

Darwin Project Information

Project Ref Number	15/018
Project Title	Developing land snail expertise in South and Southeast Asia
Countries	Sri Lanka, India, Nepal, Thailand, Laos, Vietnam, Malaysia
UK Contract Holder Institution	The Natural History Museum, London (NHM)
Host country Partner Institutions	The Wildlife Heritage Trust (WHT), Sri Lanka Ashoka Trust for Research in Ecology and the Environment (ATREE), India Centre for Biological Conservation (CBC), Nepal Chulalongkorn University, Thailand National University of Laos Hanoi University of Science, Vietnam (now including Vietnam National Museum of Nature and Department of National Parks) Universiti Sains Malaysia
Other Partner Institution(s)	University of Nottingham, University of Cambridge, University of Antwerp.
Darwin Grant Value	£262,657
Start/End dates of Project	Start date: 1 May 2006 End date 31 October 2009
Reporting period	Reporting period 1 st April 2008 to 31 st March 2009 Annual Report 2 (No Annual Report for 2007/2008 following MTR)
Project Leader Name	Fred Naggs
Project website	www.nhm.ac.uk/tropicalsnails
Author(s) and main contributors, date	Fred Naggs in consultation with Dinarzarde Raheem and the following project leaders: Somsak Panha (Thailand); Rohan Pethiyagoda (Sri Lanka); N. Aravind (India); Prem Budha (Nepal). 29 th May 2009

1. Project Background

The phylum Mollusca are second only to Arthropoda in terrestrial diversity. They are powerful research tools in evolutionary biology and for understanding patterns of global biological diversity and conservation needs. They are sensitive indicators of habitat change as exemplified by the fact that there are more recorded extinctions of land snails than for all other animal groups combined. There are few terrestrial malacologists world wide and very few in tropical countries where the greatest diversity of species occurs. This project seeks to build expertise and capacity in land snail work in South and Southeast Asia to foster regional cooperation and build on the regional centre of expertise available at Chulalongkorn University, Thailand

2. Project Partnerships

Thailand

The main regional partnership for Southeast Asia is with Professor Somsak Panha and colleagues at Chulalongkorn University. After a difficult start at the beginning of the reporting year we have resumed a close and productive working relationship, communicate frequently by email, work together very closely in running and developing the project and jointly edit *The Natural History Journal of Chulalongkorn University*. Chris Wade (Nottingham) and Fred Naggs (NHM) have just returned from a joint field programme in Western Malaysia with the Malaysian and Thai teams. The World Congress in Malacology <http://www.wcm2010.com/symposium.asp> is to be hosted in Thailand in

2010 and we are arranging sessions that will highlight the Darwin initiative project. Dinarzarde Raheem will be organising and chairing the session: *Community Ecology of Tropical Forest Land Snails* and Fred Naggs will be organising and chairing the session: *The Systematics of Asian Land Snails*. Fred Naggs will also be serving on the World Congress Organisation Committee. We will be holding a workshop to launch an Asian land snail interest/research group and opening up membership of the project discussion group SnailAsia@googlegroups.com to any interested individuals. The original plans to set up an Asian Malacological Society received limited support from Korea, Japan and Taiwan, countries already served by malacological societies. However as these are national societies, some of which are dominated by a general sea shell collectors' membership, we will address a wider audience when raising the question of the desirability of an Asian-wide society at the Congress workshop.

Laos, Vietnam, Malaysia

Prof. Panha continues to have direct responsibility for day to day coordination with other project partners in Southeast Asia. The Malaysian partnership is progressing extremely well with field programmes in place and joint surveys in progress. The partnership in Laos is more limited and relies on direct participation with Thai partners. In Vietnam our project partners have introduced us to the Department of National Parks and the Vietnam National Museum of Nature, significantly enhancing the legacy potential in Vietnam (see Annex 3). In the original application we recognised that partnerships would not all deliver the same level of activity and we anticipated that we would need to adopt a flexible approach with project partners when focusing activity and resources. We are very satisfied with the current profile of partnership activity.

Sri Lanka, India and Nepal

Fred Naggs and Dinarzarde Raheem have direct responsibility for coordinating the Sri Lankan, Indian and Nepalese projects. These are all running as planned, have field programmes in place and are building the information base that will allow delivery of projected outputs. The Sri Lankan (WHT) and Indian (ATREE) projects both have a strong institutional base but the situation in Nepal is more complicated. From Fred Naggs' first visit in November, 2006, it was clear that, following the political problems that have beset Nepal, civil society is near collapse, institutional capacity is poor and, with a few notable exceptions, interaction with the international academic community is minimal. In addition, there have been only very limited taxa descriptive studies and no faunal reviews of Nepalese snails from which the project workers can build. Project partners in Nepal are capable and enthusiastic but isolated and with few resources; there is a need to provide more basic support to the project in Nepal than for other projects and we are arranging an additional visit to the NHM for, Prem Budha, the Nepalese project leader in June 2009. Financial support from ATREE, our Indian project partner organisation, has allowed funding to be used to support a visit to the NHM by Aravind at the same time as Prem Budha's visit.

UK partnerships

University of Nottingham

Collaboration with Chris Wade at the University of Nottingham has progressed well and our molecular studies and publications have continued to demonstrate ancient origins for some faunal components and the phylogenetic distinctness of some taxa that enhances their previously unrecognised conservation value as rare or unique representatives of ancient lineages. In addition to describing a new family based on a Thai type genus (accepted for publication by the *Zoological Journal of the Linnean Society*) we have established a previously unrecognised higher level phylogenetic structure for the Stylommatophora, the main land snail group. This will form a basis for erecting a new higher level taxonomy for the group. Chris Wade is the fund holder for a British Council project with our Malaysian partners. We have just returned from the project launch and field programme that began in March 2009. A team of four Malaysians will be working on the project at the NHM and at Nottingham in September 2009.

University of Cambridge

Richard Preece's (University Museum of Zoology Cambridge) expertise in patterns of change in land snail faunal composition through time will be of considerable value in establishing past habitat and climate change in our study areas and allow informed projections of the pattern and impact of future climate change to be developed. Project partners from India, Nepal and Thailand have also had the benefit of access to the Benson collection in Cambridge University Museum of Zoology, a major reference collection of Asian taxa rich in type material (see:

http://www.nhm.ac.uk/resources/research-curation/projects/tropical-land-snails/publications/archiv_nat_hist.pdf)

The UK lead institution: The Natural History Museum, London

The Natural History Museum provides key resources with unparalleled regional specimen and literature reference material that provides the essential tools for identifying survey material and building national databases and reference collections. We have an excellent team and outstanding support in the Zoology Department is provided for financial management by Jeni Stewart and for our database work and Geographical Information (GIS) investigations by Jim Chimonides. Additional support in delivering computer generated reports and illustrated species lists is provided by Tim Conyers. We also have excellent support for imaging work from Harry Taylor (NHM Public Engagement Group). Our ecological work is carried out with collaboration from the Soil Biodiversity group in the Department of Entomology. Fred Naggs has extensive experience of land snail systematics and Dinarzarde Raheem has considerable expertise in the systematics and ecology of South Asian snails, of public outreach and of running land snail field projects in Asia. Engagement with CBD objectives is an extension of the traditional activity of research and collections services at the NHM. The appointment of Fred Naggs as Biodiversity and Conservation Officer in the Department of Zoology in 2003 is aimed at focussing attention on CBD objectives and is demonstration of the support the NHM is providing for running Darwin Initiative projects.

Additional Collaboration

Thierry Backeljau, University of Antwerp, has joined in collaborating with the project in Nepal, is providing additional training in malacology for Prem Budha and has accepted Prem Budha's research output as the basis for a PhD project jointly supervised by Fred Naggs.

Our project partners work within extensive national networks, academic institutions, government agencies and NGOs. For example, in Thailand our project personnel are based in three universities and Prof. Panha is a visiting lecturer throughout Thailand and gives numerous presentations about our projects, particularly on the National Biodiversity Training Programme. All country project partners have contacted National CBD focal points and provide NFPs with project updates.

3. Project progress

3.1 Progress in carrying out project activities

Field programmes

Although most field surveys were only scheduled for the first two years of the project, field surveys have continued to be a significant activity for project partners. The surveys provide distribution records, reference collections and specimen material and data for research

Thailand & SE Asia

The Thai groups carried out field work with Malaysian partners in Johore Bahru, including the islands of Tioman, Pulau Tulai and Pulau Besar (11-18th May, 2008). The Thais and Malaysians were joined by Chris Wade (Nottingham) and Fred Naggs (NHM) in Perlis, Langkawi, Perak and Selangor, with funding from the British Council (March/April 2009). The Thai group surveyed limestone areas in NW Thailand (22-27th May, 2008). Fred Naggs was hosted by the Department of National Parks (DNP), Vietnam and joined by Luong Van Hao, Head of International Relations at Cuc Phuong National Park, on surveys in Ba Vi, Cuc Phuong, and Cat Ba National Parks and also at Marble Mountain, Danang (14th May – 2nd June, 2008). This was a very promising visit for establishing contacts for future projects and meetings were held with National Parks' Directors and the Director of the new Vietnam National Museum of Nature (VNMN) and his research staff. This led to a very successful visit to London and the NHM (7th – 15th February 2009) by Luong Van Hao (DNP) and Dr Pham Van Luc, Director of VNMN. Plans for cooperation across a wide range of museum activities, including exhibitions and education, were set in motion in addition to joint research plans in Zoology, Entomology and Botany departments at the NHH and also with the SE Asian Research Group at Kew: <http://www.kew.org/scihort/directory/teams/WetTropicsSEAsia/index.html>. (see Annex 3 of this report).

South Asia

Aravind (ATREE) has carried out surveys at Kalakkad Mundanthurai Tiger Reserve, Southern Western Ghats; Madikeri, Central Western Ghats, and in the Charmadi Ghats, Central Western Ghats (dates not available). Prem Budha in Nepal has carried out surveys in Middle Hill, Shivapuri National Park and High Mountain, Langtang National Park (April – May 2008); flood plain and Sal forest up to Churia Hill in Chitwan National Park (CNP) (4th-10th June 2008); Middle Hill Community Forest, Godawari, Lalitpur Area (1st-8th October 2008); lowland buffer zone of CNPincluding Bandipur, leasehold forest, Kurintar, national forests and CNP Sal forest (14th-31st October 2008); garden and religious forests (sacred sites) in Kathmandu (1st-7th September 2008); National Forest, previously the Royal Nagarjun Forest (8th-15th September 2008; 1st-21st January 2009; 7th-14th March).

Public engagement: exhibitions, poster presentations, public talks

Thai group

The Thai group arranged exhibitions on land snails and their role in the agro-ecosystem at the 3rd Siam Flora and Fauna Exhibition (21st – 27th April 2008) and the 4th Siam Flora and Fauna Exhibition (16-22nd June 2008). The patron of these exhibitions is Her Royal Highness Princess Somsawalee Mahidol; they are held in central Bangkok at the Bangbon Branch of the Mall Department Store and reach a very diverse and wide audience. An exhibition titled *Thai Science Day: about the Darwin Initiative project on land snails: how important are land snails* was held at the National Science and Development Agency (NSTDA) (7th – 16th August 2008). Using land snails as evolutionary models the Thai group are currently presenting the central exhibit to celebrate the 200th anniversary of the birth of Charles Darwin and 150 years since the publication of *On the Origin of Species* held at the Science Park, Ministry of Science and Sinrindhorn Permanent Science Camp under the patronage of Princess Maha Chakri Sinrindhorn (February to December 2009).

<http://brt.biotech.or.th>

"หอยทาก" อัญมณีแห่งผืนป่า

รูปร่างที่งดงามและวิถีชีวิตที่น่าทึ่งของหอยทาก และสิ่งมีชีวิตของระบบนิเวศที่ได้สร้างโดยหอยทาก

"หอยทาก" ถือกำเนิดมาตามกระบวนการทางธรณีวิทยา มีวิวัฒนาการขึ้นมาอาศัยอยู่บนบกได้อย่างสมบูรณ์ ตั้งแต่ยุคคาร์บอนิเฟอรัส (CARBONIFEROUS) ประมาณ 200 กว่าล้านปีที่ผ่านมา

หอยทากพบได้ทั่วโลกประมาณ 30,000-50,000 ชนิด ในประเทศไทยคาดว่าจะมีมากกว่า 1,000 ชนิด พบได้ตั้งแต่ในดิน บนพื้นดิน ภูเขา ดำ บนต้นไม้ ในป่าทุกประเภท รวมทั้งป่าชายเลน และแม้กระทั่งในทะเลทราย

หอยทากมีความหลากหลายทั้งขนาด รูปร่างและสีสัน บางชนิดมีฝาปิดเปลือกที่สวยงามดุจดังอัญมณีแห่งผืนป่า บางชนิดไม่มีฝาปิดเปลือกที่ดูแล้วเหมือนปลิงหรือหากมากกว่าที่จะเป็นหอย บางชนิดก็ลดรูปร่างปิดเปลือกจนเหลือเปลือกบางเพียงนิดเดียว นอกจากนี้ รูปร่างการเวียนซ้ายและเวียนขวาของเปลือกหอยยังแสดงถึงความมหัศจรรย์ของสัตว์ไม่มีกระดูกสันหลังกลุ่มนี้ที่ได้ปรับตัวและวิวัฒนาการมาโดยตลอด

รูปร่างลักษณะภายนอกและวิถีชีวิตของสัตว์กลุ่มนี้ แสดงถึงพลังของธรรมชาติที่ได้สร้างสรรค์สรรพชีวิตบนโลกนี้

ข้อมูล/ภาพ : ดร.จิรศักดิ์ สุจริต และ ศ.ดร.สมศักดิ์ ปิณฑุชา ภาควิชาจุลชีววิทยา มหาวิทยาลัยบูรพา
 กิจกรรมประกาศ : โครงการวิจัยได้รับทุนสนับสนุนจากโครงการ BRT ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ (ชช.)
 สำนักงานกองทุนสนับสนุนการวิจัย (สกว.) และบริษัท ปตท. จำกัด (มหาชน)

<http://brt.biotech.or.th>

Figure 1. Central panel of snail display at the 4th Siam Flora and Fauna Exhibition



Figure 2. Professor Somsak Panha with Princess Maha Chakri Sirindhorn viewing part of the snail exhibit at the 4th Siam Flora and Fauna Exhibition



Figure 3. (above) Professor Somsak Panha receiving award from Princess Maha Chakri Sirindhorn in recognition of his snail work in support of the Princess's conservation charity at the 4th Siam Flora and Fauna Exhibition
Fig.4 (below) Entrance gallery to Thai Darwin celebration exhibit





Figure 5. (Above) Part of snail exhibit at Thai Darwin celebration exhibition.

Figure 6. (Below) Princess Maha Chakri Sirindhorn being shown part of the snail exhibit at Thai Darwin celebration exhibition by Professor Somsak Panha.





Figure 7. (Above)Aravind and poster at Bombay Natural History Society

Figure 8. (Below) Aravind, second on left, at National Symposium on Environmental Degradation



Scientific Meetings

Aravind presented a poster on monitoring the exotic invasive species *Lissachatina fulica* in India at the international conference *Conserving Nature in a Globalising India* in Bangalore (17th – 19th February 2009) and at a meeting held at the Bombay Natural History Society (figure 7). Aravind gave presentations at Kuvempu University (12th and 13th November 2008) and a key note address on the role of snails for biomonitoring at the National Symposium on Environmental Degradation at Haunsbhavi, Karnataka (23rd December 2008).

Members of the Thai group have given presentations at a large number of meetings in the past year but full records of these have not been supplied yet. On their visit to the NHM in October/November 2008 Prof. Panha, Dr Sutcharit and Dr Tongkerd attended the Annual Mollusca Forum hosted at the NHM. Prem Budha presented a paper titled *Species diversity of land snails in the Phulchowki mountain forest* at the fifth National Conference on Science and Technology held in Kathmandu 10th -12th November 2008 and organised by the Nepal Academy of Science and Technology.

Media coverage

The Thai group featured on a radio broadcast on Thailand National Radio Channel (7th July 2008) about invasive snail species and their impact as agricultural pests. A panel discussion (6th December 2008) and exhibition on land snails at the Thai Orchid Exporter Association and Kasetsart University on the control of slugs and snails received wide media coverage. The exhibitions mentioned in the above section also received wide radio, television and press coverage, particularly relating to the visits made by Princess Somsawalee Mahidol and Princess Maha Chakri Sinrindhorn. At the NHM we are working with the BBC to include project coverage in the four part series they are working on about the Museum.

Training

Training is one of the most successful aspects of the project. Chulalongkorn University is fulfilling its role in developing as a regional centre of expertise. Having completed their PhD's during the course of the project three lecturers (Dr Prasankok, Dr Kongim, Dr Tumpeesuwan), have resumed their posts in three different Thai universities where they are continuing their snail research and including land snail studies in their teaching programmes. Two have been appointed to lectureships at Chulalongkorn University (Dr Sucharit, Dr Tongkerd) where we have two new PhD students and one new MSC student jointly supervised by Somsak Panha (Chulalongkorn), Fred Naggs (NHM) and Chris Wade (Nottingham). There are also plans for the Thai group to extend their training of our current Malaysian project MSc students in Bangkok and to have joint PhD studentships between Chulalongkorn University and Universiti Sains Malaysia, Penang.

In addition to giving lectures to undergraduates Aravind has given talks and lead land snail field trips for Indian school students in Bangalore, Dharwad, Ankola Narasipur and Ujre.

Figure 9. Aravind giving a talk to school children.





Figure 10. (Above) Aravind with School group at Charmadi Ghats Field Station.

Figure 11. (Below) Aravind instructing school field group at Dandeli Wildlife Sanctuary



Training in Nepal has been greatly enhanced by Prem Budha having been appointed as a full-time lecturer at Tribhuvan University, Kirtipur. We have planned the MSc courses that he is running on Taxonomy and Malacology jointly. In addition to formal training Prem is a member of several forest community committee groups, two in Chitawan one in Kurintar and one in Bandipur. In these he promotes awareness about forest biodiversity and sustainable forest use, using snails as both examples of biodiversity, how they can be exploited as a food source, their importance as pests to cultivation and how they can be controlled as pest species.



Figure 12. (Above) Fred Naggs teaching the course unit on nomenclatural theory and practice to the Tribhuvan University MSc Taxonomy class. Prem Budha is seated to the right in the image on the left.

Figure 13. (Below) Fred Naggs giving lecture on Asian land snail diversity to undergraduates at Universitat Sains Malaysia, Penang





Figure 14.(Above) Fred Naggs giving presentation to Vietnamese Forestry Institute students at Cuc Phuong National Park on the role of snails in forest ecosystems

Figure 15. (Below) Somsak Panha talking to school group carrying out snail projects at Umphang National Park, Thailand





Figure 16. Tam Phet Arboritum, Takli District, Nakonsawan Province Thailand, Arboretum staff with Richard Preece and colleagues from the University of Cambridge and Fred Naggs (NHM).

Figure 17. Dinarzarde Raheem giving a presentation at a 2 day workshop and field programme she ran at Kanneliya Forest Reserve, Galle District, Sri Lanka for Forest Department staff, eco-tourist guides and university undergraduates. Part of series funded by the Sri Lankan Wildlife Heritage Trust



3.2. Progress towards Project Outputs

Illustrated species lists for six countries

As discussed above, illustrated species lists will no longer be generated from a database. The Thai research group are using the database software developed at the NHM by Jim Chimonides to assemble data for the SE Asian projects. The Thai Ministry of Science and Environment will host a website that will include the SE Asian national species lists with images. Illustrated species lists for the Western Ghats (India) and Nepal are being compiled manually by Dinarzade Raheem with support from Fred Naggs, Aravind (India) and Prem Budha (Nepal). These will be made available as hard copies and online as interactive lists linked to images on the NHM web site. The arrangement will be similar to that of our current Sri Lankan online illustrated list at:

<http://www.nhm.ac.uk/jdsml/research-curation/research/projects/tropical-land-snails/taxa.dsm>

Field guides for six countries

The Thai partners have worked with Fred Naggs to produce an illustrated guide to Thai land snails and it is currently in press.



Figure 17. Early draft of part of Illustrated guide to the land snails of Thailand

The Thai group have undertaken to produce illustrated guides for Laos, Western Malaysia, and Vietnam. With support from Harry Taylor (NHM) Fred Naggs (NHM) and Aravind (ATREE) Dinarzade Raheem (NHM) is preparing an illustrated guide to the land snails of the Western Ghats that should be completed in the near future and Dinarzade Raheem has made progress on a guide to the land snails of Nepal with assistance from Fred Naggs and Prem Budha. In addition, a revised edition of our Sinhala language guide, with corrections, additions and updates has been published.

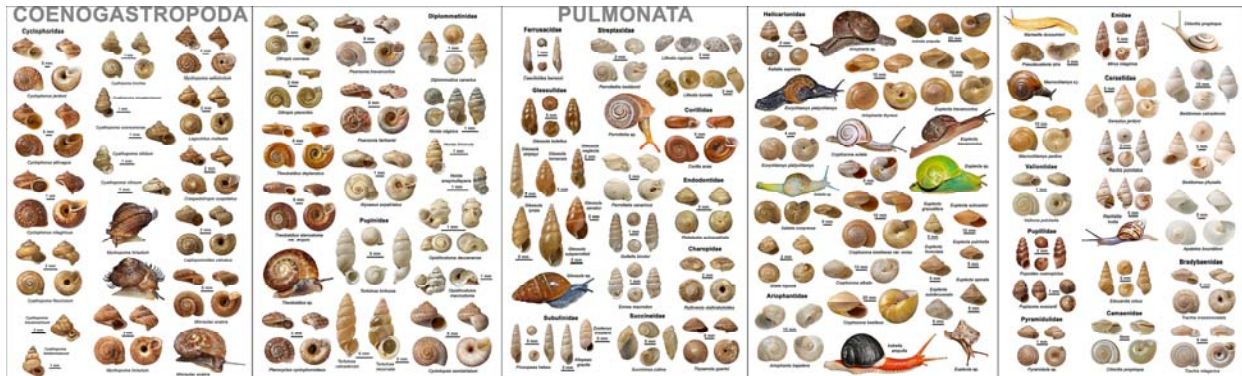


Figure 18. One side of draft illustrated guide to land snails of the Western Ghats, India

Taxonomic Revisions

Taxonomic revisions (see table 2) are being carried out as part of the process of preparing national and local species lists but in addition we continue to prepare a number of taxonomic revisions for publication as research papers. These include revisions of selected Sri Lankan genera such as *Glessula* and *Theobaldius*, Nepalese genera such as *Glessula* and *Rishetia* and a wide range of SE Asian groups. Our revision of relationships in the Streptaxoidea (accepted by the *Zoological Journal of the Linnean Society*) is primarily a systematic research paper but it also has a significant taxonomic component, including the erection of a new family, the Diapheridae. This is a significant advance in knowledge for a group of over a thousand species that was previously placed in a single family, the Streptaxidae. It also exemplifies the level of collaboration we have achieved in combining research contributions from the NHM, University of Nottingham and Chulalongkorn University to produce research in a high impact international journal that raises the level of research output for our project partners.

Compilation of national databases and regional database

As explained below under section 5, no one was employed as a full time data-basing coordinator and this part of the project has been restructured. The Thai group are going ahead with data-basing of the Thai and SE Asian project partner's snail faunas and the database will be made available on the web on a site hosted by the National Science Technology Development Agency (NSTDA), Ministry of Science and Technology. The Indian Western Ghats and Nepalese faunas are being compiled manually as illustrated lists by Dinarzarde Raheem for publication and placing on the NHM's website, they will be included on Indian, Western Ghats and Nepalese national databases compiled with country partners and the web interactive image lists will perform a similar role to that planned for an Asian international database. The Western Ghats and Nepalese illustrated lists should be completed before the end of the project (31st October 2009).

Publication of research papers and conservation strategies.

Dissemination of outputs on WWW and through media

The NHM website <http://www.nhm.ac.uk/> hosts our project web pages at: www.nhm.ac.uk/tropicalsnails. We will be adding the interactive species list for the Indian Western Ghats and for Nepal and these will follow a similar pattern to our Sri Lankan species list at: <http://www.nhm.ac.uk/jdsml/research-curation/research/projects/tropical-land-snails/taxa.dsml>. Species lists will give revised classifications and the changes will be promoted on the main NHM web site and advertised through various national and regional links such as the South Asian Natural History List at: http://www.Isoft.com/SCRIPTS/WL_EXE?SL1=NATHISTORY-INDIA&H=PRINCETON.EDU. The publications pages at: <http://www.nhm.ac.uk/jdsml/research-curation/research/projects/tropical-land-snails/publications.dsml> are regularly updated (but currently exclude publications by project partners that do not include NHM authors). The other web pages need updating and we have a large number of images and discussion pages on project activity to be added to the 'tropicalsnails' pages. Judging from the number of enquiries we receive via the site, it reaches a large international and UK audience.

Building specimen reference collections

All of the country projects are survey based and as a result enormous advances have been made in building and enhancing reference collections. Collections have been established or greatly enhanced in India, Nepal, Thailand and Vietnam and regional collections from Laos, Malaysia and Vietnam have been established in Thailand.

Figure 19. ATREE have moved to a new research centre and museum where the project's snail reference collections are housed.



Figure 20. Cabinet showing drawers of land shell reference collections in the ATREE Museum



Contribution of material to Frozen Ark

The UK project participants consider that the aims of the Frozen Ark <http://www.frozenark.org/> are commendable and all project partners have been encouraged to pursue them. However, the constraints of national legislation controlling the export of biological material in host countries has prevented their being in a position to formally sign up to the Frozen Ark Consortium and depositing material in the UK. There are additional problems in that new regulations controlling the transport of deep frozen or ethanol preserved material have made shipping prohibitively expensive. Project partners in Nepal and Vietnam are storing DNA material in absolute ethanol while project partners in Thailand are building frozen collections for SE Asia and our ATREE project partner in Bangalore is building a deep frozen collection at -80°C.

3.2 Standard Measures

Please expand (eg paste from application form or previous reports) and complete Table 1. Quantify project standard measures over the last year using the coding and format from the Darwin Initiative Standard Measures (see website for details: <http://darwin.defra.gov.uk>) and give a brief description. Please list and report on relevant Code Nos. only. The level of detail required is specified in the Standard Measures Guidance notes under 'definitions' column. Please devise and add any measures that are not captured in the current list. Please note that these measures may not be a substitute for output level objectively verifiable indicators in the project logframe.

Table 1 Project Standard Output Measures

Code No.	Description	2006 Total	2007 Total	2008 Total	2009 Total	Total to date	Number planned for this reporting period	Total planned from application
Established codes								
1A	Thai PhD students 1 Nepalese PhD student	2 1	2 1	2 1	2 (new) 1	4 1	2 1	3
1B	Thai PhDs awarded			2				
2	Nepalese MSc research students	2	2	2	2 (new)		2	2
4A	Number of undergraduate students receiving training 1.Thailand 5 lecturers in 3 universities plus 1 professor average 20 students each = 120 students per year from year 3 plus 50 students on short courses 2. Nepal 20 per year	(3 x 20 + 50 + 20)	160	300	300	400	50	210
4B	Students on mollusca courses in Sri Lanka, India, Nepal and Thailand records not fully collated (details will be provided in final report)	2	4	4	4	16	2	4
4C	Nepalese MSc biology students taking courses in malacology and taxonomy	0	20	36	50	106	50	0
4D	Number of training weeks provided	Approx 30	Appro x 30	Appro x 50	Appro x 50	Approx 160	Not listed	Not listed
6A	People receiving training on workshops and field trips. Approx 100 each year across all country projects details not fully collated (details will be provided in final report)	100	100	100	100	400	Not specified	150
6B	Training weeks provided	7	5	5	5	22	Not specified	5
7	Training manuals and information posters	1	1	1		3	Not specified	4
8	Weeks spent by project staff in host countries	19	45	6	14	84	Not specified	65

9	Action plans incorporated in publications and pest reports	0	0	3	0	3	Not specified	8
10	Field guides	1			2	3	Not specified 3 more in advanced preparation	8
11A	Papers published in peer reviewed journals	4	3	6	0	11	Not listed	0
11B	Number of papers submitted to peer reviewed journals	4	3	6	3	16	Not listed	12
12A	Computer databases for all project partners now abandoned following MTR. SE Asian database will be hosted in Thailand by end of project							7
13A	Collections set up in Nepal, Malaysia and Vietnam and collections for Laos, Malaysia and Vietnam established in Thailand					6	End of project objective	6
13B	Enhancement of national collections in Thailand and India and regional SE Asian collections in Thailand					2	End of project objective	2
14A	National workshops/seminars specifically on project	4	4	2	1	11	Not specified	7
15A	Press releases	4	4	4	0	12	Not specified	10
15B	Local press releases	2	2	2	0	6	Not specified	4
16A	Project agenda publication in <i>Natural History Journal of Chulalongkorn University</i> newsletter objectives not followed up by project partners who favoured replacement by online news/discussion group at SnailAsia@googlegroups.com	1				1 + online news/discussion site with regular items / updates	Not specified	7 but superseded by online communication at SnailAsia@googlegroups.com and publication given to website www.nhm.ac.uk/tropicalsnails
16B	Copies of <i>NHJCU</i> distributed to libraries in Thailand and internationally	1000				No direct measure of online hits but large number of enquiries generated from website viewers		3,000 copies based on printed updates
16C	UK news circulation					Online access as above	Not listed	Not listed
17A	Regional dissemination Networks established	1 Asian network established via SnailAsia@googlegroups.com and plans for launch of up rated version and possible Asian Malacological Society to be launched at 2010 World Congress						1
17B	Networks enhanced	Network for Thai research group centred at Chulalongkorn University and extending to previous Chulalongkorn post docs now lecturers in other Thai universities						1
18A	Number of national TV programmes/features	3 feature TV programmes in Thailand plus extensive news coverage of exhibitions and princesses' visits				3++	0	2
19A	Local radio broadcasts in India and Nepal	2	2			4	0	4
20	£1, 316 of equipment supplied to	£1,316				£1,316	0	£1,316

	Nepal at start of project							
22	Number of permanent field plots set up in Sri Lanka and India	9					0	9
23	Value of resources raised from sources other than Darwin	In addition to securing the matching funding set out in the project proposal we have secured a number of supporting grants that will be fully tabulated in the final report.						

Table 2 Publications

Type (eg journals, manual, CDs)	Detail (author, year, title)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal	Raheem, D.C., Naggs F., Preece, R.C., Mapatuna, Y., Kariyawasam, L., and Eggleton, P. 2008. Structure and conservation of Sri Lankan land-snail assemblages in fragmented lowland rainforest and village home gardens.	Journal of Applied Ecology 45 : 1019-1028.	contact D. Raheem	free
Journal	Budha, P.B., and Naggs F. 2008. The Giant African Land Snail <i>Lissachatina fulica</i> (Bowdich) in Nepal	The Malacologist 50 : 19-21	View as PDF	free
Journal	Raheem, D. 2008. Persistence and conservation of Sri Lankan rainforest snails in a landscape of fragmented forest and modified habitats	The Malacologist 50 : 26-27	View as PDF	free
Journal/ scientific magazine	Budha, P.B. 2008. Land snails: Important aspects of Nepalese Biodiversity. (in Nepali).	<i>Scientific World</i> 7 (7): 32-33, 38.	Pdf available from Prem Budha	free
Journal	Sutcharit, C & Panha, S. 2008. Taxonomic re-evaluation of <i>Sarika diadema</i> (Dall, 1897) and <i>S. asamurai</i> (Panha, 1997), two endemic land snails from Thailand (Pulmonata: Ariophantidae: Macrochlamydiae).	<i>Raffles Bulletin of Zoology</i> 56 (1): 95-100	http://rmbr.nus.edu.sg/rbz/biblio/56/56rbz95-100.pdf	free
Journal	Prasankok, P. Sutcharit, C. Tongkerd, P. Panha, S. 2008. Biochemical assessment of the taxonomic diversity of the operculate land snail <i>Cyclophorus fulagaratus</i> (Gastropoda: Cyclophoridae) from Thailand.	Biochemical Systematics and Ecology 36 (12): 900-906	Biochemical assessment of the taxonomic diversity of the operculate land snail, <i>Cyclophorus fulguratus</i> (Gastropoda: Cyclophoridae), from Thailand	free
Book	Sutcharit, C. Panha, S. 2008. Reprinted 2009. Land Snails of Thailand: Land Snails in Khao Nan National Park. (in Thai)	BRT Program (Biodiversity Research and Training Program)	Widely available in bookshops in Thailand	Thai Baht 250 = £5 approx
booklet	Naggs F. and Raheem, D. 2009 <i>An illustrated guide to the land snails of Sri Lanka (in Sinhala)</i>	The Natural History Museum, London	Copies available free on request from	free

3.3 Progress towards the project purpose and outcomes

The project purpose: to develop a long-term relationship between the NHM and Chulalongkorn University, establishing Chulalongkorn University as a regional centre of land snail expertise is now fully on course. The Thai research group has undoubtedly become a regional centre of expertise. Firm links are established between the Thai research group and all SE Asian partner countries, especially with Malaysia that has joint research in progress and exchanges of research students. Hosting the World Congress of Malacology in Phuket in 2010 will demonstrate this to a global audience. The long-term relationship with the NHM is dependent on the NHM continuing to retain expertise in land snails; the long-term future of land snail work in Thailand has been assured by five research students having been appointed to tenured university posts.

3.4 Progress towards impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The project's impacts on biodiversity and sustainable use are diverse. For example, our research on the impact of forest fragmentation on species survivorship and on survivorship in different types of transformed habitat in Sri Lanka is of wide applicability. We have demonstrated the need for establishing forest corridors for medium to long term species survival; it is absolutely clear that conserving isolated forest fragments will not be sufficient. We have demonstrated that certain transformed habitats, most notably traditional 'home gardens' support a significant subset of forest species and are important reservoirs of diversity that have a major role to play in sustainable agricultural practice and conservation. Our findings on the conservative nature of the distributional ranges of many species show that un-quantified factors limit distribution ranges and that for many taxa distribution ranges persist even when habitats are transformed. Thus, in these instances, introducing taxa to areas outside of their natural range as a conservation measure have a poor chance of success. Our work in SE Asia is demonstrating the degree of endemism in limestone hill environments, highlighting that the increasingly rapid loss of limestone hills through quarrying and extraction for cement production is in direct conflict with conservation of biodiversity. How to reconcile the need for commercial products of high economic value with the need for conservation is a significant challenge. The first step is to highlight the issue and one obvious measure would be to set aside some area of each limestone outcrop for conservation. In Nepal we are working with community forest groups helping them to understand the difference between native, mostly detritivore species harmless to harvesting of traditional forest products and pest species that are almost exclusively exotic alien species. Research underwrites all of these measures and goals and, having established a number of project partners in research careers, we have set in place the means for providing sustained input to establishing informed practice for the future.

4. Monitoring, evaluation and lessons

Sustained effort to maintain and, if need be, to recover working relationships has proved to be key to project success. Regular communication with project partners by email and regular visits are essential. Pressing for delivery of outputs is important but the need to recognise and respond to any difficulties calls for some measure of flexibility. Our measurable outputs remain important but arguably of more lasting value is the extent to which project personnel continue to pursue careers in the subject area. The lessons gained from a decade of running Darwin Initiative projects remain the same: there are always problems and you have to keep working at them.

5. Actions taken in response to Mid-Term review (MTR)

The MTR report considered that the overriding priority was to maintain cooperation rather than to push for partner's compliance with project objectives. In addition, transfer of funds to the UK in order to achieve the objective of an international Asian database was considered to be unacceptable as it went against the Darwin Initiative principle that a certain though unspecified proportion of project funds should go to overseas partners. Thus the full international data-basing component of the project will not go ahead. Data-basing will be confined to the work carried out in Thailand for SE Asian projects. The loss of a three year fulltime post has had a major knock on effect on other project outputs because the data-basing programme was a core activity for computer generated illustrated guides and illustrated species lists. These will now be prepared manually for the projects in India and Nepal, a time consuming activity that does not have the advantage of being based on a centralised interactive resource and for which the time devoted to this will have a significant impact on time spent on other planned activities. Extension of the project end date to 31st October 2009 will allow us to catch up on a number of outputs that were delayed during the MTR process and the consequences of giving up attempts to make alternative arrangements for a database but we have no additional funding and Dr Dinarzarde Raheem's contract ended on 30th April 2009. Dinarzarde's role has been invaluable and we will be dependent on her availability and goodwill in volunteering to complete objectives.

The main priority in the past year has been to restore project cohesion following the disruption occasioned by the MTR. We have achieved this. The need for establishing long term collaboration and providing supporting indicators was both highlighted in the MTR and set at risk by the MTR. We are now in a position to demonstrate that we will achieve this objective. Aravind has set up a discussion group SnailAsia@googlegroups.com and acts as the moderator. This acts as our communication hub relating to snail work in Asia. Access is currently restricted to the current project workers but will be extended to a wider audience at the 2010 World Congress. In addition to Fred Naggs and Dinarzarde Raheem running sessions at the Congress, in which our Darwin Initiative country projects will be highlighted, we will launch an Asian interest group to communicate and promote continued collaboration as set out in the project's overall purpose. This will set a mechanism in place to reduce the polarisation between the SE Asian and South Asian project partners.

6. Other comments on progress not covered elsewhere

The past year was difficult. Keeping all of the project partners on board was a very demanding exercise but as discussed above, we are now fully on track. Political instability has been a major issue in several of our project countries and even Thailand and Malaysia have been affected. Political instability in Nepal was recognised as being an issue from the start of the project. With a deteriorating situation, sixteen hour power cuts daily and the break down of civil society and central government it is a difficult environment to work in but Nepal can nevertheless be counted as a successful project.

7. Sustainability

As detailed above the project has set and established long-term goals. The sustainability is most assured in India, Nepal, Thailand, Malaysia and Vietnam where project staff hold or have gained permanent posts. The project partner in Laos holds a lectureship but he has not worked independently so far and his continued involvement with the project's subject matter is likely to be dependent on his continuing to collaborate with our Thai partners.

8. Dissemination

The project has achieved an extremely high profile in Thailand and royal patronage has generated enormous publicity. The Thai research group is also the most secure because of the six tenured positions held in three Thai universities.

9. Project Expenditure

Table 3 **Table 4 Project expenditure during the reporting period (Defra Financial Year 1 April 2008 to 31 March 2009)**

Item	Budget (please indicate which document you refer to if other than your project application or annual grant offer letter)	Expenditure	Variance
Rent, rates, heating, overheads etc			
Office costs (eg postage, telephone, stationery)			
Travel and subsistence			
Printing c/f to 2009-10			
Conferences, seminars, etc			
Capital items/equipment			

(specify)			
Others (specify) Audit Consumables Overhead			
Salaries (specify by individual) £5k vired to travel D Raheem P Budha Ramesh Devotka Sunita Khatiwara Srijana Khanal Rajman Maharjan Aravind Kamalesh L Da Silva V Vinhana			
TOTAL			
We request that the £4,808.52 under-spend on travel and salaries be carried over to 2009/2010 (revised project end: 31 st October 2009)			

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2008/09

<p>Goal: <i>To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve</i></p> <p><i>The conservation of biological diversity,</i></p> <p><i>The sustainable use of its components,</i></p> <p><i>and</i></p> <p><i>The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</i></p>	<p><i>(report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity eg steps towards sustainable use or equitable sharing of costs or benefits)</i></p>	
<p>Purpose</p> <p>To develop a long-term relationship between the NHM and Chulalongkorn University, establishing Chulalongkorn University as a regional centre of land snail expertise.</p>	<p>Setting up land snail projects in South and Southeast Asia that are supported regionally and with long-term cooperation from the NHM. Establish reference collections, national databases and a regional database, provide training, develop research output with raised standards, publish local snail guides. Develop and publish conservation strategies based on snails as key indicators.</p>	<p>Land snail projects are operating in Sri Lanka, India, Nepal, Laos, Thailand, Malaysia and Vietnam (see section 7 for details of long term sustainability) with growing reference collections for both research and public display. A SE Asian database has been developed at Chulalongkorn University that will shortly go online on a site hosted by the Thai Ministry of Science and Technology. Extensive and long-term training and teaching are in place. Research output has been raised and project partners supported in producing high quality research published in high impact peer-reviewed, international journals. Snail guides are in preparation as detailed in this annual report. Conservation priorities and strategies applicable to all project countries have been published in the <i>Journal of Applied Biology</i> and are in press in the <i>Journal of Biogeography</i>.</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. Illustrated species lists for six countries. 2. Field guides for six countries. 3. Taxonomic revisions. 4. Compilation of national databases and regional database. 5. Publication of research papers. 6. Dissemination of outputs on WWB and through media. 7. Build specimen reference collections. 	<ol style="list-style-type: none"> 1. Publication of illustrated species lists for regions covered in project in India, Nepal, Thailand, Laos, Cambodia and Vietnam. 2. Publication of six field guides. Suitable for use by schools, universities and naturalists. 3. Publication of taxonomic revisions. 4. Web access to regional database. 5. Publication of research papers on distribution, faunal origins, status and conservation. 6. Project web site, media coverage. 7. Collections established in partner countries. 8. Contribution of material to Frozen Ark 	<ol style="list-style-type: none"> 1. A considerable amount of work has gone into manually producing illustrated species lists for India and Nepal and these will be added to the NHM website by the end of the project. Illustrated species lists for Laos, Thailand, Vietnam and Western Malaysia will be hosted on the Thai Ministry of Science and Technology site. 2 A laminated guide to the land snails of Thailand is in press and the first in a series of booklets to the snails of Thailand's National Parks, Khao Nan National Park, was published in 2008 and reprinted in 2009. A new version of the Sinhala guide to the land snails of Sri Lanka was published in 2009. Illustrated guides to the land snails of the Western Ghats, India and for Nepal are in preparation and the Thai group are working on the guides for Laos, Malaysia and Vietnam. 3. Four taxonomic revision papers published two in press and four in preparation. The illustrated species lists are also based on extensive taxonomic revision. 4. Our data will now be hosted on two websites, one at the NHM and one hosted at the Ministry of Science & Technology, Thailand. 5. Ten research papers (including 4 referred to above with taxonomic content) published; three in press and eight in preparation. 6. Publication pages have been updated on the NHM project website and the main pages are being revised. An additional web site is presented by the Nepal Centre for Biological Conservation http://www.cbcnepal.org.np/ (the video loop on this site features Dinarzarde Raheem demonstrating the use of features of the reproductive anatomy for systematics and showing field assistants how to carry out 100m transects). 7. Major reference collections have been established for all partner countries and all but Laos hold national reference collections.

8. Contribute material to Frozen Ark – new objective		8. Partner countries have not been able to sign up to the Frozen Ark consortium because of legal constraints but frozen and ethanol preserved tissue collections for all partner countries are in place.
Activities Conduct field surveys, establish reference collections, establish databases, analyse data, publish research, prepare illustrated species lists in printed and electronic form. Prepare field guides: communicate information on web and gain media coverage.	Activity Milestones Year 1. Launch project with training workshop at Chulalongkorn University with international partners. Years 1 and 2: run field programs. Years 1, 2 and 3: two members of Thai group spend two months per year working on identifying material (includes Laotian, Cambodian and Vietnamese) at NHM. Year 2: Indian and Nepalese partners work up their collections in London. Year 2: publish illustrated species lists. Year 3: publish illustrated guides to snails in the Western Ghats, India, Thailand and areas covered in surveys in Nepal, Laos, Cambodia and Vietnam. Submit a minimum of twelve papers to be published in peer-reviewed journals, covering subject areas presented in proposal, including conservation, and including results from work in Sri Lanka. Database to be available on web.	Survey based research programmes, reference collections and trained staff are operating in all project countries and as planned with project staff now holding permanent posts, promising an outstanding legacy in partner countries

Annex 2 Project's full current logframe

LOGICAL FRAMEWORK

19. Please enter the details of your project onto the matrix using the note at Annex B of the Guidance Note. This should not have substantially changed from the Logical Framework submitted with your Stage 1 application. Please highlight any changes.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Goal:</p> <p>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</p> <ul style="list-style-type: none"> • the conservation of biological diversity, • the sustainable use of its components, and • the fair and equitable sharing of benefits arising out of the utilisation of genetic resources 			
<p>Purpose</p> <p>To develop a long-term relationship between the NHM and Chulalongkorn University, establishing Chulalongkorn University as a regional centre of land snail expertise.</p>	<p>Setting up land snail projects in South and Southeast Asia that are supported regionally and with long-term cooperation from the NHM. Establish reference collections, national databases and a regional database, provide training, develop research output with raised standards, publish local snail guides. Develop and publish conservation strategies based on snails as key indicators.</p>	<p>Outputs from survey based projects in India, Nepal, Thailand, Laos, Cambodia and Vietnam: establishment of reference collections; publication of results in peer-reviewed journals; publication of field and other guides. Web access to regional database and other outputs.</p>	<p>1. Political problems may limit activity in some of the associate partner countries. 2. Significant further increases in fuel prices and costs of international flights would result in adjustments to international travel arrangements.</p>
<p>Outputs</p> <p>1. Illustrated species lists for six countries. 2. Field guides for six countries. 3. Taxonomic revisions. 4. Compilation of national databases and regional database. 5. Publication of research papers and conservation strategies. 6. Dissemination of outputs on WWB and through media. 7. Build specimen reference collections. 8. Contribute material to Frozen</p>	<p>1. Publication of illustrated species lists for regions covered in project in India, Nepal, Thailand, Laos, Cambodia and Vietnam. 2. Publication of six field guides. Suitable for use by schools, universities and naturalists. 3. Publication of taxonomic revisions. 4. Web access to regional database. 5. Publication of research papers on distribution, faunal origins, status and conservation. 6. Project web site, media coverage. 7. Collections established in partner countries. 8. Contribution of material to Frozen ark</p>	<p>1. Published illustrated colour species lists. 2. Publication of six coloured field guides. 3/5. Submission for publication of taxonomic revisions and research papers (minimum of 12 papers: revised objective from partners). 4. Database available on web. 6. Access available to project web site; publication / presentation of media coverage. 7. Collections held in institutes. 8. Material held in Frozen Ark collections.</p>	<p>Collaboration with Thailand is well established and proven to be robust and reliable. Some of the subsidiary partner countries are politically unstable and adjustments may have to be made, contracting activities in some countries, expanding in others.</p> <p>Partnerships in subsidiary countries hold up.</p>

Ark – new objective			
<p>Activities</p> <p>Conduct field surveys, establish reference collections, establish database, analyse data, publish research, prepare illustrated species lists in printed and electronic form. Prepare field guides: communicate information on web and gain media coverage.</p>	<p>Activity Milestones</p> <p>Year 1. Launch project with training workshop at Chulalongkorn University with international partners. Years 1 and 2: run field programs. Years 1, 2 and 3: two members of Thai group spend two months per year working on identifying material (includes Laotian, Cambodian and Vietnamese) at NHM. Year 2: Indian and Nepalese partners work up their collections in London. Year 2: publish illustrated species lists. Year 3: publish illustrated guides to snails in the Western Ghats, India, Thailand and areas covered in surveys in Nepal, Laos, Cambodia and Vietnam. Submit a minimum of twelve papers to be published in peer-reviewed journals, covering subject areas presented in proposal, including conservation, and including results from work in Sri Lanka. Database to be available on web.</p>		<p>Assumptions</p> <p>This is an ambitious project and we recognise that capacities for participation vary greatly in different partner countries and assume that Defra will allow contraction in some areas and expansion in others if appropriate.</p>

Annex 3 supplementary material

Case example: Vietnam

The project in Vietnam was expected to be relatively small-scale and initial participation with our project partners at the Hanoi University of Science fitted this expectation. We have established good cooperation and active participation in fieldwork but none of the personnel in this host institution have taken up snail investigations as a primary research interest. However, as the project progressed and we were introduced to a wide range of people in various institutions and government agencies it became clear that not only is there enormous potential for snail based investigations but that Vietnam currently offers a unique opportunity for a broad range of cooperation with biodiversity agencies in the UK.

Snail fauna

The snail fauna is very diverse and, in the limestone rich Annamite Mountain range of central and northern Vietnam in particular, highly endemic. Although there are extensive areas of forest and limestone exposures the pace of industrialisation and economic development is such that these habitats are disappearing at an alarming rate.



Figure 21. An unidentified Limacoid - a large and striking example of the snail fauna in Cuc Phuong National Park, Vietnam.

Figure 22. A *Plectopylis* species from Cuc Phuong, representative of an ancient group probably of Laurasian origin.



Figure 23. A *Tortaxis* species from Cat Ba National Park. From our molecular phylogenetic studies *Tortaxis* is a sister group of *Glessula*, which is likely to have evolved on the late Cretaceous/Early Palaeogene Deccan Plate. A hypothesis that could explain this relationship is that *Tortaxis* originates from a continental fragment of Gondwana that made contact with SE Asia in the Late Mesozoic.



Figure 24. (Above) *Megaustenia*, another striking snail in which the soft tissue from the mantle edge extends over the shiny shell giving a matt papillae covered surface that conceals the snail when viewed against the limestone surface.

Figure 24. (Below) Luang Van Hao with part of the invertebrate display in Cuc Phuong National Park Museum. Snails are displayed on the middle row.



Snail project in Vietnam

The snail project in Vietnam is now focussed on the Department of National Parks, most notably in Cuc Phuong National Park where Luang Van Hao, Head of International Relations, has taken up the study of land snails with considerable enthusiasm. One of the first exhibits Hao is setting up in Cuc Phuong National Park's new museum is an exhibit of the Park's land snails. The Museum should be open to visitors by late 2009. Hao is also initiating snail surveys in other national parks and in collaboration with NP staff is planning to set up a national scheme for surveying snail diversity in all of Vietnam's National Parks. This can only be followed up with further collaboration and funding but the potential for further work in Vietnam is far greater.

Some background

The troubled history of Vietnam in the 20th century is well know but this war ravaged communist country has been transformed following a rejection of an extreme state run economy in favour of a Chinese style market economy. This has led to rapid economic development and a corresponding pressure on the environment such that the need to understand and conserve the country's rich biota has been recognised and embraced by the government. It has set about establishing the institutional foundations and developing appropriate expertise. From discussions with heads of Vietnamese government agencies that Fred Naggs has communicated with over the past two years it is clear that they plan to move on from earlier models for developing biodiversity capacity that were based on building from past Soviet connections and seeking support from Russian institutions. They are seeking major collaboration with institutions in Western Europe and North America. So far they have not established any significant links and there is an opportunity for British institutions to step in and fill this void.

There is a clear need on the part of the Vietnamese to collaborate with institutions in the west. Whatever tradition of studying the country's biota that may have existed in the past has been lost. There is no in-country expertise of collections based research and little experience of taxonomic and systematics practice. There are virtually no specimen reference collections and literature resources are minimal. For obvious historical reasons the Vietnamese biota has received little attention for many years and even in the French colonial period the country's rich biota was little studied. And it is a truly remarkable biota. Much of what is now tropical rainforest in SE Asia was open savannah during periods of the Quaternary but with prevailing winds carrying a high water content from the Pacific east and onto the highlands of Vietnam it appears likely that a rainforest biota has persisted in the area for many millions of years and that this would largely account for its being a centre of biological diversity within a global biodiversity hotspot.

A number of National Parks have been set up and the government has recently established the Vietnam National Museum of Nature. The Museum has been designated as the core institutional basis for biodiversity in Vietnam as part of the Vietnamese Academy of Sciences. It is currently housed in temporary accommodation at the Academy of Sciences in Hanoi and the Director has appointed some thirty research staff from other institutions. A site in or near Hanoi is currently being sought for the new museum to be housed. Fred Naggs held extensive discussions with the Director and staff on his visit to Vietnam in May 2008. Fred's assessment is that there is a unique opportunity for collaboration with the Vietnamese. As with the NHM, the VNMN has a wide remit that can broadly be divided into collections development and associated research and in communicating with the general public through exhibitions and education programmes. The VNMN will work closely with the Department of National Parks in setting up national survey programmes as a basis for building collections and a foundation for research programmes, following a similar structure to that followed in our Darwin Initiative project. However, the scale will be completely different and will encompass the whole biota.



Figure 25. Fred Naggs talking to the research staff of the newly established Vietnam National Museum of Nature. Dr Luc, the Museum's Director is seated to the left of Fred and Luong Van Hao to his right.

How might this opportunity be carried forward?

With agreement from the Darwin Initiative, project funding was used to bring the Director of the VNMN and the Head of International Relations at Cuc Phuong National Park to the UK for one week in February 2009. The objective was to both give the Vietnamese first hand knowledge of the resources available at the NHM and for NHM personnel to have an opportunity to make contact with and discuss potential for collaboration with the Vietnamese.



Figure 26. (Above) Jackie Mackenzie Dodds showing Hao and Dr Luc around the NHM Molecular Biology Laboratory at the NHM.

Figure 27. (Below) In the New NHM Darwin Centre with Harold Schneider (left) and Johannes Vogel, Keeper of Botany (right)





Figure 28 (Above). With Richard Lane, Director of Science

Figure 29. (Below) With Judith Magee, examining archives in the NHM Rare Books Room.





Figure 29. (Above) discussing research and collections development potential with Malcolm Scoble, NHM Keeper of Entomology.

Figure 30. (Below) With Craig Walker at the Zoological Society of London, visiting the *Partula* breeding project





Figure 31. (Above) Examining historical records of Vietnamese material in the Herbarium, Royal Botanic Gardens Kew with Rogier de Kok, Head of Kew's South East Asian Research Group and Dinarzarde Raheem

Figure 32. (Below) With Honor Gay, NHM Head of Learning, and Gordon Rankmore, Head of Interpretation and Design





Figure 32. Viewing the collections' storage area under construction at the NHM Darwin Centre.

Where might we go from here?

We have a unique opportunity for the UK to be a major player and long term collaborator in a biodiversity rich country that is effectively starting from scratch. Most importantly we can help formulate policy and obtain an equitable share of specimens that will allow full participation in collaborative research as a foundation for building an informed knowledge base for conservation. A minimal response would be a series of small projects run as and when modest funding is obtained. However, such a modest approach would not be commensurate with the available opportunity; this calls for a far more ambitious programme involving a range of UK and Vietnamese institutions and perhaps a consortium of funding agencies.