

Herbarium

Whereas the richest garden only contains but a few thousand species growing at any one time, a herbarium may contain tens or hundreds of thousands of species . . .

J. H. Maiden, 1899

You can imagine it as a vast filing cabinet, one that's large enough to walk around inside. These are big, high rooms, one on top of the other and filled with corridors of shelves stacked ceiling-high with red plastic boxes. It's dim in here, and quiet, and the air is soft with the leftover smell of naphthalene. This is the National Herbarium of New South Wales at the Royal Botanic Gardens, Sydney, repository for more than a million plant specimens – not just from every corner of this continent but from all over the world.

A three-dimensional reference work, herbaria aren't just for carefully worded definitions of everything from trees to lichen; they hold actual pieces of them. The Latin name for these collections, *hortus siccus*, is literally a dried garden, and each pressed specimen that's mounted on a sheet of paper is inscribed with what the plant is, who collected it, when, and where.

The ideal garden in many ways, a herbarium needs no water, no pruning, no fertiliser. It defies seasons, climate, geography and even time itself, accommodating the newly found spiky green leaves of Australia's famous dinosaur-tree, the 40-metre Wollemi Pine, as easily as a tiny starburst of whortleberry cactus picked in Mexico in the nineteenth century, or a banksia taken during European botany's first glimpse of eastern Australia in 1770. It's a place where buds from Australia's south coast can sit with buds from its north, alpine flora with algae, plants from this country with those from anywhere else.

Botany, a science of comparison, would be impossible without this archive; botanists decide what a plant is by understanding what it isn't. Confronted with a branch they've never seen before, they work through the species stored in a herbarium's drawers – plants already defined and named – to judge the similarities and differences between the newcomer and the rest of the floral world. A plant pressed onto a sheet has no official place until it's named and classified, either as something already known or, if it matches nothing that any herbarium holds, as a new thing altogether.

Specimen names have their own layers of language. Take a piece of white stringybark. A eucalypt, its genus is *Eucalyptus*. This species, in particular, is *Eucalyptus globoidea*. Like all eucalypts, it belongs in the Myrtaceae family, some of whose members produce valuable things like cloves, allspice, guavas. In the Herbarium in Sydney's Gardens, there's a piece of this eucalypt that's valuable above all others. Collected in 1901 near Berrima in New South Wales, it's the type specimen, the single sample selected and preserved to be the permanent reference point for this species. This one is the holotype, the one sample designated by the botanist who first classified it as the 'original' for the name of the white stringybark. There are isotypes too, duplicates of that holotype taken from specimens collected at the same time from the same plant, which are often sent to other herbaria to provide a reference point for their collections.

In a way, this fragment of white stringybark in its drawer in Sydney stands for all white stringybarks. It defines *E. globoidea*.

But to collect something, to classify it and name it, is by no means to reach the end of its story. Amongst all the foliage in herbaria, botany wages fierce battles. Just as new names are created, old classifications are reconsidered, struck out and replaced. This botanist regards that species as the same as another, and changes its name. Years pass; another botanist looks at the same specimens and sees not similarities but differences: the name changes again. This genus is split. That species turns out to contain three distinct things. Handfuls of other species are scooped up together and called the same name. Some specimen sheets are cramped with these revisions.

The mosaic of the planet's plants shifts and grows constantly as botanical knowledge changes with new eras, new workers – new methods and insights. And herbarium collections reflect all this movement.

Diverse by definition, a herbarium can be anything from a small collection – one box holding a few things gathered by a single person – to sprawling institutions that draw on myriad people across generations of time, aiming for as many things from as many places as possible. Sydney itself may be known to hold more than a million plants, but there's no estimate of the number of collectors responsible for them all. It would run into the thousands.

And beneath the sheer weight of so many specimens and the catalogue of growth and place that they create is the moment when each one was picked. One person was walking the 'slow and roundabout' walk of a plant-hunter: maybe they were a scientist focused on a single genus, a professional employed to collect this species one week and another the

next, or an enthusiast delighted by collecting on any walk they took. Whatever the case, they saw something, stopped, and cut a stem, selecting one sample of that fern, that shrub, that tree to stand for its whole breed. They pressed it, dried it, and made it part of a collection. In these stories of hunting and gathering, of so many people unable to walk through nature without pausing and picking, there's an edge of compulsion: that human urge to collect that, beyond science, might apply to postcards or teapots as much as to plants.

Lift the name of any collector from any herbarium specimen sheet. Magnify it with some of their history, their anecdotes, coincidences and disasters. And Australian botany – the stories behind this huge dried garden – comes up into view like a photograph emerging from the blank of its paper.

History

Species: Viola banksii K. R. Thiele & Prober

Common name: A Native Violet

Family: VIOLACEAE

Collector: J. Banks & D. Solander

Locality: Botany Bay, New South Wales

Date: May 1770

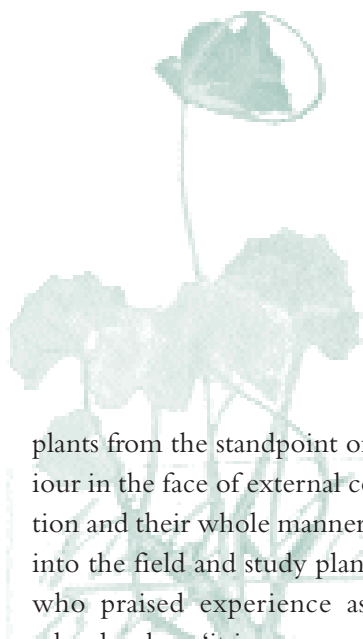
The world begins with water and gas spinning on its globe. Then, 3460 million years ago, photosynthesis – that clever connection between chlorophyll and sunlight – begins. The first land plants grow from 450 million years ago. Ancient algae evolve into mosses; fungi move across the most inhospitable surfaces; some mosses creep, becoming the ancestors of ferns. From 410 million years ago come Australia's first vascular plants. There are conifers, and then, 200 million years on again, the flowering plants that thicken and prevail on the face of the earth.

Time passes. The continents move and split, and rain-forests and oceans cover Australia. Twenty-five million years

ago, the weather changes, and the country's famous drought-resistant plants – acacias, banksias, eucalypts – begin to dominate the landscape. The rich velvety gold of a banksia's flower breaks in among the greens, the greys, the browns of the land's foliage. The soft white blossom of a scribbly gum bursts in late spring, touching the sky above its pretty bark.

If the count could ever be completed, Australia's flora may be found to nurture more than 25,000 species. Some, conservative in their evolution, remain fairly unchanged across millions of years; others diversify in and adapt to different environments. In either case, the complete suite of Australia's flora and fauna is one of the oldest and most distinct on the earth.

Against the time span of their evolution, the activity of collecting plants stretches as far as civilisation. By the third century BC, Theophrastus was already arguing that botany should move beyond medicinal and other practical uses to 'consider the distinctive characters and general nature of



plants from the standpoint of their morphology, their behaviour in the face of external conditions, their mode of generation and their whole manner of living'. As for the need to get into the field and study plants where they grew, it was Pliny who praised experience as 'the best teacher', criticising schools where 'it is more agreeable to sit on benches ... than to go out into deserted places and look for different herbs at each season of the year'.

By the sixteenth century, Italy's great medical cities – Pisa and Padua in particular – were reviving botanical activity, just as its great commercial cities – Venice, Florence, Genoa, Milan – had revolutionised science in the fifteenth. Beyond the established canon of medicinal and agricultural plants on which people had always focused, botanists began the larger task of counting and naming all the vegetation around them.

The catalogue of the floral world had begun. 'Not a hundredth part of the herbs existing in the whole world was described' by the Greeks, wrote one physician from Ferrara, 'but we add more every day'. Amongst all this activity, in the early decades of the 1500s, a man called Luca Ghini found a way to make plants both portable and immortal.

A driving force behind the establishment of Pisa's botanic gardens, one of the renaissance world's first, Ghini had created there a harbour of living plants for quick reference. Sometime in the first decades of the sixteenth century, he also began to preserve plants by placing them between sheets of paper, under the pressure of some weight, until they were dried and could be mounted on card. Here was the first recorded *hortus siccus*, the first 'dried garden'. Here were the first herbarium specimens, allowing piles of plant portions to be kept for easy reference or, even better, exchanged for those collected by other people in other places.

At first, this culture of collecting reflected the world as it was revealed by thrusts of exploration, trade and colonisation. An influx of strange and exotic specimens – plants, shells, animals, anything offered up by somewhere else – had wealthy European gentlemen constructing special cupboards in which to show off these amazing treasures from the ends of the earth. As Francis Bacon put it, these were cabinets where 'whatsoever singularity chance and the shuffle of things hath produced; whatsoever Nature hath wrought in things that want like may be kept'. The plants they held were trophies, precious objects, status symbols, haphazardly gathered and arranged, and almost works of art themselves in their value and display.

Between the mid-1500s and the beginning of the eighteenth century, collections of such 'rare, exceptional, extraordinary, exotic and monstrous things' flourished.

Of course, the people who regarded their *hortus siccus* as something to cherish and flaunt were a long way from the scholars who would later relish such sheets as a means of explaining and naming the world. But the herbarium specimens of each were the same, as was the desire to possess them.

These two motivations – the compulsion to possess precious things, and the compulsion to collect in the name of advancing science – collided spectacularly in the life of Joseph Banks, the man who would catapult Great Britain to the forefront of botanical conquest. As a boy, he bought specimens from women who collected the berries and leaves, herbs and roots, used in pharmacy, and by the time he reached his twenties, his herbarium already bulged with the collections of more than a decade.

Although he went to Oxford, Banks, like many gentlemen of his age, didn't take a degree. But his commitment to botany was demonstrated by his paying a Cambridge lecturer to travel down and tutor him (Oxford's professor of botany had delivered only one lecture in 35 years). After some time at university, Banks' attention turned to his Grand Tour, a requisite part of life for any rich young man. Most went to Europe, which made Banks scoff: 'Every blockhead does that; my Grand Tour shall be one around the whole globe'.

He would accompany the expedition of Lieutenant James Cook to the South Seas, with a private party of eight including Daniel Solander and another naturalist, two artists, and four servants, plus dogs and luggage. This included reams of paper for drying and storing plant specimens (including proof pages of Milton's *Paradise Lost*); more than 100 books (including the great botanical works); material for his artists (to capture the plants at their freshest); an underwater telescope, bottles, barrels, nets, hooks, wax, bug catchers, even a guitar. Observers described it as 'the Argonautic Expedition for the Study of Nature'. 'No people,' said one, 'ever went to sea better fitted out for the purpose of Natural History'.

The pursuit of that purpose often required some ingenuity. Denied permission to land in Brazil, for example, Banks and Solander slunk ashore at night to hunt their plants, while other specimens were sent aboard labelled 'grass' and ostensibly for the ship's seafaring livestock.

Under sail, the herbarium had its own routine. ‘Now do I wish that our friends in England could by the assistance of some magical spying glass take a peep at our situation,’ Banks wrote. ‘Dr Solander setts at the Cabbin table describing, myself at my Bureau journalizing, between us hangs a large bunch of sea-weed, upon the table lays the wood and barnacles ...’

The plants were taken to the captain’s cabin (given over to Banks’ entourage), sketched by the artists, and then carefully pressed and dried. In the afternoons, there was time to study specimens, to elaborate on the quick descriptions that had been attached to them as they were picked, and to consult the travelling library for synonymous plants from elsewhere. (Solander’s thoughts on which plant fitted which family, what species resembled what, were so changeable as he moved through this completely foreign flora that he swapped bound notebooks, in which the pages couldn’t be rearranged, for a system of loose sheets of paper – still known as ‘Solander slips’ – that could be shuffled and reorganised as it became obvious that *this* belonged in *this* family, not *that* one, or that *that* sat somewhere in *this* genus, not anywhere near the first slot he’d suggested.)

During any landfall, Banks’ journal hummed with references to ‘botanizing’, the plants at one spot on Australia’s east coast so thrilling him that he convinced Cook to alter its proposed name. Stingray Bay became Botany Bay instead.

And there, from the first opportunity, he was ‘into the woods and ... found many plants’. Out along a river, he was stopped by the small purple points of some native violets and picked a posy of their flowers. So plentiful was the new and strange flora of this place that by the fifth, and rainy, morning he was ‘well contented to find an excuse for staying on board to examine them a little’. When the afternoon cleared, however, it was straight back to ‘our old occupation of collecting, in which we had our usual good success’.

‘Our collection of Plants was now grown so immens[e]ly large,’ Banks discovered before finishing a week in New South Wales, ‘that it was necessary that some extr[a]ordinary care should be taken of them lest they should spoil in the books’ in which they were being dried. ‘I therefore devoted this day to that business and carried all the drying paper, near 200 Quires of which the larger part was full, ashore and spreading them upon a sail in the sun kept them in this manner expos[e]d the whole day, often turning them and sometimes turning the Quires in which were plants inside out. By this means they came on board at night in very good condition.’

The young Joseph Banks sat in the sun on the shore of Botany Bay, the richness of his treasure-trove of plants – from Brazil, from Tahiti, from New Zealand, from the waters of the Pacific, from this one tiny piece of an immense new continent – surrounding him as he prepared them for his herbarium.

Arriving home in England in 1771, the *Endeavour* was heralded by London’s newspapers as having ‘made a voyage around the world, and touched at every coast and island where it was possible to get on shore, to collect every species of plant and other rare productions in nature’. It had brought home more than 30,000 specimens of over 3,600 different species, almost half of which had never been seen in Europe.

England was captivated – all these new and gorgeous things. It was as if the biggest cabinet of curiosities had landed in its midst. People went to parties hoping that Banks and Solander might arrive with an account of their voyage, ‘which I am told,’ said one lady, ‘is very amusing’. Banks commissioned a portrait of himself surrounded by the finest prizes of his mighty ‘grand tour’: a ceremonial cloak, a wooden club, and a herbarium sheet at his feet.

In his capacious house on New Burlington Street, he converted several rooms into a global cabinet, open to anyone who was interested. ‘Here is ... a large collection of insects, several fine specimens of the bread and other fruits,’ one visitor sighed, ‘... together with a compleat *hortus siccus* of all the plants collected in the course of the voyage ... What raptures must they have felt to land upon countries where every thing was new to them! whole forests of nondescript trees clothed with the most beautiful flowers and foliage ... I could be extravagant upon this topic ...’

If the function of a herbarium is to collect and preserve plants in one place, it’s the scientific work of classification that transforms it from a curiosity to a resource: botanical rendering has no value, in the world of science, until it’s been published. A fine collector (even before his voyage he’d been known to accumulate everything from china and caricatures to a list of how much his friends weighed), Banks appeared to be a man whose publications would be forever delayed.

The leading natural historians of the day couldn’t wait for this next scientific step to be made. One confessed he was ‘almost entirely’ deprived of sleep by the fact that the herbar-

ium's classifications hadn't been finalised, written up, and published. 'Consider my friend,' he wrote to a fellow scholar, 'if these treasures are kept back what may happen to them. They may be devoured by vermin of all kinds. The house where they are lodged may be burnt. Those destined to describe them may die.'

As Solander did, unexpectedly, in 1782, after years of puzzling at his sheets of pressed plants and notes. This bottle-brush, he wondered, did it belong to the genus *Metrosideros* he'd devised for some trees in Tahiti? Was that gum tree the same genus again? He never unravelled the answer, and Banks published neither this material, nor any other scientific papers on his collections. The huge herbarium moved house, from New Burlington Street to Soho Square, still open to any gentleman of science who wanted to consult it. But Banks had another collection project underway, and it came with the patronage of the King, George III.

Both passionate about botany, George III and the young botanist formed a bond over the Royal Botanic Gardens at Kew, which Banks had visited for the first time in 1771 and called 'the finest ... in Europe'. Quickly offered its honorary directorial position, Banks embraced it with a new proposal for the King. Why not make Kew the very hub of a mighty botanical empire, he suggested, gardens that

reflected the breadth and magnitude of the King's Empire itself? Why not assemble a herbarium extensive enough to be the centre of all the world's classifications? Why not send collectors out to gather specimens of the entire Empire's flora, and use Kew to grow and acclimatise them all? As Banks saw it, the King of such a powerful and vast Empire should surely have gardens that reflected that status.

The King approved the funds, and the foundation was laid for a huge network of gatherers to pick the world for Kew, chosen, employed, instructed and despatched by Banks. And before long, too, an opportunity presented itself for Banks to augment both his collections and Kew's with more exciting new items from those florally rich Antipodes. The English government needed a penal colony, and Banks heartily advocated Botany Bay. More than a decade after his frenzied week of collection there, he felt that many of the plants he had seen (and certainly the ones he hadn't) would 'no doubt possess properties which might be useful for physical and economic properties which we were not able to investigate'. The captain and officers of the settlement's First Fleet set sail with instructions on what to collect for him – and how.

The first herbarium of Australia's plants was set to expand exponentially.



The field

Species: *Sowerbaea juncea* Sm.
Common name: Vanilla Lily
Family: ANTHELICEAE
Collector: G. Caley
Locality: New South Wales
Date: September 1802

The strange environment of New South Wales – its residents, its weird animals, its even weirder plants (who knew that trees

might shed their bark, rather than their leaves?) – filled the journals and letters of the people sent there, their impressions ranging from one extreme to another. Where some saw 'rare and beautiful plants', others saw a place 'so very barren and forbidding that it may with truth be said that *here nature is reversed*'.

However the country looked, its new settlers began their floral gatherings: both herbarium specimens for Banks and whatever they could find that was edible. Saturday was collecting day, every able-bodied person heading out from

Port Jackson (Botany Bay had proved uninhabitable, despite Banks' memories of its fecundity) to pick and pluck any 'vegetables' from the bush – things like wild spinach, and a liquorice-flavoured creeper that earned the name 'sweet tea'.

Yet for all Banks' preoccupation with the colony's plants, he had – as its first governor soon felt obliged to mention – entirely failed to provide it with either an official botanist or gardener: 'it is not therefore in my power to give more than a very superficial account of the produce of this country, which has such a variety of plants that I cannot, with all my ignorance, help being convinced that it merits the attention of the naturalist and the botanist'. Someone with some sort of knowledge should be sent over – someone with a better idea of what to pick or, in an increasingly hungry settlement, what to plant.

The personnel Banks chose didn't get off to a good start. Two were shipwrecked during their voyage; another shot himself on a duck-hunt in his first 18 months in the colony. Then, as the nineteenth century opened, Banks despatched two more men. One, George Caley, he financed himself (the colony had no position for him). Fifteen shillings a week, he said, for which he expected 'to be supplied with new or rare plants for his own Herbarium and with seeds for Kew'. Caley, sailing to Sydney, would collect from there, while Banks' other man, Robert Brown, was assigned to Matthew Flinders' circumnavigation of the continent to collect wherever the expedition went ashore. While Caley gathered up shipment after shipment of specimens, Brown would build up his own herbarium – one that would lead him to the first attempt to describe every plant known to grow in Australia.

The first of the two to arrive in this 'remote country', Caley sailed into Port Jackson in 1800, almost immediately assuring his employer that 'in the course of one year, provided no obstacles fall in my way, I could collect half the specimens [i.e. species] of plants in the colony'.

He began at once, walking, stopping, picking, and then pausing to compare what was in his hand with other Australian plants he'd seen before leaving – in gardens, or in the files of Banks' *hortus siccus* – and plants he'd read about in the journals, books and papers that were starting to make sense of Australia's vegetation. Orchids, boronia, peas, heaths, buttercup-ish *Hibbertia* and lilies (including the delicate scented flowers of the Vanilla Lily) were all parcelled up with pages of notes, descriptions, suggestions of which plant was what, and what altogether new things might be called – and sent to Lon-

don. 'Your descriptions of plants do you credit,' Banks told him as another bundle was swallowed by his herbarium.

As Caley's first year ended – without his collecting that proportion of the colony's species he'd promised – Brown waited to sail with Flinders, preparing himself for a continent on which some 370 plant species had so far been identified. The possibilities of his assignment were enormous. No naturalist before him had had the opportunity of visiting so many different parts of this landmass. Even Banks, whose collections formed the basis for the entire notion of Australia's botany, had only touched at spots along its east coast and on some of its islands.

Possibly with the lesson of Banks' unpublished collections before him, Brown resolved to complete his investigations as he went along; he wanted his herbarium written up by the time he sailed home. He also resolved to spend the voyage out (Flinders proposed the west coast as the *Investigator's* first landfall) learning as much as anyone already knew of where he was going. He read Cook's journal. He studied the *hortus siccus* he'd made for himself from samples of Banks' huge collections and the other Australian herbaria taking shape in London, and he'd already identified a new grass among these before his ship left England.

The *Investigator* reached Australia on 8 December 1801, Brown stepping onto its soil for the first time the following day. Describing the moment in his journal, he was nothing but calm: 'the plants grew pretty freely in the loose sand their variety not so great as we expected'. He didn't go ashore the next day, noting instead that he 'remain[e]d on board' and 'describ[e]d a few plants'. December 11, he remarked, was 'more successful in Botanizing'.

However astonishing or exciting it may have been to stand among Australian flora, his journal entries remained brief, direct, unemotional. He was a man of science, facing a continent full of material that needed to be picked, pressed, dried, classified, and taken back to England. Dramatic phrases about 'nature reversed' were not for him: he would simply do his job. In his first two months, he collected upwards of 700 individual specimens (he estimated that nearly 500 came from that first landfall at King George Sound alone), including a beautiful pitcher plant, *Cephalotus follicularis*, with lusciously striped lips, 17 different sorts of banksia, and some tall kangaroo paws.

His herbarium grew steadily, as did the trouble he had preserving it. The problems anyone faced trying to keep plants dry on a ship were daunting. Space was always at a premium, which made it hard to carry much paper to press and dry spec-

imens, let alone finding a spot to store everything. Mice, on the other hand, were plentiful – even with a famous sailing cat like Flinders’ Trim aboard – and they liked to eat paper. In addition to which, the *Investigator* was one of the leakiest ships the Admiralty had ever sent out, making conditions even less ideal.

The voyage made its way along Australia’s southern edge before plunging into Bass Strait (touching King Island), returning to mainland Port Phillip (not yet settled) and tracing the *Endeavour*’s route up to Port Jackson. Kangaroo Island, for example, gave Brown ‘a species of eucalypt not before seen’; Doubtful Island Bay gave him a parasitic native ‘Christmas tree’. In two places – both of which he found ‘too late in the season for botany’ – sore legs prevented his going anywhere.

But in Sydney, as the *Investigator* was patched up, he was mobile again and, meeting Caley, they began to discuss what they had found: ‘Mr Brown has informed me that this is *Elaeocarpus*,’ Caley amended his notes; ‘Mr Caley separates *Melaleuca laurina* from *Melaleuca*,’ Brown wrote later in his, also noting that Caley had ‘not yet begun to examine the trees’ but ‘seems to attend more to plants resembling British than those peculiar to the country’.

While picking and pressing everything from gum trees and cabbage palms to passion-flowers around Sydney’s settlement, Brown hoped Banks might send more paper before Flinders’ repaired ship headed north: ‘The kind of paper I wish to have is Imperial brown paper. It is fully the size of cartridge, and in many respects is much superior, both for drying and preserving specimens, especially of the rigid shrubs of this country, and, what is no small advantage in our situation, mice do not eat it.’

They sailed again on 21 July 1802, spending eleven months travelling up past Fraser Island and the Great Barrier Reef to the Cape York Peninsula and the Gulf of Carpentaria. It was a dismal journey: Brown was stung by ‘a single plant of *Morus incendiarius* ... having incautiously touch’d it’ and some of his companions were half-poisoned with ‘[Arum] roots ... w^{ch} several of the people incautiously tasted & tho in very small quantity the effects were in some cases rather alarming. They were a continued flow of Saliva a[n]d heat & pain in the tongue, palate and fauces, so great that the patient was unable to speak for some hours.’

By December, the *Investigator* was leaking so badly she was unseaworthy, and scurvy was rife. Continuing to Arnhem Land, Melville Island and Timor, the crew contracted tropical dysentery as well, limping back into Sydney in early June 1803. There were more than 1,400 new dried specimens in Brown’s *hortus siccus*.

When Flinders decided to sail to England in the *Porpoise* to ask for a new vessel, Brown combed his herbarium specimens for the finest to send with him for Banks. He’d made 66 landfalls, but was ‘upon the whole disappointed ... The number of species of plants observ’d by us in New Holland, exclusive of the few which belong to the class Cryptogamia, scarcely amounts to 2,000, and of this number not more than 700 or 800 are nondescript. Even of these the far greater part are referable to genera already publish’d ... and a considerable proportion have been seen only in an imperfect state ...

‘The *Porpoise*,’ he also worried, ‘... is so much crowded that she can take but a very small part of the collection of specimens, and even this must be put in the hold. She is, moreover, so wet a ship that I am afraid, small as it is, it may suffer very materially in the passage.’

He was right. The ship sank a week out of Sydney and for Brown, ‘the loss of the garden and specimens is to my department irreparable, for altho’ I possess duplicates of almost all the specimens, yet those sent were by far the best’.

Flinders, meanwhile, having rowed 1,400 kilometres back to Sydney in a six-oared cutter, sailed again for England on the *Cumberland*. Arrested in Mauritius, he was not released until 1810: his expedition was over. Should there be a long delay between Flinders’ departure and his return with the promised new ship, Brown had written to Banks, he would busy himself with collecting trips to Tasmania and around the colony.

Which he did.

In May 1805, he left Caley – now collecting eucalypts – and sailed for home in, of all ships, the again-patched *Investigator*. His luggage included another 1,200 specimens, packets of seed and a live wombat (who, when it saw people it liked, would put its forepaws up on their knee and, if invited, sleep in their lap). His herbarium, he informed Banks, was ‘provided for, as well as the reduced state of the vessel and her crazy condition would admit ... while within the Tropics the plants were carefully examined & those that most requir[e]d it were chang[e]d into dry paper but such has been the wet state of the ship that they must again be suffering & that I fear considerably’. This time, his fears were unfounded: the specimens were hailed as ‘by far the most excellent that ever resulted from any expedition’. Even Banks was moved: ‘employed to gather in the Harvest from the Boundless Fields of nature,’ he gushed, Flinders’ team had ‘reaped plentifully’.

Brown unpacked his *hortus siccus*. He had a book to write.

Settling down to work, it was clear he and Solander had had one experience in common. Both men's papers were thick with revisions, reversals, reconsiderations and reclassifications as they had tried to fit this new botany into any system that accommodated Europe's. It was (as one botanist had commented on Joseph Banks' Australian collections) as if one found oneself 'in a new world. He can scarcely meet with any fixed points from whence to draw his analogies ... not only the species themselves are new, but most of the genera, and even natural orders.' As for Brown's plan to work out and write up his specimens as he went, he had had to tell Banks as early as 1803 that although his descriptions 'amount to about 1,600[,] only a few of these ... are finish'd and none of them rewritten'.

In the first years of the nineteenth century, the world's plants were supposed to fit the sequence of families, tribes and so on devised by the Swedish botanist Linnaeus more than 50 years before. Famously based on a 'sexual system' categorising plants by pistils and stamens, some Englishmen had always struggled with it: one vicar claimed that endorsing it encouraged unauthorised sexual unions between people, and that an association with plants may lead to licentious love; the *Encyclopaedia Britannica* said succinctly that 'obscurity [was] the very basis' of it.

Unable to fit his specimens into its spaces, Robert Brown changed the course of modern botany by abandoning Linnaeus for a more 'natural' arrangement based on Jussieu's system, setting a new standard for the organisational structure of large botanical works. First, the ferns, then 19 families of monocotyledons (such as grasses and orchids), and 37 families of dicotyledons (including Australia's famous banksias and waratahs in the Proteaceae family), with the cycads nestling between the two. He also decided, ambitiously, to include not only his own specimens in the book but 'the generic and specific characters of all the plants known to be natives of New Holland', and in 1806 several botanists agreed that all other publications on 'New Holland plants' be suspended in anticipation of his.

Published in 1810, covering 464 genera and about 1,000 species, the *Prodromus Florae Novae Hollandiae et Insulae Van Diemen* was hailed as 'most excellent' and 'precious', with botany's leaders said to be 'astonished' by it. And decades later, it was still applauded: 'We are indebted to Brown's powers of generalisation for a plan of the entire flora, constructed out of fragmentary collections from its different districts,

which requires but little correction from our increased knowledge, though necessarily very considerable amplification'.

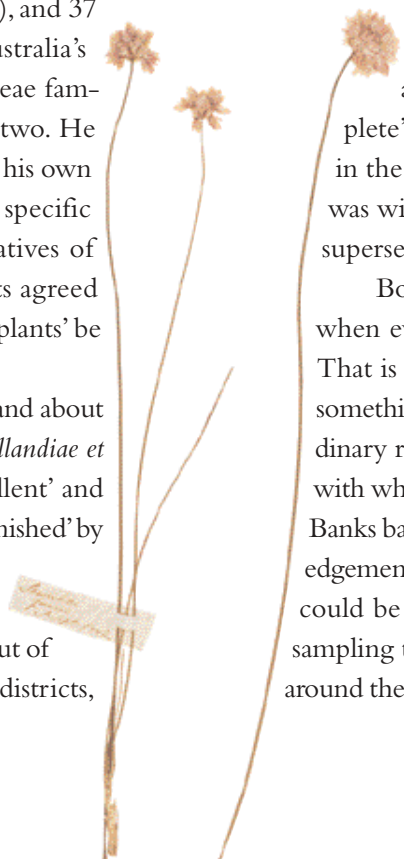
Unfortunately for Brown, the book didn't sell. Botany, as Banks had observed two years earlier, was no longer 'quite as fashionable' as it had been. And the *Prodromus* volume published was only part of the complete flora of Australia that Brown had planned; the rest remained unwritten. He got on with other things.

Still, even incomplete, it had set the formula for a wave of volumes that sought to catalogue the flora of entire regions, even entire countries; it also laid the foundation for Australia's systematic botany. In just over a decade, the number of Australian species that Brown knew had expanded from 370 to 4,200. Even his approach to those thousands of specimen sheets – using a microscope, comparing not just different specimens of the same species, but similar species worldwide – propelled botany's science forward.

Brown never finished that *Prodromus*, and in old age he was criticised for leaving those 'dried plants, or what remains of them,' from Flinders' voyage languishing in cases and 'buried in the recesses of his cabinets'. Years after his death in June 1858, botanists lamented his 'huge collections; the great proportion of which consisted of bundles that had never been opened & were never even dusted'. Yet as his specimens sat, others, collected by different people in different parts of Australia, filtered into botany's knowledge of the colony, the dried gardens of different herbaria expanding again and again.

Quests for completion – for a total set of this, a total exposition of that – are almost always doomed. By the time the next 'complete' description of Australia's plants was attempted in the 1860s and 1870s, its author, George Bentham, was wise enough to know that his volumes would be superseded the moment they were published.

Botany would never reach a conclusion, a moment when everything was known, set down and ruled off. That is the nature and truth of science: there is always something new waiting to be found, something extraordinary ready to challenge the patterns and explanations with which people have codified the world. For men like Banks back in the first decades of the 1800s, the acknowledgement of this simply meant finding more people who could be relied on to travel through these new worlds, sampling their plants and carefully sending them halfway around the globe to the old world's waiting enthusiasts.



Exploration

Species: Oxalis perennans Haw.

Common name: A Native Wood Sorrel

Family: OXALIDACEAE

Collector: L. Leichhardt

Locality: Archers Station, Durundur, east of Kilcoy [Queensland]

Date: August 1843

Even when Sydney was less than three decades old, the land on which its Botanic Gardens sat already had a significant British history. Occupying the site of the colony's first farm, just across from its first Government House, the poor soil wasn't the best for gardening, nor had anyone given the Gardens that most necessary facility for true botanical work, a herbarium of dried plants to supplement its living ones. But nonetheless they sprawled on land that ran down to the edge of a magnificent harbour and the very place where the First Fleet had come ashore: the position was superb.

In December 1816, more than a decade after Brown's departure and six years after Caley's, another Banksian botanist sailed into that harbour. Allan Cunningham presented himself to Governor Macquarie, who greeted him with the grand epithet of 'the King's botanist' and sent him out with John Oxley's expedition in search of the source of the Lachlan. Just as maritime expeditions included naturalists, so terrestrial parties were expected to collect, with an eye to anything that might be economically useful, to 'specimens of the most remarkable' plants, and to the seeds 'of any plants not hitherto known'. It would be 'the highest ambition of my life to exert myself in the perform[ance] of the requisite Duties that constitute a Collector,' Cunningham had told Banks when first applying to work for Kew. Making his careful way beside Oxley's slow carts, learning Australia's bush and the way its plants grew, he assembled over 400 herbarium specimens – waratahs, banksias, grevilleas, and more – and 150 boxes of seed: his ambition fulfilling itself.

His botanical companion on the trip was the fledgling Botanic Gardens' first superintendent, Charles Fraser, himself such an enthusiastic collector that he was known to strip off his clothes and carry specimens in them rather than abandon

something for want of a way of holding it. When Fraser set out again with Oxley, searching this time for the Macquarie River's source, Cunningham was sent out with Phillip Parker King's coastal survey, intended to fill any gaps left by Flinders.

By the time King finished his survey in 1822, Cunningham had used it, and other expeditions he made alone, to collect in north-east Australia's tropical forests and in Timor, along arid stretches of Australia's western coast, in the mangroves of the north, the Illawarra's rainforests, the wild forests of Van Diemen's Land – even once in Mauritius. At sea, his specimens suffered not only from the damp, paper shortages and mould familiar to Robert Brown, but also from particularly ferocious cockroaches (they even ate cartridges). Nevertheless, he made collections of about 1,300 different species for his employers.

For nine more years Cunningham combed Australia and sometimes beyond – travelling to Norfolk Island, to New Zealand. He gathered and collected wherever he went: grevilleas and eucalypts, pines and acacias. On the day he was to return to England in 1831, a gale forced his ship to wait inside Sydney Harbour. Cunningham went ashore and found a perfect orchid specimen. He'd been hunting it for ten years.

It was Sydney's Botanic Gardens that brought him back, and their potential had clearly played on his mind. The possibility of extensive plantings; the possibility of a good herbarium – and all the scientific knowledge that could spring from this.

At the end of 1831, Charles Fraser had died, his final report stating that some 1,800 herbarium specimens had been sent to Glasgow's botanic gardens, 1,200 to Edinburgh's. There was still no suggestion of creating a *hortus siccus* of Australia's plants in Australia itself.

Cunningham, miserable in the cold damp of his first winter back in England, was recommended as the new superintendent. His health increasingly poor, he declined and instead recommended his brother Richard. But he did sit down and write a long memorandum on how the Gardens might work in the future. The superintendent should join all possible expeditions; the plants already growing should be

classified and catalogued; and, finally, it would be highly desirable, he said, to begin a herbarium.

Richard not only took the job, he also took note of the memo, purchasing ‘an excellent Botanical Press with patent screws, 22 inches long ... a most useful appendage ... in preparing for an Herbarium’. He also paid heed to his brother’s endorsement of exploring.

In April 1835, he wandered off from Sir Thomas Mitchell’s expedition as it headed into the dry west of New South Wales. Despite repeated cautions ‘about the danger of losing sight of the party,’ it was Richard’s habit to peel off in search of plants. Unfortunately, this time, he was lost and while Mitchell later found his horse – dead – there was no sign of his botanist. Wandering delirious and disoriented, Richard had blundered into an Aboriginal camp and was clubbed to death.

The position of Sydney’s superintendent again open, Allan Cunningham was again asked to apply for the job. He was back in Sydney by March 1837. But his plans for scientific scholarly work, and the possibilities of a herbarium, were a long way from what was really asked of the Gardens: that they provide vegetables for important people. It was, thundered the *Sydney Herald*, a scandal that ‘a kitchen garden, under the pretext of being a Botanic Garden, is supported in Sydney at the expense of from £800 to £1000 a year’, and Cunningham thought so too. After a very short period of time, he would, as the *Herald* put it, ‘no longer consent to remain a mere cultivator of official cabbages and turnips, and ... resigned the management of the *Botanic* garden in disgust’. His replacement, James Anderson, was not a botanist. He was a gardener.

Increasingly frail, Cunningham made optimistic plans to join another survey of Australia’s coast. But he wrote to Robert Brown, who after Banks’ death in 1820 was hailed as the pillar of British botany, describing himself as ‘a poor, decrepit, prematurely old traveller who ... formerly strove to advance, for years, botanic science here from pure love’. As the southern winter of 1839 crept in, he died.

The death of Banks may have also elevated Robert Brown to the position of Australian botany’s greatest expert, but it had in no way stemmed the tide of interested collectors, botanists and otherwise adventurous souls heading south. If anything, the numbers increased as enthusiasts in other European countries took up the British passion for the continent’s plants.

Less than three years after Cunningham’s death, a young Prussian naturalist sailed into Port Jackson. Like Cunningham, he was both botanist and explorer. Like Cunningham, he had grand ideas of all that Sydney’s Botanic Gardens might do and be. Like Cunningham, he would see it remain ‘a kitchen garden’.

His name was Ludwig Leichhardt, and as he ‘sprang ashore’ on 14 February 1842, he could hardly describe ‘with what joy I greeted every new plant, and how the wealth of novel sights almost turned my head’.

Through a somewhat peripatetic education (including studies with Brown’s model, Jussieu, in Paris), Leichhardt had yearned, above all things, to become a discoverer. Among the many disciplines he had studied, he relished botany. Europe, he knew early on, was too small for him: ‘You know I have a life full of perils before me in which success and failure alike depend only slightly on human foresight,’ he had told his father.

But after years of casting through different courses of study, different thoughts on where to travel, Sydney, it seemed, was about to offer Leichhardt something particular and fixed. Shortly after his arrival, James Anderson, Cunningham’s successor at the Gardens, died. Leichhardt was encouraged to apply for the position which, friends assured him, was bound to be his. ‘Leave no stone unturned,’ one counselled, and Leichhardt didn’t. He spoke to people who might be able to help. He wrote long letters outlining his suitability.

‘My mind,’ he confessed, ‘was teeming with the scientific possibilities and I would have accepted the position even on a low salary for the sake of securing a point of support from which I could make myself better known’. But the dead man, as Leichhardt noted, was ‘an ordinary gardener, a man without scientific knowledge,’ and that – unfortunately, perhaps, not only for the Gardens but for Leichhardt too – was precisely the sort of replacement chosen. Leichhardt may have advocated preserving Australian specimens in Australian herbaria, but the colonial bureaucracy didn’t see the need for it. They gave the job to William Naismith Robertson, who’d been principal gardener to New South Wales’ powerful Macarthur family for years.

Leichhardt’s gaze shifted further afield.

From Sydney, he worked his way up the coast: Newcastle, the Hunter Valley, the Liverpool Plains (‘one of those areas,’ he felt, ‘that still hold out the hope of something new to the botanist’), on to Moreton Bay and inland to places like Durundur, where he found an elegant little oxalis. He learnt