# The Botany of the British Empire

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## Abstract

Most of the world's major herbarium collections and botanical gardens, fundamental institutions for systematic botany, were built during periods of Empire and colonisation. This applies as much to the USA and USSR as it does to the former European powers. The great British botanical institutes and gardens at the Natural History Museum (BM), Royal Botanic Gardens, Kew (K) and Edinburgh (E) are no exception, their living and preserved plant collections having influenced plant science, agriculture and horticulture worldwide over many generations.

**Key Words:** Hans Sloane, Joseph Banks, Joseph D. Hooker, Royal Botanic Gardens, Kew, The Commonwealth, William Hooker

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> 'There scarcely exists a garden or a country however remote, which has not already felt the benefit of this establishment (The Royal Botanic Gardens, Kew). All our public gardens abroad - those in Ceylon, Mauritius, Sydney & Trinidad; & cultivators of the soil, Governors of our own colonies, & consuls are supplied with various products of such divers (sic) as may be deemed suitable to them'.
>
> William Hooker letter to the British Government (quoted in Desmond 2007)

The United Kingdom has three botanical institutions of international significance: The Natural History Museum, London, The Royal Botanic Gardens, Kew, and The Royal Botanic Garden, Edinburgh. Although these often collaborate or have mutually agreed specified areas of research I will concentrate during this presentation on the development of botanical collections and botany in the British Empire on the role of one of these, the Royal Botanic Gardens, Kew, one of the world's largest and most influential botanical gardens. I will discuss its relevance to the botany of the British Empire and Commonwealth and its continuing influence and relevance.

When I was employed on the staff of the Royal Botanic Gardens, Kew, I was asked in the early 1990s to undertake a review of Kew's collections. I was somewhat surprised to end up with details of 17 separate collections of varying size and importance based at Kew, including the 7,000,000 or more herbarium specimens, the comprehensive botanical library and archives, the Economic Botany collection of 50,000 items, the 70,000 bottle spirit collection, the 300,000 botanical illustrations and the rapidly growing Millennium Seed Bank. Our predecessors understood clearly the utility and significance of such comprehensive collections. Their relevance today is often dismissed or ignored and the activities of the botanists that work on them considered as old-fashioned science. In this presentation, I will discuss how the Empire influenced the development of major British collections, such as those at Royal Botanic Gardens,

Kew, and how those collections influenced the Empire. I will then consider the significance of those collections for botanical science today.

Botany and its associated collections came to England somewhat later than their development in continental Europe. Broadly the rise and development of botany can be considered through four periods. Its origins lie in the Renaissance in the 16th century, it was driven forward during the Enlightenment of the 17th and 18th centuries, transformed into a full-blown science during the days of Empire and invigorated by the technical developments associated with computing and the discovery of how to use DNA for taxonomic and other studies since the 1960s, a period that coincided with the loss of Empire and rise of the less formal associations of Commonwealth and European Union.

## The Rise of Botany and Botanic Gardens in Britain

William Turner (1508-1568) was the author of *A new Herball* (Turner 1551-1568), the first herbal published in England. He studied in Italy and travelled widely on the Continent where he came under the influence of Guillaume Rondelet (1507-1566) in Montpellier. Rondelet had been a student of Luca Ghini (1490-1556), the first to prepare books of pressed plants (herbaria) to aid identification (see Friis 2017). Botanic gardens and their collections arose originally from man's need for useful plants. In the European tradition, apothecaries' gardens were places where simples, plants with medicinal or supposed medicinal properties, were cultivated for use. In Britain, the first botanic garden, where plants with medicinal properties could be studied, was founded in 1621 at Oxford University. It was followed in 1670 by the Royal Botanic Garden, Edinburgh and, in 1673, by the Chelsea Physic Garden, established by the Society of Apothecaries. This was a period of rapid change in the country. The Tudor dynasty had challenged the established European power of the French and Spanish with trading companies and piracy. By the early 17th century England had a foothold in the Caribbean, on the eastern seaboard of North America while the Honourable East India Company was establishing a presence in the Indian subcontinent. Exotic plants flowed into England from around the world. In many ways, some of these, such as coffee, tea, potatoes, maize and cocoa had a greater long-term impact on the world than the desired spices and gold for which many of the adventurers set sail. These were grown in botanic gardens prior to being cultivated on a wider scale.

## Cabinets of Curiosity and the Rise of Horticulture

The increasing wealth of England as a trading nation in the 16th and early 17th centuries provided the funds and leisure time for the development of gardens for royalty, the aristocracy and the landed gentry. John Tradescant (c. 1570-1638) was one of the first to appreciate the potential for servicing this growing market. He began his career as head gardener to Robert Cecil, 1st Earl of Salisbury at Hatfield House, who sent him to the Low Countries for fruit trees from 1610 to 1611. He was kept on by Robert's son William, to develop gardens at the family's London house, Salisbury House. He then designed gardens on the site of St Augustine's Abbey for Edward Lord Wotton in 1615-1623.

Later, Tradescant became gardener to the royal favourite George Villiers, 1st Duke of Buckingham, remodelling his gardens at New Hall, Essex and at Burley-on-the-Hill, Rutland. In 1618, Tradescant travelled to the Nikolo-Korelsky Monastery in Arctic Russia (his own account of the expedition survives in his collection). Then, in 1620, he travelled to the Levant and to Algiers during an expedition against the Barbary pirates, returned to the Low Countries on Buckingham's behalf in 1624, and finally went to Paris and (as an engineer for the ill-fated siege of La Rochelle) the Ile de Rhé with Buckingham. After Buckingham's assassination in 1628, he was then engaged in 1630 by the king to be Keeper of his Majesty's Gardens, Vines, and Silkworms at his queen's Oatlands Palace in Surrey.

On all his trips he collected seeds and bulbs everywhere and assembled a collection of curiosities of nat-

ural history and ethnography which he housed in a large house, 'The Ark,' in Lambeth, London. The Ark was a 'Cabinet of Curiosity', a collection of rare and strange objects, that became the first museum open to the public in England (the *Musaeum Tradescantianum* now forms part of the Ashmolean Museum at Oxford). He also gathered specimens through American colonists, including his friend John Smith (1581-1631). From their botanical garden in Lambeth, on the south bank of the Thames, he and his son, John (1608-1662), who later made two expeditions to North America, introduced many plants into English gardens that have become part of the modern gardener's repertory.

## Sir Hans Sloane and the Foundation of the British Museum

Sir Hans Sloane (1660-1753) was one of the most influential of those who followed in the Tradescant tradition of collecting curiosities (De Beer 1953; MacGregor 1994). In his youth, he collected objects of natural history and other curiosities which led him to study medicine in London. Following a period in France he returned with a considerable collection of plants and other curiosities, of which the former were sent to Ray and utilised by him for his *History of Plants*.

He was elected to the Royal Society in 1685 and a fellow of the College of Physicians in 1687. The same year he went to Jamaica aboard HMS *Assistance* as physician in the suite of the new Governor of Jamaica, the Duke of Albemarle. In fifteen months there; he collected about 800 new species of plants, which he catalogued and published as a work in two volumes *A Voyage to Madera, Barbados, Nieves, St Christopher and Jamaica* (Sloane 1707-1725). Sloane encountered cocoa while he was in Jamaica and devised a means of mixing it with milk to make it more pleasant. When he returned to England, he brought his chocolate recipe back with him where it was initially manufactured and sold by apothecaries as a medicine.

His practice as a physician among royalty and the upper classes was large, fashionable and lucrative and, in 1716, he was created a baronet, making him the first medical practitioner to receive a hereditary title. In 1719 he became president of the Royal College of Physicians, holding the office for sixteen years. In 1722, he was appointed physician-general to the army, and in 1727 first physician to George II. In 1727 he succeeded Sir Isaac Newton as president of the Royal Society; he retired from it at the age of eighty. He was a founding governor of London's Foundling Hospital, the nation's first institution to care for abandoned children.

Sloane purchased the manor of Chelsea in 1712, provided the grounds for the Chelsea Physic Garden. When Sloane retired in 1741, his library and cabinet of curiosities had grown to be of unique value and included the extensive natural history collections of Engelbert Kaempfer's from Japan, William Dampier's from NW Australia (made 70 years before Banks reached the continent), and Mark Catesby's from Florida and the Carolinas and also those of William Courten, Cardinal Filippo Antonio Gualterio, James Petiver, Nehemiah Grew, Leonard Plukenet, Mary Summerset, the Duchess of Beaufort, the rev. Adam Buddle, Paul Hermann, Franz Kiggelaer and Herman Boerhaave.

He bequeathed his collections to the nation and, together with George II's royal library, it was opened to the public at Bloomsbury as the British Museum in 1759. His Natural History collections were later to become the foundation for the Natural History Museum (MacGregor 1994).

## Sir Joseph Banks and the Rise of the Royal Botanic Gardens, Kew

Sir Joseph Banks (1743-1820) was the critical link between Enlightenment figures, such as Sloane, and the recognition of the strategic importance of plants for the nation that eventually led to the establishment of a national botanic garden at Kew (Gasgoigne 1998). As a wealthy and enthusiastic young man seeking adventure and sponsored by the Admiralty but largely self-funded, he accompanied Captain James Cook on his round-the-world voyage in 1768-1771. On his return he was feted and became a confident of King George III whose estate at Kew had been established

as a botanic garden by his mother Princess Augusta with the help of Lord Bute. By 1773, Banks had become the unofficial director of the garden, a position that was formalised in 1797. Banks dispatched explorers and botanists to many parts of the world, and through his efforts Kew Gardens became arguably the pre-eminent botanical gardens in the world, with many species being introduced to Europe through them and through the Chelsea Physic Garden and their head gardener John Fairbairn. Banks directly fostered several famous voyages, including that of George Vancouver to the Northwest Pacific, and William Bligh's voyages to transplant breadfruit from the South Pacific to the Caribbean islands. He also chose Allan Cunningham for voyages to Brazil and the north and northwest coasts of Australia to collect specimens. The Royal gardener and botanist at Kew, William Aiton published in 1789 a catalogue in three volumes of the plants grown in the gardens at Kew, *Hortus Kewensis* (Aiton 1789). The second and nearly twice as large edition of this work was edited and much augmented by William Aiton's son, William Townsend Aiton (Aiton & Aiton 1810-1813) and listed plants from Australia (c. 300 species), South America (c. 260 spp.), Siberia (c. 220 spp.), and China (c. 120 spp.).

Banks was also instrumental in the colonisation of the east coast of Australia, giving glowing reports of its potential to the government who were looking for places to site penal colonies after the loss of North America during the War of Independence. Increasingly, Banks influenced the development of the botany and agriculture of the Empire through his numerous contacts in government and science, particularly through his role as President of the Royal Society. He actively supported existing botanic gardens in the colonies and campaigned for new ones (Desmond 2007).

During the reign of King George III, the East India Company established botanic gardens in India at Samalkot and Calcutta specifically to learn about native plants and to experiment with species suitable for cultivation there (see Sanjappa & Venu 2017). Initially the interest was in the culture of spices, such as nutmeg, pepper, cinnamon and cardamom, but the rich flora of the region sparked considerable local collecting and botanical expeditions. William Roxburgh (1751-1815), Nathaniel Wallich (1786-1865) and William Griffith (1810-1845), the first three superintendents of the Calcutta Botanic Garden were all pioneering collectors. Roxburgh established the first Indian herbarium and an associated collection of watercolour paintings of native plants drawn by local artists, Wallich made the first collections in Nepal, while Griffith ventured into Afghanistan in the First Afghan War, Bhutan with the first diplomatic embassy and Burma. Their collections form a large part of the herbarium of the East India Company which came to England in 1837 before being split into a set for Calcutta and another that eventually came to Kew at the beginning of the 20$^{th}$ century. It forms the basis for the botany of the Indian Subcontinent (de Candolle & Radcliffe-Smith 1981; Desmond 1992).

At this time, horticulture began to realise the potential of tropical plants and the Empire provided easy access. The nursery of Messrs Conrad Loddiges of Hackney, which flourished from 1771 until 1852, pioneered growing tropical plants for commercial horticulture. For example, it received plants from the professional collector Hugh Cuming (1771-1865) from the Philippines (Dance 1980). Cuming also sent many of his plant collections to William Hooker at Kew. Loddiges' example was followed by Messrs Low & Co of Upper Clapton, another London nursery, and soon afterwards by many other nurseries, notably Messrs James Veitch & Sons of Chelsea and Exeter, and Messrs Fredk. Sander & Sons of St Albans. Orchids were a particular focus for many of the collectors. Many of the finest plants to be introduced ended up at Kew and the link between Kew and horticulture continues to the present day.

One of Banks's greatest protégés was Robert Brown (1773-1858) whom he sponsored to join HMS Investigator as botanist on Matthew Flinders' circumnavigation of Australia (Mabberley 1985). There he collaborated with Ferdinand Bauer, the great botanical illustrator, and Peter Good, a gardener from Kew. Brown collected 3400 species in Australia, of which

some 2000 were new to science and were published in his *Prodromus Florae Novae Hollandiae* (1810), considered now as the basis for the botany of the continent. Brown became Banks' librarian in 1810 and was bequeathed his collection and library on Banks' death. Brown, in turn, gave them to the British Museum (Natural History) where he worked for the rest of his life.

## The Hookers at Kew

The death of Banks coincided with a loss of interest by the Royal family in Kew. By 1838, concern about the state of Kew and its future led to the government commissioning John Lindley (1799-1865) and Joseph Paxton to prepare a report on the state of the garden and its future. The report strongly recommended that Kew should assume a role as 'an efficient institution for the promotion of botanical science throughout the Empire'. After some delay, William Hooker (1785-1865) was appointed as the first director of the Royal Botanic Gardens, Kew, under its new government patronage. It proved an inspiring choice. Hooker had already established a network of correspondents during his time as Professor of Botany at Glasgow. Notable amongst these was George Bentham (1800-1884) who started working at Kew in 1854 when he presented his herbarium and library to the Gardens. Hooker followed in Banks's footsteps, training gardeners and botanists and recommended the best for service in colonial gardens in Ceylon, India, Singapore, Australia, the West Indies, and Canada. Amongst others, Walter Hill was recommended for Brisbane, William Purdie for Trinidad and George Gardner for Ceylon. This network was then used to transfer exotic plants, both showy and useful ones, around the world, most notably to develop crops to enhance trade. A notably successful collaboration involved British diplomats who received instructions from Hooker to collect plants and plant products for Kew's economic botany collections. Two remarkable examples are the collections of rare hand-made paper collected in Japan by Harry Parkes from 1869-1871 (Uyama 2006) and Japanese lacquer and lacquer-ware assembled by John Quin in 1882 (Prendergast *et al.* 2001).

Kew received preserved collections from many officially sponsored expeditions. The Zambezi Expedition (1858-1864), led by David Livingstone and funded by the British Foreign Office, set out to ascertain whether the Zambezi was navigable in its whole length and to catalogue its natural resources in order to identify raw materials for British industry and to promote commercial markets and civilization to supplant the slave trade. Livingstone was accompanied by John Kirk, Charles Meller, Thomas Baines, Richard Thornton and Charles Livingstone. Kirk and Meller's collections came to Kew. At the same time John Hanning Speke (1827-1864) and James Augustus Grant (1827-1892) set out on a Royal Geographical Society sponsored expedition to determine the source of the Nile. Grant's collection also came to Kew.

On the elder Hooker's death in 1865, the directorship passed to his son Joseph (1817-1911), an eminent botanist in his own right. He had already travelled as surgeon botanist on HMS Erebus on James Ross's Antarctic expedition from 1839-1843. The expedition circumnavigated the southern ocean, visiting Tierra del Fuego, Tasmania, New Zealand and a number of other sub-Antarctic islands. From 1847-1851 he explored the Himalayas of Sikkim and north-east India, introducing amongst others, several species of rhododendron to British gardens, starting a horticultural craze for them. Hooker continued his father's development of Kew as a major botanical institute and also sponsored botanic gardens, botanists and collectors around the Empire. By now, a number of colonists were making systematic collections of plants for Kew and their own newly established botanic gardens. Hooker provided the British Government with advice and recommended staff for the overseas gardens (Desmond 2007). Kew provided an efficient identification service, sending back identifications that could be applied to the specimen retained in country and allowing local botanists to identify native plants accurately. Thus, botanic gardens and collections of accurately identified living and preserved specimens grew

throughout the Empire with Kew directors and staff exercising a continuing influence over many decades.

At this time, two of the best-known examples of the encouragement of colonial agriculture are the collection of rubber and quinine from the Americas to the Old World. Richard Spruce (1817-1893) left England in 1849 and spent 15 years collecting over 30,000 specimens in the Amazon and Andes. His main set came to Kew along with seeds of quinine (*Cinchona* spp.) from the Ecuadorian Andes. Successfully grown at Kew, plants were rapidly despatched to Ceylon, India and elsewhere in the Far East where plantations were established. Quinine protected millions from malaria in the succeeding decades. Henry Wickham (1846-1928) is a more controversial character, often unjustly accused of bio-piracy. He sent seeds of rubber (*Hevea brasiliensis* Muell.Arg. ) to Kew in 1876 from Santarem region of Brazil. Kew sent the germinated seedlings to gardens in the Far East. The establishment of successful rubber plantations was largely down to the enthusiasm of Henry Ridley (1855-1956), then director of the Singapore Botanic Garden and his good relations with Chinese plantation owners in Malaya.

In parallel with Kew sending out its own collectors and expeditions and encouraging locally based botanical collection in the British Empire, the Hookers used their extensive network of contacts in Europe and North America to build up collections from regions outside the Empire. The significance of sharing collections was emphasised when the Berlin and Philippines herbaria were destroyed during the Second World War. Fortunately, duplicates sent by them can be found in other herbaria, including Kew.

## In-country Collectors

Kew and its associated herbaria and gardens continued to benefit from collections from the Empire. One of the most fruitful networks was that set up by Edgar Milne-Redhead, the Kew Herbarium's deputy keeper, at the end of the Second World War. He encouraged the colonial civil servants, medics, farmers and missionaries (or more specifically their wives) in tropical Africa to collect systematically for Kew. Large collections resulted from west, east and south-central Africa. Ladies, such as Marjorie Tweedie on Mt Elgon and Helen Faulkner in Tanga, Tanzania (then Tanganyika) made extensive herbarium collections and produced scrapbooks full of beautiful watercolour drawings of them. The latter are now in Kew's archives. *Upland Kenya Wildflowers* (Agnew 1974) was illustrated by Marjorie Tweedie's drawings. The most remarkable of Milne-Redhead's team was Mary Richards (1885-1977) who first visited Africa at the age of 65 and proceeded to collect 35,000 numbers in Tanganyika (Tanzania) and Northern Rhodesia (Zambia), including large numbers of novelties.

## The Commonwealth

The Second World War proved a watershed for the British Empire with many countries acquiring independence in its wake, beginning with India and Pakistan in 1947 and most of the remainder the Empire during the 1960s. However, the existing links were fostered by the creation of the British Commonwealth, which most of the newly independent nations joined. Three countries, Australia, India and South Africa sent liaison botanists to Kew to deal with requests from their fellow countrymen. The Australian liaison botanists stayed a year, whereas the Indian and South Africans stayed three years at Kew. Most of them were young scientists who, upon returning home, rose to senior and influential positions in their own institutes. Research on the floras of Commonwealth countries continued at Kew with an increasing input from in-country botanists. The tropical African floras, such as the *Flora of Tropical East Africa* and *Flora Zambesiaca*, were written as regional monographs, greatly enhancing their scientific value and longevity. Increasingly, Kew has contributed to extra-Commonwealth floristics, notably in tropical Africa, South America, and China, both as authors and as editors of floristic accounts and relevant monographs.

Monographic work and revisions were also encouraged, many leading to doctoral thesis for Kew and Commonwealth botanists. I would like to high-

light the series of monographs of monocotyledon families that have been produced in recent years, including *Genera Graminum* (Clayton & Renvoize 1999), *Genera Palmarum* (Dransfield *et al.* 2008), *Genera Aracearum* (Mayo *et al.* 1997) and *Genera Orchidacearum* (Pridgeon *et al.* 1995-2014). Each involved Kew staff, often as coordinators, editors and authors, but nearly all of them also involved a network of contributors from around the world. In the case of the last, 180 scientists contributed to its success. These monographs now provide the basis for future research and will hopefully inspire young scientists to enter the profession. When I started to work on orchids at Kew in the early 1970s I would have given my eye-teeth to have had a synopsis like *Genera Orchidacearum* as a starting point for my life's work.

Alongside the floristic and monographic work, Kew continued to produce important databases and tools for the botanical community, notably *Index Kewensis* (originally funded by a bequest from Charles Darwin) that has now transmogrified into IPNI (The International Plant Names Index), the *Authors of Plant Names* (Brummitt & Powell 1992) and others. Staff members also contribute to many international projects for the botanical community, an increasing number now that the world-wide web is so accessible.

Kew started as an institute to deal with the economic plants of the Empire and its economic botany collections continue to be relevant and a source of significant research and development programmes. The Plantas do Norde-Este (PNE) project that sought to bring high-quality plant information and techniques to local communities in the nine states in the arid and impoverished north-east of Brazil is a fine example of how botany can catalyse development. Seed money from Shell and the UK's Overseas Development Ministry brought together institutes in the region and local Non-Governmental Organisations (NGOs) to provide information (from Kew's SEPASAL database of useful plants of arid lands), techniques and seed sources (from the Millennium Seed Bank) to solve local problems, such as fuel wood deficiency, control of goat grazing, increasing honey yields and living pharmacies to local communities. Kew's participation acted as a catalyst for the institutes to collaborate and credibility to the project in the eyes of government in Brazil. The project is now funded in-country and continues its successful path.

Kew, Edinburgh and the Natural History Museum each have long-established relationship with British and foreign universities, running specialist courses and co-supervising students at various levels up to post-doctoral level. Training and technology transfer to sister institutions around the world has been a major element of the work of these institutes and remains a high priority.

Perhaps the most important developments of the late 20th century for systematic botany were the discovery of the structure of the DNA molecule by Watson and Crick in the 1950s, the increasing use of DNA sequences as taxonomic markers in the 1950s and onwards and the development of powerful computers that started in the Second World War but gained incredible momentum from the 1970s onwards. These have energised botanists and have brought the botanical community together and made possible collaborative approaches that could not have been contemplated before. However, I think that the influx of young enthusiastic and well-qualified scientists is equally important to a science that was rapidly being seen as old-fashioned by others.

## Conclusion

The British Empire provided easy access for British botanists to countries around the world. Collaboration with locally based expatriates, and more recently with local botanists and collectors, allowed for efficient use of time and resources for field-work. The government's establishment of botanic gardens in the colonies to encourage plantation agriculture and the study of potentially useful native species in every part of the Empire meant that botanists and collectors could use them as bases for intensive studies of the native floras. Specimens flowed back to the major British institutions at an impressive rate (60,000 a year to Kew when I started there in the early 1970s), duplicates remained in-country to enrich the national

herbaria while those collections were enhanced by the accurate identification and naming provided by botanists at Kew and by the flow of potential new crops to the colonial gardens.

Although it is currently fashionable to decry this (e.g., Figueiredo & Smith 2010; Smith & Figueiredo 2011), many benefits for botanical science, agriculture, horticulture and conservation have accrued as a result. The major botanical collections, such as at Kew, have the advantage of relatively comprehensive geographical and systematic scope, good curatorial standards, accessibility, a large, dedicated and well-qualified staff and efficient and effective networks. Furthermore, many are situated in regions of relative political, climatic and geological stability that has enabled them to survive for two centuries or more. Comprehensive collections provide the basis for wide-ranging systematic and related projects, including training and technology transfer. Botanic gardens and botanical institutes around the world continue to consult and collaborate with Kew for the same reasons.

The Hookers' legacy provided Kew with a base for major botanical projects, the first being Bentham and Joseph Hooker's *Genera Plantarum*, competed in 1883. The collections at Kew have continued to grow and develop during the 20th and early 21st centuries. One result has been that Kew has taken a leading role in several large-scale and long-term projects that smaller institutes cannot contemplate on their own. Major floras, notably a series of southern and tropical African floras have been completed. Major monographs of economically important plant families have been successfully published. Kew botanists have played a significant role in the new APG III (http://www.mobot.org/MOBOT/research/APweb/). The institution has also continued to play a major role in training, conservation and development projects around the world. It established or helped establish the Herbarium Techniques and Botanical Garden Management Courses, the World Conservation Monitoring Centre for plants, the Survey of Economic Plants for Arid and Semi-Arid lands (SEPASAL) and Plant Resources of Tropical Africa (PROTA) programmes, the Millennium Seed Bank network and much else.

Institutes, such as Kew, the Natural History Museum and Edinburgh, face many challenges over the next few years such as the loss of political will and funding, taxonomy not being taught at universities, taxonomic expertise not being replaced and the demand for short-term, high impact science and marketable products. In a period of rapid change and the loss of taxonomic expertise, I provide here my assessment of the strengths, weaknesses, threats and opportunities for a collection such as Kew (Table 1). In a challenging time, the botanical community needs more than ever to speak with one voice and make clear the contribution it makes and can continue to make to solve the world's many problems, not least of which are overpopulation and the associated changes of climate that seem now to be inevitable. Taxonomic botany has a major role to play in meeting the challenges of feeding a rapidly increasing world population when biodiversity and ecosystems are increasingly threatened. It is a challenge that we can meet but only by working together and by challenging the political and scientific elites to recognise that collection-based systematic botany is still relevant and can provide solutions.

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**Table 1.** An assessment of the strengths, weaknesses, threats and opportunities for large herbarium collections such as that at the Royal Botanic Gardens, Kew.

| Strengths | Weaknesses | Threats | Opportunities |
|---|---|---|---|
| Systematic depth | Systematic and geographic holes | Loss of political will and financial support | Political imperative for sound and easily accessible plant taxonomy |
| Geographic depth | Unbalanced curation | Historical projects that have not been completed | Kew's track-record as a leading institute |
| Excellent curation | Non replacement of experienced staff | Lack of relevant training in universities | Modern techniques attractive to young scientists |
| Skilled staff | Poor systematic knowledge of newly recruited staff | Strategic muddle | New collaborations |
| International collaborators | Management by accountants | Retirement of experienced staff | Novel uses for herbarium collections |
| Long-term goals for research | Funding easier for short-term, high impact research | Short-term high impact emphasis for funding | Pressing needs of climate change and rapid loss of biodiversity |
| Long-term impact of research | | Lack of appreciation on long-term impact of systematic work | Increasing power of computing and access to information via the internet |