

Darwin Fellowship - Interim Report

(Please check guidance for submission deadlines, max 3 pages.)

Darwin Main Project Ref No	162/12/030; EIDPS035
Darwin Project Title	Building Capacity for Plant Biodiversity, Inventory and Conservation in Nepal (2003-2006)
Name of Darwin Fellow	Dr Sangeeta Rajbhandary
UK Organisation	Royal Botanic Garden Edinburgh
Your Organisation(s)	Central Department of Botany, Tribhuvan University
Your role within your Organisation	Senior Lecturer
Start/end date of Fellowship	15/9/2013 – 14/9/2013
Location	Royal Botanic Garden Edinburgh
Darwin fellowship funding (£)	18,500
Type of work (eg research, training, other, please specify)	Research and training
Main contact in UK Organisation	Dr Mark Watson
Author(s), date	Dr Sangeeta Rajbhandary and Dr Mark Watson

1. Background

- Briefly describe your involvement in the Darwin project before the start of your fellowship.

I was also one of the Darwin Scholars trained during the Darwin project Building Capacity for Plant Biodiversity, Inventory and Conservation in Nepal (2003-2006; 162/12/030). I was one of the top performers in the project and went on to undertake a PhD degree jointly between Tribhuvan University and Royal Botanic Garden Edinburgh. I was awarded my PhD in 2010 and continue to develop my botanical biodiversity research

- Describe aim and objectives of the Fellowship, and programme of work

This Fellowship will produce a field guide and web resource for the ferns of Nepal. Ferns are a significant component of Nepalese biodiversity, with 534 species from an estimated total of 7000 species of vascular plants. However, they are understudied relative to other plant groups, primarily because there are no publications which allow non-experts to identify ferns. The reference collections at the National Herbarium, Kathmandu (KATH), are often badly named, poorly curated, and are consequently difficult to use for identification.

It is impractical to produce a comprehensive field guide to the ferns of the whole of Nepal within one year, so this Fellowship concentrates on the ferns of Central Nepal. However, the key to genera will include all genera known from Nepal, and so it will be useful throughout the country. The field guide will be published in Nepal, where high quality colour publications can now be printed at very reasonable costs. The web resource will be hosted at RBGE and based on data held in RBGE's Flora of Nepal Padme database. This database has been purpose designed at RBGE and manages all data for the publication of the Flora of Nepal. District-level distribution maps will be generated by databasing representative specimens at RBGE, the Natural History Museum, London and RBG Kew.

For several years I have been collecting data and images suitable for a field guide of Nepalese ferns and is currently working on fern projects at two locations in Central Nepal, Daman in the Mid Hills and Manaslu in the High Himalaya. Some 200 species have already

been photographed, and many other species have also been photographed by RBGE collectors on other collecting expeditions.

The programme of work includes:

1. Arrival at RBGE (Sept)
 2. Consultation and planning (Sept-Oct)
 3. Library and herbarium research revising the checklist (Sept-Jan)
 4. RBGE Herbarium specimen study, imaging, data capture (Sept-Jan)
 5. Natural History Museum herbarium specimen research (March)
 6. RBG Kew herbarium specimen research (April)
 7. Data synthesis and species documentation at RBGE (May-August)
 8. Report to Darwin Initiative (Sept)
 9. Return to Nepal (Sept)
- Briefly describe the roles of the UK and Fellow's institutions

RBGE's mission statement is 'to explore and explain the world of plants'. It has an international reputation as a centre for excellence in plant taxonomy, molecular systematics and biodiversity science based on its rich herbarium, living collections, library and archives. RBGE has wide-ranging education activities which include PhD, MSc, BSc, HND courses as well as diverse public education programmes. RBGE contributes to many Flora projects worldwide, and coordinated the completed European Garden Flora (2000), Flora of Bhutan (2002) and Ethnoflora of the Socotra Archipelago (2004). The Floras Group manages the Flora of Nepal in collaboration with the University of Tokyo and the Nepal Academy of Science and Technology, Tribhuvan University and the Department of Plant Resources in Kathmandu. The Group is developing innovative biodiversity informatics tools to aid compilation of Floras and has an active fieldwork schedule. In addition to the Nepal project RBGE has successfully undertaken Darwin projects in Bhutan, Vietnam, Turkey, Laos, Peru, Chile, etc.

Tribhuvan University, the largest university in Nepal, has campuses located across the country. The Central Department of Botany (CDB) is responsible for all academic programs in botany throughout the university, and itself specialises in M.Sc. and Ph.D. level education. Postgraduate courses include plant taxonomy, ecology, biotechnology, and other related fields in botany. CDB is the only place in Nepal where students can study for an MSc in plant taxonomy, and CDB has an excellent track record in producing high quality graduates who find work in the biodiversity sector or go on to further research. As one of the three collaborating institutes in Nepal on the international Flora of Nepal programme, staff and students are involved in contributing information, undertaking expeditions and writing accounts. CDB staff are co-authors of Flora of Nepal accounts for their specialist groups, and are involved in the mentoring of other co-authors.

2. Progress

- Provide a brief account of your work since the start of your fellowship, showing progress against the programme of work.
 1. **Arrival at RBGE (Sept)**
I arrived at RBGE on 25th September 2013
 2. **Consultation and planning (Sept-Oct)**
I met frequently with Drs Mark Watson and Colin Pendry to establish a detailed work plan for the Fellowship, prioritise training and research over the first months, and be guided on issues that came up.

3. **Library and herbarium research revising the checklist (Sept-Jan)**

I was trained in the use of electronic catalogues; on-line and web-based searches of library databases; scanning technique of useful resources especially for ferns and fern allies for references.

I completed the revision of the checklist of ferns of Nepal, and sorted out some nomenclatural problems with Dr Mark Watson. Recent years have seen several changes to generic concepts and so deciding which genera to accept in the checklist was a challenge but a useful basis for future work. Several taxonomically complex groups were identified as in need of further research and will form the subject of future MSc and PhD student projects in Nepal.

The 2002 Nepal fern checklist reports 534 species of fern and fern-allies, whilst in 2010, including subspecies and their varieties, the total number of ferns and fern allies account have been recorded as 556 taxa. In the recently published Flora of China fern volumes they have adopted the most recent family-level treatments of pteridophytes, but at generic level they have used several generic treatments based on molecular and morphological evidence. These needed to be considered for Nepal as they would involve many changes in scientific names.

In my revised checklist the number of genera in Nepal has increased from 102 (compared to the 2002 checklist) to 113 genera. For some genera depending on the morphological character decisions have been made to retain the existing genera even though it has been moved to different genera in Flora of China treatment. For example, Flora of Thailand includes all *Polypodioides* in *Goniophlebium*, a treatment not accepted by Flora of China. Flora of China separates one Nepalese species as *Metapolypodium*, but from observations it is difficult to maintain this, so including all within *Polypodioides* is preferred for Nepal.

So far records of 12 species new to Nepal have been identified but with complete data entry from BM and K, there might be more.

4. **RBGE Herbarium specimen study, imaging, data capture (Sept-Jan)**

I was trained by specialist Dr. Elspeth Haston, Assistant Curator: Digitisation, in the production of high resolution images of micro elements (sorus, indusium, trichomes, mega and microspores, etc.) from specimens using a digital camera on microscopes; manipulation of the images using Photoshop software. RBGE Flora of Nepal team also trained me in the use of the Flora of Nepal database Padme, entering and accessing data; linking data and developing maps; constructing and preparing reports; constructing keys for the genera.

The working of a major herbarium was important work experience for me, especially experiencing the different types of storage and arrangement of specimens in three major herbaria (Royal Botanic Gardens Edinburgh (E); The Natural History Museum (BM), Royal Botanic Gardens Kew (K) and identification of species.

Library and herbarium training was consolidated through research experience in locating literature; abstracting information from specimens; organising information into the form most suitable for entering into the databases used in the project; synonymy; specimen and literature citation.

All the specimens of fern and fern allies deposited at RBGE were consulted and recorded. All the fern specimen information from Wallich's Nepalese specimens listed in his Wallich Catalogue was recorded, in advance of consulting the original specimens held mainly in the herbarium at Kew. Some 600 species database entries have been completed from E,

A Key to 102 fern genera and fern families has been developed, including a glossary of around 240 descriptive terms with illustrations.

Detailed micro photographs of around 500 species have been taken for use in the illustrated guide.

5. **Natural History Museum herbarium specimen research (March)**

All specimens of ferns and fern allies at the Natural History Museum herbarium were consulted and recorded. This included the Buchanan-Hamilton collections from Nepal dated 1802-3 (and duplicates at the Linnaean Society) – these are among the most important historical collection of those relating to Nepal and contain numerous type specimens.

I was able to discuss taxonomic and floristic problems relating to Nepalese ferns with Kew staff and visitors working on ferns at NHM and Kew.

6. **RBG Kew herbarium specimen research (April)**

All specimens of ferns and fern allies in the Kew herbarium were consulted and recorded.

Around 8000 photographs of specimens from BM and Kew were taken. Data entry of the occurrence data from these is ongoing.

In addition to the planned programme of work, I attended the 111th Annual General Meeting of the British Pteridological Society held at the Natural History Museum, London on 12th April 2014 was also attended and got the opportunity to meet people working on Pteridophytes. In April I also attended the 2-day study workshop of the Britain Nepal Academic Council in Oxford, where I presented a paper on the work undertaken in the Darwin Fellowship.

- Provide an account of any problems encountered and how you have or are planning to overcome them.

I have not had any significant problems that have affected my work programme.

- Are there any issues you would like to raise?

There are no issues I would like to raise.

3. **Achievements and Outcomes**

- What have been the main achievements and outcomes to date, and how do they relate to the overall aim and objectives of the Fellowship.

The achievements are detailed above in section 2. The main ones were:

- Producing the revised checklist of ferns of Nepal (needed as the basis for deciding what to include in the guide and for all future fern research)
- Completing the examination of fern species, producing the key to genera and illustrated glossary of terms (enhancing my knowledge of fern morphology, diversity and genera/species boundaries, and a major component of the guidebook)
- Producing a dataset of detailed micro photographs of around 500 species (for illustrating the glossary and guide book, and as a knowledge base for future research)
- Recording all the fern specimens at RBGE, RBGK and NHM (providing accurate distributional data and completing the morphological examination)
-

4. **Next Steps**

- Briefly describe forthcoming activities, events, milestones

The remaining months of my Fellowship will be for analysing and databasing the herbarium records taken at Kew and NHM and synthesising the information ready for producing the guide book, and producing the necessary reports.

I will also take the opportunity to be trained and use the Scanning Electron Microscope at RBGE to examine in more detail some interesting discoveries that I have made using the dissecting microscope, with a view to revising the generic placements of some difficult species.

Darwin Fellowship - Final Report

(Please check guidance for submission deadlines, max 6 pages.)

Darwin Project Ref No.	
Darwin Project Title	
Name of Darwin Fellow	
UK Organisation	
Your Organisation	
Your role in your Organisation	
Start/end date of Fellowship	
Location	
Darwin Fellowship funding (£)	
Type of work (e.g. research, training, other, please specify)	
Main contact in UK Organisation	
Author(s), date	

1. Background

- Briefly describe your involvement in the Darwin project before the start of your fellowship.
- Describe aim and objectives of the Fellowship, and programme of work.
- Briefly describe the roles of the UK and Fellow's institutions.
- If you have undertaken a formal course of training, please provide a brief explanation of the course and a link to the course website if available.

2. Achievements

- Summarise the work undertaken during your Fellowship. What were the main activities undertaken. Highlight any work undertaken but not originally planned and explain why this happened. Highlight any problems encountered and how they were overcome.
- What have been the main achievements of your fellowship? Key documents should be annexed to this report.

3. Outcomes, lessons and Impact

- Do you feel that the work undertaken during your Fellowship has improved skills that are relevant and important for your work in your organisation? How are you planning to apply those skills in future work?
- What arrangements have been made for your future involvement, what more could be done, what discussions have taken place with your original employer to ensure that your new skills are utilised?
- Has the Fellowship helped to improve your capacity to solve practical problems related to the sustainable use and/or conservation of biodiversity in your country?
- Have you had the opportunity to make contacts with other UK biodiversity institutions, intergovernmental organisations, NGOs or the private sector during your fellowship? Will these contacts be useful for your future work, and how are you planning to maintain them?

- Any other issue emerging from your experience as Darwin Fellow that you would like to raise, or suggestions for improvements to the Darwin Initiative Fellowship scheme.