

Student's Volunteer Botanical Internship Program 2015

Australian National Herbarium, Canberra, ACT, Australia

5th Jan 2015 – 20th Feb 2015

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Introduction

This report documents my undertaking of the 2015 Student's Volunteer Botanical Internship in Canberra, Australian Capital Territory, Australia.

The Student's Volunteer Botanical Internship is a seven-week, intensive, unpaid internship designed for students at the end of second or third year of a course such as my BSc in Horticulture with Plantsmanship. This type of internship is not available elsewhere and is exactly what I wanted in terms of furthering my education and training. I have a strong interest in Australian native plants, particularly the adaptations of desert and rainforest plants to their environment, as well as an interest in conservation horticulture through ex-situ and in-situ cultivation, all subjects relevant to the internship. The placement itself is comprised of a large amount of herbarium curatorial work along with lectures on various aspects of botany, herbarium subjects and other skills and subjects applicable to scientific work, such as specimen collection, collections management, genetics, conservation, field identification and job-seeking.

Most of the internship was undertaken at the Australian National Herbarium (ANH), located at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Black Mountain site where the ANH is located, and the Australian National Botanic Gardens (ANBG), adjacent to the CSIRO site and where a number of lectures took place. The herbarium curatorial work was undertaken in pairs or small groups and many different tasks were done to give a good idea of the jobs needing done in an institution like this, for example incorporating mounted specimens into the collection, mounting, sorting duplicates of collected specimens, dealing with loans and exchanges and various other jobs. At the CSIRO site we were able to see two of the other collections, the Australian National Insect Collection and the Australian National Wildlife Collection and learn about their work too.

Whilst on the internship I went on two field trips, the first a day trip to vegetation communities in the local area and the second a four day residential trip to the coast to get experience of practical field work.

Main aims and objectives

My main aim in taking part in the internship was to get practical experience in doing herbarium work to complement and build on the training I received at the Royal Botanic Gardens Edinburgh's Certificate in Practical Field Botany course. The focus was on specimen collection, herbarium work, collections management, botany, plant conservation, field identification and job-seeking.

Within this I hoped to

- achieve new skills and knowledge and study aspects I became interested in through Plantsmanship in greater depth
- gain transferable skills for future work and study
- work with experienced staff
- improve my career prospects
- experience different ways of working
- get 2 months intensive experience at a horticultural and scientific institution
- get specialised training in seeking employment and presenting
- gain theoretical grounding of benefit to my career and studies, including my upcoming honours project

Details of the work programme

Week 1 Monday 5th Jan.

We had our official welcome and introduction to the programme, then orientation tours of the Australian National Herbarium (ANH), where most of the internship would take place, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) site where the ANH is located and the Australian National Botanic Gardens (ANBG) which is adjacent to the CSIRO site and where a number of lectures took place.



Fig. 1. The Australian National herbarium

Tuesday 6th Jan

We had our first lecture today, on Plant Nomenclature and description, with a briefing of Work Health and Safety principles afterwards. We also did our introductory herbarium training which covered the general principles of herbarium curation including specimen retrieval and incorporation and mounting of specimens. I spent the afternoon working with another intern in the herbarium incorporating specimens into the collection, in this case Euphorbiaceae species.

This involved alphabetising the specimens, finding the correct folder in the herbarium compactus, checking various items on the specimen sheet such as database stamps and putting them into the collection. If there was no folder in the compactus, we would check the name of the plant against an online database and if the name was valid, create a new folder. Often older specimens would have new names, for example.



Fig. 2. Part of the herbarium compactus housing the collection

Wednesday 7th Jan

In the morning we were given a tour of the ANBG by one of the volunteer guides. The gardens collection is entirely Australian native species, planted by geographical area, mainly, and has its own herbarium housing cryptogams as well as a public reference herbarium which is a great idea. In the afternoon we were again incorporating specimens from several plant families, working on a different level of the herbarium for part of the time.

Thursday 8th January

Today we did more specimen incorporation, including several boxes of DNA voucher specimens of *Cocos nucifera* (coconut) from a research project. The excitement of the morning was a white-tailed spider running out of a box of Cyperaceae when I opened it! These are not the most cordial of species...We also had a lecture on using field notebooks to record good plant data whilst collecting and how important a high level of detail is.

Friday 9th Jan

I spent the day in the mounting room, mounting various specimens sent from the herbarium in Perth, Western Australia, including remounting an old specimen onto new card. The techniques at Canberra are different from those at Edinburgh, using archival quality tape and bookbinding thread to attach the specimens to the mounting card. The mounting is usually done by volunteers, as is the case at all the herbariums we have visited whilst in Australia.



Fig. 3. Me at my mounting station (photo Daniel Fisher)

Week 2

Monday 12th Jan

Much of the day was spent mounting as before, with a lecture on herbaria and policy as well, which gave a good overview of the uses herbarium data is put to, including things I hadn't thought about such as contributing to policies dealing with threatened species and plant and animal communities, environmental reports and quarantine/biosecurity, even police forensics.

Tuesday 13th Jan

Field trip 1: Australian Capital Territory and New South Wales:

During this trip we visited 10 sites including threatened *Eucalyptus melliodora-blakeleyi* (Yellow Box and Blakely's Red Gum) woodland; rocky, dry hillside; weedy roadside and various sites at different heights in the Tallaganda Ranges National Park. The aim of this was to show us some of the different local habitats and the different species and vegetation communities that grow in them, as well as the things to look at for identifying plants in the field.



Fig. 4. *Wahlenbergia* sp.

Wednesday 14th Jan

First thing we were given the details of one of our assignments – to research the taxonomy and growing requirements of a native Australian plant species each and to do a presentation on this at the end of the internship. We were also to create a version of this to go up online on the ANBG website to provide information to the public about growing them (ANBG and Centre for Australian National Biodiversity Research, Canberra, 2012). This is not yet up online. My plant was *Archontophoenix cunninghamiana*, a tropical and subtropical palm extensively grown on the East coast. For the rest of the day I worked with another intern on several boxes of unmounted specimens, sorting through them carefully and removing duplicates to be sent to other herbaria, putting these into boxes to be sent. Often a requirement of being granted a collecting permit in a state is that a duplicate of all specimens must be sent to the state herbarium. Duplicates may also be sent if a herbarium is interested in a particular group of plants.

Thursday 15th Jan

The morning was spent finishing off the duplicates sorting from yesterday, then we moved onto our next task: working out how to integrate a huge stack of donated Australian area maps with the current herbarium collection. This involved a fair bit of problem-solving and planning as there was not a system in place for this. Together with a member of staff we worked out a method of sorting and recording the maps and of comparing them with the ones already in the collection. Later it was more maps: a workshop on map reading and using grid references to pinpoint specimen collection locations from records.

Friday 16th Jan

Started off with a briefing on the residential field trip next week, before having a workshop on the principles of plant identification, including features to examine and the use of dichotomous keys and interactive keys (printed and computer-based). We also had the chance to make up our own keys in groups based on an imaginary set of plants. Work-wise, we continued sorting the donated maps and refining our system.

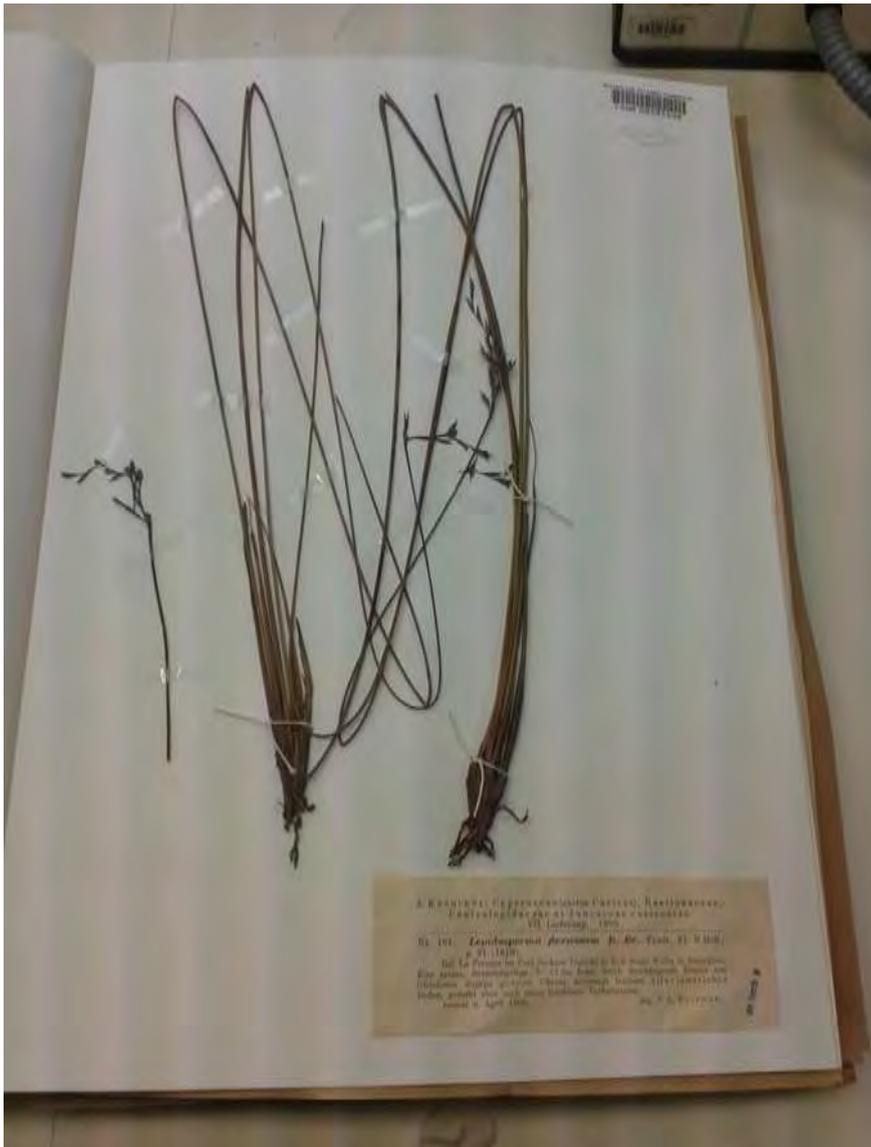


Fig. 5. The oldest specimen I came across: *Lepidosperma flexuosum* from 1909

Week 3

Monday 19th Jan

Working all day today, doing maps as before. Whilst it was going smoothly after all the practise it got a bit repetitive...

Tuesday 20th – Friday 23rd Jan

Field Trip 2: Australian National University Kioloa Field Station, Jervis Bay and surrounding New South Wales:

During this trip we undertook tasks such as collecting herbarium specimens, involving locating plants, taking specimens, recording details in field notebooks, pressing specimens in the field and then identifying these specimens in the field station lab using printed floras, interactive keys and hand lenses and microscopes. We also had an exercise in relocating plants in the area from past specimen records as a demonstration of the importance of accurate and detailed data recording – this was hot and sometimes frustrating work that made the point well! We also visited two botanic gardens during the trip, Eurobodalla Regional Botanic Gardens and Booderee Botanic Gardens, both with collections of plants specific to their local areas and their own herbaria, and were shown other Australian habitats such as *Eucryphia moorei* forest and mangroves. We visited an area where an eradication program for Bitou, an invasive coastal shrub, has been ongoing for several years and learned about the conservation management programme from ranger staff. We passed many different forest and vegetation types during our travels which was very interesting and had a great time as a group watching goannas, having a laugh and sitting round the bonfire.



Fig. 6. Scribbly Gum *Eucalyptus rossii* at Booderee Botanic Gardens

Week 4

Monday 26th Jan

Australia Day holiday

Tuesday 27th Jan

Worked with another intern all day incorporating orchid specimens into the collection. Orchids press down very thin so stacks are heavier than those of most other groups; extra care must be taken when moving them. Some of them look more like paintings than preserved plants.

Wednesday 28th Jan

Had an interesting lecture this morning on grasses, sedges, rushes and related groups, then looked at the flowers and fruit of several grass species under the microscope and learned their identifying features, which came in useful – I got to identify quite a few of them on the way into work and back. I worked in a small group in the loans department for the afternoon, learning about herbarium exchanges, loans and the sending and receiving of plant specimens, packaging up unmounted specimens to be sent to other herbaria. Also scanning in the barcodes of returned specimens into the database.

Thursday 29th Jan

There was a lecture on the role of genetics in conservation today which I found fascinating. It discussed the causes and effects of inbreeding and outbreeding depression in plants and the consequences of genetic variability and origin for revegetation and reintroduction projects. It made me think deeper about the differences e.g. 14nological between various populations of a species. During lunch a few of us went on an extra, a walk around the site with the staff member who gave us the lecture on grasses etc. to see some of the species here and put the identification features we'd learned into practise. In loans later, scanning more returned specimens into the database and checking off older returned specimens against a loans list. In the afternoon we had a tour of the Australian National Wildlife Collection, located at another of CSIRO's sites in Canberra, to see how other collections operate: in many ways they are similar to the herbarium, though animal specimens obviously need different preservation from plants.



Fig. 7. *Acacia rubida* displaying heteroblasty, with the adult phyllodes above and the juvenile leaves below.

Friday 30th Jan

In loans again in the morning, scanning returned specimens in and wrapping unmounted specimens to be sent out. For the afternoon we had a lecture and Q & A on jobs and funding in the science and conservation industries/fields, covering CVs, job applications and grants.

Week 5

Monday 2nd Feb

Today was work all day, back in loans with a small group as before, packaging up specimens for loan, then working with one other intern on something the herbarium had not tried with their interns before: key work. Our aim was to create a key to *Leontodon* species in Australia to be published online on KeyBase, an online resource being established for identifying plants. To do this we first needed to know which species were found in the country, for which we used the Australian Plant Census database, accurate species descriptions, for which we began looking up the Australian Floras in the herbarium library and comparing and contrasting these descriptions with herbarium specimens of the plants themselves. This was a challenging but interesting.

Tuesday 3rd Feb

We had our first of three sessions on bryophytes today, over at the Cryptogam Herbarium at ANBG. This was an overview of the major groups (bryophytes, liverworts and fungi) and an introduction to the collection and collecting techniques there. As well as having the differences and features of these groups we were given a large number of preserved specimens to examine with the use of microscopes and hand lenses. Afterwards I continued on the key research for *Leontodon*, gathering more information about the appearances of the plants. As they are quite variable species generally it was quite a challenge getting standard definitions from the herbarium specimens.

Wednesday 4th Feb

Session two on bryophytes, lichens and fungi was a half day in the Botanic Gardens themselves, finding and identifying, to group, the plants and fungi themselves. This was very enjoyable and we found some that looked pretty amazing under a hand lens! In the afternoon we again worked on research for keys, with our group gaining a member.

Thursday 5th Feb

Session three on bryophytes, lichen and fungi covered on their taxonomy, ecology and economic uses with a separate lecture focusing on each group. During the afternoon everyone attended the symposium of the CSIRO summer students to watch their final presentations on their projects. This was varied as the summer students work in different departments and comprised:

Botany session:

- Life in the dirt: species delimitation in soil crust lichens - Farzana Kastury
- How do plant traits bias seed collecting efforts for conservation? – Kathryn McGilp
- How many have you got? Chromosome numbers and genome sizes in alpine daisies – Meghan Castelli

Zoology session:

- Climate adaptation in birds: characterising genetic variation in Red-browed Finches – Ayla Wilson
- Comparing morphological, molecular and ecological diversity – Laura Welsh
- Discover new butterfly and moth species with molecular tools – Brodie Foster
- Description of a new beetle fossil from the Jurassic – Lauren Ashman

Friday 6th Feb

This morning there was a lecture on fire ecology focusing on the Canberra region covering types of fire, the different plant responses to fire and a case study on a monitoring project done on burnt sites in the nearby hills, by someone who had worked on the project. It is a very interesting topic and also extremely important, particularly in Australia. We were then taken on a walk up part of Black Mountain itself to look at the forest there and have pointed out the signs and effects of past fire which illustrated some of the points in the lecture well. That afternoon we finished our key work, with me writing the actual key itself. This is now up online for general use at <http://keybase.rbg.vic.gov.au/key/nothophoenix/4349!>



Fig. 8. One of my finished mounted specimens

Week 6

Monday 9th Feb

Today was an all-day workshop on scientific presentation and media skills, covering audiences, different media, policy and the importance of media; also how positive it can be but how careful you must be with it.

Tuesday 10th Feb

Two lectures today: molecular phylogenetics, showing how DNA samples are turned into phylogenetic trees, with a rundown of types of DNA sequencing and demonstrations using tree software; and one on polyploidy and fitness, using a long-term project run onsite with species of grass with different ploidy levels being subjected to varying conditions to assess their fitness and whether their ploidy level seems to affect it. This type of study will be important in planning for changing climate conditions. This researcher also gave us some handy hints on submitting publishing papers for publishing. In the afternoon I was back in loans, packing up specimens for sending away and also sorting incoming specimens into boxes for incorporation.

Wednesday 11th Feb

Most of today was spent in loans packaging outgoing specimens, but we were also taken on a tour of the ANBG seed bank and given a short lecture on seed conservation biology (collecting, storage, usage) – it was useful to see their seed cleaning room, drying room and lab as well.

Thursday 12th Feb

Working all day today but a bit of a change: our supervisor kindly arranged for myself and the other intern studying horticulture to spend a day at the ANBG. We spent the time digging out invasive blackberry and clearing an area of old, overgrown climbers and dead tree and shrub material. It was good to get out and get some graft done in the sun!

Friday 13th Feb

We had a lecture first thing from a researcher at the herbarium on Asteraceae research being done there, on the relationships between certain genera and their changing classification as a result of this, then one on a study on collecting bias in Australian herbaria. Work today was something different: down in the large Myrtaceae section with a partner, matching up old, undatabased packets of *Eucalyptus* seed to databased pressed specimens using the handwritten notes on the seed packets and the details for specimens in the database – this was definitely a challenge! However, we managed to match up most of the ones we got through, placing the seed packets in with the specimens and boxing them to be attached and databased. My partner did the database searching, I did the physical finding and matching of specimens. Today was also the hand-in for another assignment, a mock job application for the herbarium.

Week 7

Monday 16th Feb

This morning we had a lecture on doing science based on floras and natural history collections, with a gymnosperm phylogeny project to illustrate. For me it followed on from the previous lecture on use of this information in policy etc. and it was good to get a practical example. Work-wise we continued matching *Eucalypt* seeds and specimens. In the afternoon we had a tour of the Australian National Insect Collection, also located on the CSIRO Black Mountain site, which I really enjoyed as I am an amateur entomologist.

Again it was useful to compare curatorial techniques and interesting to hear about the collections use for study and publication.

Tuesday 17th Feb

Another day spent at the ANBG, weeding around the car park area for a couple of hours then in the Rainforest Gully for the rest of the day with most of the horticulture team, tidying up ferns and trimming old fronds off the many tree ferns – hot and dirty work but fun.



Fig. 9. *Ranunculus lappaceus*

Wednesday 18th Feb

Presentation morning...all of us made our way over to the small lecture theatre at the ANBG and did our Growing Native Plants presentation to a small audience of staff and each other. This was fairly nerve-wracking but I feel it went fine for everyone. In the afternoon I was working by myself for the first time – two interns had had to leave the week before to get back to their degrees so there were a few of us working solo. I was incorporating Cyperceae specimens into the collection.

Thursday 19th Feb

This morning we got our job applications and cover letters back, along with personal feedback for them which was very helpful. We had a group discussion on application and CVs etc. then each had a mock interview to go with the application, in front of the group so we could all benefit from the feedback and talk about it with each other. I thought this would be scary but it wasn't. In the afternoon I continued to incorporate Cyperaceae specimens.



Fig. 10. Some stacks of specimens in the herbarium compactus

Friday 20th Feb

Last day! First thing I finished incorporating the boxes I'd been working on, then we all made our way over to the ANBG for the presentation of our certificates and a presentation by Brownwyn, our supervisor, which was lovely. A couple of other staff made short speeches too, along with a spokesman for us interns. Our sadness was comforted by vouchers for the Botanics Bookshop, which we all immediately went and spent on the books we'd been eyeing up for weeks. We had a farewell lunch put on for us at the herbarium, then that was us...

Future plans

I have recently been offered the opportunity to take part in a project monitoring the effects of feral camel browsing on vegetation in the Simpson Desert whilst still in Australia where I will be able to use what I have learned. I hope to take part in further monitoring and collecting for conservation projects and related horticultural and botanical projects; the greater experience that I now have will stand me in good stead. The research I have been shown should give me a better idea of how to go about my own honours project.

Conclusion

The internship was a very worthwhile experience and I feel that it lived up to my expectations. It was of great benefit to me from an educational, professional and personal perspective.

The skills I've learnt through this internship are transferable to other horticultural and botanical institutions and jobs. The field work including specimen collection skills and data recording are very useful to have and can be transferred to working with botanic gardens, conservation horticulture projects and similar, the type of employment I aim to get into once I have achieved my honours degree.

Doing actual herbarium curation work was invaluable experience for the future as this may allow me to gain employment in a herbarium or other natural history collection since I now have knowledge and practical experience of the work required and the level of care and attention needed.

I have learned a great deal from the lectures and gained greater depth of knowledge about subjects I was interested in before, for example the role of genetics in conservation and how to apply this information; this and other subjects covered gives me a grounding for looking into material for conservation projects and climate change studies, which are important subjects and becoming more so. The examples of studies carried out at CSIRO and similar will help me when designing and carrying out my own honours project soon.

Industry-specific job application and suchlike feedback and training will assist me to further my career, as will gaining a reference from an important botanical institution; working with and learning from experienced staff and researchers has been invaluable and it's good to have more professional contacts.

Seeing all the native plants and habitats was fascinating, including those around the Canberra area I visited in my spare time and this is another thing I enjoyed and found valuable.

I also feel I gained a lot personally: the team of interns from different backgrounds came together really well and we became friends, many of us spending time seeing the sights and going out together at the weekends. This means that as well as having gained lots of knowledge and experience I also have good memories of the time outside the internship.



Fig. 11. Intern group photo! (photo Student's Volunteer Botanical Internship)

Final budget breakdown

Item	Cost
Air fare to Australia	£468.55
Air fare from Australia	£543.26
Air fare to Canberra	£164.69
Air fare from Canberra	£98.59
Bus travel	£105.99
Mileage	£160.60
Taxi from airport	£11.30
Travel insurance	£426.50
Australian visa	£230.79
Accommodation in Canberra	£395.48
Food £3.87 a day for 60 days	£232.48

Total costs	£2,828.23
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Merlin Trust Bursary received	£800.00
Other Bursaries received	£1,750.00
Total Bursary received	£2,550.00

Total Bursary - Total costs	-£278.23
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Print name: Heather Forbes

Sign name:



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