

Darwin Initiative for the Survival of Species

Final Report

Diversity and sustainable management of rattans in Lao PDR



A research and training project

Contents

1.	DARWIN PROJECT INFORMATION.....	2
2.	PROJECT BACKGROUND/RATIONALE.....	3
3.	PROJECT SUMMARY	4
4.	SCIENTIFIC, TRAINING, AND TECHNICAL ASSESSMENT	7
5.	PROJECT IMPACTS	9
6.	PROJECT OUTPUTS.....	11
7.	PROJECT EXPENDITURE.....	13
8.	PROJECT OPERATION AND PARTNERSHIPS	14
9.	MONITORING AND EVALUATION, LESSON LEARNING	15
10.	DARWIN IDENTITY.....	16
11.	LEVERAGE	17
12.	SUSTAINABILITY AND LEGACY.....	18
13.	VALUE FOR MONEY.....	19
14.	APPENDIX I: PROJECT CONTRIBUTION TO ARTICLES UNDER THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD).....	20
15.	APPENDIX II OUTPUTS.....	21
16.	APPENDIX III: PUBLICATIONS	23
17.	APPENDIX IV: DARWIN CONTACTS.....	26
18.	APPENDIX V: RESEARCH PROGRAMME.....	27
19.	APPENDIX V: TRAINING PROGRAMME.....	32

1. Darwin Project Information

Project title	Rattan diversity and sustainable management in Lao PDR
Country	Lao PDR
Contractor	Oxford University
Project Reference No.	162/6/046
Grant Value	£142,771
Starting/Finishing dates	October 1997-March 2001

2. Project Background/Rationale

Project location and circumstances

Three organisations co-operated on the project: the Lao government's Forestry Research Centre, (a part of the National Agriculture and Forestry Research Institute, NAFRI), Oxford Forestry Institute (University of Oxford) and the Royal Botanic Gardens, Kew.

The project was conducted mainly in Lao PDR (hereafter called Lao). The project team was based in the national capital, Vientiane and fieldwork was conducted at forested sites throughout the country. A significant part of the work was also conducted in the UK, at Kew and at Oxford University.

Problem addressed by the project

The project aimed to address the problem of declining wild rattan populations in Lao. Both the national economy and the livelihoods of the rural poor are strongly dependent on natural resources in Lao. Rattans are widely recognised to form one of the most significant of these resources, both as canes and as foodstuffs, for domestic use and for trade. However, scientific data on the management of rattans are scarce, and there is also little comparative information available from neighbouring countries. This lack stems partly from the limited number of trained national researchers and partly from the scarcity of past research by outsiders. These constraints, amongst others, hampered both improved management of the wild stocks and efforts towards domestication.

Heavy commercial harvests had been widely reported through the 1990s, together with extensive reductions in the extent and condition of native forests. These facts suggested that some species would be faced with commercial exhaustion or even biological extinction, as was the case amongst better studied taxa such as birds and large mammals.

Among the many significant obstacles to resolving this problem were two that could be addressed in the context of a Darwin Initiative project: limited technical capacity at central government level and a limited scientific knowledge base. Improved technical capacity at central level was essential if the government was to make informed decisions about management and conservation of this resource; the individuals involved were also expected to become better able to make a case for conservation within government. The project was also in a position to make significant advances in knowledge of rattan taxonomy, conservation status and ecology in Indochina, given the almost total dearth of existing botanical data. Furthermore the role of the newly established national protected areas system in conserving wild plants was unclear. It was therefore envisaged that the legacy of the project would be a nucleus of capable staff, a set of useful research findings and publications and a clearer understanding of the needs and opportunities for rattan conservation (at site and national level) that could be addressed during follow-up work.

Identification of the need for the project

The need for this particular project was identified during discussions between a UK member of the project team and staff of the Forestry Research Centre (FRC), Vientiane during 1996. At that time a project funded by the International Development Research Centre through the International Network for Bamboo and Rattan was drawing to a close. Baseline socio-economic, taxonomic and ecological work had been conducted (including the drafting of a basic guide to the Lao species) but the achievements had been limited and few publishable data had been collected. It was felt that further great advances could be made from this baseline given increased technical support, further training, access to international facilities (such as herbaria) and additional fieldwork. The proposed Darwin Project was thus greatly welcomed and FRC staff provided many suggestions as to its design and content. Since two existing projects were addressing socio-economic issues, a focus on taxonomy and ecology was chosen. The real demand for the Darwin project was clearly shown by the fact that initial efforts to achieve some of its goals had already been made by the national partner.

Subsequent commitment by the national partner is in evidence throughout this report; noteworthy indicators are the provision of three full time counterparts (compared to only two required by the project proposal), provision of office space and the full time use of a vehicle donated to FRC by a previous project. Much administrative support was also given, and FRC strongly backed the project during dealings with other agencies and organisations.

3. Project Summary

Project purpose and original objectives

The purpose of the project was 'to help Laos record and sustainably manage its rattans and climbing palms' (from the original Project Schedule).

The original main project objectives were:

- 1) To train a Laotian to MSc standard in taxonomy and for him/her to produce a national rattan identification manual.
- 2) To determine the rattan species present in Nakai-Nam Theun Protected Area and to produce a manual for the identification of those rattans.
- 3) To train Laotian staff in methods of participatory resource inventory and then to investigate the abundance and growth rates of one or more commercial species in the reserve and provide guidelines for their sustainable use.
- 4) Establish working links between the Laotian Department of Forestry and organisations in the developed world able to offer technical support, particularly Oxford Forestry Institute and the Royal Botanic Gardens, Kew.

A Logical Framework did not form part of the original proposal.

Modifications to the original objectives

The project evolved substantially during its life, to take account of such factors as the existing skills of national counterparts assigned to the project, changes in the rattan sector in Lao, political developments in proposed study sites and delays in obtaining full project approval. The main changes were approved by the Darwin Secretariat, whose great flexibility contributed much to the eventual successful outcome of the project. These changes are discussed below in relation to the project achievements.

Project structure in relation to the Articles of the Convention on Biological Diversity

The project addressed several Articles of the Convention on Biodiversity. These are listed below in Table 1, together with the approximate percentage of the project that contributed to each article.

Table 1

Article Number	Article Title	Proportion of project relevant to the Article
7	Identification and Monitoring	20 %
10	Sustainable Use of Components of Biological Diversity	10 %
12	Research and Training	40 %
13	Public Education and Awareness	5 %
16	Access to and Transfer of Technology	5 %
17	Exchange of Information	20 %

Success in meeting objectives

The project achieved all of its agreed modified objectives, broadly according to the original timetable. This was achieved despite significant delays in obtaining full governmental approval for fieldwork.

Original plans to focus on a single protected area had to be revised since security considerations prevented work at this site. No alternative site existed where management activities required a rattan-specific management plan at that time. For this reason, and because the unexpected availability of three counterparts and a vehicle made it feasible, the focus was shifted to questions of national interest (discussed with and approved by the Darwin Secretariat during June-August 1999). Due to this restructuring, objectives 1 and 2 are discussed together in the following summary.

- 1) *Taxonomic training and production of a technical manual.*
- 2) *Production of a site-specific manual*

Training

Despite their relevant practical experience, none of the three assigned counterparts was sufficiently qualified to take up the planned MSc place. Therefore a specially tailored alternative programme of training was developed (in several stages, approved by the Darwin secretariat in letters dated 13/8/98, 17/8/99 and 28/9/00). This included a substantial amount of on-the-job training, extensive fieldwork, development and expansion of an existing small specialist herbarium, development of and training in the use of a specimen management database (Appendix III, output 19), extended study visits to Kew (Appendix III, outputs 21 and 24), shorter visits to regional herbaria (Appendix III, outputs 22 and 23), tuition in botanical illustration techniques and English language training.

Staff greatly increased their expertise and were able to contribute substantially to the scientific outputs of the project. Specific indicators of success are discussed in a later section.

Taxonomic research and identification tools

Many peer-reviewed taxonomic papers were written (Appendix III, outputs 12-18), including descriptions of eight new species and a major review and synopsis of all Indochinese species. The latter replaced (following discussions with the Darwin Secretariat in June-August 1999) the proposed site-specific guide; in addition to presenting taxonomic advances it forms a technical guide to the whole of Lao and a large area around it.

This body of papers represents a major advance in taxonomic understanding of the Indochinese species, forms a framework for identification and information exchange between countries, provides assessments of conservation status and effectively repatriates to the region a great deal of data held in overseas institutions.

The national manual (Appendix III, output 1) was designed to be suitable for non-specialists; thanks to additional support in kind from Kew it was increased in scope and quality from that originally envisaged. Line-drawings were produced by one of the project team; numerous colour photos were used and versions were produced in both Lao and English languages. The English version will be equally useful in Cambodia, Vietnam, much of Thailand and parts of China since it also covers all species known from those areas. Free copies have been widely distributed. As well as covering identification the manual contains introductions to rattan ecology, conservation, management and cultivation. The guide was well-received; most Lao copies have already been distributed and the national partner plans to produce a low-cost second edition using their own funds.

In parallel with the field guide a computer-based interactive key was developed (Appendix III, output 2), covering the same area. This provides a novel and highly flexible approach to plant identification, valuable to specialists or as a tool for learning about rattans. It is available online, free of charge. It contains much additional information and many extra images. This was an additional output to those in the project schedule.

3) *Ecological research and training*

Training

Ecological training involved a tailor-made programme, as for taxonomy. On-the-job training was central, revolving around the design, execution and analysis of the field studies. One counterpart with previous statistical knowledge attended a short advanced training course in Thailand. Another attended a special ten-week foundation course in statistical design of planting experiments at Oxford University.

Research

Delays in the granting of Government permission significantly reduced the time available for ecological fieldwork. Rather than developing management proposals for a specific site it was more appropriate to conduct studies of wider, more strategic interest based at several sites. Productivity models were developed for one commercially significant species (the first time this has been done in Indochina) and two studies were conducted to develop more cost-effective methods for collecting growth rate and abundance data. One paper based on this work has been published with another in press (Appendix III, outputs 8 and 9), an internal report have been produced on another study (Appendix III, output 20) and two papers based on the studies are in preparation. Notes on the ecology of two unusual species were also published (Appendix III, outputs 10 and 11).

In parallel with studies of wild populations it became clear that rattan cultivation for the

production of edible shoots was booming, and that this was relevant to the wider goal of enhancing national efforts to manage and conserve rattans. Therefore the project team researched and published two papers on the socio-economic aspects of this sector (Appendix III, outputs 6 and 7). The study tours mentioned for taxonomy (above) also included a major component observing rattan management systems in nearby countries (Appendix III, outputs 22 and 23). The project's main counterpart was enabled to continue his ongoing studies of nursery techniques and plantation economics under the project's umbrella, and a paper he has written on this work has been accepted for publication (Appendix III, output 5).

4) Establish institutional links

Lao project staff spent prolonged periods studying and working in the UK and UK staff worked extensively in Laos, leading to a very friendly and productive relationship. The strength of these links was demonstrated by the relatively good progress made by the project at a time when most other biodiversity conservation projects in the country experienced severe difficulties. Kew has become custodian of a complete spare set of Lao rattan specimens, held in trust until work on the national herbarium commences.

FRC was highly supportive of proposals for the same partners to undertake a new project building on the previous successes, although that proposal did not find funds in its original form. One component of it, looking at plantation development, has now been funded and UK project staff are providing informal technical backstopping to that project. It is anticipated that active links of this kind will continue.

Valuable working links were also established between the Lao researchers and those in neighbouring China and Thailand, largely as a result of the study tours, increasing the opportunity for regional information exchange.

5) Additional successes

All three counterparts continue to work on non-timber forest products as government employees within FRC and there is clear evidence of a Darwin legacy in this regard. As a result of training received on this project one counterpart reached a level at which he was subsequently able to qualify for MSc training under another FRC project, and is now taking a course in Natural Resource Management in Thailand. A second has obtained funding (with help from UK project staff) for a follow-up project on the experimental domestication of other rattan species, building on his training.

Interim results were presented at a national forestry research strategy seminar in September 2000 and at a specially organised all-day governmental meeting in December 2000. The final project seminar was held in November 2001 with 30 delegates invited from across the country. All trainees made presentations, the herbarium and nursery were demonstrated, publications were distributed and there was a discussion session on priorities for conservation and further research. Feedback from delegates was highly favourable, interest was stimulated in the project's outputs and the meeting successfully raised the profile and prestige of the project team within the Lao research community.

The project presented papers by invitation at two conferences: at Forest Research Institute Malaysia near Kuala Lumpur (Rattan cultivation: achievements, problems and prospects: May 1998) and at the Food and Agriculture Organisation (Expert Consultation on Rattan Development: December 2000). Both papers have been published in the relevant proceedings (Appendix III, outputs 3 and 4).

The project also achieved good exposure in the national newspapers; there were several articles in the official English-language paper and one in the Lao language press.

4. Scientific, Training, and Technical Assessment

A detailed account of the scientific programme is given in Appendix IV and of the training programme in Appendix V. Here a brief outline is given of aims, methods and findings.

Staffing

Research on both taxonomy and ecology was jointly executed by a Lao-based team comprising three national staff and a British Research Assistant, with supervisory and training input from the two UK-based senior project advisors.

Taxonomic research

The main objectives of the taxonomic research were to determine which species were present in Lao, to clarify their distribution and to develop tools to enable their identification. Very little indeed was known about Lao rattans when the project began. The research coupled extensive fieldwork with a herbarium-based revision of the species limits and identification criteria. Extensive comparisons were made with neighbouring countries and this regional coverage adds to the reliability and applicability of the results.

A revised taxonomic system for the region was published, distributions were mapped and many new taxa were described in a series of seven refereed papers (Appendix III, outputs 12-18). Several different identification tools were also published for different user groups: a technical key for specialists (output 14); a non-technical colour field guide in English and Lao editions (output 1); and an online interactive key (output 2).

Ecological research

Ecological studies concentrated on the sustainable management of wild populations, with some work on aspects of cultivation. The planned focus on developing guidelines for a specific site was replaced with research of wider applicability, since the intended study site ceased to be appropriate. Ecological research was seriously delayed by difficulties in obtaining permits.

Research covered four subject areas.

- 1) *A detailed site-based productivity study was conducted for one commercial species.*
This predicted low per-hectare yields for that particular species and site. Supplementary data collected for other sites and species suggested that this would be a typical result elsewhere in Lao, with significant policy implications. An internal report (Appendix III, output 20) has been produced and a refereed paper is in preparation.
- 2) *Survey methodologies were studied to assess the effectiveness of standard density estimation techniques and to trial new rapid methods for estimating growth rates without permanent plots.*
The trial of a standard density-survey technique highlighted its high cost to obtain reasonable precision, and its relatively low sensitivity when used in a monitoring programme. Papers reporting this have been accepted for publication both internationally and nationally (Appendix III, outputs 8 and 9). The trial of methods for estimating growth rates found one of the two methods to be highly promising and a published paper is in preparation.
- 3) *The conservation status of Indochinese species was reviewed.*
Species of high conservation concern were identified to show priorities for improved protection or management and highlighted in several project publications (e.g. Appendix III, outputs 1, 2, 3, 11 and 14).
- 4) *The factors involved in the recent adoption of one rattan species for cultivation were reviewed.*
Papers discussing the relationship between rattan cultivation and conservation were published in one international and one national journal (Appendix III, outputs 6 and 7). A related paper on nursery techniques is in press (output 5)

Two overviews of project findings concerning rattan management in Indochina have also been published (Appendix III, outputs 3 and 4), as have notes on the ecology of two unusual species (Appendix III, outputs 10 and 11).

Training Programme

Initial plans were for two counterparts to receive training; one undertaking a Master's degree in taxonomy, the other on-the-job training in ecological methods. FRC was able to assign three staff but

none was qualified to undertake a Master's degree and so, with the agreement of the Darwin Secretariat, a revised programme was developed. The emphasis was on on-the-job training during the course of project research activities, complemented by a range of more structured components and formal courses. In the revised programme approximately 200 person-weeks of on-the-job training and structured courses were provided, rather than the 60-80 originally proposed.

Most on-the-job training was provided by the Research Assistant during over 18 months spent in Lao, with substantial periods provided by the project advisors both in the UK and Lao. As many research tasks as possible were carried out by the trainees themselves, to maximise opportunities for experiential learning, and there was a productive policy of making trainees feel responsible for the quality of the data and specimens they collected.

Formal components of the training included study tours to Thailand and China (Appendix III, outputs 22 and 23), prolonged study visits to Kew and Oxford (covering taxonomy, statistics, botanical illustration and presentation skills; Appendix III, outputs 21 and 24), an intensive statistics course in Thailand and English-language lessons both in Lao and the UK.

Formal accreditation was only available for limited parts of the programme. Various indicators of progress are discussed in Appendix V.

5. Project Impacts

Evidence that the project purpose has been accomplished

The original purpose of the project was 'to help Laos record and sustainably manage its rattans and climbing palms' by removing some of the information and capacity constraints to the establishment of sustainable management systems for wild rattan populations. This has been successfully achieved, paving the way for the further steps that will be needed to bring about lasting changes in on-the-ground management practices.

Information constraints have been reduced through published research. The taxonomic publications and identification tools provide what is probably the best information base for any large taxon of plants in the Lao flora (Appendix III, outputs 1, 2 and 12-19). Information on species limits, identification, distribution, ecological characteristics and conservation status is now widely available in several formats to support local and national management regimes. International exchange of information has also been improved by forming active research links with China, Vietnam and Thailand (e.g. Appendix III, outputs 22 and 23) and by including neighbouring countries in both the taxonomic review and the identification tools.

Useful ecological research has also been completed, part has been published and the remainder is being prepared for publication (Appendix III, outputs 3-11 and 20). Clarification of the likely productivity of wild populations provides essential information for policy-makers and project planners. Technical advances concerning growth patterns, methods for inventory and the estimation of growth rates will also prove valuable for bodies attempting active management.

Capacity constraints have been reduced by providing extensive training for three counterparts, all of whom work in the non-timber forest products section of the relevant government agency. They have made substantial professional progress, have gained much enhanced recognition within the Lao forestry community, and all have continued to work in the same field.

Contribution to the host country's obligations under the CBD

Please see Appendix I for a breakdown of the project's contribution to different articles under the CBD.

At the time of the project the host country was in the early stages of discussions concerning implementation of the CBD and so no formal contribution could be made through project activities. The principal contribution has been to make public a body of relevant information and also to establish a group of skilled researchers within government who will be able to apply that knowledge when appropriate. For example, the Lao government has now begun (with UNEP/UNDP support) to develop a National Biodiversity Strategy and Action Plan. Former project staff have been actively involved in supplying data for the first component of this, which is, a comprehensive nationwide review of biodiversity data. It is hoped that they will also be active and influential in later stages of the process.

Contribution to local capacity to further biodiversity work

As noted above, all three project counterparts continue to work in the governmental body responsible for research on non-timber forest products. One has developed his skills with the project to the level where he has been able to undertake a Master's degree in Natural Resource Management. A second has obtained funding for a new research project studying the domestication of rattan, following on from his research during the project. They have also provided data for the National Biodiversity Strategy and Action Plan

The impact of the project on collaboration between UK and the local partner

There is currently no formal collaboration between the UK and local partners, but active informal links continue. For example, the FRC has begun to use the specimen naming service offered by Kew, which was never the case before, and the UK staff are voluntarily providing technical advice to assist with a follow-up project on rattan cultivation. It is hoped to develop new joint activities in the future, once the current project is completed and Mr Thammavong completes his Master's studies.

An MOU has recently been signed between FRC and Edinburgh Botanical Garden for botanical inventory and training work (M. Newman pers. comm. 2002). It seems likely that the positive experiences of FRC with the Darwin project made it easier to develop the Edinburgh project.

Local collaboration mainly involved exchange with the Faculty of Forestry, National University of Laos. Two students accompanied project staff on fieldwork and one completed a Bachelor's degree

dissertation on the subject of rattan cultivation.

Social impact

As this was a research and training project there was little scope for direct impacts on local communities, either positive or negative. Modest financial benefits were received by people contracted as porters, guides and assistants. The principal benefits were experienced by the three trainees, as discussed above. Findings relating to management of wild populations are likely to improve the quality of future interventions in this field, which should benefit harvesting communities. Progress in rattan domestication, both during and following on from the project, has benefits for many small-scale farmers.

6. Project Outputs

Outputs produced - research and training

Appendix II summarises the project's outputs in comparison with those planned. Appendix III gives full publication details. Most outputs were achieved or substituted (as agreed) with others of comparable or greater value. Several additional outputs were also achieved.

The exact nature of the research outputs changed in several ways, but they remained highly relevant to the project's goals and probably exceeded in scope and value the initially planned outputs. The full set of research outputs and the key changes can be seen in Table 2.

Table 2

Proposed	Achieved
Research time by UK project staff - not quantified	Approximately 82 weeks.
<i>Taxonomic work</i>	
One or more papers	Seven published taxonomic papers including one major 84-page study (Appendix III, outputs 12-18)
Guide to the species of one reserve	Replaced (and expanded in scope) by the largest of the seven papers noted above (output 14).
Technical manual in Lao and English to Lao species	Colour field-guide in Lao and English covering all species in the region (output 1).
	Interactive online key (additional output, number 2)
One database for herbarium specimens developed and handed over	Achieved (output 19)
One species reference collection enhanced	Achieved
Ecological work	
Written report to the Lao government on management of rattans in one reserve	Objective changed: research of national relevance conducted and internal reports supplied.
One or more papers	Four international peer-reviewed papers (outputs 6, 8, 10 and 11) One national peer-reviewed paper (plus two in press) (outputs 5, 7 and 9) Two papers in conference proceedings (outputs 3 and 4) One internal report (output 20)

The key training outputs differed substantially in structure from those proposed. The proposal called for two counterparts receiving: initial training in botanical collection and identification (duration not specified); on-the-job training in resource inventory techniques (1 person, minimum 60 person-weeks) and an M.Sc. in Taxonomy (1 person). Under the revised programme three counterparts together received approximately 200 person-weeks of on-the-job training covering taxonomy, resource inventory, plant ecology, technical English and presentation techniques, many parts of it as structured courses or study tours (Appendix III, outputs 21-24). Although the final skill levels of the trainees probably do not equate with those planned, since they started at a more modest level, the 'value-added' to their initial skill levels is felt to be comparable.

Dissemination

Dissemination activities are summarised in Table 3. They substantially exceed the outputs planned at the start of the project (Appendix II).

Future dissemination is also planned, led by the project Research Assistant and Lao Project Leader. Three papers are intended for publication, two in international journals and one in the national forestry journal. Further copies of the field guide and published papers will be distributed in response to requests or where other opportunities arise. Wherever possible this will be done as a part of other activities being carried out by former project members and no specific budget has been planned for this work.

Table 2

Mode of dissemination	Quantity
Publication in international journals	11
Publication in national journals	1 (+ 2 in press)
Publication in conference proceedings	2
Direct distribution of written outputs	Field guides distributed at the project final seminar and later by post and by hand. Over 200 Lao-language copies and over 300 English-language copies have been distributed, the latter in at least ten countries. Offprints of scientific papers distributed to over 30 rattan specialists worldwide and many interested parties in-country.
Hosted seminars	December 2000 – NAFRI internal seminar. Approximately 25 attendees from the capital for full day. November 2001 – Project final seminar. Approximately 30 attendees from throughout country for full day.
Conferences attended	May 1998. Rattan cultivation: achievements, problems and prospects. (Forest Research Institute, Malaysia). Paper presented. September 2000 NAFRI Annual Review and Strategy Meeting December 2000 Expert Consultation on Rattan Development (FAO, Italy). Paper presented.
Press releases	Four to English-language national paper (Vientiane Times) and two of these also to Paxaxon (a Lao-language national paper).
National radio appearances	Project counterparts appeared twice on national radio in segments devoted to the use and management of rattans
Online materials	Interactive key (includes full text of field guide) Rome conference paper Economic Botany paper

7. Project Expenditure

Overall the project showed a small (2%) overspend, due to an accounting error whereby part of the inflation-related increase in salaries and overheads was not fully allowed for in viring money between years. The University of Oxford has taken the liability for this difference, and overall the total requested from Darwin equalled the originally planned amount.

Table 3 presents a summary of expenditure. Discrepancies between budget and recorded actual expenditure occurred for several categories. This is partly because the budget headings used by the Department do not entirely coincide with the uses implied by the categories used in the original proposal and partly because a few items were erroneously logged in the accounting system under an inappropriate heading.

By correcting these differences (as shown in the table) the discrepancies between the various budget lines can be seen to be modest. Although there were several agreed modifications in spending plans (especially in the training budget) none of these involved significant movement of money between categories and so they are not discussed here.

Table 3

Category	Original plan	Actual recorded	Modifications	Modified actual total	Discrepancy
Rents etc (overheads)					+7%
Postage etc. (consumables)					-6%
Travel/subsistence					-4%
Capital items (equipment)					-29%
Staff costs					+7%
Miscellaneous (printing, training)					+1%
Total					(+2%)

All figures are in £.

Notes

Note 1 Overheads are calculated as a % of any payroll transaction. Some payroll transactions related not to core staff costs but to payment for botanical illustrations, and are more appropriately treated under Miscellaneous, as a part of the money earmarked for printing and book production costs. Therefore the related overheads are also moved to the Miscellaneous category.

Note 2 The fee for the statistics training course in Thailand was erroneously recorded here. It is best moved to 'Miscellaneous'.

Note 3 The cost of the motorbike was recorded here but is better placed under Capital Items. Some costs relating to the final UK training visit were also recorded here but are more appropriately placed under Miscellaneous.

Note 4 The cost of the motorbike needs to be added here. The 29% underspend is due to the fact that the expected car hires costs were not incurred. This is compensated by substantial repair costs for the vehicle that FRC made available on loan to the project – these are now contained in the Travel/Subsistence budget line.

Note 5 As noted above, staff costs related to botanical illustration are best moved to 'Miscellaneous' In addition, staff costs relating to training given in January-March 2001 were also taken from the training budget within Miscellaneous and so are best counted against that budget line.

Note 6 As explained above, the following items are best counted against the printing and training budgets grouped under 'Miscellaneous': Thai training course, UK 2001 training course and botanical illustration costs.

8. Project Operation and Partnerships

Local partners

As planned, the sole local partner was the governmental Forestry Research Centre. During the project this was moved from the Ministry of Forestry to the newly-formed National Agriculture and Forestry Research Institute. FRC has a broad remit concerning research into forestry issues, with activities in fields including agroforestry, natural forest management and non-timber forest products. They liaise with the Centre for Protected Areas and Watershed Management, which is responsible for the management of national-level protected areas and technical advice on the designation of protected species.

There were several meetings and extensive correspondence with FRC during project formulation which had a strong impact on the eventual design. There was constant liaison during most of the implementation phase since the project team was based at the FRC head office and all counterparts were FRC staff. All project activities in country were subject to the annual, quarterly and monthly planning requirements of NAFRI, giving extensive opportunities for fitting activities to local requirements.

Collaboration with similar projects

There were two projects with related goals active in FRC at the time of the Darwin project: the Netherlands government funded IUCN Non-Timber Forest Products Project (IUCN-NTFP) and the CARE-Austria funded Non-Timber Forest Products Information Centre (NIC). The Darwin project received extensive logistical support from these projects during our start-up phase and at times also shared their office space and facilities. There were opportunities for frequent discussion with them on technical matters. The Darwin Lao Project Leader also acted as a formal short-term technical consultant to the IUCN-NTFP project on a number of matters relating to bamboo and rattan.

There was no host country Biodiversity Strategy Office with relevant activities at the time of the project.

International Partners

Two UK partners took part – Oxford Forestry Institute, Department of Plant Sciences, University of Oxford and the Royal Botanic Gardens, Kew. There were no third-country partners.

Continuation of local partnerships

No formal local partnerships were established as a result of the project.

9. Monitoring and Evaluation, Lesson learning

Monitoring and evaluation strategy

The principal means of monitoring was a list of project milestones laid out in the initial project proposal and subsequently modified with the agreement of the Darwin Secretariat. When the focus of work was outside the UK this monitoring was achieved through regular communication between Research Assistant and UK Project Manager. The Lao partner also monitored progress through their routine monthly, quarterly and annual reporting procedure. Training visits by each of the two senior UK staff included a supervisory element, to meet senior Lao representatives, and to ensure that fieldwork was progressing adequately. External evaluation of the project was not proposed.

Initial progress over the first 14 months was relatively slow and uneven, in particular due to the long delay in being granted full clearance for fieldwork, but herbarium work was able to begin and fieldwork was conducted close to the capital. Progress during the two years following full approval was much more rapid. This contrasted with the very limited progress of a number of wildlife and biodiversity research projects active in the country at that time, suggesting that the Darwin project was unusually fortunate in the support it received.

Evaluation of the research programme was carried out by assessing the quality and quantity of the written outputs of the project and of the training programme by noting the achievements of the trainees. These indicators are discussed in detail in Appendix V.

Key lessons learnt

- 1) Diversity in objectives spreads risk and reduces vulnerability to unforeseen events. The taxonomic studies were less vulnerable to delays in obtaining permission than the ecological studies, since much could be done in herbaria using existing materials. This enabled the project to make progress even during serious early delays, and in addition to their direct value these activities may also have helped to demonstrate the good faith and appropriate behaviour of the project at a time when the Darwin Initiative was unfamiliar in the country.
- 2) Prolonged, full-time presence by a UK representative with local language skills is likely to have strengthened relationships with local partners. Face-to-face communication was essential, especially in the early stages.
- 3) Research alone may be an insufficient basis for meaningful collaboration. A strong commitment to training and a genuine collaborative approach to research activities is likely to have fostered good working relationships, especially in a research environment where the goal of producing peer-reviewed publications is not paramount.
- 4) Small projects depend on individuals as much as on procedures, strategies or organisational structures. Obtaining committed counterparts was crucial to success, as was support from line managers in FRC; however these factors were largely beyond the control of the UK project staff and so we were highly fortunate. Preliminary visits were only able to help so much: for example proposed postgraduate training had a particular candidate in mind but he was assigned to other work in the 18 months between project formulation and commencement.
- 5) Having several counterparts is preferable to just one or two. This diversifies the experience and skills available in the group and maximises opportunities for co-working in the face of other demands on people's working time (which can be substantial for Lao government employees).
- 6) English-language skills are indispensable. Weak English closes down opportunities for self-study, teaching and international networking; provision for English lessons should be considered when budgeting.

10. Darwin Identity

Publicity for the Darwin Initiative

The Darwin name was always used when the project received public exposure. This included:

- acknowledgements in all published scientific materials
- on the cover of the field guide (with logo)
- on the introductory page of the online key
- all specimen labels
- most correspondence (headed notepaper with logo)
- during study tours to Thailand and China
- during public presentations in Lao, the UK and at two international conferences
- in briefing materials for the 1999 national, biannual donors' conference
- in several national newspaper articles about the project

Understanding and profile of the Darwin Initiative in the host country

The Darwin project was a stand-alone project with its own clear identity distinct from others in the same field. Familiarity with the project, and the Initiative more generally is likely to be high amongst many members of DoF and NAFRI, and in the ex-patriate donor, conservation and biological research communities.

11. Leverage

Additional funds during the lifetime of the project

Two additional sources of funding were attracted by the work of the project.

1. Contributions in kind for accommodation with a benefactor were received by the participants in the 1999/2000 study visit to the UK, reducing the cost of their stay by about £1500.
2. Contributions in kind to the design and layout of the field guide (worth an estimated £3000) were received from the Royal Botanic Gardens, Kew. They hope to recoup these costs through sales of an additional print run they have also funded.

Progress in securing further funds

A new research project was designed building on the findings and training of the current project. The national partner was closely involved in developing this project and some initial applications were made to international donors to seek funding for it. Due to changing personal circumstances a narrower project was then developed using one component of the original proposal and this has successfully gained funding from the Asean Regional Centre for Biodiversity Conservation.

12. Sustainability and Legacy

Enduring legacies of the project

Among the most enduring achievements are likely to be:

- the increased skills and knowledge of the three national counterparts, all of whom continue to work in the same field and one of whom has been enabled to enter post graduate education as a result of the project
- the key research findings of the project, all of which have been or will be published in international journals and many of which are also being made available in the relevant national journal
- the identification guides (both hard-copy field guides in two languages and the online key)
- the large collection of high quality Lao rattan specimens, with duplicates housed in the UK and Lao

Project resources (e.g. computer hardware, motorbike, specimen storage cabinets) were donated to FRC following completion of the project and have continued to be used by the former project staff in their day to day work on conservation and management of non-timber forest products.

The partners remain in regular contact over technical issues and follow-up work.

Have the project's conclusions and outputs been widely applied?

The published outputs are widely available and are likely to be used by any researchers working in the field. Correspondence with specialists confirms that the taxonomic work is now being widely used in the region, and the key outputs are likely to form the standard reference for some time to come. Reprint requests are often received for the ecological papers, but it is too early to judge how often they will be cited.

Clear evidence of the application of the results in-country is not available, since the UK staff have spent very little time there after the project ended. However, the Lao project staff themselves continue to use the findings, for example in the follow-up project on rattan cultivation and in providing data to the ongoing National Biodiversity Strategy and Action Plan process. The wish of FRC to print their own second edition of the Lao-language version of the field guide also shows that this output has been well received by users in-country.

The legacy of the project could perhaps best have been improved by finding funding for a greater range of follow-up activities, especially tying in with the National Biodiversity Strategy and Action Plan process. However, changes in personal circumstances have made this difficult in the short term.

Efforts to find funds for follow-up work

This subject was addressed in Section 11.

13. Value for money

We consider that the project has provided good value for money. The number, range and quality of research and dissemination outputs has been substantially higher than expected and the training outputs are of comparable value to those proposed, in terms of 'value added' to the trainees. The project has left a good legacy of well-received outputs and active, skilled counterparts in relevant posts and the Darwin name is now associated with a respected and well-executed project. The provision by the national partner of a field car and three good counterparts opened opportunities not envisaged in the original project document. Furthermore strong administrative support from the national partner also enabled the project to achieve its goals in an environment when many other comparable biodiversity-related projects could not.

Author(s) / Date

Tom Evans
Nick Brown
Khamphone Sengdala
John Dransfield

26 March 2003

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

Table 4

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use		Develop national strategies which integrate conservation and sustainable use.
7. Identification and Monitoring	20	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities which have adverse effects; maintain and organise relevant data.
8. In-situ Conservation		Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity	10	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	40	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
16. Access to and Transfer of Technology	5	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such access and joint development of technologies.
17. Exchange of Information	20	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Total %	100%	Check % = total 100

15. Appendix II Outputs

Table 5

Code		Planned	Achieved
Training Outputs			
1a	Number of people to submit PhD thesis	0	0
1b	Number of PhD qualifications obtained	0	0
2	Number of Masters qualifications obtained	1	0
3	Number of other qualifications obtained	0	0
4a	Number of undergraduate students receiving training	0	2
4b	Number of [on-the-job] training weeks provided to undergraduate students	0	4
4c	Number of postgraduate students receiving training (not 1-3 above)	0	0
4d	Number of training weeks for postgraduate students	0	0
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(i.e not categories 1-4 above)	1	3
6a	Number of people receiving other forms of short-term education/training (i.e not categories 1-5 above)	0	0
6b	Number of [on-the-job] training weeks not leading to formal qualification	c. 70	– approx. 200 person weeks
7	Number of types of training materials produced for use by host country(s)	0	0
Research Outputs			
8	Number of weeks spent by UK project staff on project work in host country(s)	not specified	82 weeks
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1	0
10	Number of formal documents produced to assist work related to species identification, classification and recording.	3	3
11a	Number of papers published or accepted for publication in peer reviewed journals	2+	14
11b	Number of papers published or accepted for publication elsewhere	0	2 (conference proceedings)
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1	1
12B	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	0	0
13a	Number of species reference collections established and handed over to host country(s)	0	0
13b	Number of species reference collections enhanced and handed over to host country(s)	1	1

	Dissemination Outputs	Planned	Achieved
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2	2
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/disseminated.	0	3
15a	Number of national press releases or publicity articles in host country(s)	0	4
15b	Number of local press releases or publicity articles in host country(s)	0	0
15c	Number of national press releases or publicity articles in UK	0	0
15d	Number of local press releases or publicity articles in UK	0	0
16a	Number of issues of newsletters produced in the host country(s)	0	0
16b	Estimated circulation of each newsletter in the host country(s)	0	0
16c	Estimated circulation of each newsletter in the UK	0	0
17a	Number of dissemination networks established	0	0
17b	Number of dissemination networks enhanced or extended	0	0
18a	Number of national TV programmes/features in host country(s)	0	0
18b	Number of national TV programme/features in the UK	0	0
18c	Number of local TV programme/features in host country	0	0
18d	Number of local TV programme features in the UK	0	0
19a	Number of national radio interviews/features in host country(s)	0	2
19b	Number of national radio interviews/features in the UK	0	0
19c	Number of local radio interviews/features in host country (s)	0	0
19d	Number of local radio interviews/features in the UK	0	0
Physical Outputs			
20	Estimated value (£s) of physical assets handed over to host country(s)	£4000	£5400
21	Number of permanent educational/training/research facilities or organisation established	0	0
22	Number of permanent field plots established	0	0
23	Value of additional resources raised for project	0	£4500 (in kind)

16. Appendix III: Publications

Table 6 Outputs are given code numbers, referred to in the text. All listed outputs are included with this final report.

Type (code)	Detail	Publishers	Available from	Cost £
Field Guide (1)	Evans, T., Sengdala, K., Thammavong, B. and Viengkham, O. V. (2001) <i>A field guide to the rattans of Lao PDR</i> . (96pp, English and Lao language editions).	Royal Botanic Gardens, Kew, Surrey, UK.	In UK: Tom Evans, Department of Plant Sciences, South Parks Road, Oxford OX1 3RB	Free
Online key (2)	Evans, T. and Kirkup, D. (2001) <i>An interactive key to the rattans of Lao PDR</i> .	Royal Botanic Gardens, Kew, Surrey, UK and Oxford Forestry Institute, Oxford, UK	http://www.kew.org/data/rattanslao/ A CD-ROM version available from	Free
Conference paper (3)	Evans, T. D. (2002) The status of the rattan sectors in Lao People's Democratic Republic, Viet Nam and Cambodia – with an emphasis on cane supply. In Dransfield, J., Tesoro, F. O. and Manokaran, N. <i>Proceedings of the Expert Consultation on Rattan Development, Rome, 5-7 December 2000</i> .	Food and Agriculture Organisation, Rome.	http://www.fao.org/DOCREP/003/Y2783E/Y2783E00.HTM	Free
Conference paper (4)	Sengdala, K. and Evans, T. (1999) Rattan cultivation in Lao PDR: Achievements, problems and prospects. pp. 210–216 in Bacilieri, R. and Appanah, S., (eds.) <i>Rattan cultivation: achievements, problems and prospects</i> .	CIRAD-Forêt, Montpellier, France and Forest Research Institute Malaysia, Kuala Lumpur.	Publishers	N/A
Refereed paper (ecology) (5)	Sengdala, K. (in press) Preliminary studies of the germination of fresh seed of some Lao rattan species.	<i>Lao Journal of Agriculture and Forestry</i>	Publishers	N/A
Refereed paper (ecology) (6)	Evans, T. and Sengdala, K. (2002) The adoption of rattan cultivation for edible shoot production in Lao PDR and Thailand – from non-timber forest product to cash crop.	<i>Economic Botany</i> 56(2): 147-153.	http://www.econbot.org/journal/Vol56_2/56.2.html - also available as in pdf format from	Free
Refereed paper (ecology) (7)	Evans, T.D. and Sengdala, K. (1999) From Non-Timber Forest Product to cash crop - the recent spread of rattan cultivation for edible shoot production in the Lao PDR. [this is a slightly shortened version of the Economic Botany article]	<i>Lao Journal of Agriculture and Forestry</i> 1999(2): 40–47.	Publishers.	N/A

Type (code)	Detail	Publishers	Available from	Cost £
Refereed paper (ecology) (8)	Evans, T. D. & Viengkham, O. V. (2001) Inventory time-cost and statistical power: a case study of a Lao rattan.	<i>Forest Ecology and Management</i> 150: 313-322	Publishers.	N/A
Refereed paper (ecology) (9)	Evans, T. D. & Viengkham, O. V. (in press) A trial of methods for surveying rattans in central Lao PDR: optimal design, time costs and survey sensitivity	<i>Lao Journal of Agriculture and Forestry</i>	Publishers.	N/A
Refereed paper (ecology) (10)	Evans, T. & Sengdala, K. (2001) <i>Calamus acanthophyllus</i> – a fire-loving palm.	<i>Palms</i> 45(1): 25-28.	Publishers.	N/A
Refereed paper (ecology) (11)	Evans, T. (2000) The rediscovery of <i>Calamus harmandii</i> , a rattan endemic to southern Laos.	<i>Palms</i> 44(1): 29-33.	Publishers.	N/A
Refereed paper (taxonomy) (12)	Dransfield, J. (2001) Two new species of <i>Daemonorops</i> (Arecaceae) from Vietnam.	<i>Kew Bulletin</i> 56: 661-667.	Publishers.	N/A
Refereed paper (taxonomy) (13)	Dransfield, J. (2000) <i>Calamus bousigonii</i> .	<i>Kew Bulletin</i> 55: 711-716.	Publishers.	N/A
Refereed paper (taxonomy) (14)	Evans, T., Sengdala, K., Viengkham, O., Thammavong, B. & Dransfield, J. (2002) A synopsis of the rattans (<i>Arecaceae: Calamoideae</i>) of Laos and neighbouring parts of Indochina.	<i>Kew Bulletin</i> 57: 1-84.	Publishers.	N/A
Refereed paper (taxonomy) (15)	Evans, T. (2002) A new species of <i>Calamus</i> (<i>Arecaceae: Calamoideae</i>) from North-east Thailand.	<i>Kew Bulletin</i> 57: 85-90.	Publishers.	N/A
Refereed paper (taxonomy) (16)	Evans, T. and Anh, T. P. (2001) A new species of <i>Calamus</i> (<i>Arecaceae: Calamoideae</i>) from central Vietnam.	<i>Kew Bulletin</i> 56: 731-735.	Publishers.	N/A
Refereed paper (taxonomy) (17)	Evans, T., Sengdala, K., Viengkham, O. V., Thammavong, B. and Dransfield, J. (2001) <i>Calamus pauciflorus</i> T. Evans <i>et al.</i> non Ridley renamed <i>Calamus oligostachys</i> T. Evans <i>et al.</i>	<i>Kew Bulletin</i> 56: 242.	Publishers.	N/A
Refereed paper (taxonomy) (18)	Evans, T., Sengdala, K., Viengkham, O., Thammavong, B. & Dransfield, J. (2000) Four new species of <i>Calamus</i> (<i>Arecaceae: Calamoideae</i>) from Laos and Thailand.	<i>Kew Bulletin</i> 55: 929-940.	Publishers.	N/A
Database (19)	Bilingual specimen management database for the rattans held by the Forest Research Centre, Vientiane, Lao PDR	Internal project document.		N/A
Internal report (ecology) (20)	Evans, T., Sengdala, K., Viengkham, O., Thammavong, B. and Brown, N. (2002) An estimate of the productivity of a population of the rattan <i>Calamus solitarius</i> in central Lao PDR.	Internal project report.		N/A

Type (code)	Detail	Publishers	Available from	Cost £
Internal training report (21)	Evans, T. and Sengdala, K. (1998) Report on a training course in rattan taxonomy at the Royal Botanic Gardens, Kew, UK, 27 July-27 August 1998.	Internal project report.		N/A
Internal training report (22)	Darwin Rattan Research Project (1999) Report on a study tour to Thailand, 3-12/8/99.	Internal project report.		N/A
Internal training report (23)	Darwin Rattan Research Project (1999) Report on a study tour to China, 5-15/9/99.	Internal project report.		N/A
Internal training report (24)	Darwin Rattan Research Project (2000) Report on a rattan taxonomy training course in the UK, 1/10/1999-2/3/2000.	Internal project report.		N/A

17. Appendix IV: Darwin Contacts

Table 7

Project Title	Rattan diversity and sustainable management in Lao PDR
Ref. No.	162/6/046
UK Leader Details	
Name	Dr Nick Brown
Role within Darwin Project	Project Manager
Address	Department of Plant Sciences, University of Oxford, South Parks Road, Oxford OX1 3RB
Phone	
Fax	
Email	
Other UK Contact (if relevant)	
Name	Dr Tom Evans
Role within Darwin Project	Research Assistant
Address	Department of Plant Sciences, University of Oxford, South Parks Road, Oxford OX1 3RB
Phone	
Fax	
Email	
Partner 1	
Name	Mr Khamphone Sengdala
Organisation	Forestry Research Centre
Role within Darwin Project	Lao Project Leader
Address	Forestry Research Centre, PO Box 7174, Vientiane, Lao PDR
Fax	
Email	

18. Appendix V: Research programme

Project staffing

The project conducted research in two broad areas – taxonomy and ecology. Table 8 lists the personnel involved and their main research roles. All Lao-based members of the team worked jointly on most aspects of the research programme. However, as noted in the table, each of the three Lao collaborators chose to focus increasingly on a particular aspect of the research as the project matured.

Table 8

Name	Nationality	Post	Research roles
Dr Nick Brown	British (UK-based)	UK Project Manager	Ecology
Dr John Dransfield	British (UK-based)	Project Advisor	Taxonomy
Tom Evans	British (Lao-based)	Research Assistant	Taxonomy and ecology
Khamphone Sengdala	Lao (Lao-based)	Lao Project Leader	Taxonomy and ecology; emphasis on cultivation studies
Banxa Thammavong	Lao (Lao-based)	Researcher	Taxonomy and ecology; emphasis of taxonomy
Oulathong V. Viengkham	Lao (Lao-based)	Researcher	Taxonomy and ecology; emphasis on ecology

The taxonomic and ecological research programmes are discussed in turn below.

Taxonomic research programme

Objectives

The main objectives of the taxonomic research were to determine which species were present in Lao, to clarify their distribution and to develop tools to enable their identification.

Methodology

The research coupled extensive fieldwork with a herbarium-based revision of the species limits and identification criteria. It covered species occurring in Lao and those from neighbouring areas. Fieldwork was required because so few specimens existed from Lao; herbarium research was required to compare both old and newly collected specimens to the various taxa named from elsewhere South-East Asia so that past taxonomic opinions could be re-assessed and names could be uniformly applied.

Taxonomic decisions were based on the identification of consistent morphologically distinct groups of plants, taking into account observed patterns of within- and between-individual variation in natural populations. This is the universally recognised standard method used by palm taxonomists.

When the project began almost nothing was known of Lao rattans. Only four species had been reported in published sources and very few specimens existed outside the country (probably fewer than ten in Western herbaria). Preliminary studies during 1992-1997 had led to the collection of about 40 additional specimens and the drafting of a manual but the researchers had received limited technical support and had no access to comparative material in herbaria abroad, so they had made limited progress with naming. Table 9 outlines the main stages in the taxonomic research programme conducted once the Darwin project began. In the initial proposal there was to be a focus on a particular site for part of the work; for reasons discussed in the ecology section below this was replaced by a national focus for the work.

By the end of the study approximately 250 specimens of Lao rattans had been collected and compared with a similar number from neighbouring countries and hundreds of others from more distant areas. A complete set of Lao specimens is held by FRC in Lao, where they occupy a room refurbished by the project. An Access database was developed (Appendix III output 19) to enable FRC to manage data on the specimens and training provided in its use. Duplicates of most specimens have also been donated to Kew, where they are available to researchers from all over the world. Lao still lacks a national herbarium and so the long-term future of the specimens held by FRC is uncertain; to this end a second set of duplicates is held at Kew on behalf of FRC as insurance, pending the eventual development of a national herbarium.

Table 9

Timing	Activity
10/97-1/98	Review of material from neighbouring countries held at Kew
2-5/98	Re-curation and re-assessment of the specimens held in Lao Initial collecting trips
7-8/98	Study visit to Kew, taking the Lao material for direct comparison Production of a working checklist of the Lao species
12/98-10/99	Major targeted collecting trips to most areas of the country
8/99	Study visit to herbaria in Thailand (Appendix III, output 22)
9/99	Study visit to herbaria in Yunnan, China (Appendix III, output 23)
10/99-2/00	Herbarium research at Kew, drafting a full taxonomic account. Drafting of field guide
3/00-10/00	Supplementary collecting trips, further herbarium research.
10/00-10/01	Finalisation of scientific papers, field guide and interactive key

Species distribution was assessed by mapping the locations of all identified specimens using the GIS programme ArcView. The dot distribution maps were included in the field guide and summary distributions plus specimen lists in the published taxonomic papers.

Findings

A revised system of taxonomy was developed for the whole of Indochina. This was comprehensive for the region covered, defined for the purposes of this study as Lao, Vietnam, Cambodia, non-peninsular Thailand and Yunnan Province, China. Wherever possible the study was also extended to cover related species in neighbouring regions (North-East India, coastal China, the Thai-Malay Peninsula) although due to constraints of time and budget this wider coverage was not comprehensive.

This regional (rather than national) approach is expected to reduce the common problem of species being named differently either side of national borders. The study also had access to far more material and more herbaria than any previous study in the region, and was based on an unusually large amount of fieldwork, all factors that should increase the quality of the results.

The taxonomic results have been published as a series of peer-reviewed papers, principally in the *Kew Bulletin* (Appendix III, outputs 12-18). The Synopsis in *Kew Bulletin* 57 (output 14) represents the key publication in this series.

Fifty named species are now considered to occur in Indochina, eight of which were newly named as part of the project (four from Lao, three from Vietnam and one from Thailand). One new subspecies was also named. Thirteen species reported from the region, several from elsewhere and many varieties have now been recognised as synonyms of existing taxa; removing them removes a significant impediment to communication between people working on rattans in the region.

Based on current knowledge 21 species are wholly restricted to the area of study. These include some of the most important commercial species, especially the large-diameter species *Calamus poilanei*. There are 12 species restricted to single countries (3 in Lao, 6 in Vietnam and one each in Cambodia and the parts of China and Thailand covered by the study). Given the varying levels of coverage Vietnam is predicted to have the highest species richness and the most localised endemics. However Lao probably has the most significant populations of many commercial species due to the large areas of forest and poor road network.

Several species were identified as being of high conservation concern. These fall into two main groups; highly localised species and species under excessive harvesting pressure. Those most at risk from heavy harvesting are thought to be the single-stemmed species *C. poilanei* and *C. solitarius* which cannot sprout after cutting.

Table 10 describes the three principal identification tools developed and the likely user groups.

Table 10

Type	Notes
Standard dichotomous key (Appendix III output 14)	For experienced herbarium-based botanists
Field guide (Appendix III output 1) English-language and Lao-language editions.	Aimed at botanists, foresters, conservationists, agroforestry and plantation workers and naturalists. Contains colour photos, numerous line drawings, simplified keys, illustrated glossary, introductory sections on identification, ecology, vernacular names, conservation and cultivation
Interactive key (Appendix III output 2) English-language, using the programmes Delta and Intkey.	An innovative approach, aimed at both experienced and inexperienced botanists, with or without access to a herbarium. Centred on a flexible multi-access key using up to 69 characteristics in any order chosen by the user. Key leads user to the species accounts from the field guide, to allow confirmation. Supported by illustrated glossaries for most character states and the full text of the field guide.

Ecological research programme

Objectives

Ecological studies concentrated on the sustainable management of wild populations but some work was also conducted on aspects of cultivation. Research was initially intended to concentrate in Nakai-Nam Theun Protected Area and to contribute to reserve management activities. However, during the early stages of project execution it became clear that this would be inappropriate because of security problems at the site and management delays and upheavals in the reserve related to planning for a major hydropower project. Therefore, other study sites were chosen and the emphasis was shifted from developing guidelines for a named site to conducting more broadly applicable research.

Two factors reduced the time available for conducting these studies. Firstly, there were significant delays in starting, since fourteen months of the project elapsed before approval was granted for the main programme of fieldwork to begin. Secondly, in the early stages of fieldwork it proved impossible to locate a healthy, secure, accessible population of the species of greatest commercial value and so studies were eventually refocused on other commercial species.

Methodology

The ecological research can be discussed under four headings.

1) Productivity

A study was made of the productivity of a natural population of a commercially important wild species. Prior to this there had only been one published study of this kind anywhere in the world, and none in seasonal forests of the kind found in Lao. The study recorded growth and mortality for all age classes on a plot in central Lao. These data were combined with information on the overall population structure and density for the site to allow the short-term projection of rates of cane production. Data on cane weights and market prices were included to estimate the projected economic productivity.

Supplementary data on densities, growth rates and prices were collected for several other species and sites.

2) Survey methodology

Two studies were conducted under this heading.

The first study assessed the suitability of plot-based transect sampling as a means of estimating rattan densities. Densities are required for formal assessment of stocks, estimation of sustainable harvest levels and monitoring population trends. A pilot transect survey, based on large, sub-divided individual plots, was conducted using standard methodology in an area with moderately healthy rattan populations. Subsequent analysis estimated the relationship between plot size, plot number and precision; together with data on the time budget of surveys this made it possible to estimate the most cost-effective number and configuration of plots in a given survey area, and the time such a survey would take. Finally, power analysis was used to estimate the sensitivity of different survey designs as a means of monitoring declining populations.

The second study tested two novel methods of estimating rattan growth rates. This information is invaluable in estimating productivity and regeneration times but is difficult to collect by marking and remeasuring individuals because a) rattan stems grow only at the tip, which are often out of reach of even skilled climbers and b) study plots are difficult to protect from harvesters. The novel methods used anatomical characteristics that were hypothesized to vary in parallel with the strong seasonal cycle found in Lao; rattan stems grow only by elongation so these seasonal markers should delineate annual stretches of growth. One approach considered cyclical variation in the spacing of leaf nodes along the stem, whilst the other compared the spacing of inflorescences. Plot-based methods were used to test these hypotheses, comparing the results from the novel methods against results obtained from the traditional method over a 1-2 year period.

3) Conservation status

Conservation status was assessed in general terms for each species based on distribution, observed abundances, ecological characteristics and reported harvesting pressure. It was considered premature to make a comprehensive attempt to assign new IUCN global threat categories since the level of data remains relatively poor for many species, especially in areas outside Lao.

4) Cultivation

The project proposal did not cover research on cultivation but one Lao co-worker had begun his own studies prior to the start of the project and the project gave him some logistical and technical support to continue these. The work mainly concerned nursery and plantation techniques relevant to the newly domesticated species *Calamus tenuis*. Descriptive papers on the domestication of this species were written, based on the experiences of this researcher, extension leaflets produced by FRC and observations of plantations during fieldwork for other purposes. Further observations were gathered during study visits to rattan cultivation areas in Thailand and Yunnan (Appendix III, outputs 22 and 23).

Findings

An overview of the rattan sector in Indochina, placing many of the project's findings into context, was published in the proceedings of the 2000 Expert Consultation on Rattan Development held in Rome (Appendix III output 3). This superseded an earlier conference paper (output 4)

1) Productivity

Results of the productivity study have been fully written up as an internal report (Appendix III output 20) and are currently being prepared for submission to an international peer-reviewed journal. Projected economic productivity of the studied population over the next few years was notably low (approx \$0.06-0.49/ha/yr), due to a combination of low growth rates (approx 1-3 m/year, increasing with stem length), low population densities (approx 38.5 climbing stems/ha, many too short to harvest) and low prices (approx \$0.01/m). The total potential benefits available to the villages harvesting in these areas are still significant since they currently have low cash incomes and access to large areas of forest, but the results greatly weaken the concept of rattan extractive reserves as a means of forest conservation in Lao. Partial data from other populations suggest that these findings are likely to be typical of most other rattan populations in Lao, and they are in accord with a growing body of evidence literature concerning other wild-harvested NTFPs. It is conceivable that some sites with markedly higher potential exist in remote areas that have yet to experience any harvest.

Detailed analysis of the results revealed that growth rates are higher for longer and better-lit stems. This suggests that annual productivity will be highest if relatively long minimum harvest sizes

are enforced, ensuring that each stem is allowed to pass through the most productive phase of its life before being cut. Well-lit logged or second growth forests may also be more productive, in the rare cases where high rattan densities have survived past disturbances.

2) Optimal survey techniques

The study of plot-based line transect sampling has been published in an international peer-reviewed journal (Appendix III output 8), with a modified version also in press in a local journal with a higher readership amongst Lao foresters (Appendix III output 9). The principal finding of this study was that, for low-density, patchy populations similar to that of the rattan studied, the time cost of conducting sufficiently precise surveys is likely to be prohibitively high relative to the value of the resource. The power of repeated surveys to detect declines in time to take corrective action is also likely to be low. This result calls into question the commonly proposed model of non-timber forest product management based on techniques developed for timber species.

The study of novel, one-visit methods for estimating growth rates has been analysed and is currently being prepared for submission to an international peer-reviewed journal. The principal method tested (variation in node spacing) was found to be ineffective, due to wide variations in rate of node production and low seasonal variation in their sizes. However, the trial using inflorescence spacing as a marker for annual growth gave highly promising results and this merits further research.

3) Conservation status

Conservation status was described for all species in the principal taxonomic paper (Appendix III output 14) with species of high concern highlighted in other key publications (e.g. outputs 1, 2, 3 and 11).

4) Cultivation

The paper covering domestication of *Calamus tenuis* for edible shoot production was published in an international, peer-reviewed journal (Appendix III output 6). A shortened version was published in a local journal with a higher readership amongst Lao foresters (Appendix III output 7). The paper highlights the rapid adoption of this new crop since first domestication in 1990, discusses why cane cultivation has not taken off in the same way, and discusses the various linkages between plant domestication and conservation of wild stocks. A related paper on nursery techniques is in press (output 5).

In addition, notes were published on the unusual ecology of two poorly known species (Appendix III outputs 10 and 11).

19. Appendix V: Training programme

Training and capacity building activities

It was initially planned to work with two Lao counterparts, one of whom was to complete a Master's Degree in Taxonomy in the UK, but this proved impossible since at the commencement of the project FRC was unable to assign to the project any counterparts with suitable prior qualifications or English-language skills. However, FRC was able to assign three counterparts with a relevant technical background and Diploma-level qualifications. Therefore a modified training programme was developed, tailored to the abilities and interests of the assigned staff. Technical training covered both taxonomy and ecology with supplementary training given in English language and in presentation skills. There were two principal modes of training: informal, on-the-job training and formal, organised courses/training activities.

On-the-job training

This was the principal training method. Most of it was conducted by the project Research Assistant, who was in constant daily collaboration with the three Lao team members during his 18 months in Lao. This type of training was also provided by the project's UK supervisors during their visits to Lao and during the trainees' prolonged visits to the UK.

Most of this training was structured around the project's research activities, which made best use of time and also maximised both the relevance of training and the opportunities for experiential learning ('learning by doing'). For example, virtually all specimens and most ecological data were collected (with guidance) under the name of one or other of the Lao researchers, who were thus made responsible for the quality of the material collected. This is highly preferable to trainees passively observing research activities being conducted by the trainer. Every effort was made to ensure that training covered the whole research process from planning through to analysis.

A valuable bonus of this approach was improved English-language skills, although the trainer was able to revert to the Lao language for difficult-to-translate concepts.

This part of the programme did not have formal accreditation. Nonetheless, there are numerous indicators that good progress was achieved. These are outlined below.

- monitoring of progress by the trainees' line managers in FRC. They provided regular feedback and stated that they were very pleased with the progress made by their staff during the project.
- commendations received for presentations made by project trainees at the official annual review meeting held by NAFRI
- the high quality of specimens and data collected
- meaningful collaboration in the authorship of scientific papers produced by the project
- entry by one of trainees into a Master's degree programme in Thailand in Natural Resource Management after the end of the Darwin project. This trainee was raised to a Master's entry-level standard through his work with the project.
- success by another of the trainees in obtaining funding for a follow-up project on rattan domestication. The new project relies on training he received during the Darwin project.

Formal, organised courses

Table 11 lists some of the more formal, structured elements of the training programme and documentary evidence of progress.

Table 11

Training	Evidence of progress
Study tour to the UK, 1998	Internal report co-written by trainer and participants (Appendix III, output 21)
Study tour to Thailand, 1999	Internal report co-written by trainer and participants (Appendix III, output 22)
Study tour to China, 1999	Internal report co-written by trainer and participants (Appendix III, output 23)
Course in advanced statistical techniques, Thailand, 1999	Certificate of attendance.
English language lessons at the Lao-American language school, Vientiane, 1999-2000	Records of attendance.
Taxonomic studies visit to the UK, 1999/2000	Internal report co-written by trainer and participants (Appendix III, output 24)
Training in botanical illustration, UK, 1999/2000	Full set of line drawings produced for the field guide (appendix III Output 1).
Training in statistical methods, UK, 2000	Short paper written by trainee accepted for publication by Lao Journal of Agriculture and Forestry (Appendix III, output 5)
Training in presentation technique, UK, 2000	Trainee gave two public presentations in English language to academic audiences at Kew (15 people) and Oxford (25 people) and in Lao language to an audience of about 30 at the final project seminar.
English language course, King's School, Oxford, 2000	Certificate of attendance