trust, Cofnod (The North Wales Local Biological Records Centre), and the National Museum of Wales in Cardiff, who employ a network of Community Scientists to work to support community groups in their regional area. Bob Griffiths is the Community Scientist for north west Wales, based at Cofnod.

- **Bug Count:** Finding and recording invertebrates.
- **Water Quality :** Looking at water clarity, and freshwater invertebrates.
- **Air Quality :** Using Lichens on trees as indicators of pollution.
- **Biodiversity:** Looking at life in hedgerows.
- **Soil Quality :** Using earthworm species as indicators.
- **Tree Health :** The latest survey to be developed, in response to the latest threat of disease to oak and ash trees.

OPAL Wales 2014

In April 2014, the Open Air Laboratories (OPAL) Project was established in Wales. The three Community Scientists have since worked with local communities, using resources developed and extensively used in England and adapted for Wales to help develop skills in assessing and monitoring aspects of the environment.

Highlights from our Community Scientists

- Seeing the fascination that children (and adults) have about lichens.
- Seeing people from sheltered housing taking great interest in measuring the height of trees.
- So many teachers, after seeing us as Community Scientists doing surveys with the children, saying that they will do more with the surveys themselves.

- The positive reaction that I get from almost everyone, after they see the high quality of the resources and when I offer a session with a group or a class.
- We've worked directly with 11,765 people in the community and 2,900 school pupils. Indirectly that number increases to 250,000!!!

Following on from a talk to the pupils about the environment and his work as a Community Scientist ,Bob carried out surveys with all pupils from Ysgol O M Edwards near Bala. As a result he was invited back to help the pupils build a bug hotel from a list of materials they found in their homes. Some of the pupils who were initially wary or even afraid of insects happily played an active part in collecting and recording. Bob says:

“Even though many pupils from the school are from a rural farming background, few realise the importance of insects to crop and food production. The children learnt about the vital role of insects in the countryside ”

Bob Griffiths



Fig. 8. Carreglwyd Woodfestival in Anglesey AONB. [p. 37]



Fig. 9. Coed Llwyn Onn woodland work in Angelsey AONB. [p. 37]



Fig. 10. Israel planting Douglas fir seedlings in the Rhizotron, after soil beds were prepared. [p. 47]

New Ozone Injury Smart Phone App!

Help us record incidences of visible ozone injury to vegetation this growing season by downloading the new smart phone App developed by the Centre for Ecology & Hydrology (CEH), Bangor.

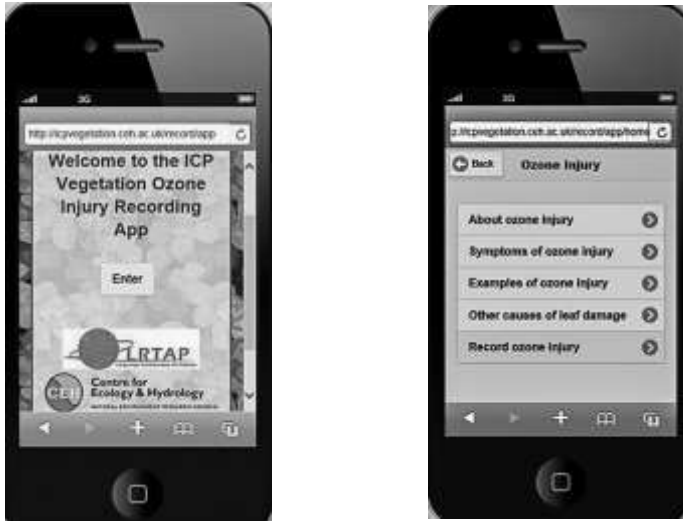
While ozone occurs naturally in both the stratosphere (comprising the “ozone layer,” 10-40km above the Earth) and the troposphere (0-10km above the Earth), further ozone is formed in the lower level of our atmosphere as a result of human activities, particularly due to vehicle and industrial emissions from the burning of fossil fuels. In addition to the background level of ozone pollution present in the air, certain conditions, for example, warm, sunny weather, can lead to “ozone episodes,” with concentrations peaking for several days at a time.

Ozone is a very reactive gas and can have a variety of negative effects on both humans and plants. In humans, ozone primarily affects the respiratory system, causing irritation and inflammation in the lungs. In plants, ozone is absorbed via the pores at the leaf surface, leading to cell wall and membrane damage and the disruption of photosynthetic processes in sensitive species. This can result in the appearance of visible injury on leaves and also a reduction in the quality and quantity of plant biomass and crop yield. Plant species vary in sensitivity to ozone: for example, beech, birch, and legumes such as white clover, wheat, soybean and pulses have been found to be the most sensitive (Figures 13 and 14). This difference in sensitivity to ozone has the potential to affect plant community composition, with ozone-sensitive species showing a reduced ability to compete with more tolerant species.

The easiest way to detect ozone damage on plants is to search for evidence of visible injury on the leaves. Exposure to ozone can cause small, pale yellow, cream or bronze coloured pin-head sized blotches (known as stipples) on the leaf surface. When ozone levels are high for a number of days, these spots can join together, covering large areas of the leaf. While symptoms can vary between plant species, there are several diagnostic features that tend to be commonly found in ozone-damaged plants: 1) Spotting on the leaves occurs between the leaf veins; 2) Damage appears on the upper surface of the leaves, spreading to the underside in severe cases; 3) Older leaves (towards the base of the stem and branches) tend to be more affected than younger leaves as damage is determined by the accumulated uptake of ozone over time.

In order to collect records of visible injury worldwide, we have created an ozone smart phone App, allowing incidences of ozone injury to be recorded in the

field as soon as they are spotted. After registering (with a username and password), App users can upload photographs of ozone injured plants, while coordinates for the location where the injury was detected are recorded automatically using the phone's GPS. The broad vegetation type of the damaged plant and the species name can be chosen from a list (or added by hand). Information on the symptoms of ozone injury (including the colour, location on the leaf and age of damaged leaves) is then requested from the user.



Questions designed to assist with quality assurance, for example, specifying any previous experience of identifying ozone damage or plant diseases and describing recent weather conditions will also be asked. For guidance, the App contains an 'Ozone information' section, which includes details of the key symptoms of ozone injury, and other causes of leaf damage that may be mistaken for ozone injury. There is also an 'Examples of ozone injury' page, containing photos of ozone injury on a variety of species.

The App will be available to download in the spring of 2015. For those without a smart phone, a web-based recording facility has also been created. Both the App and web recording form will be available from our website: <http://icpvegetation.ceh.ac.uk/record/index>.

The ozone injury smart phone App will enable the collection of widespread evidence of ozone damage to vegetation around the world. This will allow us to build upon the list of ozone-sensitive species worldwide and to validate risk maps,

which predict where ozone levels are expected to be highest. As ozone damage is more likely to occur in the UK during “ozone episodes,” we will be sending email alerts to registered App users to let you know the best times to go and look for damage. We would like to encourage people to get involved and download the App this spring, to help us to gather as much data as possible. If you think you can help, please visit our website for more information.

Dr. Katrina Sharps

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Nigel Brown: Treborth’s Curator

Our series of the lives of prominent Treborth people continues with Nigel, who has been Curator of the Garden since 1976.

Nigel was born in Sheffield to a Yorkshire-based family. His father came from Hornsea on the east coast, where many happy summer holidays were spent with Nigel’s grandparents, exploring the Mere (a ‘paradise’) and other natural places. His father had started to read medicine at Leeds when the war interrupted his studies; he didn’t go back to complete them afterwards but became a brewer of Tennant’s Gold Label (was this Nigel’s first tipple?) in Sheffield. Nigel remembers visiting the brewery on many occasions at weekends, being fascinated by the vastness of the production line and manufacturing processes with all their noises

and smells, and the eerie brewing tanks. He became a collector of beer labels and the proud owner of many in mint condition, thanks to his father's contacts.

His father and grandfather were very keen naturalists, birding and collecting butterflies, and the beginning of Nigel's interest in natural history stems from their enthusiasm. The family grew vegetables and flowers too. Both parents were very keen walkers and since they had no car, walking was a way of life and a great pastime. His mother was also interested in natural history and the two parents used to take Nigel and his sister out for walks of discovery – expeditions always with a particular interest in mind. Nigel's sister has retained her interest in the topics of those earlier days although, later, she went on to work in the arts. Nigel also had a group of like-minded friends to go around with, and since the family lived on the western side of Sheffield, the Peak District was within easy reach. Another important aspect of his earlier life was the working holidays spent with his cousin Roscoe on their farm in the Brendon Hills of Somerset. The cousin was a 'real country boy' who knew all the moths, plants and birds, and from whom Nigel learned bird songs. Things came full circle when Roscoe's daughter, Tara, studied zoology at Bangor University, graduating in 2007!

From his mid-teens, the greatest influence on Nigel's interest in nature came from Sheffield's Sorby Natural History Society, founded by and named after a great Victorian collector and scientist. He came into contact with excellent specialists in all areas of natural history – botany, geology, entomology, ornithology to mention a few – on field trips and other meetings. He feels he was in the perfect environment, physically and socially, to develop his interests.

At secondary school, an excellent biology teacher who was keen on fieldwork further encouraged Nigel. He recalls an ecology field trip to Aberystwyth when the group converted the basement of the hotel in which they were staying into a marine laboratory. They visited the spectacular river estuaries nearby, and it is a special area for Nigel that he revisited many times. His teacher was particularly interested in plants and Nigel gradually turned more to botany. Nigel recalls his father buying him his first flora, very expensive at the time – the renowned Clapham, Tutin and Warburg. Nigel set up a natural history society at school, which was well-supported and busy.

Nigel harks back to a family holiday in Guernsey that finally set him on the botany road, when he found many rare plants, including the Loose-Flowered Orchid, for the first time. That experience encouraged him to look for the orchid rarities in the Peaks with his local botanist mentor, Charles Waite (associated with the Sorby),

and to his first scientific monitoring of an area in the Derbyshire Dales specifically restored for native orchids.

Although he applied to Oxbridge to read botany, he was unsuccessful and went through clearing to Bangor. He instantly liked Bangor and Anglesey, and the School of Plant Biology (as it was then) was at its peak, with four famous professors (Greig-Smith, Lacey, Richards and Harper) working there at the same time. It was a classical botany and ecology course, field-based and flexible with regard to personal interests. Nigel undertook his final year project at Treborth, studying plant communities in the woodland. There, he met the then curator of Treborth, Len Beer, who shortly afterwards left Bangor to take up a post in Durham in 1976.

On graduation, he was, much to his surprise, offered the post of Curator at Treborth and accepted it. He lived in Beaumaris, in a sea-front house overlooking the magnificent Strait, whilst he worked his 3 months' probationary period and couldn't believe his luck! His position was confirmed and he moved into the house next to the laboratory. This coincided with his 21st birthday, and to mark the occasion, his father offered him the choice of an original Tunncliffe or some furniture for the empty house. Citing his naivety, he is rather shame-faced to admit he choose a bed... Not long after the start of Nigel's employment with the university, Professor Greig-Smith took a sabbatical and inveigled Nigel into teaching his course on monocotyledonous plants, and the rest is now history.

Nigel met Caroline, his wife, in 1979 through the university's Bird Group. Caroline's father gave a talk to the Group and later revisited Treborth, this time with his daughter. They were married within 6 months, and Caroline obtained work in Occupational Therapy in Bangor. Daniel was born in 1981 and Laura three years later.

Under Len Beer, two women were employed as gardeners and they continued for a while when Nigel become Curator. However both eventually left, and their places were taken by successive young trainee gardeners. They were based at the Pen y Ffridd Field Station on the 'apprentice' scheme but gained experience at Treborth under the University Horticultural Scholarship established by Charles Ellis, when he was Pen y Ffridd's Superintendent. One of the scholars was John Cooper, who was Nigel's assistant in the first half of the 1980s but was tragically killed in a road traffic accident. Treborth's last gardener, Mike Roberts, came through the scheme to work permanently in the Garden later in the 1980s. To bring things up to date, the John Cooper Fund, generously established by John's parents, is presently financing Rosie Kressman in the horticulturist's post at Treborth.

Nigel has developed and improved the Garden over the years, and has striven to link it with the public in whatever area of interest is required. During the 1980s

when Daniel and Laura were young, he and Caroline were very much involved with the North Wales Wildlife Trust running a Watch group (the wildlife club for children) from Treborth for about 10 years. He was also part of a team that set up the Spinnies (a local wildlife reserve near Penrhyn Castle) and began to lead Fungus Forays, a hugely successful activity which has continued to this day. He was one of the leading lights of the Bird Group and takes great delight in the summer and winter Bird Races to record the greatest number of bird species in a day. These days, he says he simply attends the Group's lectures which he describes as a 'treat'. He was also, with Ian Bonner, the vice-county recorder of plants in Anglesey (but he retired from this role at the end of last year). He started trapping and recording moths daily in the 80s and sends his records to Butterfly Conservation. He has also kept records on a daily basis over the last 20 years of the weather experienced and wildlife and plants observed at Treborth. Many of you will be familiar with these in the Friends' newsletters. These statistics are vitally important in the study of phenology (the science of recording how plants and animals respond to changes in the weather) and many individuals' records across the UK are now being used by the Woodland Trust to analyse the impact of climate change. Although at first Nigel was sceptical about the possibility of climate change, the trends and differences he has observed in Treborth over the last few years and reports of rising sea levels and changes to the ice caps have converted him to the idea. He is however worried that concentrating on this too much may take the scientific eye off other equally pressing world problems such as habitat loss and the ever-increasing population.

Over the years, his involvement in teaching within the university departments increased (as a result of the loss of other lecturing staff with botanical specialisms), a shift that took him away from much hands-on work at Treborth. But Nigel is a born teacher, and Treborth's loss was the students' huge gain. This culminated in his being awarded a Teaching Fellowship in 2002 by the university. He regards this as his highest accolade, along with the student-led 'Bringing Teaching to Life Award' in 2013 in recognition of his inspirational approach to understanding the natural world.

Nigel is a communicator *par excellence*, none more so than when, on Fungus Forays, he encourages a competition amongst the young enthusiasts (the Nigels of the future?) to find the tiniest or prettiest fungus, or he explains in clear language a complicated process in nature or makes connections between observations. He is always ready to help with queries from his students, the volunteers and the public, or give his time to a project. There is really not very much Nigel can't tell you about our natural world, and over the years of knowing him through work and leisure, I've been amazed at his encyclopaedic knowledge of all things that have roots, legs and wings or their equivalents, and astronomy. We shall miss him when he retires in July.

Angela Thompson



Fig. 11. Ruppell's Starling and Pied Kingfisher in Ethiopia [p. 39]



Fig. 12. Children in Ethiopia [p. 39]



Fig. 13. Ozone injury on birch [p. 29]



Fig. 14. Ozone injury on clover [p. 29]

The Isle of Anglesey Area of Outstanding Natural Beauty

The Isle of Anglesey Area of Outstanding Natural Beauty (AONB) was designated in 1966 to 'Conserve and Enhance' the outstanding Natural Beauty of the coastline. It is predominantly a coastal designation covering most of Anglesey's 201 km coastline. The backdrop to this coastal landscape includes Mynydd Bodafon near Moelfre, Mynydd Twr in Holyhead and Mynydd y Garn in Llanfairynghornwy.

The landscape of the AONB reflects the varied underlying geology and is a diverse mixture of marine and terrestrial habitats including rugged cliffs, heath land, sand dunes, salt marsh and mud flats. The northern coastline is dominated by the cliffs and rocky coves such as North and South Stack, with the east coast characterised by vertical limestone cliffs and sandy beaches. The Menai Strait dominates the coast between Penmon and Abermenai point leading on the west coast which is much less rugged and consists of sandy beaches and dunes (Figure 15).

So how do we 'Conserve and Enhance'?

The AONB is managed by Anglesey County Council with officers based in the Planning and Public Protection Service and they have a statutory duty to produce and review a 5 year Management plan which details the vision, strategy and action plan for the AONB. Of course, the delivery of the action plan is much harder to achieve than its production and the AONB depends heavily on its partners to deliver elements of the action plan. The majority of these partners are part of the Joint Advisory Committee (JAC) which helps steer the management of the AONB whilst creating links to those who live and work in the AONB. Members include the North Wales Wildlife Trust, National Trust, and Farming Unions, Councillors and Natural Resources Wales as well as many others. We will be consulting on the revised management plan for 2015 to 2020 within the coming months, and copies will be available in libraries as well as being available online. Following the 6 week consultation period, the plan will be amended where, and if, necessary before being adopted by the County Council.

One of the great assets that we have to help achieve our goals is the Sustainable Development Fund (SDF), which allows us to fund projects that achieve the aims and objectives of the AONB and are mostly located within it. Some of the previous successes of this grant include the restoration of church grounds and the development of community centres.

However, I would like to focus on a few of the more recently funded projects which I feel demonstrate what can be achieved in a nationally designated

landscape. The first of these is the new Halen Môn building in Brynsiencyn. By firstly securing money from the SDF, the applicants were able to secure further funding and demonstrate that a production plant needn't be incompatible with its surrounding landscape and that aesthetic improvement could be achieved thus securing employment in a rural part of Anglesey.

The second project is called Actif Woods Wales or Coed Lleol, and they work with health referral teams (both mental and physical) to show how being active in woodlands can benefit a range of disorders. This has been an incredible success and activities range from physical exercise with logs and other items found in the woods to carrying out practical tasks such as rhododendron clearance. The scheme has also helped participants learn new skills such as wood working and cooking in the outdoors. The results are clear to see with participants becoming more involved and feeling healthier, and indeed a participant from one of the earliest schemes in Aberystwyth said that without the scheme they would still be afraid of coming out of the house (Figures 8 and 9). Further information on this project can be found at <http://www.coedlleol.org.uk/> including a short film.

Re-engagement with our environment is the topic of another project we have recently funded. The Little Hedgewitch project in Llanfwrog has already been working with children in the Valley area by raising awareness of what foods can be found in our hedgerows and fields, and how important they are to us. Having been out foraging for wild plants, the children are then taught how to prepare them and what culinary and medicinal properties they contain. The culmination of the project will be a series of recipe cards suitable for children that will keep them engaged with their surrounding environment.

What ultimately ties these projects together is the need for us to look for new areas of funding, as public resources decrease whilst the need increases. Therefore we need to engage with businesses and explain to them that we can help them deliver their social and environmental responsibilities in a way that engages the communities within the AONB. We also need to extol the health benefits of the AONB either through physical engagement or by experiencing the peaceful solitude that can be experienced within the AONB which could possibly open new funding streams that continue to help us conserve and enhance the Outstanding Landscape of the AONB.

Efan Milner
Swyddog Prosiect AHNE / AONB Project Officer
Cyngor Ynys Môn / Anglesey County Council

A Visit to Ethiopia

Our friend Richard works for SHEPEthiopia (SHEPE), a charity that raises funds for health and education projects in Ethiopia. A year ago he said, "Do you want to come out with me on my next visit? I'll be spending a few days seeing the schools and health centres that we're supporting, then I will be travelling around the country". Straight away we said yes, then wondered what we were letting ourselves in for. We'd heard from Richard about the very poor and underdeveloped area where the charity worked, and of course remembered the famines of the mid 80s. What we didn't realise then was that the country has stunning scenery, fascinating culture and welcoming people.

So last October we flew into Addis Ababa. As we had our first cup of fiercely strong coffee on the hotel balcony, we watched the steady stream of blue minibuses (no apparent bus stops but periodically they would stop for people to get on and off), goats being herded down the road and people with white shawls on their way to church (it was a Sunday). Then we met up with Getachew, the local representative of the charity, for the journey up to Jidda, a *woreda* (district), about 100 km north of Addis. It's an agricultural area, with scattered clusters of houses (*tukels*) and one small town, Sirti. The few roads are unsurfaced. Less than 50% of the houses have access to fresh water and the only properties that have electricity are those near a road. The farming is at subsistence level; there is no machinery, and if there is a poor harvest, as there was in 2008, families have to eat the seed that should be saved for next year. Over the next three days we visited seven schools and two health centres in order to assess the most pressing needs of each site. The buildings of the five primary schools were of basic construction - timber frames with mud and straw infill, earth floors and very little natural light in the classrooms. Desks and bookcases had been provided by SHEPE in previous years; before that the children had sat on the floors. This year we delivered a set of football shirts, gifted by a school in Shropshire where SHEPE is based, to its twinned local school (the charity has set up links between the schools in each country) and volleyball nets and footballs for each of the schools. Education is clearly very important, but schooling has to be fitted into the families' farming needs: children only attend for half the day so that they can look after the animals for the other half. So in the middle of the day, there are streams of children walking to and from school. The schools clearly appreciate the contribution that the charity is making to them, and at some of the schools all the children were out in the playground to greet us (Figure 12). At one school the teachers said they had a present for us - and brought out a live sheep! We were a bit flummoxed by this (would it fit into the overhead lockers on the plane we wondered?); Getachew suggested that we thank them then offer it back to them for them to sell and use the money for equipment for the school. But they insisted that we have a feast! So while we looked around

the school and talked about what the charity should support next year, the teachers slaughtered and cooked the sheep. They served it on injera, which is a kind of large pancake made out of teff, a widely grown cereal in Ethiopia which is gluten-free and has to be fermented for three days before it can be cooked.

It became clear at these visits that the priority for the schools and health centres must now be access to water, and improved toilet facilities. A couple of the schools had no water at all, and not even a pump nearby, and the children had to bring water with them each day. Also, the toilets were appalling; we could understand that pit latrines were the most appropriate system, but there was no system in place to empty them so after a few years they were overflowing. A general problem was the lack of maintenance and, since our return, SHEPE has initiated two projects: the first to empty the full latrine and dig a new one, and secondly, to mend broken desks that we'd seen discarded at one of the schools.

Our visit to Jidda finished with the weekly market in Sirti, which was fascinating. People had walked from miles around with animals and produce to sell. There were large sections for horses and donkeys, which are vital to the local economy, being the main form of transport for people and goods. The horses were decorated with brightly coloured rugs and saddles. Donkey hides are cut into strips and used for bridles, thongs and webbing for seats, and we were rather taken aback to see freshly skinned hides pegged out on the ground, pink and smelly, right beside some (unsurprisingly) gloomy looking live donkeys. We bought coffee pots - black earthenware pots that are a key part of the Ethiopian coffee ceremony - and saw stalls of fabrics and lines of men with treadle sewing machines doing repairs and making clothes. In the market, as well as in the towns and villages, there were plenty of stalls selling, cleaning and repairing shoes; even simple plastic or slip on shoes are valued in an area where many people are bare footed.

We then drove for two days further north. On the way we passed stands of eucalyptus which is widely used for building, fuel and charcoal making. There is some controversy about this, as it was introduced about 150 years ago to help development but the eucalyptus' water demand is affecting crop yields, and there is a programme to replace eucalypts with native trees. Alongside the road there were the striking *Senna didymobotrya* shrubs, also known as Popcorn Cassia (Figure 2), with bright yellow flower spikes and black buds. We also stopped at Zenga Lake, a volcanic crater surrounded by trees, where we saw little vervet monkeys, beautiful black and white colobus monkeys, and many birds including a fish eagle and the pretty white cheeked turaco with its green plumage and crest, red eye and beak.

Once in the Wollo Highlands, we went on a three day trek. It started at an altitude of 2500 m over fairly flat terrain but very rocky under foot in places. Each

night was spent in tukels that were perched on the edge of an escarpment overlooking a wide valley; we arrived before sundown each evening and had wonderful views of the countryside below as we sipped cinnamon or thyme tea and ate bread and local honey, provided by the nearby community. In the evening we sat around a fire and our guide told us about the history and legends of Ethiopia while we tried the local spirit, araki. Sometimes we saw Gelada baboons which are endemic to this area; they form large social groups and sleep overnight on the cliff edges. Vegetation was sparse on the rocky exposed areas but there was aloe with tall red flowers and several species of sage.

After the trek, we had a couple of days in Lalibela and went to see the rock-hewn churches. These were carved down into the ground in the twelfth century and are an extraordinary sight. There are steps and tunnels to take you down to the entrances and you then look up to ground level, some 40 ft above. The eleven churches were built by King Lalibela as a New Jerusalem and have been in continuous use by Ethiopian Christians ever since.

We finished our visit to Ethiopia with a few days R&R in an eco lodge on the shores of Lake Langano, one of a line of lakes running south of Addis Ababa along the Rift Valley. As we drove there, we passed huge blocks of glasshouses growing flowers for the world-wide markets; the irrigation requirements for these are immense and we were to see the effect at our lakeside lodge where the lake had retreated some 50 metres from the eco-village in the last 10 years. The lodge was a perfect end to the holiday. Birds galore – including a row of pied kingfishers (Figure 11) perched near the water, the shimmering blue-green plumage of Ruppell's starling, about 30 pelicans all swimming as one in an identical pose, and the loud cry and quick flash of the silvery cheeked hornbill in the trees above us. Animals too (Figure 3): we saw a group of hippos in the water, warily watching us with just their ears and eyes showing, and, as we went to breakfast on the last day, a family of warthogs wandered past us while olive baboons fed and lounged in the trees around.

What are our abiding memories of Ethiopia? It's a very religious country made up of many different tribal groups. There's a lot more to it than its reputation as the African capital of famine: it's the fastest growing economy in Africa. Like most undeveloped countries, education is prized very highly, however primitive the schools. The cliché is borne out that wealth isn't a prerequisite for happiness as the many people we met proved by their generosity and positive attitude. Would we recommend you to visit? . . . a resounding yes.

If you are interested in learning more about SHEPE, please see their website: www.shepethiopia.org.uk

Sarah Edgar and Gerry Downing

A Brief Background to the Len Beer Lecture

Many of you will have been to a Len Beer Lecture, or at least have heard about what has been for many years the premier public indoor horticultural event in North Wales. For over 30 years in fact, for the first lecture was delivered by Roy Lancaster in 1984. But do you know anything about the late Len Beer himself, or how the annual lecture came into being? Well, first a bit about Len. He was a big man, with a personality to match. He was born (1942) and brought up in Devon, his mother instilling an early interest in wild flowers during walks in the countryside where she pointed out the different kinds and told him their English names. After attending local primary and secondary schools, he gained a place at Dartington Hall near Totnes where he spent two years doing a course in horticulture. He then went to Hilliers of Winchester for a further two years, which is where he met Roy Lancaster who was at that time Curator of the Hilliers Arboretum, with whom he became close friends. After Hilliers, Len won a scholarship to Cambridge University Botanic Garden where he spent two years as a student gardener, winning the cup for the best student in his second year.

Len arrived at Bangor as Curator of Treborth Botanic Garden in 1965, taking over from Barry Shearman. He was told that there would be a house for him at Treborth but this did not actually materialise until 1973, by which time Len had married Sheila (now Sheila Hargreaves), whom he had met at Bangor in 1965, she being his next door neighbour while he was in digs at Maesgeirchen. Len's time at Bangor (1965-1976) was an exciting and busy one because botany teaching and research was at its zenith in the University, which had an international reputation in this field, requiring a continuing major involvement of staff and students at Treborth. Len made major contributions to the development of the garden, including enlarging and enhancing the glasshouse facilities. He was also an active member of various horticultural groups, including the Alpine Garden Society, the Primula and Auricula Society, and the British Orchid Society. In addition to all this he managed to find time for travel and his other main interest, Rugby Union football: he joined Bangor Rugby Club, playing regularly for the first team and twice being capped for North Wales. He travelled widely on holidays in Europe, and to Singapore and Malaysia, always focusing on plants. In 1969 he won a competition run by the 'Daily Mirror' which gained him a place on the Trans-African Hovercraft Expedition. On this trip he made friends with many people including the notable Kew botanist and plant collector, Nigel Hepper.

It was always Len's dream to go plant hunting in China (which in those days was closed to most people), and in particular to the Himalaya, one of the world's most important plant biodiversity hotspots. He even wrote to the Prime Minister, Ted Heath, to enlist his help in getting there after Heath had made a

successful visit to Beijing (returning with two pandas for London Zoo!). Heath's staff checked out his credentials with the authorities at Bangor, but, alas, no entry visa was forthcoming. Len then decided to settle for going to Nepal, which was open to foreigners, and so organised the 1971 BLM (Beer, Lancaster and Morris) Nepal Expedition, which was successful, resulting in the introduction of a number of new species to cultivation. Len organised and led a second Nepal expedition in 1975 on which he was accompanied by his wife, Sheila, and an Oxford student, Paul Howse.

In May 1976, Len and Sheila moved to Durham, where he was appointed Curator of the Durham University Botanic Garden: their daughter Abigail was born later that year. Sadly Len had less than one year to live and he died very prematurely in March 1977.

So how do we get from Len's period as Curator at Treborth to the establishment of the annual Len Beer Memorial Lecture? Well, at the time when Len left Bangor, he was in the process of organising the annual (peripatetic) conference of the University Horticultural Officers Conference, which had been invited to Bangor. Charles Ellis, who was Director of the Pen-y-Ffridd Field Station of the Department of Botany, and Eric Williams, who was in charge of university grounds, decided to run the conference. It was successful and as a result there was a surplus of some £1600. By this stage, Len had died and it was felt that it would be appropriate to use this money to create a lasting memorial of some kind to his work at Bangor. In a meeting to discuss the possibilities, Prof. Geoff Sagar, Charles Ellis and I hit upon the idea of an annual Len Beer Memorial lecture. Of the main 1971 expedition participants, Dave Morris was doing his PhD at the time so was not available, but when we approached Roy Lancaster, who was a very high-profile media figure in the horticultural world by this time, he embraced the idea enthusiastically and very generously offered to waive his normal lecture fee. This first lecture, entitled 'Plant Hunting in Nepal' was a huge success, with many people sitting on the stairs in the School of Engineering main lecture theatre, unable to find a seat. This set the tone and every year since the lecture has taken place, jointly sponsored by the Friends of Plant Biology (until 1993 when Pen-y-Ffridd closed and the Friends of Treborth Botanic Garden was established and took over) and the North Wales Group of the Alpine Garden society. From the start it was agreed that the choice of speaker should alternate between the two sponsors, and as the list of speakers and their subjects below indicates, many of the most eminent botanists, plant hunters and horticulturists in the country have accepted our invitations to give the lecture. This year's lecture, by Dr Martin Sheader on the flora of central Patagonia ('Patagonia coast to coast') was the 30th in the series and there seems no sign of it coming to an end.

R Lancaster	1984	Plant hunting in Nepal
J Sales	1985	Gardens Advisor to National Trust
C Brickell	1986	
Dr Robinson	1987	
C Grey-Wilson	1988	Plants of Afghanistan
A Stevenson	1989	Gardens of the Royal Parks
R McBeath	1990	Plant hunting in China
J Hancock	1991	Powys Castle
J Archibald	1992	Western American Alpines
S Lacey	1993	Scent in the Garden
T Schilling	1994	Bhutan, Land of the Thunder Dragon
P Brandham	1995	A Year at Kew
K Cox	1996	The SE Tibet Expedition '95
P Swindells	1997	Sharjah Gardens, Eden from Desert
P Erskine	1998	In search of the Pink Celmisia
Prof Gren Lucas	1999	Why save plants?
Pete Cunningham	2000	A Ramble in the Cascades
Liz Radford	2001	From Welly Boots to Gucci shoes - Plant Conservation
Sir G Prance	2002	Plants for People
David Rankin	2003	Through the seasons in SW China
Dan Hinkley	2004	The Explorers Garden
Jim Jermyn	2005	Alpines of Europe
Dr Peter Jackson	2006	A World of Botanic Gardens
C Sanders	2007	Sikkim Adventure
Prof. S. Hopper	2008	SW Australia biodiversity
Harry Jans	2009	Alpines on the Equator
Keith Wyllie	2010	On the wild side
Tony Kirkham	2011	Wilson's China - a century on
Sarah Oldfield	2012	Saving Plants from Extinction
John Richards	2013	Mainland Greece
Dr Trevor Dines	2014	Challenging conservation
Dr Martin Sheader	2015	Patagonia, coast to coast

John Good and Charles Ellis

Acknowledgements

We would like to thank Sheila Hargreaves for her essential help in providing details of Len's early life and his career before arriving in Bangor. Sheila has attended almost every lecture, often with her daughter Abby, and it always makes it special for the organisers that she continues to do so. Pete and Pam Boardman and Grace Gibson have kindly supplied the details of past Len Beer Lectures.

Book Review: 'Botanic Gardens' by Sarah Rutherford
Shire Publications Ltd. 2015, Shire Library no.807, ISBN-13:978 0 74781
444 3, £7.95 pbk 64pp, monochrome and colour illustrations
throughout.

The Shire Library is deservedly respected for offering affordable non-fiction paperbacks that provide incisive reviews of popular topics ably written by relevant, knowledgeable and articulate authorities. The author of this latest title, Dr Sarah Rutherford, is well-placed to review the world's botanic gardens having gained the prestigious Kew Diploma in 1987, gained an MA in the conservation of historic parks and gardens at York University, worked at Oxford Botanic Garden, headed the English Heritage Historic Parks and Gardens Register and is now a freelance consultant and writer.

With commendably direct style Sarah firstly defines botanic gardens and briefly describes their functions, from scientific research to public enjoyment of plants. There follows a concise yet always freshly written review of the historical development of botanic gardens, beginning with the physic gardens of Europe including the four oldest - Pisa, Padua, Florence and Bologna in northern Italy. Many early botanic gardens were associated with universities, a tradition which happily continues to this day.

As you would expect there is a strong and illuminating chapter dealing with the evolution of British botanic gardens during the 18th and 19th centuries, rightly giving the author opportunities to acknowledge the achievements of some well known botanists and horticulturists from William Turner, the Tradescants, William Curtis, Henry Danvers, Robert Sibbald, Andrew Balfour, Joseph Banks, and Joseph and William Hooker. Another fascinating chapter deals with the strategic influence of colonial botanic gardens in establishing most of the world's major crop plants. Perhaps less well known is the strong emergence of botanic gardens in USA in the second half of the 19th century and the early 20th century, with Missouri dominating since its founding in 1859.

More recent developments are tracked under the heading 'education and conservation' and understandably focus on British botanic gardens including Kew, Edinburgh and Glasnevin in Dublin. The Royal Horticultural Society's garden at Wisley is given special mention along with the National Botanic Garden of Wales in Carmarthenshire, the most recent new botanic garden in Britain (2000). Conservation is the main aim of many of the new botanic gardens established beyond Europe – for example 150 in the former USSR; it would have been useful to read more about gardens in the southern hemisphere (where sadly there is a paucity and an urgent need to initiate new centres for *ex-situ* conservation.)

In a chapter entitled 'What makes a Botanic Garden', Sarah amplifies her earlier definitions and examines key components – glasshouses, order beds, herbaria, libraries, and associated botanical museums and art collections. In each case she describes changing fashions and some technical and scientific advances.

Taxonomic research, plant biochemistry including screening for pharmaceuticals, conservation genetics and ecological restoration are all important modern aspects of botanic gardens which are somewhat neglected in this short book. Widening public education and collaboration also deserve greater emphasis as botanic gardens assume their full potential to help deliver the Global Strategy for Plant Conservation, a vital international effort to save plants. While the author acknowledges the role of the charity Botanic Gardens Conservation International (the influential network of botanic gardens and arboreta in the British Isles known as PlantNetwork), promoting modern initiatives in research, education and conservation is not mentioned.

The book is very attractively illustrated throughout with relevant, well-captioned images on every page, many in colour. There is a list of 18 gardens to visit in Britain and Ireland, a reading list and short index.

In conclusion this is an attractive, well-written and informative introduction to botanic gardens, strong on their historical development in Europe (and its colonies) and USA but somewhat deficient in explaining the vital purpose which now confronts botanic gardens world-wide: saving our planet's plants and improving our scientific understanding of all things green and growing.

Nigel Brown



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Rhizotron - a unique experiment still running strong!

As many of you may have noticed, there has been quite a transformation in the Rhizotron over the past year. Almost one year ago my loyal field assistants, Israel (Figure 10) and Joan, and I began removing all of the pre-existing vegetation (Figure 16) and their accompanying roots in an effort to clear the Rhizotron soil bays for my new experiment. It took a few weekends, several trips to the coffee shop, and three pairs of gardening gloves, but we finally had the soil beds prepared for their new inhabitants: four different species of trees!

I spent a large chunk of time considering which tree species to plant in the soil bays, and used a combination of natural history information, natural tree association guides, and a healthy dose of advice from Nigel, and my PhD supervisory committee members at Bangor University, the University of Copenhagen, and University of British Columbia-Vancouver. We chose Douglas fir and red alder as one pairing, which are representative of tree species that occur together both naturally and in managed forests in British Columbia, Canada. This means $1/6^{\text{th}}$ of the soil bays are planted with an evenly-spaced mixture of red alder and Douglas fir. Another $1/6^{\text{th}}$ of the soil bays are planted with red alder growing by themselves, and another $1/6^{\text{th}}$ of the soil bays are planted with Douglas fir growing by themselves. The second pairing consisted of common oak and sycamore, which were selected due to their widespread distribution in Denmark and the UK.

One of the really interesting features of this experiment is that I will be able to isolate the effects of tree species on rhizosphere soil properties and microbial communities. Additionally, the unique access to soil bays from below ground enables me greater access to soil sampling without disturbing the trees growing above. Due to the planting arrangements where trees are grown in a bay by themselves or evenly mixed with an associated species, I am able to determine if trees are growing better in certain conditions.

This past autumn, towards the end of the growing season, I measured how tall each of the trees had grown (Figure 17). These data showed that Douglas firs were growing taller when planted in mixture with red alder, while alders generally grew equally tall whether planted by themselves or in mixtures. Sycamores grew taller when planted in mixtures with oaks, but oaks in mixtures grew less than those planted by themselves. I also collected initial soil characterization data on soil carbon and nutrient content, pH, moisture, and other soil physico-chemical properties, prior to planting any tree seedlings. At the end of the experiment, I will

thus be able to compare how soil properties have changed over time, in the various tree treatments.

I had the pleasure of presenting the current findings and the experimental design at the British Ecological Society's Plants-Soils-Ecosystems and Plant Physiology special interest group meeting last November at the University of Manchester. There was a great deal of interest in the Rhizotron infrastructure, and I extended an invitation to interested parties to come explore the Rhizotron and Trebroth Botanic Garden in person in the future. Additional data will be collected this year as the trees continue to establish and grow in the Rhizotron, so be on the lookout for me (I'm usually wearing blue wellies), and please come ask me any questions you have. I love chatting about my research, or gardening in general.

Relena Ribbons

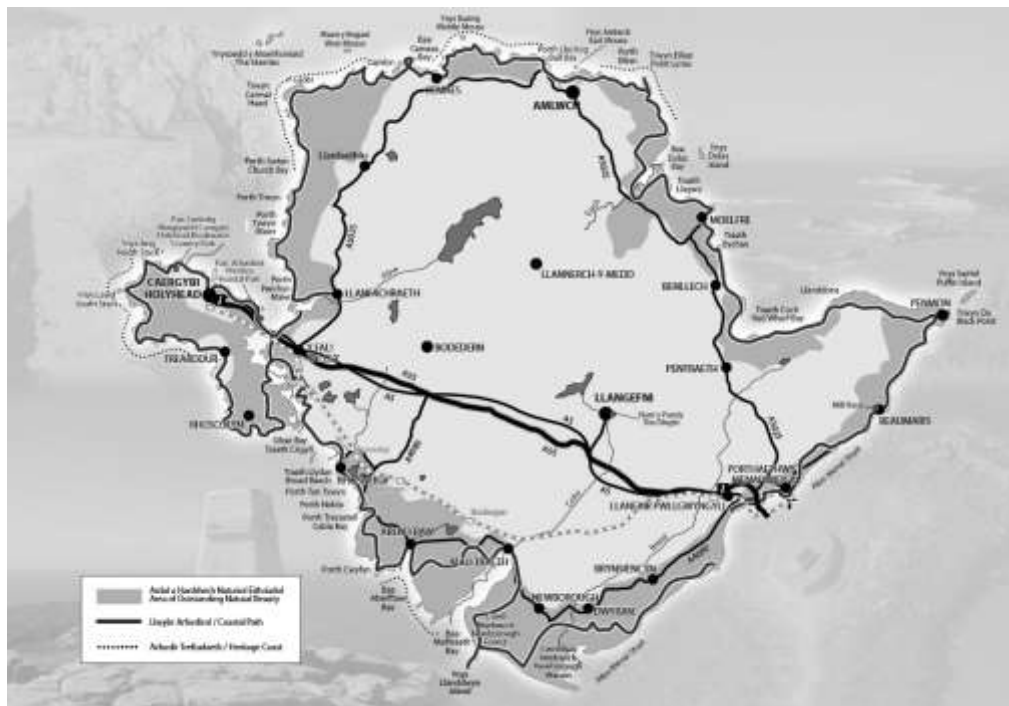


Fig. 15. Isle of Anglesey Area of Outstanding Natural Beauty [p. 37]



Fig. 16. Relena standing next to the Rhizotron prior to vegetation removal, 1 year ago. [p. 47]



Fig. 17. Relena standing next to the 1-meter tall alders in the Rhizotron! They grew up so fast! [p. 47]



Fig. 18. Skeins of wool drying (with Pat Denne). Yarns dyed with plant dyes at the Gwynedd Guild of Weavers, Spinners & Dyers dyeing day, September 2014, Treborth Botanic Garden. [p. 15]