

Darwin Scholarship - Final Report

(Submit within 2 months of Scholarship completion, max 6 pages.)

Darwin Project Ref No.	
Darwin Project Title	Tree diversity and conservation priorities in Peruvian seasonally dry tropical forests
Name of Darwin Scholar	Reynaldo Linares-Palomino
UK Organisation	Royal Botanic Garden Edinburgh (RBGE)
Your Organisation	MOL-Forestales Herbarium, Universidad Nacional Agraria La Molina
Your role in your Organisation	Associate Researcher
Start/end date of Scholarship	September 2004 – August 2005
Location	San Martin and Lima departments (Peru), Edinburgh and London (UK)
Darwin Scholarship funding (£)	£
Type of work (e.g. research, training, other, please specify)	Research (fieldwork, herbarium and bibliographic)
Main contact in UK Organisation	R. Toby Pennington
Author(s), date	R. Linares-Palomino (14 October 2005)

Background

- Briefly describe your involvement in the Darwin project before the start of your scholarship.
- Describe aim and objectives of the Scholarship, and programme of work
- Briefly describe the roles of the UK and Scholar's institutions

Involvement in Darwin Project 09/017 "Tree Diversity and Agroforestry Development in the Peruvian Amazon"

I was a Darwin-funded MSc scholar at the University of Edinburgh and RBGE (2001-2002), gaining my degree in "Biodiversity and taxonomy of plants", and a distinction for my dissertation research, which has subsequently been published (LINARES-PALOMINO, R. 2004. *Los Bosques Tropicales Estacionalmente Secos: I. El concepto de los bosques secos en el Perú*. *Arnaldoa* 11(1):85-102; LINARES-PALOMINO, R. 2004. *Los Bosques Tropicales Estacionalmente Secos: II. Fitogeografía y Composición Florística*. *Arnaldoa* 11(1):103-138; LINARES-PALOMINO, R., R. T. PENNINGTON & S. BRIDGEWATER. 2003. *The phytogeography of the seasonally dry tropical forests in Equatorial Pacific South America*. *Candollea* 58(2):473-499). The support for my studies in the UK formed part of the training element of this project, which aimed to build the capacity of Peruvian scientists, technicians and students in plant collection, identification, taxonomy and herbarium curation.

Aims, objectives and programme of work of Darwin scholarship

The main aim of the scholarship was to raise awareness of a highly threatened, but poorly studied non-Amazonian ecosystem: seasonally dry tropical forests. In Peru, these forests are represented by formations in the northern coastal region, inter-Andean valleys and in one area east of the Andes (Tarapoto and the Huallaga valley). Protected areas of dry forest exist only in the coastal area, but there are no conservation areas in the other, more severely threatened stands in Inter Andean and eastern Peru, despite preliminary surveys indicating high levels of species endemism. Critically, little information is available on the floristic composition, structure and ecology of Peruvian seasonally dry forests, which hampers raising their scientific and conservation profile. Three main objectives were identified in order to address this problem:

1) To produce a checklist of the woody species present in the dry forests of Peru, providing a vital tool for biodiversity scientists and conservationists by facilitating accurate naming of species in the field and in Peruvian herbaria.

2) To survey the vegetation in the valley of the Huallaga River (Tarapoto, Department of San Martin), which has patches of dry forest remnants. Preliminary surveys in this area provided very different floristic lists, which were identified as potentially highly distinct from all other neotropical dry forest formations by preliminary biogeographic studies carried out by the proposed Darwin scholar as part of his MSc dissertation (LINARES-PALOMINO, R. 2002. *A floristic and phytogeographic analysis of Peruvian seasonally dry tropical forests*. Master of Science, University of Edinburgh, United Kingdom.).

3) To quantify levels of endemism of woody species in Peruvian dry forests in order highlight hotspots of endemic species that most merit conservation.

The programme was as follows:

- Sep – Oct 2004: Field work in the Huallaga River valley, collection of vouchers and preliminary identification at MOL, Lima Peru. Feedback with local conservation organizations.
- Nov 2004 – Feb 2005: Herbarium work at RBG Edinburgh. Bibliographic research for checklist (compilation of species list from all published floristic inventories in Peru, and checking for synonyms using bibliographic sources), preliminary annotation of the checklist (for each species: life form, distribution in Peru, total distribution).
- Feb – Apr 2005: Herbarium work and complementary bibliographic research at RBG Kew.
- May – Aug 2005: Online publication of checklist. Phytogeographic and endemism analyses of seasonally dry forest inventories and checklist. Submission of phytogeographic and endemism study for publication. Production of additional manuscripts (causes of levels of endemism in inter-Andean dry forests, Structural characteristics of a dry forest in the Inter Andean Marañon valley).

Roles of UK and scholar's institutions

RBGE's mission is to explore and explain the world of plants through programmes of scientific research, horticulture, conservation and education. RBGE carries out an international programme of research in plant taxonomy, systematics and conservation in more than forty countries and maintains and develops living and preserved plant collections.

The Peruvian National Forest Herbarium (MOL-Forestales) is part of the Department of Forest Management, Faculty of Forest Sciences, Universidad Nacional Agraria La Molina. It aims to promote the conservation and sustainable use of Peruvian forests. MOL carries out a research programme of inventory, taxonomy and conservation in Peruvian forests.

Achievements

- Summarise the work undertaken during your scholarship. 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.

The initial two months were spent in Peru doing field and bibliographic research.

A two-week inventory expedition to understudied dry forests in the in the Huallaga River valley (Picota region) resulted in the recording of several typical rain forest tree species, suggesting that these forest may receive more rainfall and be less seasonal than previously considered. In total, some 200 specimens (including duplicates) were collected, though unfortunately we were not able to collect many specimens in flower because the seasonal rains had not yet started, and these are generally the trigger for flowering. Identifications were made subsequently at MOL

Subsequent herbarium and bibliographic research was carried out in Peruvian herbaria (MOL-Forestales, MOL-Biologia) and libraries (Universidad Nacional Agraria La Molina, Museo de Historia Natural San Marcos) to draft a preliminary list of woody species occurring in Peruvian dry forests.

The period in the UK consisted of three phases:

- 1) an initial phase at RBG Edinburgh, where the preliminary species list produced in Peru was extended through additions from a) bibliographic resources such as taxonomic monographs, revisions and floras, as well as floristic accounts from Peru, South America or the Neotropics, b) information from herbarium specimens at Edinburgh, c) online plant specimen data from the Missouri Botanical Garden (W3 Tropicos database), the Field Museum Chicago (Neotropical Herbarium Specimens database), the International Legume Database & Information Service (ILDIS) and the International Plant Name Index (IPNI).
- 2) an intermediate phase at RBG Kew in London to complement the work done in Edinburgh, with a brief visit to the University of Oxford Herbarium to exchange of data and information on Andean dry forests endemics and conservation with Dr Colin Hughes. This linked my work with the related Darwin project "Plant endemism of the central Andean valleys, Bolivia" (11/010). Additional specimen data for dry forest species from recent collecting work in Peru were also checked in Oxford.
- 3) the final phase at RBG Edinburgh refined the checklist with contributions, comments and suggestions from taxonomists working on Peruvian plant species, produced the database version of it, and uploaded it onto the RBGE internet server. The checklist has been a valuable source for quantitative and qualitative information on the diversity and levels of endemism reflected in the production of an accepted book chapter manuscript on Peruvian dry forests (LINARES-PALOMINO, R. In press. *Phytogeography and floristics of seasonally dry forests in Peru*. In: Neotropical savannas and seasonally dry forests: plant diversity, biogeography and conservation, Pennington, R. T., Lewis, G. P. & Ratter, J. A (eds.). CRC Press, Boca Raton, FL.), and another manuscript on patterns of plant endemism in Peruvian inter-Andean seasonally dry tropical forest in preparation, to be submitted to *Biodiversity and Conservation*.

An additional and valuable piece of work was made possible thanks to a grant (£1500) from the Davis Expedition Fund, School of Biological Sciences, University of Edinburgh. I had the opportunity to plan an expedition and travel to the Marañón inter-Andean valley in northern Peru. The trip, lasting three weeks, allowed me to visit one of the most striking dry forest areas in Peru. I was able to record plant structure and diversity on four 250m x 2m transects on an altitudinal gradient (850 – 1500 masl), as well as the composition of gallery forests at 800 masl and associated vegetation on the slopes of the valley. I collected 22 species, of which seven were endemic and restricted to the Marañón valley. This information was crucial for improving distributional data for some species in the checklist.

Problems encountered

The only major problem related to the level of the stipend offered. Edinburgh and London are expensive cities and it was difficult to find adequate accommodation for the time spent in each at a price that left sufficient funds for subsistence.

Achievements

- What have been the main achievements of your scholarship? Key documents should be annexed to this report.
1. A productive and successful experience working among scientist leaders in their field, sharing ideas and allowing me to make important contacts within and outside RBG Edinburgh for future collaboration and research.
 2. The production of an annotated checklist of woody plants of the six main geographical areas with seasonally dry forest in Peru, available in English and Spanish on line at: <http://rbg-web2.rbge.org.uk/dryforest/database.htm>

The advantages of having an online version of the checklist are several. Among the most important is that it can be accessed by people from remote regions in Peru, where libraries are poor and printed versions would reach only a handful of readers. Perhaps surprisingly, following privatisation of Peruvian telecoms, these areas are well served by the internet, which is available in universities, NGOs, local government offices and reasonably priced internet cafés. Another advantage of the online format is that it will be easily updated once additional information is gathered.

3. The biogeographic analyses indicate that there is a high degree of diversity and endemism in the Marañon inter-Andean valley in northern Peru, as compared to other traditional dry forest areas such as in northwestern coastal Peru. This will have serious implications since none of the dry Marañon valley has conservation or protected areas, and is under similar high threat as the much more publicized, and better protected, dry forests of Tumbes and Piura.
4. An accepted book chapter (LINARES-PALOMINO, R. In press. *Phytogeography and floristics of seasonally dry forests in Peru*. In: Neotropical savannas and seasonally dry forests: plant diversity, biogeography and conservation, Pennington, R. T., Lewis, G. P. & Ratter, J. A (eds.). CRC Press, Boca Raton, FL.). The main data used for the analyses in this work arises from the data collated for the checklist.
5. Preparation of the manuscript "Patterns of plant endemism in Peruvian inter-Andean seasonally dry tropical forests", which will attempt to discuss the origin of the high levels of endemism found in the Marañon Inter Andean valley.
6. An accepted lecture at the II International Dry Forest Congress in Loja, Ecuador, next November, to present the results produced during the scholarship.
7. An invitation by the Dirección de Conservación de la Biodiversidad from the Instituto Nacional de Recursos Naturales (INRENA, Peru's national authority on biodiversity conservation and management) to give a presentation of the results produced during the scholarship. It coincides with a program INRENA is now implementing to assess the conservation status of existing protected areas and to find new areas in need of protected area status. This revision of the Plan Director (<http://www.plandirectorandp.com/index.html>) will, among other issues, evaluate the representativity of the several ecosystems in Peru. The scholarship has produced valuable information in this respect, highlighting new and unexpected areas in need of conservation and formal protection, such as the dry Marañon river system in inter-Andean Peru. This information has been supplied to the coordinator of

the evaluation (Conservation Data Center at La Molina), with the suggestion of beginning studies for the establishment of a protected area.

8. A draft species list of the seasonal forests in San Martín has been sent to the contact person there (Marco León, from the Asociación de Municipalidades de San Martín).
9. Several informal presentations on dry forest diversity and distribution:
 - a. Final year biology students of the Facultad de Biología, Universidad Nacional Agraria La Molina, Sep. 2004.
 - b. Forestry and biology students and staff from the Universidad Nacional Agraria La Molina, Sep. 2004
 - c. Volunteers of the Grupo Chullachaqui from the Instituto Superior Pedagógico de Picota, Picota, San Martín, Oct. 2004.
10. Collection of 113 specimens, most in four duplicates to be sent to Peruvian herbaria (USM, HAO). The main collection will be left at MOL Forestales.
11. Improved information, data and images on my seasonally dry forest webpage, focused mainly on Peruvian forests. The webpage is in Spanish and can be accessed at:
<http://www.geocities.com/bosquesecos/>

Outcomes, lessons and Impact

- Do you feel that the work undertaken during your scholarship 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?

Work at RBGE has definitely improved my capacity as researcher. It has allowed me to learn to do research independently and collaboratively. These skills will be of critical use in future research and conservation projects I am currently developing. At some time I hope to participate in university level teaching courses. The immediate use of these skills will be during my PhD (Albrecht-von-Haller Institut for Plant Sciences, University of Goettingen, Germany) which will focus on the diversity and conservation of Inter Andean dry forests in Peru and Bolivia.

- Has the scholarship helped to improve your capacity to solve practical problems related to the sustainable use and/or conservation of biodiversity in your country?

Definitely yes. The data gathered will have a direct impact on the revision of the Plan Director (Peru's framework document on protected areas management and implementation). One of the programs being reviewed is the representativeness of critical ecosystems in the National System of Protected Areas. Dry forests are clearly under-represented and the information produced during the scholarship has helped to identify areas in need of protection.

- Have you had the opportunity to make contacts with other UK biodiversity institutions, intergovernmental organisations, NGOs or the private sector during your scholarship? Will these contacts be useful for your future work, and how are you planning to maintain them?

I was able to make contact with UK and Peruvian institutions and individuals:

1. Darwin-Net (www.darwinnet.org), a UK Darwin funded project in Peru and Ecuador. Contact persons in Peru: Jeremy Flanagan (Director of the project) and Luis Alban (Director of NCI), both from from Nature and Culture International Peru (NCI-Peru) (www.natureandculture.org/index.asp).
2. Museo de Historia Natural, Universidad Privada Antenor Orrego, Trujillo. This Institution is specialized in northern Peruvian plants and animals. Contact persons: Dr. Abundio

Sagastegui (Curator of the HAO herbarium) and Carolina Tellez (Research assistant at HAO).

3. Area de Conservacion Privada Chaparri (www.chaparri.org). This private initiative in Lambayeque, northwestern Peru is developing several conservation programs with the local community and I have already initiated conversations and preliminary field studies which might develop into a long-term research program in dry forest ecology. Contact persons: Dr. Robert Williams (Scientific Director of Chaparri and BirdLife International contact) and Heinz Plenge (Administator of Chaparri).
4. Dirección de Conservación, INRENA. Contact person: Sidney Novoa and Karina Ramirez.
5. I have been able to establish close contact and exchange information with taxonomic specialists in some groups and tropical forest ecologists:

Carlos Ostolaza, Peruvian Cactaceae specialist, from the Asociación Peruana de Cactus y Suculentas, Peru

Ary T. Oliveira-Filho, Tropical forest ecologist from the Universidade Federal de Lavras, Brazil

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

I would have liked to contact other Darwin scholars working in the UK at the time I was in Edinburgh and Kew to exchange working experiences in our country as well as in the UK. It would have been interesting to learn what other scholars are doing in some kind of informal meeting.