Taxonomic Training for a Neglected Biodiversity Hotspot in Lao PDR

Darwin Initiative for the Survival of Species

Final Report

Project 163/13/007

BY

P Thomas & M Newman, RBGE
Sounthone Ketphanh & Khamphone Sengdala, FRC
Bouakhaykhone Svenguska & Vichith Lamxay, NUoL

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Final Report

Project Ref. Number	*163/13/007*
Project Title	*Taxonomic training for a neglected biodiversity hotspot within Lao PDR*
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Note 1. The official title of the country is Lao Peoples Democratic Republic, abbreviated to Lao PDR. The word "Lao" may mean the people, the language or the country, depending on the context. The terms Laos or Laotian are not used in this report.

Note 2. At the beginning of this project, the protected areas of Lao PDR were called National Biodiversity and Conservation Areas (NBCA) but this has since changed to National Protected Area (NPA).

1. Project Background & Rationale

Lao PDR is a landlocked country about the size of England, Scotland and Wales together but with a population of fewer than 6 million. It lies entirely within the tropics and is bordered by Thailand, Burma, China, Vietnam and Cambodia. These countries are noted for their high levels of biodiversity and there are strong indications that Lao has similar levels, at least in terms of its fauna. Average incomes in Lao PDR are among the lowest in Asia and more than 75% of the population is dependant on agriculture or the natural resources of the forests and rivers. There are few industries and international communication links are poor. The river Mekong, for example, is not navigable from the sea because there is a series of cataracts around the Cambodian-Lao border. Most of the land is steeply sloping or mountainous and the domestic transport infrastructure is also limited, restricting access to markets. These conditions make Lao PDR a good example of a country rich in biodiversity but poor in resources. Over 40% of the primary forest remains but is under increasing pressure. The population is increasing along with pressures for development and exploitation. The Lao PDR government (GoL) has, with the support of international agencies such as the World Bank, the IUCN and the United Nations Development Programme, developed policies aimed at reducing poverty as well as utilising and conserving natural resources. Hydro-electric schemes such as the Nam Theun II project in Khammouan Province are integral to the GoL's strategies.

The floristic diversity is poorly known: the lack of knowledge and trained people are hampering the development and implementation of conservation and sustainable use strategies. Thailand and Vietnam have documented floras in excess of 10,000 species but only about 2,000 were recorded from Lao PDR at the beginning of this project; botanical

work had been almost absent since World War 2. Available botanical information is mainly in French, a language no longer used by many Lao people. Taxonomic training, institutional capacity building, collaborative projects that involve the transfer of skills and knowledge to Lao staff and the creation of a national species database and threatened plant list are all priorities in the GoL's National Biodiversity Strategy to 2020 and Action Plan to 2010.

Project 163/13/007 aimed to start to address these barriers to progress which were first expressed to the UK project leader in 1999 during a visit to Lao PDR and were highlighted again during a short training course that he ran in 2002. Staff of IUCN Lao PDR and the Forestry Research Center (FRC), part of the National Agriculture and Forestry Research Institute of Lao PDR (NAFRI), requested further training in the skills of field botany and plant identification and gave their wholehearted support to the idea of a Darwin project. During the 2002 visit, an extended programme of training was designed and a Memorandum of Understanding was agreed between the Royal Botanic Garden Edinburgh and NAFRI – Darwin project 163/13/007 is the result of that consultation.

2. Project Summary

2.1 Purpose, Objectives and Outputs of the Project

The purpose of the project was to assist Lao PDR to implement its CBD obligations and BAP objectives by providing training in tropical botanical taxonomy to staff in key institutes and to establish the foundation for a National Species Database and Threatened Plant List. The project would train up to 30 Lao counterparts over 3 years through a programme of field and herbarium based work, using specimens collected in National Protected Areas (NPAs). It would include staff from the NPAs, FRC and lecturers and students from NUoL and would promote collaboration between national and provincial conservation and research agencies, by focussing the work on key NPAs such as Nakai Nam Theun. This NPA had been identified by the GoL as a target area for integrated research; one output would be a preliminary checklist. Other key outputs would include the foundation of a national species database and threatened plant list which would incorporate repatriated data from European herbaria as well as integrate data from previous projects. The threatened plant list would also assist the GoL in implementing its obligations under the international treaties and conventions that it has ratified e.g. CITES and specific CBD initiatives such as the Global Strategy for Plant Conservation.

Logframe: The most recent logframe for the project is included at the end of this report

2.2 Changes to Objectives and Operational Plans

In the first year of the project a modified Stage 2 schedule reflecting staff changes was submitted and approved by the Secretariat. The original Lao project leader was promoted and replaced by Mr Sounthone Ketphanh who also apppointed Mr Khamphone Sengdala as coordinator with Mr Banxa Thammavong as his assistant. In the UK, Dr Colin Pendry took up a permanent appointment at the RBGE and was replaced by Ms Kate Armstrong. The IUCN Lao PDR office was designated to provide financial accounting services for all transferred funds and to act as communication facilitator.

The operational plan was changed to include two additional visits to Lao PDR by the UK leader and coordinator and to reflect a delay from Year 1 to Year 2 of the visit to the UK by Lao staff. The funding for the UK visit was carried forward with the agreement of the Secretariat.

The first additional visit took place in July 2004, after the project received written approval from the Darwin Initiative. The purposes of the visit were to meet newly appointed staff at FRC, to refine the project's implementation timetable and to meet people involved in setting up the management of the Watershed Management Protection Authority (WMPA). This organisation, now responsible for the management of the watershed for the Nam Theun hydroelectric scheme, did not exist at the time of the Stage 2 application (See Section 7.1 for further details).

An additional visit also took place in the final year to allow for the final field and identification training to be brought forward to the start of the rainy season (May-June 2006) and the final workshops to be held in March 2007. Changing the timing of the field work allowed the project to undertake field work and training at different times of the year, increasing the number of species likely to be collected and widening the experience of the trainees. There were also similar modifications to the timetable in other years; these did not require approval from the Darwin Secretariat.

2.3 Contribution of the project to CBD and Biodiversity Strategy and Action Plan.

The project's activities concentrated on research and training (Article 12) aimed at the identification and monitoring of components of biodiversity (Article 7) to support in-situ conservation (Article 8). During the project, opportunities arose that allowed the project to contribute to ex-situ conservation (Article 9) and sustainable use (Article 10). The project also contributed to the Global Taxonomy Initiative and Global Strategy for Plant Conservation.

Lao PDR became a signatory to the CITES convention in 2004 with the IUCN Lao PDR office (a project partner) responsible for organising its implementation. Project staff were commissioned to review the current CITES listings for plant species known, or thought to be present in Lao PDR. A copy of this report is included as Appendix XIII. Staff continue to be involved as trainers for the IUCN's implementation plan.

During the project, the GoL produced its "National Biodiversity Strategy to 2020 and the Action Plan to 2010" (http://www.undplao.org/newsroom/publication.php). Its overall goal is to "*Maintain the country's diverse biodiversity as one key to poverty alleviation and protect the current asset base of the poor as support to the implementation of the government's priority program"*". It also includes seven objectives to be achieved through seven programs, each with a series of contributing actions. The activities of the Darwin project have made significant contributions to the objectives of three programmes:

Programme 1: Scientific Data and Biodiversity Knowledge Development, Objective 1, Identify important biological diversity components and improve the knowledge base - Actions 1,3,5-7,9-11. Objective 3, Ensure the provision of knowledge, information and understanding of the nation's biodiversity which is required for its effective utilisation, conservation and management - Actions 1,3,7.

Programme 2: Biodiversity Management, Objective 3, Conserve threatened and endangered species by enabling the species to survive in their natural habitats - Actions 1-3,9. Objective 4, Establish and maintain ex-situ research and conservation facilities - Actions 1,2.

Programme 3: Human Resource Development, Objective 1, Raise the awareness and capacity of government staff at all levels, Actions 1,2,4. Objective 2 Improve the research capacity of national experts in different fields related to biodiversity, Actions 1-5,7-9.

2.4 Success in Achieving Objectives

The project was successful in achieving the majority of its objectives and outputs. A "Checklist of the Vascular Plants of Lao PDR" (Appendix V) was published at the final workshop in March 2007 in Vientiane. It more than doubles the number of vascular plants known from Lao and the database that it is derived from forms a solid basis to which further information may be added. 750 copies were printed and are being distributed within Lao PDR and internationally. The project has also produced a list of species known to occur in and around Nakai Nam Theun NPA based on the collections made by the Darwin project and other projects that have been working in that area since 2004.

A "Glossary of Botanical Terms French-Lao-English" (Appendix VI) has been written to help Lao botanists who cannot read French to use their botanical literature. In this we gained significant extra value from the contribution of Dr Sovanmoly Hul, editor of the "Flore du Cambodge, du Laos et du Vietnam" at the Muséum National d'Histoire Naturelle, Paris. The core list of English and French terms has also been translated into Khmer and will be published in 2007 or 2008 as a joint publication between Madame Hul and staff at the Royal University of Phnom Penh, Cambodia. There may also be a Thai translation published

through the Bangkok Forestry Herbarium. These publications will acknowledge the contribution made by the Darwin Initiative.

A guide to the regional and national flora accounts that are useful for the identification of plants in Lao PDR was also published as an additional output (*Selected Resources for Plant Identification in Lao PDR* – Appendix VII). This guide is also relevant to other parts of the Indo-China area and has already been made available to botanists in Cambodia and Thailand.

Copies of the checklist and other project publications are included with this report and will also be available on the internet, initially through the RBGE and then through the IUCN Lao PDR website and NAFRI's website as they develop.

Twenty eight people have been trained in botanical identification. Several of them have made excellent progress and may go on to further formal training. In the final year of the project, a trainee (Mr Soulivanh Lanorsavanh) was awarded a Darwin Fellowship during which he worked at the RBGE and in the Bangkok Forestry Herbarium.

The project has been able to produce a preliminary list of 182 species based on existing information drawn from the IUCN Global Redlist, previous assessments of threatened tree species undertaken by the DANIDA funded Lao Tree Seed Project and assessments carried out by the Darwin project. Additional details are in Section 3.8.4

A number of scientific papers have been produced that describe the results of the field work and research. These are also included in the appendices for this report.

2.5 Objectives not met

Report for the GTI

The project did not produce a specific report for the Global Taxonomy Initiative. When the subject was discussed with the Lao project leaders it was decided that it would not be the best use of project staffs' time, given the extensive commitments of all project staff, especially our senior Lao colleagues. This was partly because the GoL has yet to nominate anyone to act as a focal point for the GTI but also because Mr Sounthone Ketphanh (project leader, FRC) and Mr Vichith Lamxay (botanical consultant, NUoL) are part of the Flora group that contributes to the Biodiversity Country Report and are better able to present the taxonomic needs through that forum.

Guides to Gingers and Conifers

The project had planned to produce identification guides for gingers and conifers. The ginger guide would have been a key to the genera of the family Zingiberaceae known to occur in Lao PDR while the conifer guide would have been a more comprehensive guide to all of the species known to occur, or likely to occur in Lao.

In the final year of the project, Vichith Lamxay, one of the NUoL consultants, started a PhD with Uppsala University and under the supervision of Dr Mark Newman. His PhD focuses on the systematics and ethnobotany of *Amomum* (Zingiberaceae). The guide to the genera will be part of that work.

A first draft (in English) of the conifer guide has been produced. During the course of the project, seven previously unrecorded species were collected; since the official end of the project, another, exceptionally rare species has been located in the Nakai area. We expect that two, perhaps three other species are present in Lao PDR and are seeking finance for additional field work to locate them. This research will be completed as part of Philip Thomas' continuing work for the International Conifer Conservation Programme at the RBGE on the conifers of SE Asia. Eventually it will be produced in bi-lingual pdf files and be available through Lao and RBGE websites. The work will be done in collaboration with FRC staff and will acknowledge the Darwin Initiative.

3. Training, Scientific and Technical Assessment

3.1 Training

Training in the identification of vascular plants was central to the project. It was delivered in the context of field work in Nakai Nam Theun NPA and in the laboratory and herbarium facilities at the Faculty of Science (FoS) in Vientiane.

The main aim was to teach trainees to identify angiosperms, gymnosperms and pteridophytes reliably using field characters, specimens, botanical keys and the taxonomic accounts in various floras. This was in marked contrast to the usual methods used in Lao. The most common and deeply ingrained method involves asking local people for the Lao name of the plant, and then referring to an out of date, incomplete and inaccurate list of scientific names with their Lao equivalent. The second method involves comparing photographs in non-Lao publications such as Trees of Northern Thailand, and finding the best match. This is not as common as the first method as there are few such books available in Lao. Occasionally the English language Flora of Thailand accounts are used although these include many species not known from Lao.

Training also included instruction in various collecting techniques suitable for fieldwork in Lao PDR, field data recording, the use of global positioning systems, processing and management of specimens and conservation assessments using IUCN 2001 categories and criteria.

Training was conducted in a mixture of Thai, Lao, English and occasionally French. Thai and Lao are closely related languages, while English is gradually becoming more widespread now that it is taught in most schools. French is rarely spoken, but the majority of the botanical literature relating to Lao plants is in French. In the UK team, the leader was fluent in Thai and French while the second botanical trainer was familiar with botanical French. On the Lao side, the two most senior staff (Dr Bouakhaykhone and Mr Sounthone Ketphanh) were fluent in French and English. The remaining Lao staff (Mr Vichith Lamxay, Mr Khamphone Sengdala and Mr Banxa Thammavong) spoke conversational English. The majority of trainees had limited spoken English although their comprehension of written English was generally more advanced. Several trainees showed significant improvement during the project.

3.2 Trainers and Project Staff

The three UK staff had previous experience of botanical training in Lao, Thailand and Vietnam and had undertaken field work in most other Asian countries. The project coordinator has been involved with two other successful Darwin projects in Vietnam and Chile.

The Lao team included four of the most senior and experienced botanists in Lao. Dr Bouakhaykhone, the ex-Dean of the Faculty of Science is the only person in Lao with a PhD qualification related to botany and the only botanist to have independently written a formal taxonomic account. Mr Vichith Lamxay, FoS senior lecturer, has an MSc in botany from Thailand and has undertaken field work in many parts of Lao. Mr Sounthone Ketphanh, vice director of the Forest Research Centre, has an MSc in botany from Vietnam. Khamphone Sengdala, head of the NTFP unit in FRC and the project's Lao coordinator, also coordinated the only previous Darwin Initiative project in Lao which reviewed the taxonomy and distribution of all the rattans known from Indo-China. Mr Banxa Thammavong was also involved in that project.

3.3 Trainees

Selection Criteria:

Trainees were mainly drawn from the staff of the Forest Research Centre, the staff and students in the Faculties of Science and Forestry, the Watershed Management Protection Authority (WMPA) in Khammouan and staff of the Department of Forestry.

Trainees based in Vientiane were selected by the Lao project leaders and the Lao coordinator on the basis of the relevance of the training to their current work while the trainees from the WMPA and NPA were designated by WMPA staff. UK staff provided guidance for trainee selection but the final decision was taken by the Lao staff each year.

FRC trainees were generally those involved in field survey work for non-timber forest products, especially rattans and bamboos. University trainees were either lecturers or recently qualified assistant lecturers in a range of biological disciplines. FRC, FoS and the Faculty of Forestry (FoF) all maintain separate herbaria and the staff involved in those herbaria were invited to attend the training. Originally it was also intended that 3rd and 4th year university students would also be involved but the timing of the training clashed with their general course work. However, some students did manage to attend, and two final year students also participated in second year's field work. In the second year, staff from the Medicinal Plants Institute and the Wildlife Conservation Society were invited for the second and third workshops. The maximum number of trainees for the Vientiane training was set at 25 for each session; field work was limited to a maximum of six. Physical fitness was an important consideration for field training. None of the trainees from the University had previous field experience in remote areas such as Nakai Nam Theun.

All trainees (and Lao trainers) were paid a per diem allowance to attend training in Vientiane and in the field. This is standard practice for externally funded projects in Lao and people are very reluctant to participate unless paid to do so. Salaries and wages are extremely low throughout Lao and many people have two or three 'jobs' to make up an income. In organisations such as the university, most staff are only paid for the hours that they teach and have no training time or research time officially allocated as part of their duties. Staff from both institutions also use short term consultancies and contracts from NGOs and other organisations to supplement their activities. These rarely include money or time for follow up work or the costs associated with mounting and managing specimens. This has reduced the incentive for actually collecting specimens in the first place, and then managing and maintaining them. Training opportunities are frequently offered to the most senior people first, or a rota system is used to ensure that as many people as possible have the opportunity to gain additional income and at least some training. In addition to this, the small national population size (< 6 million) and the relatively few people working in the government funded natural resources sector mean that there is only a small pool of trainees for all projects to draw upon. The senior Lao project staff were keenly aware of these limitations and did their best to ensure that as many people as possible attended the training as frequently as circumstances allowed. They gave the needs of the Darwin project priority over other projects whenever possible. Although only three trainees participated in all identification workshops and field visits, the majority attended at least two identification workshops and two field visits. Most trainees were highly motivated and interested in the training and in the project. This was particularly true with the people who took part in the field work.

Trainee Participation

The three identification workshops in Vientiane involved a total of 28 trainees. Ten took part in all workshops, 12 in two workshops and six in a single workshop.

The three field visits involved a total of 14 trainees; three trainees took part in all visits, four took part in two visits and the other seven in one visit. Thirteen of the field trainees participated in at least two of the subsequent identification training sessions in Vientiane. All trainees involved in the field work participated in the following identification workshop. Table 1 details the trainers and trainees involved in the project over the three years. Those marked in bold showed significant promise and improvement during the project.

In the first year, Ms Nynhom Chanthalagshy and Ms Phonevilay Sichanthongthip, two of the most outstanding trainees from FRC, received grants from SIDA to undertake MSc courses in the Philippines and took no further part in the training. Mr Bounkeut Sisoukhalath (WMPA) left the WMPA after participating in the first year's training. In the second year, Ms Viengkhorn Vannachak and Ms Vongdao Phothiluck, two final year FoS students, gained employment with another botanical project (BIOTIK) and a government department. Ms

Viengkhorn remained indirectly involved with the Darwin project through her work in the FoS herbarium and through her work on translating the user manual for the BRAHMS database. Mr Chanthalaphone Nanthavong (WMPA) was reassigned to anti-poaching patrols after he completed the first two year's training. Mr Singkone Saynhalat completed a pre-MSc course in Thailand during the period between the training visit in Year 3 (May-June 2006) and the final workshop in March 2007. Mr Soulivanh Lanorsavanh received a Darwin Fellowship in the final year of the project. Mr Vichith Lamxay started a PhD during the final year of the project.

Table 1: Trainers and Trainees involved in the project. Abbreviations PreTr = Pre training course delivered by Lao trainers in Year 1. F1 = Field Work Nakai Nam Theun. H = Identification workshop. F2 = field work in Houaphan. IUCN = Conservation Assessment Training. Trainees in bold showed significant progress over the three years.

Participant	**Organisation**	**Position/ Qualification level**	**Year 1**			**Year 2**			**Year 3**		
			PreTr	**F1**	**H**	**F1**	**F2**	**H**	**F1**	**H**	**IUCN**
Trainers											
Mr Sounthone Ketpanh	FRC	Deputy Director (MSc)	Y		Y		Y	Y		Y	Y
Khamphone Sengdala	FRC	Head of NTFP Unit (Post grad)	Y	Y	Y	Y		Y	Y	Y	Y
Dr Bouakaykhone	NUoL (Dean, FoS)	Consultant (PhD)	Y		Y			Y		Y	
Mr Vichit Lamxay	NUoL	Lecturer (MSc)	Y	Y	Y	Y		Y	Y	Y	
Trainees											
Mr Banxa Thammavong	FRC	Project Assistant (Post grad)	Y	Y	Y	Y	Y	Y		Y	Y
Mr Singkone Saynhalat	FRC	Researcher (Post grad)		Y	Y	Y	Y	Y	Y	Y	
Mr Souny Phomdouangsy	FRC	Researcher (Post grad)	Y			Y		Y			
Ms Phayvone Phonphanom	FRC	Researcher	Y		Y	Y		Y	Y	Y	
Ms Nynhom Chanthalagshy	FRC	Researcher (Post grad)	Y		Y			Y		Y	
Mr Khamtanth	FRC	Researcher (Post grad)						Y		Y	
Mr Outhong Vongsay	FRC	Researcher						Y			
Ms Phonevilay Sichanthongthip	FRC	Researcher (Post grad)		Y	Y						
Ms Somchanh Nanthavong	FRC	Researcher Silviculture (Post grad)						Y	Y	Y	
Mr Soulivanh Lanorsavanh	NUoL FoS	Teacher (Post grad)	Y	Y	Y	Y	Y	Y	Y	Y	
Ms Vongdao Phothiluck	NUoL FoS	Student (post grad after Y1)			Y	Y		Y			
Ms Viengkhorn Vannachak	NUoL FoS	Student (post grad after Y1)			Y	Y		Y			
Ms Thongluang	NUoL FoS	Teacher (Post grad)			Y			Y	Y	Y	
Ms Phoyphet Southavong	NUoL FoS	Teacher (Post grad)	Y		Y			Y		Y	
Ms Phetlasy Souladet	NUoL FoF	Teacher (Post grad)	Y	Y	Y	Y		Y	Y	Y	
Ms Khamphien Narvongsa	NUoL FoF	Student (degree - Y2)						Y			
Ms Pokmany Thammavong	NUoL FoF	Student (degree - Y2)						Y			
Mr Khamseng	NUoL FoF	Teacher (Post grad)						Y		Y	
Ms Bouly	NUoL FoF	Teacher (Post grad)			Y			Y		Y	

Participant	Organisation	Position/ Qualification level	Year 1			Year 2			Year 3		
Ms Montha Namsena	NUoL FoF	Lecturer (Post grad)	Y		Y			Y		Y	
Mr Bounkeut Sisoukhalath	NNT NPA	Researcher/ Ranger NNT NPA		Y	Y						
Mr Lakhon Sithammachak	NNT NPA	Researcher/ Ranger NNT NPA (post grad)				Y		Y	Y	Y	
Mr Chanthalaphone Nanthavong	NNT NPA	Researcher/ Ranger NNT NPA	Y		Y	Y	Y	Y			
Mr Onevilay Souliya	MP Inst.	Lecturer (post grad)						Y		Y	
Ms Somsanouk	WCS	researcher (post grad)						Y		Y	
Mr Sipaseut Insisienggmai	DoF Inventory	Forester (Post grad)	Y								
Mr Bounhouang Sengvilay	DoF Inventory	Forester (Post grad)	Y		Y			Y			

3.4 Training Content

Identification Workshops, Faculty of Science, Vientiane

A three day preparatory training course was organised and delivered by the Lao trainers in December 2004 before the first training visit by UK staff. Its aim was to assess potential trainees and to ensure that trainees would have the same minimum level of botanical knowledge. Fifteen people attended; ten of these were recommended. The course covered basic botanical terminology, flower and vegetative structures and demonstrations of techniques used for collecting specimens of groups such as bamboos and rattans.

Three identification workshops run jointly by the UK and Lao staff were held during the project, each following a period of field work and training in Nakai Nam Theun. They aimed to improve the trainees' ability to identify any vascular plant to family, genus and species wherever possible.

Family level identification was done using Thonner's analytical key to the families of flowering plants (in English). Each trainee received a copy of this work. Genus and species level identifications were done using originals and photocopies of the Flore générale de l'Indo-Chine (In French), the Flore du Cambodge, du Laos et du Viêt Nam (in French) and the Flora of Thailand (in English). These are the three key reference works relating to the flora of Lao PDR and the project supplied two complete sets. Identification involved initially working in English (Thonner's key), followed by French (Fl. Generale and FCLV) or English (Flora of Thailand) against a background of Lao and Thai explanations. Dissection techniques and the use of the keys in each of the reference works were constantly demonstrated by trainers. Students were supplied with their own dissecting kits and hand held magnifying glasses. A range of modern standard botanical texts were purchased by the project for the libraries at NUoL and NAFRI.

In the first year, specimens were chosen to represent a wide range of plant structures, e.g. simple vs. compound leaves, free sepals and petals vs. fused ones, superior vs. inferior ovaries, apocarpous vs. syncarpous ovaries. They included some of the most common families encountered in SE Asian forests (Lauraceae, Leguminosae, Rubiaceae) as well as more unusual families that are frequently mistaken for common families e.g. Connaraceae for Leguminosae. In the second and third year, trainees who participated in the field work were able to choose some of the collections that they had made themselves. Trainees from other institutions were encouraged to bring any specimens from their own work. This was particularly appreciated by staff from the Medicinal Plants Institute. FRC staff brought flowering and fruiting specimens from provenance trials of Eaglewood (*Aquilaria* spp.) in which one particular provenance was under-performing. After keying the specimens out with the appropriate French account, they realised that the plants they were growing were not *Aquilaria*, but from a species in the related genus *Gyrinops*. This genus does not produce the same quality of eaglewood and should not have been included in the trial. The results of this

identification were written up and published in NAFRI's NTFP newsletter (Appendix XIX).

Each student's work was closely supervised by the trainers and problems were dealt with at either an individual or group level. For the majority of the training, the ratio of trainers to trainees was 1:3. Generally, the last hour of each day was devoted to group discussion about the specimens used during the day. This served to fix in the trainees' minds the main characters of the families treated. All students were required to keep detailed notes about each of the specimens examined and the families represented. As the project progressed, the best students (Mr Singkone Saynhalat – FRC, Ms Phetlasy Souladet – FoF and Mr Soulivanh Lanorsavanh – FoS) took a more proactive role in the training by supervising trainees less proficient than themselves, by leading the explanations of the identifications of particular specimens or by supervising herbarium work.

By the start of the second identification workshop (November 2005), the project had produced drafts of a tri-lingual glossary of botanical terms and a resource guide to the various treatments of families within the relevant regional and national floras. Copies of these were provided for all trainees. Nine power-point presentations were also prepared for the second workshop focussing on key characters of the main genera in the most important families collected during the field work. Copies of these were also given to trainees.

Identification workshops included training in herbarium and specimen management. Each day, small groups of trainees spent up to two hours in the herbarium learning how to manage the specimens that had been collected. As new determinations were made, the specimens were located, given a new determination label, and shelved in the new location. Trainees were also given an opportunity to use the PADME database. Over the course of the project, all specimens due to be deposited in the three Lao herbaria were mounted and laid away.

Two afternoons of the second identification training workshop were devoted to GPS training. The aim of this was to ensure that all trainees could use a GPS for recording point locations for field work. Basic use was demonstrated for trainees who had not participated in the field work. In the simplest exercise trainees were divided into groups of four, with each group required to record a series of waypoints to create a route. They then exchanged GPSs and tried to follow the other group's route.

During the final identification workshop (June 2006) small groups of trainees were taken to NAFRI where networked computers were used to show them the resources available to botanists on the internet. Some of these include on-line multi-access keys to the plant families. These are not yet a practical alternative in Lao PDR since internet access is slow and patchy but the trainees were impressed with what they saw and know that it is there to be used when internet access improves. A list of the appropriate internet sites was included in the Resource Pointer. Mr Soulivanh gained additional experience on using internet based resources during his Darwin Fellowship at the RBGE in the final year of the project.

The herbarium was radically curated during the final training visit so that all specimens could in a systematic way. Previous work with specimens in the herbarium at NUoL focussed on collections made by the project rather than on existing specimens. Species covers and genus covers were bought and training was given in how to label them. Many unlabelled and insect-damaged collections from earlier projects were discarded since they had no use. At the end, the gymnosperms and angiosperms were neatly arranged in alphabetical order by family, then by genus. This is the simplest and most convenient method for a small herbarium. The FRC herbarium was also re-curated in the same way by one of the trainees (Ms Phayvone Phonphanom) during the period between the training visit in Year 3 and the final workshop in March 2007

Training Content: IUCN Categories and Criteria Training

During the final year's identification workshop, a short workshop on the use of IUCN categories and criteria was also held. Four people were involved – the UK coordinator (a member of the IUCN Conifer Specialist Group), Sounthone Ketphanh, Khamphone Sengdala and Banxa Thammavong. The Lao staff are recognised experts on rattans, the only group of plants that has sufficient information available for the use of the IUCN system to be practical and demonstrable. A translation of the standard Redlist questionnaire and a summary of the

IUCN 2001 categories and criteria were prepared by the UK coordinator and Sounthone Ketphanh over a period of two weekends. The group used these to evaluate all rattan species and several important NTFP species that FRC staff were familiar with. Further details of this work are in Section 3.8.4.

Training Content: Field Training

Field training was combined with field work to produce, or contribute to outputs such as the NPA checklist and the National checklist and to provide material for the follow-on identification workshops. In this context, the training was 'real' – trainee's fieldwork contributed directly to the outputs of the project. The trainers aimed to ensure that trainees could collect the most appropriate material for a particular type of plant using the most appropriate equipment, record the necessary information in a systematic way and manage the collections to ensure that they could be made into useful herbarium specimens. Only flowering and fruiting specimens were collected. The trainers also aimed to ensure that trainees could at least recognise the major families.

The majority of the field work was carried out around the village of Ban Mac Pheuang in the NPA. Each year the field team consisted of up to 16 people; three UK and three Lao staff, six trainees from FRC and NUoL, two WMPA staff/trainees and various local people. Visits took place at the start of the wet season and at the start, and midway, through the dry season. During each visit a range of vegetation types was included in the field work and collections were made in sets of six. Visits lasted up to three weeks including travel time. All specimens were preserved in alcohol and dried at the university after the team returned.

In the first year, the trainers organised a rota system to ensure that all trainees undertook the full range of activities. Collecting work was halted periodically to allow trainers to demonstrate key identification characters or special techniques associated with collecting plants such as palms. All trainees were required to maintain their own field book (in Lao or in English) in addition to the main field book. These were also used in the identification workshops. In the last two days of the field work the trainees were responsible for the organisation of the field work, the collection of specimens and their processing.

In the second year, the field work and training followed a similar pattern to that of the first and in the same general area. It differed in that a small group visited the remote mountain of Phou Vang on a reconnaissance mission and to make collections at a higher altitude and in different forest types. In the third year, the field team accompanied one of the WMPA's patrols to the top of an escarpment in the most southern part of the NPA to investigate reports of an unusual conifer forest and to increase the project's coverage of the NPA. Again, the team split, with one of the UK staff accompanied by a senior trainee with the main patrol.

Additional field work was undertaken in Houaphan in the second year and in Bolikhamxai during the third. These only involved one or two staff and trainees and were organised on an adhoc basis. That work was intended to supplement the collections for the work on gingers and conifers. In Houaphan the team targeted an area close to the Vietnam border – Mr Banxa Thammavong collected a conifer species not previously recorded from Lao - *Amentotaxus yunnanensis*. This visit had the additional benefit of allowing the Lao project leader to make contact with provincial organisations and investigate NTFP trade related to bamboos. FRC had not previously had any contacts in this province.

3.5 Training Assessment and Accreditation

Field work assessment

As the field training was incorporated into the field work, trainees were assessed on a continuous basis. Once techniques or tasks had been demonstrated, trainees were encouraged to work in small groups and carry them out. Trainers rotated between groups to supervise and advise on activities. Collections were brought to a central point for processing and recording. The number of collections increased during each field visit, one indication that trainees were gaining in confidence and proficiency. Trainers ensured that trainees undertook the full range of tasks by organising a rota and to ensure that more junior, female or physically less able trainees were not left with the more mundane work of cutting specimens to size, numbering each specimen with a jeweller's tag or maintaining the field

book.

Two field examinations were organised during the second and third visits in which all trainees were required to collect, prepare and number five different collections each, record localities with GPS, record appropriate descriptions and identify them as far as possible. The areas chosen for these exercises had been visited by the trainers, along with some trainees the previous day. All trainees completed the exercises successfully.

During the second year, the visit to Phou Yang was also used as an exercise in expedition management. The expedition was organised, and led, by the Project Assistant (Banxa Thammavong) and one of the WMPA staff (Chanthalaphone) with the assistance of two trainees - Singkone (FRC) and Soulivanh (FoS). One UK trainer accompanied them. It involved negotiating with several local villages to gain access, arrange guides and soldiers and procure food. It was particularly useful for trainees as they were representing their organisations the first time in the field on their own, without their Lao seniors. The expedition was judged to be a success in that the team was well received by the local people, invited to return the following year and, although the total number of collections was low, they included five new records and one new species. A financial account was produced and an evaluation of the individual trainees was given to the other trainers.

Identification Assessment

Trainees' progress was monitored closely by the trainers in each of the identification workshops. Each day included a one hour review session which allowed problems to be highlighted and discussed. Time was also allocated at the end of the first workshop for the trainees to present overall feedback. In the second year, this was done halfway through the training so that their comments could be incorporated during the workshop. In the first and second year, a test was held as a more formal way of monitoring progress. In Year 1, the test simply consisted of asking the students to identify an unnamed specimen. In Year 2, the test was more broadly based and covered other subjects such as the use of GPSs, information recording and general characteristics of families. The exam was translated into Lao and marked by the Lao trainers. In the third year, the trainees were supervised in the same way as in the previous two years. No formal exam was held because we decided to use the limited time available to try to re-curate the main herbarium as far as possible. This work was used as training and included set exercises that all trainees had to complete in preparing and laying away specimens.

Accreditation

The project team decided against attempting to gain any formal accreditation for the training from any of the partner institutions. The amount of time that would have been involved in formalising and validating it would have compromised other important activities and outputs. The majority of the trainees were already employed at relatively senior levels within their institutions so that, in the opinion of the Lao and UK trainers, an accreditation would not have made a difference to their employment prospects. If the majority of trainees had been students, then a different view would have been taken. The university has changed parts of the field work component for its final year biology students to so that it takes advantage of the training developed during the project. Over the last two years the RBGE has been developing a properly accredited and validated field botany course that draws on much of the work in Lao and should be applicable in any country, whatever the skills, language or knowledge of the trainees: the course also includes training for trainers. It is likely to gain formal accreditation either in 2007 or 2008.

3.6 Research and Technical Assessment

The project's research and technical work are best described by detailing the main outputs: the national checklist and database, the list of species for Nakai, the scientific papers, the threatened plants list, the CITES review and the herbarium development.

National Species Checklist and Database

During the final visit by the UK leader and coordinator, the project published 750 copies of the first National Checklist of the Vascular Plants of Lao PDR. The aim of this list was to

provide the most comprehensive and accurate list of the scientific names for all of the vascular plants currently known to occur in Lao as was possible within the period of the project. It was intended to be a foundation that could be built upon. Ideally, all records would be based on specimens, rather than unverifiable field reports or other types of grey literature. Each name would be spelled correctly, be classified into its correct family and have the correct authority. The most important synonyms would also be included. Wherever possible, information about the distribution of a species in Lao would be recorded.

The final checklist included 4,850 species of native, introduced, cultivated and naturalized vascular plants. Of these, 3,688 are supported by at least one specimen record in the database – records for the remaining species are based on the literature sources described below.

A range of information sources was used to compile the list. Priority was given to recent records that could be supported by specimens lodged in international herbaria. These came from three main sources. First, collections made by the Darwin team and the few other botanical projects that have worked in Lao over the last 10 years: almost all of these have specific locality information recorded. Secondly, specimens cited in the taxonomic accounts of the FCLV were included. The third source was specimen records downloaded from the herbaria in Paris and Leiden. These only represent specimens that have been databased; many more species could be added to the checklist as work in those herbaria progresses. The majority of these specimens were collected by French collectors before 1940 and their collecting localities were usually only given to province level. These sources were supplemented by information derived from recent taxonomic accounts of new species or revisions of families and genera published in botanical journals.

Compiling the database emphasised how little is actually known about the flora of Lao and how much work remains to be done before even the most basic information relating to the composition of the flora and the distribution of individual species can be determined. For example, the north eastern provinces of Bokeo, Oudomxai and Luang Namtha had a total of 67 species recorded. In Khammouan more than 75% of the records came from the Darwin and BIOTIK project's work. This lack of distribution information presented a major problem for the compilation of the threatened species list.

Very little information came from herbaria in Lao as specimens deposited in the FoS herbarium generally lacked labels, were severely insect damaged or the identifications were unreliable while those at FRC were mainly duplicates of collections held in European herbaria. Due to lack of time, information from the two other herbaria in Vientiane (Faculty of Forestry and Medicinal Plants Institute) was not included in the database. Neither of these organisations were partners in the project although their staff participated as trainees. Their specimens represent additional information that could be added in the future, either through a new project or when there is sufficient and reliable IT infrastructure to support a networked system.

In addition to the specimen based records, a range of electronic and printed literature sources were used. The first was an electronic version of Latin names contained in Callaghan's "Checklist of Lao Plant Names" (Callaghan 2004) and generously donated by the compiler. This checklist was derived from early French works, unpublished field surveys and rapid assessments by NGOs. It also included Lao local names that the author had recorded. Published and unpublished accounts for the Flora of Thailand and the Flora of China were also consulted and taxa noted to occur in Lao PDR included. Published and draft accounts in the World Checklist Series (www.kew.org/wcsp/home.do) were also used. These records are not directly supported by specimens and are therefore not as reliable.

The database was compiled in the UK, using RBGE's in-house, Access based system - "PADME". In the third year, one of the FoS trainees, Mr Soulivanh spent three months at the RBGE as part of his Darwin Fellowship. During this time, he worked on the PADME system so that he understood the origin and the type of information that would be transferred to Lao.

A second system (BRAHMS) was installed at the University. There were several reasons for doing this. First, BRAHMS is used in many SE Asian and European herbaria making regional and international networking and information exchange easier. Secondly, the main

botanist in the BIOTIK project (Dr Paul Kessler), an experienced user, installer and trainer, was from Leiden, one of the two developmental centres for that database. Additionally, Mr Khamseng Nanthavong, a senior lecturer in the Faculty of Forestry, did his MSc with Dr Kessler and had some experience as a BRAHMS user. The installation of the database and the training for users was delegated to the BIOTIK project. Training workshops were held and Ms Viengkhorn undertook a translation of the user manual from English to Lao.

The transfer of information from PADME to BRAHMS was delayed as an opportunity came up for Mr Soulivanh to attend an additional BRAHMS training course organised by the Bangkok Forestry Herbarium and run by Dr Denis Filer, the original developer of BRAHMS. During the workshop, the data from the PADME system was imported to the BRAHMS system, so the National Checklist is now held at the Faculty of Science at NUoL. Three Lao staff can enter new information for specimens and names and will be able to produce updated lists in the future. The BRAHMS system can also handle Lao script, so that Lao common names can be included as they are matched to the correct Latin name through the identification of the appropriate specimen. RBGE will continue to maintain its own copy in case of problems at the University.

The List of Plants of the Nakai Nam Theun area

Nakai Nam Theun in the Central Annamites is the largest and one of the most important NPAs in Lao PDR. It has been described as of global importance due to its rich fauna and the large extent of relatively intact forest. It also forms the watershed for the Nam Theun hydroelectric scheme that is a key part of Lao PDR's future economic development. It is a priority area for research for the GoL although very little botanical research has actually been undertaken in this area. None of the main early French collectors worked in the area and since 1990, research has either focussed on animals or the NTFPs used by local people. The adjoining areas of Vietnam are also poorly known.

The field work carried out by the Darwin project represented the first major botanical work in the Nakai area. The team spent a total of 37 days in the field in six main areas. Maps of the area are included in the general report produced for the WMPA that also accompanies this report (Appendix XV). The Darwin team made 1532 collections, each consisting of up to 8 herbarium sheets. These were divided with the top set deposited at Faculty of Science, the second, third and fourth sets deposited at Edinburgh, Leiden and Paris herbaria respectively and the last two sets deposited at FRC and the Faculty of Forestry at NUoL

Only flowering or fruiting specimens were collected with the exception of some conifers. In most cases each species was only deliberately collected once. Field work took place at the start, the middle and the end of the dry season with no collections made during the wet season. Some localities were only visited once and as a result, the full range of species in a given habitat, vegetation type or locality was not sampled and in some cases, common or relatively well known species were not collected.

The specimens were used in the identification training courses held at NUoL and trainees identified more than 100 species. RBGE scientists have continued to work on the identification of collections following their return to the UK and have been assisted by a number of specialists from other European institutes. Lao staff have also been working on the specimens, especially the 175 orchid collections. The majority of these were collected as living material for cultivation at the orchid nursery at NUoL. To date, 614 species have been identified. Information relating to collections from the BIOTIK project and Uppsala University researchers were combined with the Darwin collections to produce a checklist for the Nakai area (Appendix XIV).

The Nakai checklist is divided into three parts. The first is an alphabetical list of the collections made by the Darwin project that have also been identified with their local name. The local name was recorded at the time of collection, either in Lao, or occasionally in English. The majority of the names were supplied by Vichith Lamxay (NUoL) and the list was compiled by Soulivanh Lanorsavanh (NUoL). This list probably represents the most accurate list of common and scientific names currently available.

In the second part of the list, all collections (Darwin and those available from BIOTIK and

Uppsala) are divided into spore-bearing plants, gymnosperms and angiosperms, then listed by family, by genus and then by species. The final section lists all genera and species alphabetically. All of the information for this list is contained in the National Species Database. Electronic copies of the records from the Darwin project have also been given to the WMPA – the records from the other projects are due to be lodged with the WMPA as they finish. The checklist is included with this report along with a copy of the general report on the project's activities in the Nakai area.

Scientific papers

Identifications based on Darwin specimens collected in the Nakai area produced new national records for 169 species. Twenty two of these came from identifications done by trainees during the identification workshops. Two jointly written scientific papers have been published or are in press (Appendix VIII & IX). Three new species have already been described and published in the Edinburgh Journal of Botany (Appendix X, XI & XII) and a fourth is in the process of being described. Dr Sovanmoly Hul, editor of the "Flore du Cambodge, du Laos et du Viêt Nam" at the Muséum national d'Histoire naturelle, Paris, described *Gentiana khammouanensis* based on material collected during the final field visit. She had only recently revised the Gentianaceae for that flora. Dr Mark Hughes, an RBGE *Begonia* specialist currently revising all SE Asian members of the genus, described *Begonia cladotricha* from material collected in the limestone areas on the way to Nakai. Dr David Middleton, an RBGE specialist in Gesneriaceae described a new species of *Aeschynanthus* (*Aeschynanthus mendumae*) that was originally collected during the training visit to Phou Yang in 2005. The fourth species is an unusual succulent *Impatiens* that was first noticed in the nursery at NUoL and seen again in a roadside market near Nakai and on the surrounding limestone cliffs. An interesting feature of these collections is that one was found near the top of a very remote mountain, another was noticed in the grass where a tent was about to be pitched while the other two were growing by a busy roadside. This highlights how little is known about the flora of Lao.

These new species were described by specialists who were familiar with other Indo-Chinese species from that genus, had access to type specimens and the literature for similar species and were therefore able to produce and publish new descriptions very quickly. Lao botanists were not directly involved in these particular descriptions but were involved in the other scientific papers as well as the reports for the WMPA. There are another 16 collections that may also represent new taxa and some of these are likely to be published jointly. Copies of all scientific papers are included with this report.

Threatened Species List

The goal of Programme 2 of the GoL's Biodiversity Strategy and Action Plan (BSAP) is to "*Improve biodiversity management and monitoring*" The third objective of this programme is to "*Conserve threatened and endangered species by enabling the species to survive in their natural habitats*". Actions that contribute to this include re-surveying and reclassifying threatened and endangered species, compiling a national Red List of declining wildlife species, and adopting the international classification for vulnerable and endangered species. These objectives and actions form part of the GoL's response to targets within CBD initiatives such as the Global Strategy for Plant Conservation (GSPC).

This part of the BSAP faces a number of problems. The IUCN categories and criteria rely on quantitative data to assess distribution, rates of decline and population sizes. In Lao, this type of information is extremely limited even for large mammals, making the IUCN system impractical for most species. There is also a lot of uncertainty about the identification of the species thought to be threatened due to the over reliance on common names that vary from district to district and province to province. For plants, the lack of an up to date, verifiable checklist and the poor state of the herbariums that should serve as reference points for identification is an additional problem. Another problem is that very few people have any experience of the IUCN system and no organisation had attempted to translate even the basic categories and criteria, let alone the complex guidelines.

An alternative system for assessing mammals was proposed at a regional workshop organised by the IUCN in 1999. It used categories such as At Risk in Laos, Potentially at

Risk in Laos, Little Known in Laos, Not at Risk in Laos and Conditionally at Risk in Laos. Since then, little progress has been made in developing that system.

In 2002, the DANIDA funded Lao Tree Seed Project (LTSP) produced a list of 110 tree species that they had assessed based on field work, expert opinion and a mixture of quantitative and qualitative criteria that broadly reflected the now outdated IUCN 1994 categories and criteria. The specimens collected for this work were lodged in various Lao herbaria but not mounted, labelled or maintained and therefore deteriorated very quickly. Without the voucher specimens, the records lost a significant part of their value. LTSP's work represents the only attempt at assessing threatened plant species before the current Darwin project.

It was impractical for the Darwin project to gather sufficient information during the period of the project to assess many species with the IUCN system. The best that could be done was to produce a list of 182 species (Appendix XVII) based on information from three sources: the IUCN Global Redlist (57 species), the LTSP list (110 species) and the assessments carried out by the Darwin project (44 species). There is some uncertainty about the status of some of the species on the list due to the variation in the methods used to assess them. In the case of the Global Redlist assessments, these reflect the conservation status of a species over its total range, not necessarily its status in any single country. For those species thought to occur in Lao, all of the information comes from surrounding countries or is based on generalised measures such as average rates regional deforestation. Most of these assessments use the outdated 1994 categories and criteria that the LTSP assessments tried to mirror.

The project produced and used translated summaries of the IUCN 2001 categories and criteria and the standard Redlist Questionnaires (Appendix XVIII). Thirty two indigenous rattan species were assessed along with a few species that are important non-timber forest products and the new species that the project discovered. Although there was more information about the identification and distribution of the rattans and the NTFPs, it was generally insufficient for anything more than a preliminary assessment to be made in most cases. For the rattans, five were assessed as potentially critically endangered, three as potentially endangered, as endangered and one as potentially vulnerable. Three may be Near Threatened with the remaining 16 assessed as Least Concern. These results were presented by Banxa Thammavong at a conference on the sustainable development of rattans held in the Philippines and organised by the International Tropical Timber Organisation in June 2006. He was the only delegate able to present even such preliminary assessments.

The general threatened list was compared with the checklist for the Nakai area; the results were included in the general report to the WMPA and discussed at a short seminar given by the project in Nakai in March 2007. The WMPA technical advisors were particularly interested in one of the rattans, *Calamus kingianus*. This had been assessed as Endangered as it is currently only known from the Nakai plateau where its main populations are likely to be threatened by the flooding associated with the hydro-electric development. The WMPA requested a more detailed assessment which was compiled by Darwin project coordinators and is included with this report. The Nam Theun Power Company has a legal obligation to ensure the protection of threatened species and have initiated conservation programmes once sufficient information has been provided to them. The report was submitted to Dr Klaus Schonfeld, the power company's Environmental Protection Unit manager who has requested a plan of action. At the very least this should involve additional surveys by FRC staff to establish its proper distribution on the plateau with the possibility of a more comprehensive programme of translocation and ex-situ conservation to follow if necessary (See Appendix XVI).

A second rattan assessment has had a completely different impact. *Calamus wailong* was assessed by the China Plant Specialist Group as Critically Endangered based on its restricted distribution in SE Yunnan. Information from Lao PDR was not used in this assessment. This species is widespread in Lao, including the Nakai area, and was assessed as nationally Least Concern. The new assessment was forwarded to the IUCN Redlist office

and as a consequence, it will be downgraded to Least Concern. It will probably remain Critically Endangered at the national level in China.

Most of the assessments have been forwarded to the IUCN's Global Redlisting Programme; some may eventually make it on to the Global Redlist (www.redlist.org). Those that represent national assessments will be kept on file or passed to the relevant Species Specialist Group. The translations are with the IUCN Lao PDR, ready to be used in any follow up work.

Developing the threatened species list to meet the targets of the GSPC and the goals of the GoL's own BSAP will require a project in its own right backed up by a considerable amount of additional fieldwork throughout the country. The project partners have expressed interest in developing this idea in collaboration with other Lao institutions. The National Checklist should provide a good foundation for this work.

CITES review

The GoL signed the CITES convention in 2004 and its implementation is being facilitated by the IUCN Lao PDR country office. One of their first requirements was an up to date list of the CITES listed species that occur within Lao; the Darwin project was commissioned to undertake this work in 2005. It was essentially a desk based study reviewing the records on the CITES Species Database maintained by the World Conservation Monitoring Centre (WCMC) and comparing them with information generated by the Darwin project. The review aimed to assess the accuracy of the names and distributions for each species listed, to compare that list with those from surrounding countries to establish which species, if any, should also be listed for Lao PDR and thirdly, to identify particular species that are currently being traded.

The review was completed by May 2006. As expected, it highlighted the lack of information about the Lao flora, especially for key groups such as orchids, cycads and tree ferns, and the consequent difficulties in establishing which of the CITES listed species were present in Lao. The project did produce a more up to date version with several new additions and a preliminary checklist of more than 400 orchid species. It also pointed out several species that could be candidates for CITES listing.

The report is currently being formatted to conform to new IUCN guidelines for its publications; once this has been done it will be sent to the WCMC so that the CITES Species Database can be updated (Appendix XIII). Madame Bouakhaykhone has also produced a number of presentations in Lao on the identification of orchids that are being used to train CITES officers. These are part of the ORCHISASIA project (see Section 7.1). The project was paid $3662 for the review on the proviso (insisted on by the UK team) that the money would be used to support additional activities in Lao PDR i.e. all money would be spent in Lao. The majority of the work for the review was done by the UK coordinator, Dr Bouakhaykhone and Sounthone Ketphanh. Lao staff are still involved with this work.

Herbarium Development

An important secondary aim of the project was to improve the herbarium management skills of the trainees, especially those directly involved with the herbaria at the Faculty of Science (FoS) and the Forest Research Centre (FRC). This was done through the training involved in the identification workshops. The project team recognised that improved management skills needed to be supported and complemented by improved facilities.

The project had a limited direct impact on this as there is a restriction on Darwin grants that limits capital expenditure to 10% of the grant. The majority of the project's capital budget was spent on buying computers and printers for each of the partners, reference books to support the identification and teaching work, field equipment such as GPSs and consumables such as the paper required for mounting specimens. BIOTIK also had a limited budget for herbarium development and staff salaries at FoS. Both projects collaborated to ensure best value for money and maximum impact. The Darwin team also helped the FoS staff apply to the Lao Environment and Social Project (LEnS) Environmental Protection Fund (http://www.laoepf.org.la/) that was set up by the World Bank to support biodiversity work in Lao. FoS received a grant of $6.8k for sealing the windows, installing air conditioning and

insect proofing the main herbarium.

Herbarium maintenance will be a continuing problem in Lao PDR as organisations such as the University and FRC struggle to provide a recurring budget and their staff are committed to a wide range of projects. After the training on herbarium management in May 2006, the FRC management changed the job description of Ms Phayvone Phonphanom to include the herbarium as one of her core activities with three days per week protected time. In recognition of the change in priorities by FRC, the project team agreed to use money from the IUCN contract to repair roof leaks and build a small extension to the FRC herbarium. This work is currently under way. In the future, the Lao staff will include herbarium maintenance costs as part of their budgets in new projects.

Other Research

In the second year of the project, two applications for Darwin Fellowships were prepared. The first was for Mr Singkone Saynhalat from FRC. This would have involved research at RBGE and in Thailand on 'bong' trees, members of the family Lauraceae that produce valuable non timber forest products and are very difficult to identify. One week before the application was to be submitted, Lao staff notified RBGE that Mr Singkone had been offered a place on a foundation course for an MSc degree in Thailand and consequently, the application was not submitted.

The second application was for Mr Soulivanh Lanorsavanh from FoS: that application was successful. His Fellowship focussed on particular species within two genera of the Menispermaceae that are over-exploited for their stems and roots. These contain berberine that is used to produce an important local and commercial medicine. One has high concentrations, the other much lower. As they have very similar roots and stems, the wrong species is often collected. Soulivanh produced an identification guide and a revision of the two genera for the Flore du Cambodge, du Laos et du Viêt Nam. His work is included as Appendices XX and XXI. These have not been counted as part of this project's outputs.

4. Project Impacts

The purpose of the project was to assist Lao PDR to implement its CBD obligations and BSAP objectives by providing training in tropical botanical taxonomy to staff in key institutes and to establish the foundation for a National Species Database and Threatened Plant List. Staff at NUoL (Lao's only University) and the Forest Research Centre have received training, the first National Species Checklist has been published and progress has been made towards a threatened plant list.

Within the three years of the project, the number of vascular plant species documented from Lao PDR has more than doubled. The work that produced the National Checklist also led to the first checklist for Lao's most important protected area. Several completely new species have been described with more to follow in the next few years. Two important multi-lingual publications have been produced that should aid Lao botanists for the foreseeable future. CITES lists have been updated and improved and identification guides and training materials produced for orchids, one of the most frequently traded and exploited groups. The conservation assessments for all known rattan species mean that Lao PDR is the first country in the region to do so.

Two of the four main herbaria have been renovated and improved and their staff trained in modern methods. More than 1500 specimens have been made available to international researchers by distribution to international herbaria. Several Lao staff had the opportunity to travel internationally and make contact with a range of researchers in institutions from Thailand to the UK. Twenty eight trainees participated in the project; almost all of these are now in a better position to participate in the range of botanically based projects that are developing. Further details are provided in Section 7.1.

All of these achievements indicate that the project has achieved its purpose and improved local capacity for biodiversity work. Details of the contribution made by each component to the relevant articles of the CBD are included in Appendix 1. Details of the current position for the trainers and the trainees are included in Table 2 below. Trainee's names that are marked in bold showed significant promise and improvement during the project.

4.1 Collaboration between RBGE, Forest Research Centre, IUCN Lao PDR and NUoL

This project was developed from existing links between RBGE, the IUCN Lao PDR office and the Forest Research Centre. A five year MoU had been negotiated as part of an earlier training project but was due to expire in the second year of the Darwin project. This was renewed in 2004 and runs until 2010. The university was a new partner although both Dr Bouakhaykhone and Mr Vichith Lamxay were known to the UK leader through their common interest in the Flore du Cambodge, du Laos et du Viêt Nam. Senior staff in FRC had very close relations with NUoL staff; Sounthone Ketphanh and Vichith Lamxay were both senior members of the flora group responsible for that section of the Biodiversity Country Reports and had collaborated on numerous projects involving NTFPs while Mr Khamphone Sengdala has supervised the final theses of a number of Faculty of Science students.

The project has provided a good opportunity for all partners to strengthen their links with each other. The most senior Lao staff had the opportunity to visit the UK for the first time and meet senior management at RBGE. All partners were able to collaborate on the CITES review, the conservation assessments and other associated work. Good relations between partners ensured that the Darwin project could collaborate rather than compete with other botanical projects such as BIOTIK and ORCHISASIA. The project also acted as a catalyst for establishing good working relations with the Watershed Management Protection Authority. Outputs such as the National Checklist, the NPA checklist and the conservation assessments helped to reinforce the position of FRC and NUoL as centres for biodiversity research and expertise.

4.2 Impacts on Local Communities

The Darwin project has had an indirect positive impact on local communities through its work on species used for NTFPs. Examples include the re-identification of different provenances of Eaglewood which should lead to more productive plantations in the future and the work done through the Darwin Fellowship on members of the Menispermaceae (see Section 3.8.7).

Table 2: Darwin project Lao Trainers and Trainees: current position

Participant	Organisation	Position/ Qualification level	Current Status
Trainers			
Mr Sounthone Ketpanh	FRC	Deputy Director (MSc)	Acting Director FRC
Khamphone Sengdala	FRC	Head of NTFP Unit (Post grad)	Secretary to the Minister of Forests
Dr Bouakaykhone	NUoL (Dean, FoS)	Consultant (PhD)	Project leader ORCHISASIA, BIOTIK CITES consultant
Mr Vichit Lamxay	NUoL	Lecturer (MSc)	PhD candidate (Uppsala)
Trainees			
Mr Banxa Thammavong	**FRC**	**Project Assistant (Post grad)**	**Head of ITTO rattan Project candidate for Head of NTFP unit**
Mr Singkone Saynhalat	**FRC**	**Researcher (Post grad)**	**MSc candidate**
Mr Souny Phomdouangsy	FRC	Researcher (Post grad)	Head of WWF rattan sustainable use and harvesting project
Ms Phayvone Phonphanom	**FRC**	**Researcher**	**Researcher/ Herbarium technician - FRC**
Ms Nynhom Chanthalagshy	FRC	Researcher (Post grad)	MSc in Philippines
Mr Khamtanth	FRC	Researcher (Post grad)	Head of Administraion (FRC)
Mr Outhong Vongsay	FRC	Researcher	Technician in Tree Seed Unit (FRC)
Ms Phonevilay Sichanthongthip	FRC	Researcher (Post grad)	MSc in Philippines
Ms Somchanh Nanthavong	FRC	Researcher Silviculture (Post grad)	Same

Mr Soulivanh Lanorsavanh	**NUoL FoS**	**Teacher (Post grad)**	**Teacher (Herbarium manager NUoL FoS)**
Ms Vongdao Phothiluck	NUoL FoS	Student (post grad after Y1)	Technician in Division of Agriculture and Forestry (Xaignabouri Province)
Ms Viengkhorn Vannachak	**NUoL FoS**	**Student (post grad after Y1)**	**Teacher (NUoL), Project Assistant BIOTIK, ORCHISASIA**
Ms Thongluang	**NUoL FoS**	**Teacher (Post grad)**	**Same**
Ms Phoyphet Southavong	NUoL FoS	Teacher (Post grad)	Same
Ms Phetlasy Souladet	**NUoL FoF**	**Teacher (Post grad)**	**Teacher (Herbarium manager NUoL FoF). Studying for MSc**
Ms Khamphien Narvongsa	NUoL FoF	Student (degree - Y2)	Student (FoF) Final year
Ms Pokmany Thammavong	NUoL FoF	Student (degree - Y2)	Student (FoF) Final year
Mr Khamseng	NUoL FoF	Teacher (Post grad)	Same
Ms Bouly	NUoL FoF	Teacher (Post grad)	Same
Ms Montha Namsena	NUoL FoF	Lecturer (Post grad)	Same
Mr Bounkeut Sisoukhalath	NNT NPA	Researcher/ Ranger NNT NPA	Same
Mr Lakhon Sithammachak	**NNT NPA**	**Researcher/ Ranger NNT NPA (post grad)**	**Same**
Mr Chanthalaphone Nanthavong	**NNT NPA**	**Researcher/ Ranger NNT NPA**	**Same**
Mr Onevilay Souliya	**MP Inst.**	**Lecturer (post grad)**	**Same**
Ms Somsanouk	**WCS**	**researcher (post grad)**	**Same**
Mr Sipaseut Insisienggmai	DoF Inventory	Forester (Post grad)	Same
Mr Bounhouang Sengvilay	DoF Inventory	Forester (Post grad)	Same

5. Project Outputs

Project outputs are detailed in Appendix II and III. Several additional outputs were produced including two additional scientific papers, 44 conservation assessments and a report reviewing the CITES listed species.

The project's work has been disseminated through seminars, printed publications and international journals. Additional copies of the National Checklist, the glossary and the resource pointer were printed at the end of the project. The majority of these have been kept by the Lao partners for distribution in Lao PDR and surrounding countries. RBGE has a limited number of copies for inclusion with reports, for distribution to herbaria and libraries in Europe and the USA as well as the major holding libraries in the UK (the main outputs all have ISBN numbers). Lao partners each have a copy of the final printer's files that were used to produce the National Checklist, the glossary and the resource pointer. These publications will also be available on the internet, initially from the RBGE, then the IUCN Lao PDR and NAFRI websites as they develop. The CITES review will be forwarded to the World Conservation Monitoring Centre so that the CITES species database can be updated. Conservation assessments have been forwarded to the Global Redlist Programme in the UK. In Lao, Sounthone Ketphanh and Vichith Lamxay will ensure that the project's outputs will be included in the next Biodiversity Country Report.

6. Project Expenditure

Table 3: Summarised Project Expenditure

Item	Expenditure £	Budget £	Difference (%)

There were no significant changes to the budget during the project. The underspend of 47% in the others heading is due to audit fees being less then budgeted and the agreed transfer, from 2004/05 to 2007/08, of £450 to cover the final audit cost.

7. Project Operation and Partnerships

The project involved three local partners. FRC were the main partner and the leader and coordinator were jointly responsible for monitoring and implementing the project. Their staff were a key trainee group. FRC is part of the National Agriculture and Forest Research Institute: its principal mandate is to "undertake appropriate research, provide information and coordinate on-going forestry research activities in Laos with national and international partners" (*www.nafri.org.la/06_centers/FRC.htm*). It specialises in the management of Non Timber Forest Products, a very important aspect of biodiversity in Lao PDR.

The second partner was the Faculty of Science (FoS) at Lao's only university. Their remit is education and biodiversity research including its documentation. FoS provided training venues, materials and trainees. The third partner was the IUCN Lao PDR office whose main responsibility was to provide financial services and facilitate communication and dissemination. The IUCN provided office and email facilities for the UK team while they were in Lao, and for the Lao coordinator during the rest of the year. Each partner was actively involved in the project and participated in all planning meetings, workshops and seminars. The Lao partners are also involved with the GoL's Biodiversity Strategy and in producing Biodiversity Country Reports. Throughout the project, partners had an opportunity to suggest changes or modifications where appropriate.

The project has benefited greatly from the assistance of our colleagues at the Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Bangkok, namely the Director, Dr Kongkanda Chayamarit and her researchers Dr Rachun Pooma and Ms Nannaphat Pattharahirantricin. Throughout the project they have helped us by arranging accommodation in Bangkok as we collected our Lao visas, by ordering herbarium materials, allowing us to photocopy old books which were needed in Lao and by supporting the Darwin Fellow Soulivanh Lanorsavanh, particularly in offering him a place on the BRAHMS training course run in Bangkok in March 2007

Collaboration with other projects

The project was able to collaborate with several other organisations and projects during the three years. The EU funded Biodiversity Informatics and co-Operation in Taxonomy for Interactive shared Knowledge base project (BIOTIK) was perhaps the most important one. This project was set up to produce computer aided identification guides for up to 100 tree species from the Annamite mountains and the Western Ghats in India. The BIOTIK partners

included FoS, the Leiden branch of the Nationaal Herbarium Nederland and the Montpellier branch of the *Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD). Throughout the three years the two projects shared information on collections, coordinated expenditure on the herbarium at FoS, developed the BRAHMS database and collaborated on the production of the checklists.

In 2006, a second EU funded informatics project involving the same partners as the BIOTIK project started – the Open (Re)source for Commerce in Horticulture aided by species Identification Systems (ORCHISASIA - http://www.orchisasia.org/summary.htm). This project aims to develop identification systems for orchids that will help the GoL implement CITES legislation. They are also researching cultivation techniques for commonly traded species. The collections made by the Darwin project represent about 50% of the living collections that the ORCHISASIA project is working with and their foreign staff also participated in the identification training in Vientiane. Both projects have been collaborating on the development of a checklist of Lao orchids. Several trainees from the Darwin project have been involved with both ORCHISASIA and BIOTIK.

The project has also been involved with the Watershed Management Protection Authority, the organisation set up by the GoL and the World Bank to manage the Nakai Nam Theun NPA and the watershed above the Nam Theun dam. The WMPA will eventually be responsible for the US$1 million levy that the Nam Theun Power Company is expected to pay towards biodiversity conservation in Bolikhamxai and Khammouan once power generation starts. The Darwin project helped the WMPA to establish its research vetting procedures and provided botanical training for three of its staff as well as the first checklist for the area. The final field visit in May and June 2006 involved a joint expedition to the southernmost part of the NPA with one of the WMPA's ranger patrols. Work with the WMPA is ongoing: FRC staff are involved in rattan work which should include the survey on conservation work mentioned in Section 3.8.1. NUoL staff are working on the taxonomy and ethnobotany of the gingers found in that area while RBGE staff continue to advise about the identity and conservation status of species in that area. Recently, a WMPA survey team collected an unknown conifer in the inundation zone which has been identified as the highly threatened *Glyptostrobus pensilis,* a relative of the swamp cypress from the SE USA.

There have been many opportunities for collaboration during the Darwin project, some of which have not borne fruit. In Year 1, project staff had numerous discussions with the Sustainable Forestry and Rural Development Project (SUFORD) about using plant species for biodiversity monitoring in various production forests. The SUFORD project eventually decided to use animals instead. In Year 1 and 2, project staff invested considerable time and effort in developing a proposal with the Mekong River Commission. Unfortunately no agreement was reached on the scope of the proposal – the MRC wanted an interactive guide to the riverine vegetation from the border with China to Cambodia to be produced within one year and without any field work. The scope of this project was well beyond the resources allocated to it and it was eventually rejected by RBGE management.

8. Monitoring, Evaluation & Lesson learning

The UK team made four visits to Lao PDR before the final workshop in March 2007. The first visit was a planning visit to clarify the roles and responsibilities of each of the partners. The next three visits all included additional planning and review meetings with all partners. During these meetings, progress towards specific outputs was monitored, annual reports, half year reports and reviewer's comments were discussed. Forward plans and timetables for the production of major outputs were adjusted as necessary to reflect progress in activities such as translations. The effectivenes of this strategy is indicated by the completion of all major outputs within a reasonable timeframe. In between visits, contact was maintained via email, principally through the two coordinators. At times this was sporadic and there were some difficulties in contacting university staff and the WMPA.

The majority of the problems encountered during the project related to IT issues. In the second year it was decided that two of the main outputs (the National Checklist and the NPA checklist) should be compiled in Edinburgh by UK staff. There were several reasons for this. IT support in the university and FRC was poor: computers were regularly infected with

viruses despite the installation of anti-virus software and firewalls. This continues to be a risk although virus awareness training has been provided by IT staff from the IUCN and the risk has been reduced. Internet communications with partners in Lao were restricted to size limited Hotmail accounts. Other problems encountered during the project were mainly related to the use of Lao fonts – transferring information such as the list of Lao equivalents for French and English botanical terms written in an older version of the standard font from spreadsheet formats to word documents or pdf formats, resulted in the deletion of certain characters. Converting older fonts to more modern fonts suitable for recent Microsoft software was not possible without retyping all of the entries. Eventually a solution was found.

Lessons learnt

In poor underdeveloped countries such as Lao PDR progress towards change is incremental and expectations by project staff and by donors need to be realistic. It is impossible for Darwin projects with their limited budgets, short funding cycles and limits on capital expenditure completely to change structural problems such as the lack of funding for salaries in institutions like the university and FRC, or the lack of recurrent budgets to maintain facilities such as herbaria. However, projects such as Darwin Initiatives can act as catalysts for other projects that can continue to support host country institutions until they are independent.

9. Responses to annual report reviews

The project received two reviews from the reports that were written in consultation with the main partners (FRC and NUoL). The replies to the reviews were also prepared in consultation with Lao staff and then included in the appropriate report.

The reviews highlighted the need to

- Produce multi-lingual outputs as soon as possible
- Develop supplementary training for trainees to undertake between visits
- Develop the assessment and possible accreditation of the training
- Develop publicity for the project in Lao
- Develop the project's website

In response to these concerns, the project

- Ensured that the multilingual literature was developed as rapidly as possible. Drafts were available for the second year's training, final drafts that incorporated trainees' feedback were available for the third year and final versions printed during the last training visit. All trainees received personal copies and additional copies are held by FRC, NUoL and the IUCN.

- The possibility of supplementary activities was discussed with Lao colleagues and other conservation organisations e.g. SUFORD. A lack of finance and lack of time (on the part of the trainees) prevented placements with organisations outside of the project. However, several of the university trainees participated in the field work organised under the BIOTIK project while others (FRC and NUoL) continued the herbarium curatorial activities that they had been trained in during the second and third year. The FRC herbarium was completely reorganised by one of the project's trainees (see Section 3.8.6).

- Assessment for the training was developed after feedback sessions with the trainees during the second year and with the advice of the Lao partners. The project decided against attempting to gain any formal accreditation with any of the partner institutions. Over the last two years the RBGE has been developing an accredited and validated field botany course that draws on much of the work in Lao and should be applicable in any country, whatever the skills, language or level of knowledge of the trainees. The university has also changed parts of its final year biology field work component for degree students to incorporate plant identification skills involving the use of keys, supported by the glossary and other training materials developed during the project.

- In Lao, the project has received limited general publicity. Press releases were given out for each of the training workshops and for the final workshop when the National Checklist was published. Very few were taken up. One reason for this is that there are at least 70 NGOs based in Vientiane, running hundreds of individual projects with their own cycle of workshops. As one of our colleagues put it, there is a "workshop weariness" in the media. Although the project had a low public profile, it did have a strong profile amongst other biodiversity organisations and within the various ministries. There are plans to have a second official launch for the National checklist at a seminar to which major policy makers will be invited. This is to be organised by the IUCN. One person from the UK team will attend.

- The project's website represents one of the least developed aspects of its work. The RBGE website only has a brief profile of the project with links to pdf files of the major publications. The UK team did not have sufficient web design skills to develop an independent website. RBGE did allocate specific IT support for the project but this was dedicated to the development of the National Species Database at the project team's request. Opportunities for web-based dissemination have been missed during the project; these tend to relate to international audiences rather than audiences in Lao where access to the internet is much more limited.

10. Darwin Identity

The Darwin logo featured prominently on the project's major publications. These have been distributed nationally and internationally. The Darwin Initiative was acknowledged in all scientific papers published in international, peer reviewed journals as well as all reports.

The profile of the Initiative was raised through the involvement of three different partners (the IUCN Lao PDR, FRC and FoS) who themselves were part of larger organisations – all parts of those organisations would have become aware of the Initiative through the internal reporting of the project partners. Senior members of the Lao government such as the Prime Minister, the Minister of Agriculture and their advisors in organisations such as the World Bank were also made more aware of the Initiative through its involvement in the Watershed Management Protection Authority and the Nakai Nam Theun NPA. The project team met the Minister of Agriculture in Nakai during the second year. The Minister was there to open the new headquarters for the WMPA.

The project was successful in applying for a Darwin Fellowship which demonstrated to the partners the alternative funding opportunities available through the Initiative.

The Darwin Initiative has a distinct identity within Lao, and is recognised as a valuable contributor to the GoL's biodiversity programmes. Some of this is due to the success of the previous Darwin project that worked on rattans.

11. Leverage

During the life of the project additional funds and resources were attracted for, or in support of biodiversity work. The project received a grant from the Royal Society of Edinburgh to support the costs of Dr Bouakhakyhone during her visit to the UK in the second year. This meant the project could use its funds to support the costs of Mr Vichith Lamxay's visit – three staff instead of two came to the UK. The project also received a Darwin Fellowship for one of its trainees that enabled to him work in UK and Thailand. As part of this work, UK staff negotiated extra database training at a special course in Thailand. The contract with the IUCN for the review of the CITES listed species enabled the project to invest in an extension to the herbarium at FRC. This was matched by the FRC decision to invest one of their staff's time for the ongoing upkeep of the herbarium. The project also supported a successful application for herbarium renovation at the Faculty of Science.

The UK project leader helped to facilitate Vichith Lamxay's PhD award from Uppsala University in Sweden by agreeing to act as supervisor for the taxonomic component of his work. The PhD has funding built into it for field work throughout Lao, laboratory and herbarium work.

UK and Lao staff are actively pursuing additional funding from a new French biodiversity

initiative for a range of activities (see Section 12 for details). Specific details of the additional funding are listed under the outputs in Appendix II.

12. Sustainability and Legacy

The majority of trainees are in secure positions with the main biodiversity research institutes and should be able to contribute to future botanical projects. The main published outputs will endure: the multilingual Glossary of Botanical terms contains the vast majority of French and English terms that are used in botany and is unlikely to go out of date. It could be enhanced by the inclusion of good line drawings. The “Selected Resources for Plant Identification in Lao PDR” will gradually go out of date as new parts of the Flore du Cambodge, du Laos et du Viêt Nam and the Flora of Thailand appear although it has been produced in a format that is easy to update and reprint. The “Checklist of Vascular Plants of Lao PDR” may go out of date rapidly, but it was only ever intended to be a foundation for future work. In fact, the project team would like to see it become outdated quickly as this would indicate continued botanical activity which is sorely needed.

In some ways, the database represents the part of the project that could be most vulnerable to change, given the rapid pace of change in technology and information handling. However, by choosing a system that is widely used both regionally and internationally, and uses software that is able to produce outputs that can be integrated into other systems relatively easily, the project has attempted to guard against this prospect. The project has tried to ensure that its trainees and staff were adequately trained in use of the database and in general information management and has also done its best to facilitate links with other institutions in the region, especially in Thailand where the same system is used and which has the most well developed botanical training and research infrastructure and the smallest linguistic barrier.

Funds are being sought from the Fonds de Solidarité Prioritaire (FSP) of the French Ministry of Foreign Affairs under a programme called Sud Experts Plantes which is directed at herbarium-based botany in the Zone de Solidarité Prioritaire, in this case Cambodia, Lao PDR and Vietnam. The work proposed is to make herbarium collections of Zingiberaceae in southern Lao PDR, southern Vietnam and Cambodia and to gather data for a revision of the Zingiberaceae in the Flore du Cambodge, du Laos et du Viêt Nam.

FSP is also expected to continue other aspects of the Darwin project, such as training in botany, eventually to MSc level, further investment in the physical infrastructure of herbaria, possibly even a national herbarium and in organizing a symposium for botanists from Cambodia, Lao PDR and Vietnam to discuss progress in botanical research.

The MoU between RBGE and NAFRI has another three years to run and all partners will be seeking additional projects to maintain the momentum gained from this Darwin Initiative.

13. Value for money

The Darwin Initiative invested a total of £156,022 over three years in one of the poorest countries in SE Asia where botanical work has been almost absent for the last 60 years. In return the project has more than doubled the number of species known from this area, trained 28 people in botanical identification, improved the herbaria that are vital for documenting and conserving the flora and provided valuable technical information for the WMPA that represents an important model for future conservation in Lao PDR. These results represent value for money.

Appendix I: Project Contribution to Articles under the Convention on Biological Diversity (CBD)

Project Contribution to Articles under the Convention on Biological Diversity	
Article No./Title	**Project %**
6. General Measures for Conservation & Sustainable Use	5
7. Identification and Monitoring	15
8. In-situ Conservation	15
9. Ex-situ Conservation	5
10. Sustainable Use of Components of Biological Diversity	5
12. Research and Training	40
13. Public Education and Awareness	
15. Access to Genetic Resources	5
16. Access to and Transfer of Technology	5
17. Exchange of Information	5
19. Bio-safety Protocol	
Total %	**100%**

Appendix II Outputs

Code	Total	Detail
Training Outputs		
4a	Number of undergraduate students receiving training	**2**
4b	Number of training weeks provided to undergraduate students	**7**
4c	Number of postgraduate students receiving training	**28** individuals over three years
4d	Number of training weeks for postgraduate students	**146** weeks over three years
6a	Number of people receiving other forms of **short-term** education/ training	**7** individuals over three years
6b	Number of training weeks not leading to formal qualification	**28** weeks over three years
7	Number of types of training materials produced for use by host country	**14:** 1 draft version of glossary, 1 draft for resource pointer, 9 powerpoint presentations, 1 guide to collecting gingers, 1 translation of IUCN 2001 categories and criteria, 1 translation of Global Strategy for Plant Conservation targets
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country	**76**
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country	**1:** 1 Conservation Assessment and proposal for survey for *Calamus kingianus*
10	Number of formal documents produced to assist work related to species identification, classification and recording.	**49:** 44 Conservation assessments, 1 Botanical Report for WMPA, 1 Checklist of Nakai area, 1 CITES review, 1 Threatened Plants List, 1 Translations of IUCN categories and criteria
11a	Number of papers published or accepted for publication in peer reviewed journals	**5:** details are in Appendix III
11b	Number of papers published or accepted for publication elsewhere	**4:** 1 National Checklist of Vascular Plants, 1 French Lao English Glossary, 1 Guide to Resources useful for Plant Identification in Lao PDR, 1 NTFP newsletter article
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	**1:** 1 National Checklist of Vascular Plants
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	**3:** Herbarium collections at Faculty of Science, Faculty of Forestry, Forest Research Centre
13b	Number of species reference collections enhanced and handed over to host country(s)	**3:** Herbarium collections at Faculty of Science, Faculty of Forestry, Forest Research Centre

Code	Total	Detail
Dissemination Outputs		
14a	Number of conferences/ seminars/ workshops organized to present/ disseminate findings from Darwin project work	**4:** 25th July 2004 Project seminar, Vientiane; July 2005, seminar presented by Dr Bouakhaykhone and Sounthone, Edinburgh; 14 March 2007: Final Seminar, WMPA, Nakai; 21 March 2007: Final workshop, Vientiane,
14b	Number of conferences/seminars/ workshops attended.	**1:** Banxa Thammavong, ITTO rattan conference, Manila, Philippines, June 2006
15a	Number of national press releases or publicity articles in host country	**3:** Press releases for training workshops and final seminar; article in NTFP newsletter – Notes on the genus *Aquilaria* in Lao PDR
15c	Number of national press releases or publicity articles in UK	**2:** Trouble in Paradise, Botanics Autumn 2004, p4-8; 'Taxonomic training for a neglected biodiversity hotspot in Lao PDR'. Newman, M.F. et al, September 2004
15d	Number of local press releases or publicity articles in UK	**0**
XX	Websites	**1**
Physical Outputs		
20	Estimated value (£s) of physical assets handed over to host country	**£13300**
23	Value of additional resources raised for project	**£12424** £2825 RSE grant for Dr Bouakhakykhone £2066 (US$3666 – IUCN CITES Review) £6700 – Darwin Fellowship £833 (US$1500 – cost of extra training on BRAHMS system - in kind donation by Bangkok Forestry Herbarium)

Appendix III: Publications

Mark (*) all publications and other material that you have included with this report

Type *	Detail	Publishers	Available from	Cost £
Book*	A checklist of the vascular plants of Lao PDR, M. Newman, S. Ketphanh, B. Svengsuksa, P. Thomas, K. Sengdala, V. Lamxay & K. Armstrong 2007	RBGE	UK - 20A Inverleith Row, Edinburgh EH3 5LR, Lao PDR: IUCN Lao PDR, Forest Research Centre, National University of Lao PDR	Free
Scientific paper*	A new *Gentiana* from Laos, S. Hul, 2007	Edinburgh Journal of Botany 64(2): in press	Pdf file available from the author,	**Free**
Scientific paper*	A new species and a new combination in *Aeschynanthus* (*Gesneriaceae*) from Laos, D.J. Middleton, 2007	Edinburgh Journal of Botany 64(1): 45-50	Pdf file available from the author,	**Free**
Scientific paper*	*Begonia cladotricha* (*Begoniaceae*): a new species from Laos, M. Hughes, 2007	Edinburgh Journal of Botany 64(1): 101-105	Pdf file available from the author,	**Free**
Book*	A glossary of botanical terms from French-Lao-English, K. Armstrong, B. Svengsuksa & S. Hul, 2006	Royal Botanic Garden Edinburgh	UK - 20A Inverleith Row, Edinburgh EH3 5LR, Lao PDR: IUCN Lao PDR, Forest Research Centre National University of Lao PDR	**Free**
Booklet*	Selected resources for plant identification in Lao PDR, M. Newman, B. Svengsuksa & V. Lamxay, 2006	Royal Botanic Garden Edinburgh	UK - 20A Inverleith Row, Edinburgh EH3 5LR, Lao PDR: IUCN Lao PDR, Forest Research Centre National University of Lao PDR	**Free**
Scientific paper*	New records of angiosperms and pteridophytes in the Flora of Laos M. Newman, P. Thomas S. Lanorsavanh, S. Ketphanh B. Svengsuksa & V. Lamxay 2007	Edinburgh Journal of Botany 64(2): in press	Pdf file available from the author,	**Free**
Scientific paper*	New records of conifers in Cambodia and Laos, P. Thomas, K. Sengdala, V. Lamxay & E. Khou, 2007	Edinburgh Journal of Botany 64(1): 37-44	Pdf file available from the author,	**Free**
Newsletter	Trouble in Paradise	Botanics, Autumn 2004, p4-8	RBGE	**Free**
Newsletter	'Taxonomic training for a neglected biodiversity hotspot in Lao PDR'. Newman, M.F. et al 2004	ECTF	ECTF : *www.nmw.ac.uk/ectf*	**Free**
Newsletter *	Notes on the genus *Aquilaria* in Lao PDR, Thomas and Thammavong,	NAFRI SNV NTFP newsletter; July 8, 2006, Issue 7	http://www.nafri.org.la/05_news/news/SNV/snv.htm	**Free**

Appendix IV: Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide contact details below.

Project Title	*Taxonomic training for a neglected biodiversity hotspot within Lao PDR*
Ref. No.	163/13/007
UK Leader Details	
Name	Mark Newman
Role within Darwin Project	Principle Investigator
Address	Royal Botanic Garden, 20A Inverleith Row, Edinburgh EH3 5LR
Phone	
Fax	
Email	
Other UK Contact (if relevant)	
Name	Philip Thomas
Role within Darwin Project	Coordinator
Address	Royal Botanic Garden, 20A Inverleith Row, Edinburgh EH3 5LR
Phone	
Fax	
Email	
Partner 1	
Name	Mr Sounthone Ketphanh
Organization	Forest Research Center, National Agriculture and Forestry Research Institute, Lao PDR
Role within Darwin Project	Project leader for main partner
Address	
Fax	
Email	
Partner 2 (if relevant)	
Name	Dr Bouakhaykhone Svengsuksa
Organization	National University of Lao PDR
Role within Darwin Project	Project leader of 2nd partner
Address	Department of Biology, Faculty of Science, National University of Lao PDR Dong Dok, Vientiane, Lao PDR
Fax	
Email	

LOGICAL FRAMEWORK Revised March 2006

Project summary	*Measurable indicators*	*Means of verification*	*Important assumptions*
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • the conservation of biological diversity, • the sustainable use of its components, and • the fair and equitable sharing of the benefits arising out of the utilization of genetic resources			
Purpose To assist Lao PDR to implement CBD obligations and BAP objectives by providing training in tropical botanical taxonomy to staff in key institutes. To establish the foundation for National Species Database and Threatened Plant List	Up to 30 Laotians from FRC, NPAs, NUOL trained in tropical botanical taxonomy Collection of 3-4000 identified specimens National Species List and Threatened Plant List published	Assessment and evaluation records of trainees at end of each training period Specimens in herbaria Databases established within 2 institutes; printouts available after Yr 1	That key areas in the draft NBSAP will form part of the final plan. That all specimens will be identified; Lao PDR flora is poorly known so new species may be found that may take longer to describe
Outputs Multilingual botanical dictionary Nat. Species Database Threatened Plant List NPA Plant checklist Incorporation of collections into herbaria Report to GTI 3 Scientific papers	Publication of dictionary by end of Yr2 Printouts from database checklist available Representation of Lao PDR flora in herbaria increased by 25% by Yr 3 Report submitted Papers written	Publication completed; copies available National Species List and Threatened Species List widely available Specimens in herbaria Report acknowledged Papers published	Linguistic expertise available within the project team
Activities 3 x 3-4 week field training sessions in NPA Identification of specimens 3 x 3-4 week taxonomy training sessions Collation of data ex-Lao PDR; Collation of data within Lao PDR Seminars in Lao PDR and UK	**Activity Milestones (Summary of Project Implementation Timetable)** Year 1: Collation of data from published Flore du Cambodge, du Laos et du Viêt Nam completed; first 2 month training visit to Lao PDR (field and herbaria, database installation; project planning meeting); collation of Lao PDR data commenced; visit to UK by Laotian counterparts (training, liaison) Year 2: Collation of other data ex Lao PDR completed; 2nd 2 month training visit to Lao (field and herbaria project progress meeting); collation of data in Lao PDR continues; Year 3: Publication of botanical dictionary in Laotian; Final 6 week field and herbaria training (May-June 06). Final wrap up visit (Feb/March 2007); National Species and Threatened Plant List published; scientific papers and reports written and submitted		