

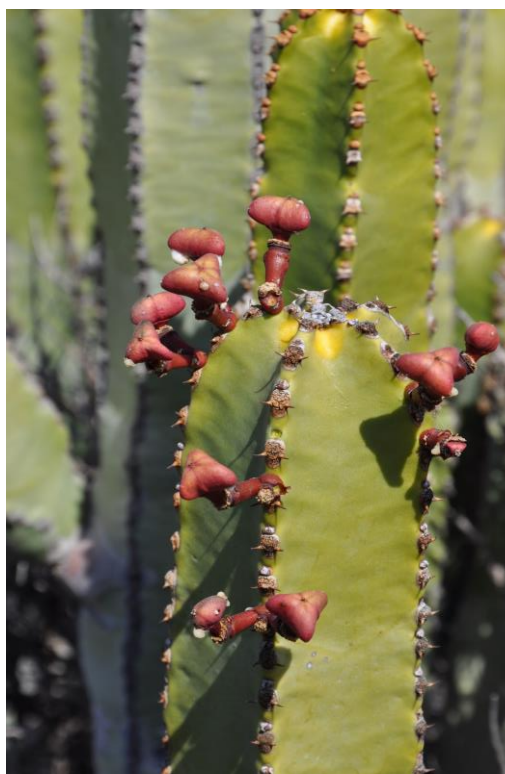
Oxford Plant Systematics



With news from Oxford University Herbaria (OXF and FHO), Department of Plant Sciences, Oxford

OPS 25

June 2019



Foreword

This is the twenty-fifth issue of *Oxford Plant Systematics* to be published since it was first produced in 1993; we missed one year when the Herbaria were being refurbished. Three striking things are obvious looking back over these issues. First, research methodologies may have changed but similar fundamental questions are being asked. Second, most users of the collections are researching questions other than plant taxonomy or ecology. Third, herbarium specimens are being used in ways that could not have been predicted in the early 1990s. Moreover, the collections are enjoying something of a golden age as application of the technology of rapid specimen digitisation has the potential to make biodiversity data, stewarded by the Department of Plant Sciences over nearly four centuries, available to all. The early eighteenth-century herbarium of Thomas Shaw, one of the poorly known historic collections, is highlighted as a candidate for digital access.

Inadvertently, a theme that runs through his year's *OPS* is reflection on current and past activities. There are articles on two undergraduate field courses, one to South Wales and the other Tenerife, both of which have been long-term successes. Based on long experience, John Wood reflects on categories of taxonomists, whilst Keith Kirby asks us to think about what we mean when plants are described as native, exotic or invasive in particular places. John also highlights a curious phenomenon in Bolivian Convolvulaceae, and raises a pertinent question about apparent rarity in the family.

There is more to *OPS* than reflecting on the past. Most importantly, there is the future, which is highlighted through the diverse activities of the D.Phil. and M.Sc. students, postdocs, and research fellows, the specimen digitisation programme that is now well underway in the Herbaria and the long-awaited release of BRAHMS version 8 (<https://herbaria.plants.ox.ac.uk/bol/>).

I hope you find this year's *OPS* of interest.

Stephen A. Harris

Curator of Oxford University Herbaria

Front cover images:

Photographs from the undergraduate field course in Tenerife: top left - *Echium wildpretii* H. Pearson ex Hook.f. in flower in the caldera of Las Cañadas; top right - the sea of cloud surrounding Tenerife from the Pico del Teide; bottom right - immature fruit of *Euphorbia canariensis* L.; bottom left - xerophytic vegetation at the Malpais de Güímar. See article on page 5.
All images © Stephen A. Harris

Typesetting and layout of *OPS* by Serena Marner

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Oxford Plant Diversity Research Group website: <http://herbaria.plants.ox.ac.uk>
Oxford University Herbaria database at: <http://herbaria.plants.ox.ac.uk/bol/oxford>

News

Funding for digitisation

The Herbaria received a substantial donation from Clive Gilmore to digitise all pre-1796 specimens, South and Central American and African specimens in OXF. It is estimated that the images and metadata from 250,000 specimens will be made available online over the next two years. We would like to thank Mr Gilmore for his great generosity in funding this digitisation initiative.

New appointments

Martina Boatfield and Alistair Orr joined the Herbaria team in April 2019 as digitisation technicians. Their activities are focused on imaging and metadata capture, which will substantially increase the accessibility and security of the collections in Oxford University Herbaria.

Capacity building for using crop wild relatives to enhance sweet potato varieties

Sweet potato is one of the world's most important root crops. Grown in over 100 countries, it is a significant food, particularly for the rural poor, with high levels of production in China, Nigeria, Tanzania and Ethiopia. The crop is highly adaptable, growing in a wide range of agro-ecological conditions, from sea level to 3000 m above sea level. Sweet potato produces the highest amounts of edible energy per hectare of all major food crops. Orange-fleshed varieties contain high levels of beta-carotene, a precursor of vitamin A, the deficiency of which affects millions of children worldwide. Despite the adaptability of the sweet potato to a range of agro-ecological conditions, there are large yield-gaps due to a range of biotic and abiotic constraints, especially sweet potato viral disease and sweet potato weevils. In addition, lack of drought resistance in high beta-carotene sweet potato varieties has led to their cautious and slow uptake.

Crop wild relatives (CWR) are the wild species most closely related to the crop. These plants are recognised for their potential to contribute viable traits to breeding programmes. CWR have provided breeders with genes for pest and disease resistance as well as abiotic stress tolerance in major crops such as potato, rice, and wheat. Yet despite the potential of CWR to contribute to the improvement of major crops, their utility remains underdeveloped in some crops due to a lack of basic knowledge and capacity.

We have recently identified, using genomic data, the 15 wild species most closely related to the sweet potato and provided a robust classification of them, opening the door to their use in breeding. Subsequently, the International Potato Center (CIP) in Peru, which holds the largest sweet potato germplasm collection worldwide, has invited

us to collaborate on a project to DNA barcode their living collection of sweet potato wild relatives, so that correctly identified material from 600 accessions can be made available to sweet potato breeders.

In summary, the aim of my project is to design a set of molecular markers to facilitate the identification of the sweet potato and its closest wild relatives. I will then provide accurate identifications for the core collection of wild relatives at the CIP germplasm bank. This project is funded by the University of Oxford Global Challenges Research Fund.

Pablo Muñoz-Rodríguez
Post Doctoral Researcher

Herbarium Exhibition Room

The Herbarium Room was opened at the Oxford Botanic Garden in July 2018. The room, which was part of the Department of Botany before the early 1950s, has been decorated with prints from Johann Dillenius' *Hortus Elthamensis* (1732). One of the room's functions is as a temporary public exhibition area for items from the Herbaria collections. The first exhibition was entitled 'The Bobarts: building botany at Oxford'.

Oxford Botanic Garden and Harcourt Arboretum Florilegium

With sixteen enthusiastic illustrators I feel that we have now reached our original target.

The collection of art work is looking impressive with over eighty pieces accepted. It is particularly pleasing to see some line drawings and works in coloured pencils and graphite in progress, besides the more usual watercolours.

For the first few years we met once a month either in the Botanic Garden or the Arboretum and took far too long selecting plants! Members then took their plants home to work on. But it works far better now that we have two consecutive days each month, based in Plant Sciences, when the whole group works together and the enthusiasm is very contagious. Clare Kelly, from the Garden, and I collect together which takes far less time.

Through the winter we again had sessions on line drawing techniques and the group looked at some of the historical specimens collected by Jacob Bobart. John Baker, our departmental photographer, kindly produced natural-sized, coloured photographs of these very precious herbarium sheets which allowed them to continue working at home.

Many thanks to Stephen Harris for all the work he put in on a grant application for the Florilegium. Sadly we were not successful but came second, which was encouraging. The next aim is to illustrate some of the living plants that Bobart introduced to the garden. These will be exhibited in the Weston Library in 2021 to mark the 400th anniversary of the founding of Oxford Botanic Garden.

Rosemary Wise
Botanical Artist

Expeditions and visits

John R.I. Wood

During March-April, John visited Bolivia and Paraguay, funded by a BBSRC GCRF-IAA grant. The purpose of the trip was to investigate wild relatives of the sweet potato and raise awareness of their importance. Various talks were given and field work resulted in the discovery of two new species and several new records of *Ipomoea* for Bolivia.

One month's field work in June-July was undertaken in remote parts of Eastern Bolivia jointly with the Royal Botanic Gardens, Kew's TIPA project and with financial support from the Weedon Foundation. The visit resulted in new records for Kew and the *Ipomoea* project, as well as new discoveries for Bolivia.

Serena Marner

In October, Serena attended a Symposium in Albany, Western Australia, entitled 'Collecting the West – histories of natural history collections & collecting' organized by the University of Western Australia and associates. She gave a talk on the history of William Dampier's botanical collections made in 1699 from 'New Holland'. The Symposium brought together a mix of curators and researchers from varied collections including maritime, geological, zoological, botanical and maritime archaeology, as well as Traditional Owners with indigenous knowledge of natural history. Outings in Menang Country, led by a guide from a Menang family, and one by a conservation biologist, informed us of how Noongar Aboriginal people used the natural environment for gathering food and medicines.

Caroline Pannell

Caroline visited New York Botanical Garden Herbarium (NY) and Harvard University Herbaria (A) in February 2018. She spoke at the ATBC (Association for Tropical Biology and Conservation) meeting in Kuching, Sarawak in July and visited SAR (Sarawak), SING (Singapore) and BO (Herbarium Bogoriense) with Elizabeth Joyce, a Ph.D. student from James Cook University, Cairns. One of the chapters in Elizabeth's thesis, on the Sahul Sunda floristic exchange, is a molecular, morphological and biogeographical resolution of the most widespread complex species in the genus, *Aglaia elaeagnoides* (A.Juss.) Benth. She and Caroline met again in September to sample *Aglaia elaeagnoides* and outgroups in (A) and the Smithsonian (US). Since then, Elizabeth has succeeded in extracting DNA from an 1845 collection made by Robert Wight in India, which Caroline sampled in NY. In BO and A, Caroline determined the mainly sterile specimens of *Aglaia* collected by Cam Webb in a series of Indonesian plots and she will be involved in the

biogeographical analysis of the data on this genus.

Publications 2018

Harris, S.A. (2018). Seventeenth-century plant lists and herbarium collections: a case study from the Oxford Physic Garden. *Journal of the History of Collections* **30**: 1-14.

Harris, S.A. (2018). Seeds: more than meets the eye. *Current Biology* **28**: 530-532.

Harris, S.A. (2018). Snapshots of tropical diversity: collecting plants in Colonial and Imperial Brazil. In A. MacGregor (ed) *Naturalists in the field: collecting, recording and preserving the natural world from the fifteenth to the twenty-first century*. Brill: 550-577.

Harris, S.A. (2018). *Sunflowers*. Reaktion Books. 256 pp.

Josekutty, E.J., Biju, P., **Wood, J.R.I.**, Augustine J. (2018). *Strobilanthes kannanii* – a new species of *Strobilanthes* from the Western Ghats, India. *Nordic Journal of Botany* **2018**: e01689

Muñoz-Rodríguez, P., Carruthers T., Wood J.R.I., Williams, B.R.M., Weitemier, K., Kronmiller, B., Ellis, D., Anglin, N.L., Longway, L., **Harris S.A.**, Rausher, M.D., Kelly, S., Liston, A., **Scotland R.W.** (2018). Reconciling Conflicting Phylogenies in the origin of sweet potato and dispersal to Polynesia. *Current Biology* **28** (8): 1246-1256.

Pannell, C.M. (2018). Reproductive biology, morphological taxonomy, biogeography and molecular phylogeny of *Aglaia* (Meliaceae): the monographic approach to a large genus of tropical trees. *Sibbaldia* **16**: 87-97.

Wood, J.R.I. & McDonald, J.A. (2018) Proposa to reject the name *Ipomoea emetica* (Convolvulaceae). *Taxon* **67** (1): 210-211.

Wood, J.R.I. (2018). *Salvia macrophylla*. Curtis's Botanical Magazine **35** (1): 75-88.

Wood, J.R.I., Martinez-Ugarteche, M.T. (2018.) Distribución y Endemismo del Género *Ipomoea* (Convolvulaceae) en el Oriente Boliviano y sus implicaciones biogeográficas. *Kaempffiana* **14** (1): 13-21.

Wood, J.R.I., Marner, S.K., Scotland, R.W. & Harris, S.A. (2018). Specimens of Convolvulaceae linked to the plates of Dillenius's *Hortus Elthamensis*. *Taxon* **67** (5): 1014-1019.

Wood, J.R.I., Martinez-Ugarteche, M.T., **Muñoz-Rodríguez, P., Scotland, R.W.** (2018). Additional notes on *Ipomoea* (Convolvulaceae) in Bolivia. *Kew Bulletin* **73** (57): 1-15.

Reflections on the first-year Biological Sciences BA field trip to Pembrokeshire, Wales



Undergraduates on the field course with Claudia in Pembrokeshire May 2019.
Photo © Claudia Havranek

For many of the first-year biologists, this was their first field trip. A surprising number of students come to university with no experience of fieldwork. This presents an important gap to be filled in the education of young biologists.

The annual Biological Sciences field trip is hosted at the Orierton Field Studies Council Centre, Pembrokeshire, Wales. This week-long field trip has been running for over 25 years, and I have attended as both a student and teacher. As a student, it was a highlight of my undergraduate degree. The trip is split into five days, with each day focussing on different types of species: sand dune plants, woodland plants, birds, insects and rocky shore marine life. The course content covers species identification and sampling methods, to give students the building blocks to conduct ecological fieldwork.

However, it is not just within the confines of formal teaching that ecological lessons are learnt. Residential field trips offer an immersive learning experience. Constantly surrounded by other biologists, the students are continually questioning and engaging

with different aspects of biology. In the time between course assignments, students take part in evening activities, including bat watching and moth trapping. Many students appeared in my classroom after supper, clutching plant specimens they wanted identifying. I even raced against a plant identification app to name plant specimens in front of the students.

Residential field trips also offer a different environment for teaching, which crosses the barriers of formality imposed by the lectures and tutorials that make up most of university teaching. The students get to talk to researchers and ask questions beyond the

confines of a packed undergraduate schedule. With several days of contact, the students get to interact at a more personal level with researchers. Students' questions ranged from the nature and content of my research, to the environmental impacts of veganism, to how long it would take to be able to identify every plant in the British flora by sight.

It is not just students who benefit from field trips, but teachers too. Many of the field-trip lecturers have been back to Orierton time and time again. For me, the draw is how much the teaching invigorated and inspired me. This year, I was lucky enough to be running the sand dunes day at the Freshwater West beach. In the sand dune habitat, I showed a pyramidal orchid (*Anacamptis pyramidalis* (L.) Rich.) to 109 different undergraduates. I experienced the delight of seeing this beautiful flower for the first time exactly 109 times.

Claudia Havranek
D.Phil. student

In Humboldt's tracks: reflections on an undergraduate field course in Tenerife

One of the most famous visitors to Tenerife was the 29-year-old Prussian polymath and naturalist Alexander von Humboldt. Humboldt described his first glimpses of the Pico del Teide, the volcano at the centre of Tenerife, and the 'sea of clouds' surrounding it, on the 19th June 1799 as he approached Santa Cruz from the sea. In the fog, quite by accident, their ship avoided English warships blockading the island, and might have forced their vessel away. Humboldt was to write later that 'it would have been distressing for naturalists to have seen the Tenerife coasts from far off and not to have been able to land on soil crushed by volcanos' (von Humboldt, 1995: 24). On 6th January 1832, Charles Darwin experienced the distress. The *Beagle* was prevented from landing at Santa Cruz and turned south to Cape Verde. In his personal diary, a frustrated Darwin wrote: 'we have left perhaps one of the most interesting places in the world, just at the moment when we were near enough for every object to create, without satisfying, our utmost curiosity' (Wyhe, 2002).

On 21st June 1799 Humboldt started to ascend the Pico del Teide (3,718 m), along the Orotava Valley, amassing information about the rocks and plants through which he moved: 'a journey to the Tenerife volcano's summit is not solely interesting for the amount of phenomena available for scientific research but far more for the picturesque beauties' (von Humboldt, 1995: 34). Humboldt left Tenerife on 25th June; he had spent six nights on the island.

At the beginning of May, each year since 2012, Professor Robert Scotland has led a team of staff (John Wood, Timothy Walker, Stephen Harris) who take a small group of undergraduates, at the end of their second year, on a week-long field course to study the biogeography of plants on Tenerife.

One of the many highlights of this week is to have the undergraduates experience the elevational zonation of Tenerifean vegetation that Humboldt described for the first time (del Arco Aguilar and Rodriguez Delgado, 2018).

On the north coast of the island, from Puerto del Cruz we drive along the TF-21, that snakes up the Orotava Valley, quickly passing through areas that have largely been turned over to agriculture and that would have been dry, thermophilous woodland. The first major natural vegetation zone we meet is the pine forest of the *Corona Forestal*, between 1200 m and 2000 m above sea level, which is composed almost entirely of the endemic Canarian pine, *Pinus canariensis* C.Sm.



Pico del Teide from Puerto de La Cruz.
Photo © Stephen Harris

Above the limits of the pine forest, the landscape is transformed as we enter the caldera of Las Cañadas and the Parque Nacional del Teide. A landscape of collapsed volcanos, cinders and ancient lava flows is studded by the few plant species, most of which are Tenerifean endemics, that can survive low mean annual temperatures, limited rainfall and high diurnal temperature ranges. It is here that we find dome-shaped shrubs, such as the white-flowered *Cytisus supranubius* (L.f.) Kuntze, pink-flowered *Ptercephalus lasiospermus* Link and yellow-flowered *Descurainia bourgaeana* (E.Fourn.) Webb ex O.E.Schulz. Most spectacular of all are the person-sized, red flowering spikes of *Echium wildpretii* H.Pearson ex Hook.f., which emerge from the centre of giant rosettes of silvery, grey-green leaves. Less prominent plants, also endemic to the caldera, include *Argyranthemum tenerifae* Humphries and *Nepeta teydea* Webb & Bertol. One of the plants we have only ever seen with the remains of the previous year's flower heads is the Canarian endemic *Cheirolophus teydis* (C.Sm.) G.López.

The students are given the opportunity to go to the peak of Teide on the cable car. At the top, besides spectacular views of the island and the 'sea of clouds', they might find the endemic violet, *Viola cheiranthifolia* Humb. & Bonpl., in flower.

Turning north west, we drive along the TF-24 and the mountainous spine of Tenerife, past the Teide Observatory, before dropping onto the south of the island at the TF-523. Passing through Arafo and Güímar, at approximately 400 m above sea level, we enter the xerophytic zone, where annual temperatures are high and rainfall is low, before ending the island transect at the Malpaís de Güímar.

At sea level, the Malpaís de Güímar is a boulder-strewn, ancient lava flow. It is here that the students are introduced to the diversity of the genus *Euphorbia*, especially the organ-pipe form of *Euphorbia canariensis* L. and hummocks of *Euphorbia balsamifera* Aiton. Other prominent plants include the silver-leaved *Schizogyne sericea* (L.f.) DC., the pink-flowered *Campylanthus salsoloides* (L.f.) Roth and the silver-grey-stemmed *Ceropegia fusca* Bolle, with its curious, purple-brown flowers.

In a single day, the students see a vast range of plant diversity across almost all the vegetation zones of Tenerife. The only one we miss is the laurel forest; which we see later in the week.



Sonchus acaulis Dum.Cours., a woody species endemic to the Canary Islands.
Photo © Stephen Harris

References

- del Arco Aguilar, M.J. & Rodriguez Delgado, O. (2018). *Vegetation of the Canary Islands*. Springer.
- von Humboldt, A. (1995). *Personal narrative of a journey to the Equinoctial regions of the New Continent*. Penguin Books, London.
- Wyhe, J. (2002). *The Complete Work of Charles Darwin Online*. <http://darwin-online.org.uk/>. Accessed 10th February 2019.

Stephen A. Harris
Curator of Oxford University Herbaria

Ghost forests, fire and sleeping beauties/ Convolvulaceae

My most recent visit to Eastern Bolivia in March 2019 produced no new species of *Ipomoea* but it did reveal a phenomenon I have not observed before.

In Bolivia, the spring of 2018 was unusually dry and fires were exceptionally fierce, sweeping through cerrado and other similar vegetation but also through areas of dry forest which are not adapted to withstand the effects of fire. The result has been the creation of ghost forests where dead trees remain standing in a darkened, ash-covered forest. The rains eventually came and regeneration began quickly in the summer warmth and by the time of my visit the trees were covered in a blanket of creepers.

We saw creeper-covered ghost forests in three places. All three had a similar physiognomy with abundant creeping plants and, in all three, species of Convolvulaceae were prominent. In the first, near San Miguel de Velasco, the most conspicuous species was the blue-flowered *Jacquemontia tamnifolia* (L.) Griseb. but *Distimake cissoides* (Lam.) A.R. Simões & Staples, *Ipomoea grandifolia* (Dammer) O'Donnell and *Bonamia subsessilis* Hassl. were common. In the second, near Taperas, the same *Distimake* was joined by *I. bahiensis* Willd. ex Roem. & Schult., *Jacquemontia cumanaensis* (Kunth) Kuntze and, unexpectedly and more rarely, *Jacquemontia gracillima* (Choisy) Hallier f. The third location, in the Chaco south of San José de Chiquitos towards the border with Paraguay, was the most spectacular. Here one species, *I. bahiensis* covered the dead forest in a continuous carpet, creating a sea of purple in every direction.

Various questions were raised by the phenomenon. *Jacquemontia tamnifolia* is not a particularly common species in Bolivia. Before this year, there were only 11 records, four from a single location, and none from within 200 kilometres of San Miguel, a location visited by numerous botanists over many years. Had we just not noticed this relatively conspicuous plant? Nor was the *Distimake* recorded here nor at Taperas. Even more remarkable was *I. bahiensis*. We cited ten records in 2015 (Wood et al. 2015) and hitherto all records were of single or few plants growing on roadsides, including near Taperas. But where had the sea of *I. bahiensis* south of San José come from?

The likely (only?) explanation is that seeds remain dormant over many years, presumably since the last fire or major disturbance, ten or twenty years earlier – assuming there was a previous fire as the area is not naturally burnt. I have observed mass germination of *I. chiliantha* Hallier f. before, following the construction of a new road



Mass flowering of *Ipomoea bahiensis* Willd. ex Roem. & Schult. following forest destruction by fire. Photo © Siri Omberg

connecting Bolivia and Brazil but nothing on this scale nor as a result of fire. However, it does strongly suggest that seeds of several species of Convolvulaceae can remain dormant for many years even in seasonally wet areas. It also raises questions about conservation assessments made for species in this family. Does apparent rarity in fact conceal a huge seed bank waiting for propitious circumstances to burst into flower and set seeds ready for the next opportunity?

Reference

Wood, J.R.I., Carine, M.A., Harris, D., Wilkin, P., Williams B. & Scotland, R.W. (2015). *Ipomoea* (Convolvulaceae) in Bolivia. *Kew Bulletin* 70 (31): 1-123.

John R.I. Wood
Research Associate

Degrees of nativeness

Does it matter where a plant has come from and how it got here?

Conservation policy and practice in the UK usually values native species of plant over introductions because they are our particular responsibility, just as eucalypts are the responsibility of Australians and sequoias the Americans. Non-native species are generally treated as neutral or actively discriminated against if they are perceived as invasive (<http://www.nonnativespecies.org/index.cfm?sectionid=15>).

Natives usually mean those plants that arrived under their own steam after the last glaciation and formed part of our natural

vegetation. Non-native species, by contrast, are those that have established themselves outside their natural range either past or present, with human assistance either intentional or unintentional. However, while the nativeness concept seems simple there can be more twists and turns in it than at first appear.

Should we restrict ourselves to only Holocene plants?

Humans have been present in Britain (and much of the rest of Europe) since before the last ice-age ended. The human-mediated extinction of mega-fauna, such as mammoths and woolly rhinoceros, meant that the Holocene post-glacial vegetation development seems to differ from previous inter-glacial warm periods by having more tree and woodland cover (Sandom et al., 2014). Some proponents of rewilding therefore argue that we should take such earlier open inter-glacial conditions as our model for natural landscapes to eliminate human impacts. If we were to adopt a similar approach to defining what should be called native plants there would be interesting outcomes: at various times rhododendron, *Rhododendron ponticum* L., and Norway spruce, *Picea abies* (L.), H.Karst. have been present in what is now Britain. The general consensus for defining native plants is to stick to the Holocene flora, but there is a risk that different parts of the conservation movement might end up working to different baselines.

Archaeophytes and neophytes: changing status and attitudes

As well as separating native from non-native species the *New atlas of the British and Irish flora* (Preston et al., 2002) separates the non-native species that have established and can



Lamium album L., the white dead nettle, an archaeophyte.
Photo © Keith Kirby

maintain themselves in the wild into archaeophytes and neophytes. Archaeophytes are those that are thought to have arrived and naturalised before 1500 AD. Some archaeophytes, such as white deadnettle, *Lamium album* L., are so widespread that most people are unaware that they are not strictly part of our native flora; others such as corn cleavers, *Galium tricornutum* Dandy, an arable weed, are the subject of active conservation programmes, so blurring the conservation significance of whether a plant is native or not.

The characterisation of species may change over time. Snowdrop, *Galanthus nivalis* L., was sometimes regarded as native but is now classed as an introduction. May lily, *Maianthemum bifolium* (L.) F.W.Schmidt, has been classed as an introduction in the past but is now accepted as native, at least at some sites. Sycamore, *Acer pseudoplatanus* L., is classed as a neophyte (recorded only post-1500 in the wild) in the *Atlas*, but there are those who argue it is at least an archaeophyte and could be native. Moreover, while it has been the target of major conservation control programmes in the past because of its perceived invasiveness, attitudes towards it are changing. It is seen as one of the species with the potential to fill gaps in woods created by the loss of ash, *Fraxinus excelsior* L., to the fungal disease, *Hymenoscyphus fraxineus* (Tokowalski) Baral, Queloz & Hosoya.

What counts as outside the natural range?

The native range for beech, *Fagus sylvatica* L., is generally taken to be southern England, south-east Wales, but excluding Devon and Cornwall. There are pollen records for further north in England but with the odd exception little evidence that there was a continuous presence of the tree in the early modern era. Hence stands in northern England, north Wales and Scotland are

generally treated as non-native because they originate in plantings. However the distribution of beech on the continent has been changing over the last few thousand years (Bradshaw and Lindbladh, 2005). So might it have reached Scotland by now without human help and could we tell such native stands from the introduced ones if it had? The *Atlas* simply notes that the 'native range has never been precisely defined and all records are mapped as native regardless of status'.



Polystichum setiferum (Forssk.) Moore ex Woynar, a possible garden escape but potentially native in Wytham.
Photo © Keith Kirby

Scots Pine, *Pinus sylvestris* L., poses the opposite problem: it was native through much of England in the early Holocene but then appears to have died out before being re-introduced in recent centuries in plantations. It is classed as non-native in England, while the native stands in Scotland are rightly celebrated.

However, John Evelyn, writing in the seventeenth century, refers to accounts of large areas with pines (hundreds of great fir trees in the original) on the lowland bogs of Hatfield Chase in Yorkshire/Lincolnshire. Perhaps scattered pine also survived on some poor sandy soils such as in the Breckland of Norfolk or the Surrey heaths, or at high altitude in Northumberland, as at Williams Cleugh in Kielder Forest (Manning *et al.*, 2010). If it did hang on in some places, would this mean we should give it also English-native status? Intriguingly, recent research in Ireland is suggesting that some Scots pine there can claim to be native (Roche *et al.*, 2018).

Garden escapes and assisted migration

In 2018, I found soft shield fern, *Polystichum setiferum* (Forssk.) Moore ex Woynar, in Wytham Woods, Oxfordshire, the first record for the site for this species. It is not that common in the wild in the surrounding 10 km squares and the spores probably blew in from a nearby garden. So, it may not be from a natural population, but we are now including it in the native list for the Woods. The *Atlas of the British and Irish Flora* includes the comment for a number of other species that their native range is confused by garden escapes. Does this matter?

Humans are responsible for both the climate change that may be putting some of our native flora under threat, and for the habitat fragmentation which makes it difficult for species to migrate 'naturally' in response to that threat. One logical response might be therefore to assist species to move by growing them in gardens outside their natural range, thus 'correcting' the problem that we have caused in the first place. However, are we actually moving the 'right' plants?

The Welsh poppy, *Meconopsis cambrica* (L.) Vig., is a native species in Wales, but many of the populations elsewhere in Britain, derived from garden escapes, have genetic links to a different glacial refuge in the central and eastern Pyrenees (Preston *et al.*, 2012). The native genotype seems to be in slow decline, but the otherwise almost indistinguishable version is expanding its range. Is that good or bad news for poppy conservation? In re-introductions programmes we already happily import genetic stock from abroad, as for example with the red kite, *Milvus milvus* (Linnaeus, 1758) and beaver, *Castor fiber* Linnaeus, 1758, releases.

Conclusion

I am not advocating that all species are acceptable everywhere, but we should be aware of inconsistencies and ambiguities in our attitudes and behaviours. For example, on a recent visit to Urquhart Bay Alderwood on the shores of Loch Ness I noticed that the Woodland Trust noticeboard referred to active control of Himalayan balsam, *Impatiens glandulifera* Royle, and Japanese knotweed, *Reynautria japonica* Houtt., as non-native, invasive species. Indeed, they are, but much more obvious on that site was the abundance of the archaeophyte goutweed, *Aegopodium podagraria* L., the neophytes sweet cicely, *Myrrhis odorata* (L.) Scop., pink purslane, *Claytonia sibirica* L., and fringe-cups, *Tellima grandiflora* (Pursh) Douglas ex Lindl., along with smaller amounts of honesty, *Lunaria annua* L., lupins, *Lupinus* spp., and non-native genotypes of Welsh poppy.

As a teenager I was into English folk music and we put great store on songs deemed to come from the 'oral tradition', the real folk

songs. Yet that did not stop us also joining in recent creations by Ewan McColl or Tom Paxton where they were good ballads. In a similar way, perhaps we should become more accepting of non-native species in the face of a rapidly-changing environment.

References

- Bradshaw, R.H.W., Lindbladh, M. (2005). Regional spread and stand-scale establishment of *Fagus sylvatica* and *Picea abies* in Scandinavia. *Ecology* 86: 1679-1686.
- Manning, A. D., Kesteven, J., Stein, J., Lunn, A., Xu, T., Rayner, B. (2010). Could native Scots pines (*Pinus sylvestris*) still persist in northern England and southern Scotland? *Plant Ecology and Diversity* 3: 187-201.
- Preston, C. D., Pearman, D. A., Dines, T. D. (2002). *New atlas of the British and Irish flora: An atlas of the vascular plants of*

Britain, Ireland, The Isle of Man and the Channel Islands. Oxford University Press, Oxford.

Preston, C. D., Valtueña, F. J., Kadereit, J. W. (2012). The intriguing case of the Welsh poppy *Meconopsis cambrica*. *British Wildlife* 24: 16-20.

Roche, J., Mitchell, F., Waldren, S., Stefanini, B. (2018). Palaeoecological evidence for survival of Scots Pine through the Late Holocene in western Ireland: implications for ecological management. *Forests* 9: 350.

Sandom, C. J., Ejrnæs, R., Hansen, M. D. D., Svenning, J.-C. (2014). High herbivore density associated with vegetation diversity in interglacial ecosystems. *Proceedings of the National Academy of Sciences* 111: 4162-4167.

Keith Kirby
Woodland Ecologist

Botanical watercolours by Charlotte Georgina Trower (1855-1928)



Meconopsis cambrica (L.) Vig., the Welsh poppy. This is a native species, but probably with non-native genes, which has shown expansion in distribution.



Aegopodium podagraria L., goutweed, an archaeophyte.

Images © Oxford University Herbaria

Towards a taxonomy of taxonomists

For several centuries taxonomists have applied their skills to the classification of life. This short article aims to reverse that process by focusing on the classification of taxonomists and provides a key to help the reader. Most taxonomists will be able to place themselves into one of the following categories, even if they sometimes cross over into another category or belonged to a different one earlier in their career.

1. Are you reluctant to make decisions and publish? **A. The over-cautious**
1. Are you happy to publish your taxonomic decisions? **2**
2. Do you publish in non-peer reviewed journals? **B. The alternative**
2. Do you publish in peer-reviewed journals? **3**
3. Are you guided by a clear theoretical framework? (C. The ideologue) **4**
3. Are you guided by pragmatic/subjective considerations? (D. The pragmatist) **6**
4. Are you committed to monophyly as your guiding principle? **C.2. The monophylist**
4. Do you base your taxonomy on other theoretical principles? **5**
5. Do you base new taxa on a matrix of differences? **C.1. The matrician**
5. Do you rely on other theoretical foundations? ... **C. Miscellaneous ideologues**
6. Do you tend to unite variable sorts into a single species? **D.1. The lumpner**
6. Do you tend to recognize distinct, sometimes minor variation, as infraspecific entities? **D.2. The splitter**

Now try a look at this second cross-cutting dichotomy:

1. Are you a writer of monographs or revisionary floras?
..... **E.1. The monographer**
1. Do you publish individual new taxa?
..... **E.2. The cherry picker**

A. The over-cautious

Inevitably, this group of taxonomists is little-known because they publish little. Inhabitants of museums and unreconstructed university departments, they are a dying breed as institutions demand publications from their staff. The over-cautious may rightly point out the errors of the rash, who must account for a significant proportion of the huge synonymy with which plant taxonomists have burdened us (Goodwin *et al.* 2015). However, over caution never attempted, let alone completed, a task. How many never write up the collections they

receive and how far is over-caution at least a partial explanation for the scandalously vast number of unnamed specimens in the world's herbaria (Bebber *et al.* 2010)?

B. The alternative taxonomist

Taxonomy has always had some appeal to the unsociable, who likes to work on his/her own and is intolerant of questioning and alternative opinions. The history of taxonomy is littered with such people. Some were ideologically motivated, such as Constantine Rafinesque, who published an early nineteenth-century classification system that was ignored or rejected. Most, however, are more pragmatic wishing to publish without the need for peer review. Hector Léveillé, who published extensively 'often apparently hurriedly, certainly inadequately' on the Chinese flora, illustrates a characteristic of this type of taxonomist – they tend to be self-publishers and journals, such as *Onira*, are established principally as a means of publishing the editors' own papers. Alternative taxonomists tend to flourish outside established institutions and often focus their research on succulents or plants of horticultural interest, such as the *Selbstverlagen* publications of Friedrich Ritter.

C. The ideologues

There have been many kinds of taxonomic ideologue, that is, a person who subjects perceived reality to a theoretical system, which tends to trump reality, or 'common sense', as some would have it. Here I focus on two which are still current.

C.1 The matrician/ mathematician

This kind of ideological approach has a venerable history. Linnaeus' eighteenth-century sexual system of plant classification, which divided plants into 24 classes, was a clear example where a mathematical formula separated intuitively/naturally related species (e.g. *Salvia* and *Rosmarinus* with two stamens were separated from other Lamiaceae with four stamens). In more recent times, this approach has been characterised by tables of ten or more contrasting characters to justify recognition of a new species. Such characters are often unweighted, so trivial differences are treated as equal to significant diagnostic characters. The significance of these characters is particularly low when tables are based on small sample sizes. Their presence in many papers I have had to review suggests this approach is advocated by many academic taxonomists in an attempt to apply rigour to taxonomy.

C.2 The monophylist

The monophylist sees monophyly as the essential element in any taxonomic decision. S/he dominates current taxonomic practice and regards other approaches as unscientific and outdated. No matter that the end result is

a classification that flies in the face of common sense or is unusable outside the laboratory. Those demanding monophyly seem to have won the battle at family level but the battle continues at generic level. A good example of the latter is the current controversy over the limits of the genus *Ceropegia*. As traditionally understood this was a morphologically well-defined group with a distinct corolla in which the lobes were fused apically. In order to maintain monophyly following molecular studies, *Ceropegia* has now become a monstrosity including all the succulent stapeliads (Bruyns *et al.* 2015).

D. The pragmatist

Most taxonomists are pragmatists who do not follow a particular blueprint but pragmatically interpret nature as they see it.

Splitters and lumpers are a well-known distinction essentially between two kinds of pragmatist. Both approaches are attempts to grapple with reality. Lumpers tend to conceal variation which could well merit further investigation, whereas splitters assign equal status to a local variant and a universally recognized species, with questionable consequences for conservation.

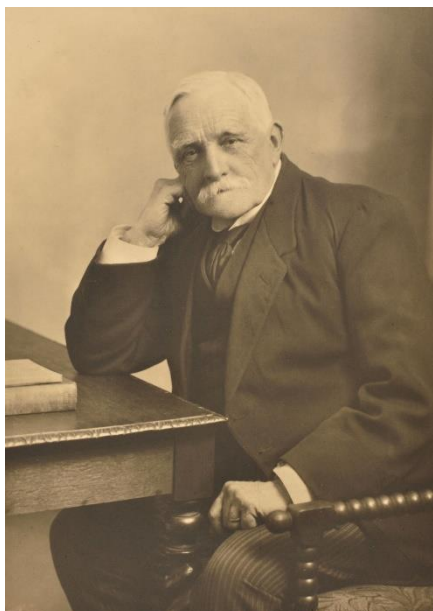
The distinction is exemplified by the treatment of *Convolvulus* in Australia. Robert Brown recognized several native species, whilst George Bentham, in *Flora Australiensis* (1839), treated them as a single species, *C. erubescens* Sims. Johnson (2001) divided *C. erubescens* into 11 species and four additional subspecies. Both treatments are problematic. *Convolvulus erubescens sensu* Bentham is clearly an aggregate of taxa but splitting it into discrete units, with non-overlapping characters, is extremely difficult.

A more recent example is the case of *Attalea* (Arecaceae). Henderson *et al.* (1995) recognized a single genus with 29 species, while Glassman (1999) split *Attalea* into five genera and recognized 65 species. Govaerts & Dransfield (2005) recognized a single genus but 67 species!

Then there are those who recognize a complex hierarchy of infraspecific entities, taken to an extreme in Emil Hassler's publications on the *Flora of Paraguay* (1909-). Fashion plays its part and different eras have favoured the recognition of infraspecific taxa. Hassler's approach was fashionable at the end of nineteenth century, as seen in works by George Claridge Druce and many European botanists.

E.1 Flora/monograph writers

This kind of taxonomist is obliged to consider all specimens and all relevant research within the compass of their study and must confront or, at the very least, set out the problem areas involved. The approach of revisionary Floras, such as *Flora Malesiana* or the *Flora of Tropical East Africa*, is not very different from that of preparing a *Systematic Botany* monograph.



George Claridge Druce (1850-1932), an 'alternative taxonomist', 'pragmatist', 'splitter' and 'cherry picker' at various points in his career.
Photo © Oxford University Herbaria

E.2 The cherry picker

Incomplete monographic work is at least partially cherry-picking but there are essentially two subspecies of this kind of taxonomist:

Subsp. A

The first kind of cherry-picking taxonomist developed gradually out of nineteenth-century expedition reports, where one or more authors would write up the results of a particular expedition describing random new taxonomic discoveries. This tradition morphed into a new kind of publication that has proliferated since the middle of the twentieth century - the paper that describes one or a few new taxa and fills journals, such as *Brittonia*, *Novon*, *Kew Bulletin*, *Nordic Journal of Botany*. They are valuable as they add to the catalogue of life but single-species papers rarely grapple with serious issues of plant taxonomy. The authors pick out one or two items, 'the cherries', leaving the more difficult issues to the monographer.

Subsp. B

The second kind of cherry-picking taxonomist, also a relatively recent phenomenon, appears to have arisen out of hybridisation with the ideologue. An early example is Cornelis Bremekamp's work on *Strobilanthes*, in which he split *Strobilanthes* into numerous genera based mostly on pollen and seed characters. Although describing some 50 genera, he was able to assign only around 75% of species into genera, leaving a rump of miscellaneous species in a limbo. The rise of molecular systematics has multiplied this phenomenon. Existing genera are split into new monophyletic genera, inevitably leaving a significant rump of unplaced species, often without even a provisional generic placement. Those who defend this situation argue that eventually all

issues will be resolved. Of course, 'eventually' may stretch into eternity given the lack of resources and the impossibility of sequencing all entities. For opponents, this constitutes a backward step, bringing taxonomy into disrepute, as taxonomists cease to be able to fulfill their basic task of providing a name for each biological entity.

A postscript: The opportunist

Most taxonomists believe in the existence of the opportunist who steals their results to publish before the original author has time. But is it a phantom? Certainly, belief in the opportunist dates back centuries. Pehr Forsskal, working in 1762, deliberately kept his collection notes separate from his specimens so they could not be easily exploited by an opportunist. His death in Arabia has led to difficulties for over 250 years in reconciling his notes with his specimens!

Conclusion

If you are a taxonomist, where do you place yourself within this taxonomy?

References

- Bebber, D.P., Carine, M.A., Wood, J.R.I., Wortley, A.H., Harris, D.J., Prance, G.T., Davidse, G., Paige, J., Pennington, T.D., Robson, N.K.B., Scotland, R.W. (2010). Herbaria are a major frontier for species discovery. *Proceedings of the National Academy of Sciences of the United States of America* 107 (51): 22169-22171.
- Bruyns, P.V., Klak, C., Hanáček, P. (2017). A revised phylogenetically-based concept of *Ceropegia* (Apocynaceae). *South African Journal of Botany* 112: 399-436.
- Glassman S.F. (1999). A taxonomic treatment of the palm subtribe Attaleinae (tribe Cocoeae) *Illinois Biological Monographs* 59: 1-409.
- Goodwin, Z.A., Harris, D.J., Filer, D., Wood, J.R.I., Scotland, R.W. (2015). Widespread mistaken identity in tropical plant collections. *Current Biology* 25: 1066-1067.
- Govaerts, R., Dransfield, J. (2005.) *World checklist of palms*. Royal Botanic Gardens, Kew.
- Henderson, A., Galeano, G., Bernal, R. (1995). *Field guide to the palms of the Americas*. Princeton University Press, Princeton.
- Johnson, R.W. (2001). A taxonomic Revision of *Convolvulus* (Convolvulaceae) in Australia. *Austrobaileya* 6: 1-39.

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Research Associate

Thomas Shaw's eighteenth-century Levantine and Barbary plants

Thomas Shaw (c.1694-1751), the son of a prosperous Westmorland cloth worker, arrived in Algiers as Chaplain to the English Factory in 1720, having completed his theological training at Queen's College, Oxford. Shaw, elected to a Queen's fellowship in 1727, returned to England in 1733 and became a member of the Royal Society in 1734. Eventually, in 1740, he was made Principal of St Edmund Hall, Oxford, and, one year later, Regius Professor of Greek.

Shaw's light professional duties in Algiers, combined with his robust constitution and a 'mind rich in most kinds of human learning' (Anonymous, 1791: 83), meant he had the opportunities and personal qualities necessary to become a respected early eighteenth-century explorer of North Africa and the eastern Mediterranean. Much of Shaw's exploration was in the interior of Barbary (Algeria, Morocco and Libya) but he also explored parts of Tunisia, Egypt, Sinai, and the Holy Land.

In 1738, Shaw summarised more than a decade of such journeys and experience in his *Travels, or observations relating to several parts of Barbary and the Levant*, to which a supplement was published in 1746, with subsequent editions in 1757 and 1808. In addition to discussions of geography, antiquities and local customs, Shaw described the plants, animals and fossils he observed. At least one late-eighteenth-century commentator considered his approach to natural history as 'instructive and entertaining', avoiding 'the dullness of superfluous description, the cruel tediousness with which many a modern naturalist burdens his unhappy readers' (Anonymous, 1791: 83).

Shaw's work was praised by many, but not all, for its attention to detail, and faithful recording of observations. The black-and-white illustrations, made by his own hand, in all their 'veracious rudeness', that pepper the work were thought to be of little value (Anonymous, 1791: 83).

The 1738 edition of Shaw's natural history included a 'Catalogue of some of the rarer plants of Barbary, Egypt and Arabia' listing 640 plants (including those mentioned in footnotes), which he had prepared with 'great Assistance from Mr. Professor [Johann Jacob] Dillenius, whose Character in Botanical Learning, is so well known to the Publick' (Shaw 1738: Preface, p. xiii). Shaw considered 140 of these plants were new species.

Six botanical plates (illustrating 30 plants) accompanied the Catalogue. Three of the plates carried dedications: James Beauclerc



Specimen of *Magydaris pastinacea* (Lam.) Paol. collected by Thomas Shaw. Image © Oxford University Herbaria



Specimen of *Lathyrus ochrus* (L.) DC. collected by Thomas Shaw. Image © Oxford University Herbaria

c.1709-87), canon of St, Georges Chapel, Windsor, and eventually bishop of Hereford; Simon Harcourt (1717-77), 2nd Viscount Harcourt, who became Viceroy of Ireland; and the royal physician, Richard Mead (1673-1754).

Shaw and Dillenius arrived at their determinations by comparing the specimens with 'that large and well-digested Collection of dried Plants, which Dr. W[illiam]. Sherard bequeathed to the Physick Garden of the University of Oxford; where all curious Persons have an easy access, through the great Affability and communicative Temper of that worthy Gentleman [Dillenius], to whose Care they are entrusted' (Shaw 1738: Preface, p. xii). Dillenius had been given the position of first Sherardian Professor of Botany at Oxford in 1734, as a condition of William Sherard's benefaction to the University.

'Lest any Mistakes should have been committed in the Descriptions of These [plants] or of the marine Vegetables, the Author has deposited the Originals in the Sherardian Collection' (Shaw, 1738: Preface, p. xiii). Specimens in Shaw's herbarium are distinctively mounted. Each one is glued to a sheet of paper with an elaborate printed border, and labelled with polynomials clipped from printed sheets identical to those in Shaw (1738). The original sheets were glued onto larger-sized paper sheets in the late-nineteenth century or early twentieth century.

Over more than 250 years, some of Shaw specimens appear to have been either lost or perhaps scattered among other pre-1796 collections in Oxford University Herbaria; to date all but 24 of the specimens have been located. Including unlabelled materials and duplicates, Shaw's herbarium currently comprises 635 specimens.

All but one of the specimens used as models for Shaw's botanical plates are in his herbarium. The exception is the figure for *Rhamnus lotus* L. (Shaw, 1738: f. 632), the model for this appears to be a specimen in the Sherardian Herbarium (Sher-0174-2), bearing a label in William Sherard's hand with reference to Shaw's work in Dillenius's hand.

Shaw recognised explicitly: (i) the permanency of physical specimens in collections; (ii) the possibility his identifications were incorrect; and (iii) that there were alternative interpretations of the plants and algae he had collected. Despite Shaw's foresight, his specimens have been overlooked by many users of Shaw's names and his natural history. For example, Carolus Linnaeus cited at least eight of Shaw's polynomials in *Species Plantarum* (1753), whilst René Desfontaines equated approximately 40% of Shaw's names with Linnaean binomials in *Flora Atlantica* (1798-1799). Neither Linnaeus, who visited Dillenius in 1736 and met Shaw (Druce and Vines, 1907: xxiv), nor Desfontaines, appear to have studied Shaw's original specimens.

Now all known specimens in the Shaw Herbarium have been digitised, it is hoped they will receive the attention Shaw thought they deserved.

References

- Anonymous (1791). The life of Thomas Shaw, D.D. Principal of St. Edmund's Hall, Oxford. *European Magazine* 19: 83-86.
- Druce, G.C. & Vines, S.H. (1907). *The Dillenian Herbarium: an account of the Dillenian collections in the herbarium of the University of Oxford*. Clarendon Press, Oxford.
- Shaw, T. (1738). Specimen Phytographiae Africanæ &c. or a Catalogue of some of the rarer plants of Barbary, Egypt and Arabia. In: *Travels, or observations relating to several parts of Barbary and the Levant*: 37-47. Oxford, Printed at the Theatre.
- Stephen A. Harris**
Curator of Oxford University Herbaria



Specimen of *Oryza sativa* L., rice, collected by Thomas Shaw © Oxford University Herbaria

News from the Herbaria

Fielding-Druce (OXF) and Daubeny (FHO)

This report concentrates on activities in the 2018 calendar year. It is pleasing to note that the numbers of people visiting the Herbaria again showed an increase from 2017. We have continued to introduce the collections to varied audiences, and to a good number of undergraduate and postgraduate students, highlighting the potential for research using the collections. In the course of introducing students to the Herbaria, we were delighted to receive a number of offers of help with curation which resulted in four volunteers. This provides an opportunity for the volunteers to learn about different aspects of botanical collections through identification, nomenclature and geographical distribution, whilst mounting or incorporating specimens. We received help from a trainee horticulturist at the Oxford Botanic Garden, Robert Taite, two undergraduates, Anna Gee and Sebastian Hatt, and one postgraduate, Marlene Roth. Many thanks to them for all of their help.

Visitors

335 visits were recorded comprising 71 visits by individuals plus 264 people within 16 groups.

New groups making their first visit to the Herbaria and Sherardian Library included ten participants on a Bodleian Summer School

course on 'The Scientific Image'. Materials shown to them included copper plates, printing proofs and published plates from Morison's *Plantarum Historiae Universalis Oxoniensis* (1699), together with herbarium specimens that were likely to have been used as models for the plates. Other relevant examples shown included the field sketches, water colours and published plates from the *Flora Graeca* (1806-1840), Besler's *Hortus Eystettensis* (1613), de Passe's *Hortus floridus* (1614-1618) and van Rheede's *Hortus Indicus Malabaricus* (1678-1703). From the University's English Department, 14 undergraduates studying a specialist class called 'Texts in Motion' visited to explore issues around the relationships among text, image and herbarium specimen, the role of herbaria in mediating knowledge and the interplays among reliability, authenticity and credibility. In particular three examples on the theme were shown and explored. These were: 1) William Sherard's manuscript *Pinax* and the specimens in his herbarium; 2) the travel writings of the privateer William Dampier, his plant specimens and the published images created from these specimens; and 3) the role of specimens in interpreting manuscript and published plant lists associated with the Bobarts and the seventeenth-century Oxford Botanic Garden. Another 14 English students visited in November, while attending a seminar on 'Eighteenth century literature and culture'. On another visit three geochemists sampled specimens of brown algae from around the UK in order to investigate changes in

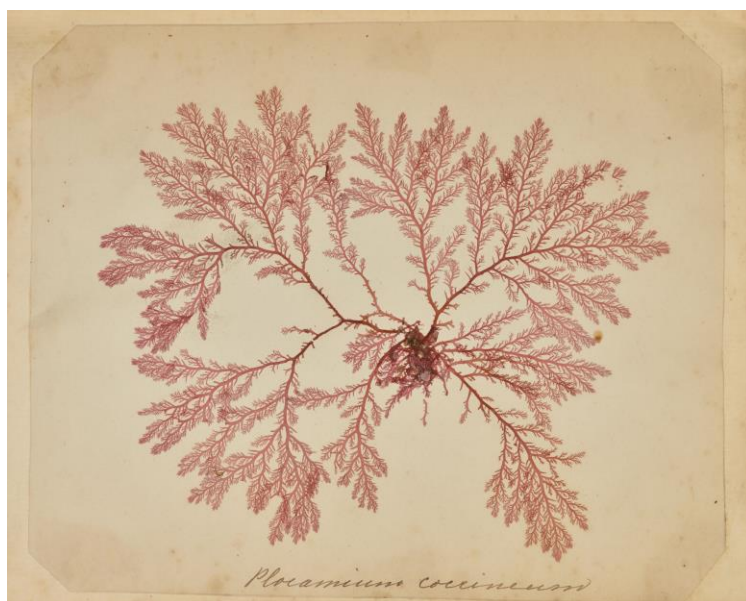
environmental pollution since the start of the Industrial Revolution.

For the past few years, some groups return to the Herbaria nearly every year, either to see different specimens and aspects of the collections, or with different participants for part of a course. We are always delighted to welcome members of the Bobarts Group of the Friends of Oxford Botanic Garden and Arboretum. The theme of their visit in March 2018 for 30 members was collecting plants for gardens and scientific collections over the last 350 years. Contemporary specimens from the Herbaria were displayed alongside books and manuscripts from the Sherardian Library of Plant Taxonomy and the point was emphasized that these objects complement each other and together create a valuable resource for use in scientific research. Among themes illustrated were: the role of specimens and illustrations in ensuring species lists and catalogues become scientific documents; transporting living material back to Britain and returning seed; and the challenges of cultivating the exotic. Another group of 50 members of the Friends of Oxford Botanic Garden and Arboretum visited in September for a general introduction to the Herbaria.

Twelve members of the local Abingdon Naturalists' Society also returned in February. On this occasion the group was shown a range of herbarium and printed material that related to the theme of botanical illustration, hybrids and the British Flora.

Another return visit was made in August by Dr Sarah Simblet from the Ruskin School of Fine Art with 16 new students on her week-long summer school on the subject of botanical drawing. The main focus was to see Ferdinand Bauer's sketches, watercolours and corresponding herbarium specimens that were used to create the magnificent illustrations for Sibthorp and Smith's *Flora Graeca* (1806-1840). In addition, this year students on the course were given an opportunity to draw from a selection of dried fruits from the carpological collection in the Daubeny Herbarium. Six botanical artists from the American Society of Botanical Artists, introduced by Margaret Best, also visited to see Ferdinand Bauer's watercolours for the *Flora Graeca* for inspiration. A visit was made by the Oxford Conservators Group to see the materials associated with this original expedition to the eastern Mediterranean in the 1780s and the making of the *Flora Graeca*. Richard Mulholland gave a lecture to the group on his work on linking Bauer's colour code and the pigments that Bauer used when making the watercolours in Oxford.

Eleven students studying a course on 'Plants in Garden History', from The Gardens Trust, based at the Institute of Historical Research in London, visited in October. The early history of the Oxford Botanic Garden was illustrated by showing a wide range of printed and manuscript materials as well as many specimens preserved by the Bobarts, Robert Morison



Images of one of the new accessions to OXF, a book of seaweeds collected in 1892 from around the south west of the UK.
Photos © Oxford University Herbaria

and Johann Dillenius. In addition, rare books were presented from the Sherardian collection that showed the history of plant use in gardens and introduced the ways in which plants have been illustrated over the past four centuries.

An assortment of genera were studied by individuals across the collections usually on one-day visits. However, Arthur Boom, from the Universite Libré de Bruxelles, spent two weeks in the Daubeny Herbarium studying the large holdings of African *Brachystegia* (Fabaceae) specimens. Other African genera were also consulted from the holdings in FHO. Dr Jacques Florence, from MNHN Paris, studied material of *Khaya* (Meliaceae) on six day visits, accompanied by his colleague, Bouka Gaël, for four days. Five researchers from Kew visited on one day to study specimens of *Cola* (Malvaceae).

Special loans for exhibition

Wider audiences were able to view specimens from the Herbaria which were lent for the following exhibitions. From 23 April to 10 October 2018 a special exhibition was presented in Magdalen College Library Oxford entitled 'The Flora and Fauna of Magdalen College'. Three herbarium specimens were included in the display, one was a specimen of the Snake's head fritillary, *Fritillaria mealagris* L., from Jacob Bobart's seventeenth-century *Hortus Siccus*. Another specimen attributed to the first Professor of Botany at Oxford, Robert Morison, *Lilium candidum* L., was included, plus a variegated *Acer pseudo-platanus* L. from the 'Physick

Garden at Chelsea' preserved at a similar period. An additional twelve seventeenth-century specimens associated with Jacob Bobart and Robert Morison, and the early history of the Oxford Botanic Garden, were displayed in the new 'Herbarium Room' at the Oxford Botanic Garden (see page 2). Pine cones from different species, plus a (modern) herbarium specimen of *Pinus nigra* J.F.Arnold, were also part of the display. One specimen from the Sibthorpi collection, *Nerium oleander* L., was lent to the Tylers Museum in the Netherlands for an exhibition on 'Franz and Ferdinand Bauer' to run from 1 February 2019 to 12 May 2019.

New accessions

169 miscellaneous specimens collected in Brazil by JEQ Faria and Carolyn Proença were received from the University of Brasilia. 142 miscellaneous duplicates of specimens collected in Liberia were also kindly sent from BR, Botanic Garden Meise. An isotype of a newly described species, *Talbotiella cheekii* Burgt. (Fabaceae), was a gift from Kew. The plant was first collected by Dr Martin Cheek in 2015, an old colleague from FHO, in a forest near Conakry in Guinea and hence named after him. We were also presented with a delightful small bound album of seaweeds, given by Malcolm Osmundson. The named seaweeds dated 1892, were collected at Sidmouth [Devon] and Marazion [Cornwall] UK.

Serena K. Marner
Herbarium Manager



An illustration of Snake's head fritillary from Robert Morison's *Historia Plantarum Universalis Oxoniensis* Part II (1680) from Tab. 18 Section 4. Jacob Bobart worked on Morison's collections.

Photo from Sherard 726 © Sherardian Library of Plant Taxonomy

Abstract of systematic thesis submitted in 2018 and student reports

The following D.Phil. thesis was submitted and successfully defended in 2018:

Systematic studies of sweet potato and its wild relatives **Pablo Muñoz Rodríguez**

Department of Plant Sciences, University of Oxford

Supervisor: Prof. Robert Scotland (Oxford)

Phylogenetic studies on the genus *Ipomoea*, and specifically on the species closely related to the sweet potato, have been hindered by limited taxon and character sampling. Any study that aims to investigate the phylogenetic relationships within a megadiverse genus such as *Ipomoea*, with an estimated 800 species, must rely on a comprehensive data set that covers as much diversity as possible, in order to provide accurate and robust phylogenetic inference.

In my thesis, I present a comprehensive phylogenetic study of the genus *Ipomoea* and of the group of species closely related to the sweet potato using genomic-scale data. The aim of this study was to provide a phylogenetic framework with which to understand the diversity existing within the genus and to inform taxonomic decisions. The phylogenies presented here identify several recurrent patterns in the evolution of *Ipomoea*, for instance the multiple origin of storage roots and the existence of multiple episodes of long-distance dispersal by natural means.

I also address several questions pertaining to the sweet potato that have been a matter of debate for decades but remained unanswered until recently. Our genome-scale data facilitated comprehensive phylogenies for all wild species that are most closely related to the sweet potato. Our phylogenies resolve that sweet potato is monophyletic and had a single origin, as well as identified the wild species that is its closest relative: *Ipomoea trifida* (Kunth) G.Don, with all other extant species more distantly related. In addition, our studies corroborate the existence of two sweet potato chloroplast lineages and infer that one of them resulted from a hybridisation between sweet potato and *I. trifida* following species divergence.

Finally, I also address a question that has been of interest for over two centuries: the presence of the sweet potato, an American crop, in Polynesia in pre-European times.

Tom Carruthers (D.Phil., 4th year) Evolution of *Ipomoea* in the Neotropics

Supervised by Prof. Robert Scotland (Oxford). Funding: NERC.

Over the past year, I have focussed on theoretical problems relating to divergence time and diversification rate estimation in molecular phylogenies. These problems are fundamental to how we make inferences about macroevolution from molecular phylogenies. I have investigated these problems both in a general context, and specifically within *Ipomoea*. With respect to general problems relating to divergence time and diversification rate estimation, I have focussed on the implementation of fossil calibrations, and the implications of substitution rate variation and diversification rate variation. I have taken into account this work on general theoretical issues when investigating questions relating specifically to the evolutionary diversification of *Ipomoea*. This has led to several noteworthy results, including strong evidence for extensive diversification rate variation among clades within *Ipomoea*; and overwhelming evidence that the sweet potato – a major global crop – evolved in pre-human times. I am now writing up this work for my D.Phil. thesis which I will submit in October. Several parts of my work are also being submitted for publication.

Ben Jones (M.Sc. Res., 1st year) An investigation into the factors influencing the distribution of rare endemic Japanese plant species

Supervised by Prof. Stephen Harris (Oxford) and Dr William Hawthorne (Oxford)

Global plant biodiversity has never faced such pressure and threat from human-based activities, with one in five plant species now threatened with extinction. In many areas across the globe, solutions to plant conservation are not going to be possible, therefore the identification, evaluation, and prioritisation of plant communities requiring intervention is of critical importance.

Japan is one of 36 biodiversity hotspots, meeting the criteria of holding at least 1,500 endemic plant species, however, in balance, this also means that it has lost 70% or more of its original habitat extent. Japan has an estimated 1,950 endemic plant species, or 34.8% of its flora. The large variety of plant species found on the islands reflects the diverse climate of the archipelago within the East Asian temperate zone, ranging from the humid southern subtropics, through the temperate northern region to the sub-arctic extreme northern zone, characterised by distinct seasonal changes. According to the

Red List of Japan, 25% of the Japanese flora is threatened with extinction.

My research focuses on deciphering the influence of scale effects and seasonal variation on the distribution of rare endemic plant species in the Japanese flora, by modelling herbarium data and conducting rapid botanic surveys, of which 44 have been conducted across Japan to date. By creating a comprehensive and up-to-date database of the Japanese flora, a standardised biogeographical map can be generated, based on the database. This work will facilitate my investigation into factors that influence the distribution of rare endemic plant species within the Japanese flora.

My aim is that this research will identify how the findings can be applied at different scales, in the context of identifying, managing and safeguarding plant biodiversity and the threatened plant species within those areas, in the context of human-mediated environmental change. Through this research, I will argue that globally rare plant species can and should be a priority in conservation strategy and management. I will also demonstrate how the outcomes of this research can be utilised as a tool to inform and assist those involved in plant conservation management at national, regional and local levels.

Gail Stott (D.Phil., 4th year) Predicting botanical hotspots for tropical forest management

Supervised by Dr William Hawthorne (Oxford) and Dr David Harris (Royal Botanic Garden Edinburgh). Funding: NERC Doctoral Training Partnership

Gail submitted her thesis in Spring 2019.

Alex Sumadijaya (D.Phil., 3rd year) Systematics of *Stictocardia* Hall.f.

Supervised by Prof. Robert Scotland (Oxford). Funding: LPDP (Indonesia Endowment Fund for Education)

Nested within the Old-World *Ipomoea*, *Stictocardia* (Convolvulaceae) is a poorly known genus that requires a comprehensive taxonomic revision. Species delimitation within this genus is unclear due to overlapping morphological variation and inconsistent descriptions as specimens accumulated over time. I have studied the morphology of c. 1000 herbarium specimens of *Stictocardia*, and closely related taxa, obtained on loan from ten herbaria. Specimen data will be employed to revise species descriptions, construct an identification key, and generate distribution maps. Furthermore, principal component

analysis of morphological data will be utilised to explore and clarify species boundaries.

To overcome limited taxon and character ampling in published molecular studies, we are using high-throughput sequencing to generate a molecular dataset. Corroboration of molecular and morphological data is expected to address taxonomic issues at different hierarchical levels, i.e., monophyly at specific and generic levels.

Tom Wells (D.Phil., 1st year) Joining the hunt for the sweet potato's (*Ipomoea batatas*) wild relatives

Supervised by Prof. Robert Scotland
(Oxford). Funding: Interdisciplinary
Biosciences DTP (BBSRC)

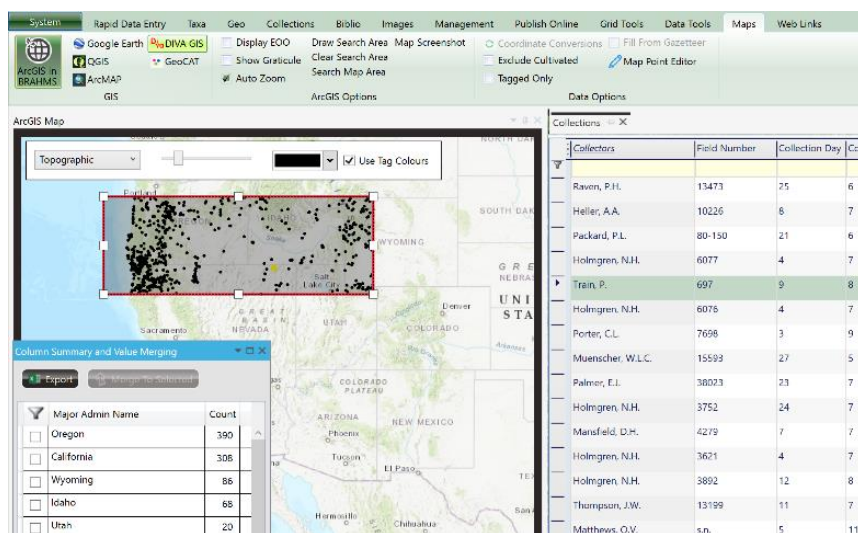
Following the publication of Muñoz Rodríguez *et al.* (2018), which resolved phylogenetic relationships between sweet potato and its 15 closest relatives, and the forthcoming Monograph of the *Ipomoea* in the New World (Wood *et al.*, in review), I am joining the group as a DPhil student to continue the process of untangling the origin of the sweet potato.

The questions include investigating the precise method of polyploidisation that might have led to a hexaploid sweet potato; how the extraordinary morphological diversity seen in sweet potato can be generated and maintained in a clonally propagated plant; what potential role geneflow and introgression might have played in generating the diversity of the modern crop and its sister species *I. trifida*; and ascertaining the taxonomic status of enigmatic specimens held in global natural history collections.

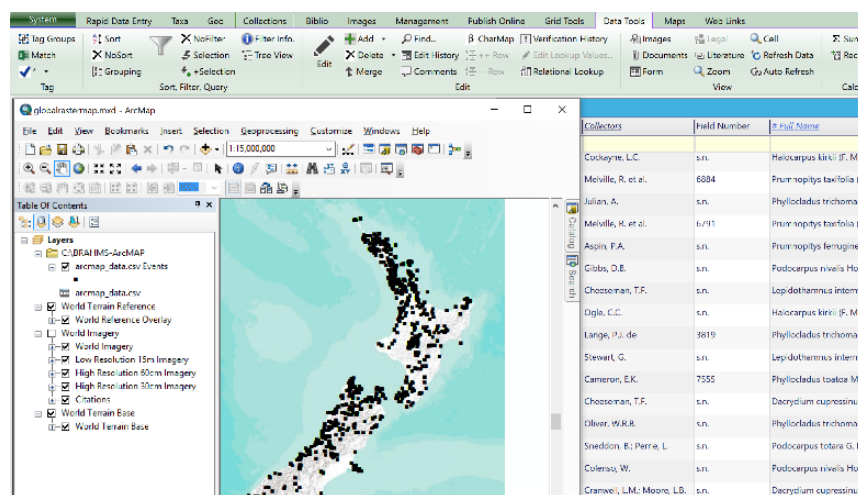
For this work I will be use a combination of fieldwork, morphological analysis of natural history collections (including herbarium specimens and living material from global genebanks); and phylogenetics using high-throughput sequence data.

As part of my Doctoral Training Programme (funded by BBSRC), I have undertaken two preliminary 12-week rotation projects before I begin my main thesis. The first of these assessed the utility of various morphological characters in the identification and differentiation of sweet potato and *I. trifida* herbarium specimens; and for the second I am using whole chloroplast sequence data and ~1000 nuclear genes to assemble a comprehensive phylogeny for the date palm (*Phoenix dactylifera*) and its wild relatives. For this second project, I have also been able to include sequence data extracted from a 3,500 year old specimen collected from the tomb of an Ancient Egyptian priest, which may offer valuable information on the history of one of the most important crops in the Middle East.

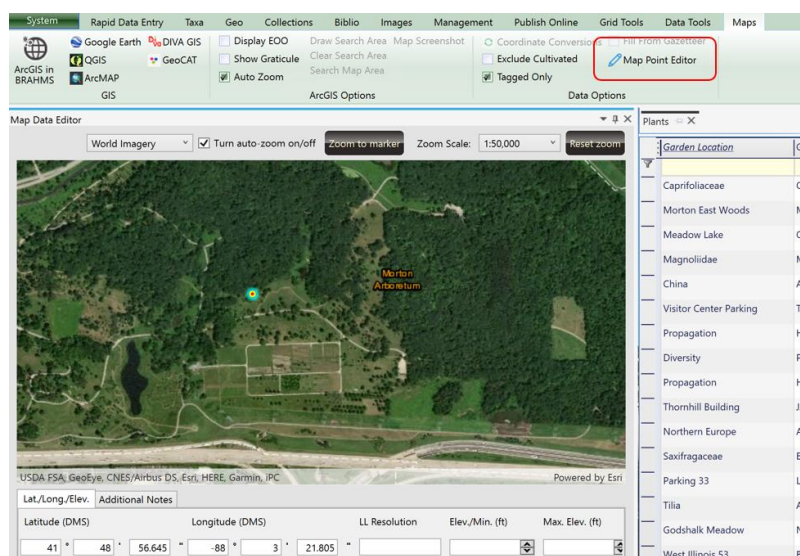
Advances with BRAHMS mapping



The built-in ArcGIS mapper provides features to search maps, calculate areas and locate records with map errors. When adding a search area, the data grid is filtered to show records from the selected map area.



Links are provided to ArcMAP and QGIS providing interactive access to these mapping packages.



Using the Map Point Editor, points can be added or re-located by right-clicking on the map. You can also type in map locations in DD, DMS or DM format.

Denis Filer and Andrew Liddell Independent Research Fellows

Oxford Botanic Garden and Harcourt Arboretum Florilegium



Recent paintings from the Oxford Botanic Garden and Harcourt Arboretum Florilegium.
Top left: *Aesculus parviflora* Walter © Maura Allen. Top right: *Acer palmatum* Thunb. © Gaye Norman.
Bottom left: *Viburnum rhytidophyllum* Hemsl. © Rosemary Wise. Bottom right: *Picea smithiana* (Wall.) Boiss. © Tracy Howell.