

Darwin Initiative Annual Report

Important note:

To be completed with reference to the Reporting Guidance Notes for Project Leaders – it is expected that this report will be about 10 pages in length, excluding annexes

Submission deadline 30 April 2008

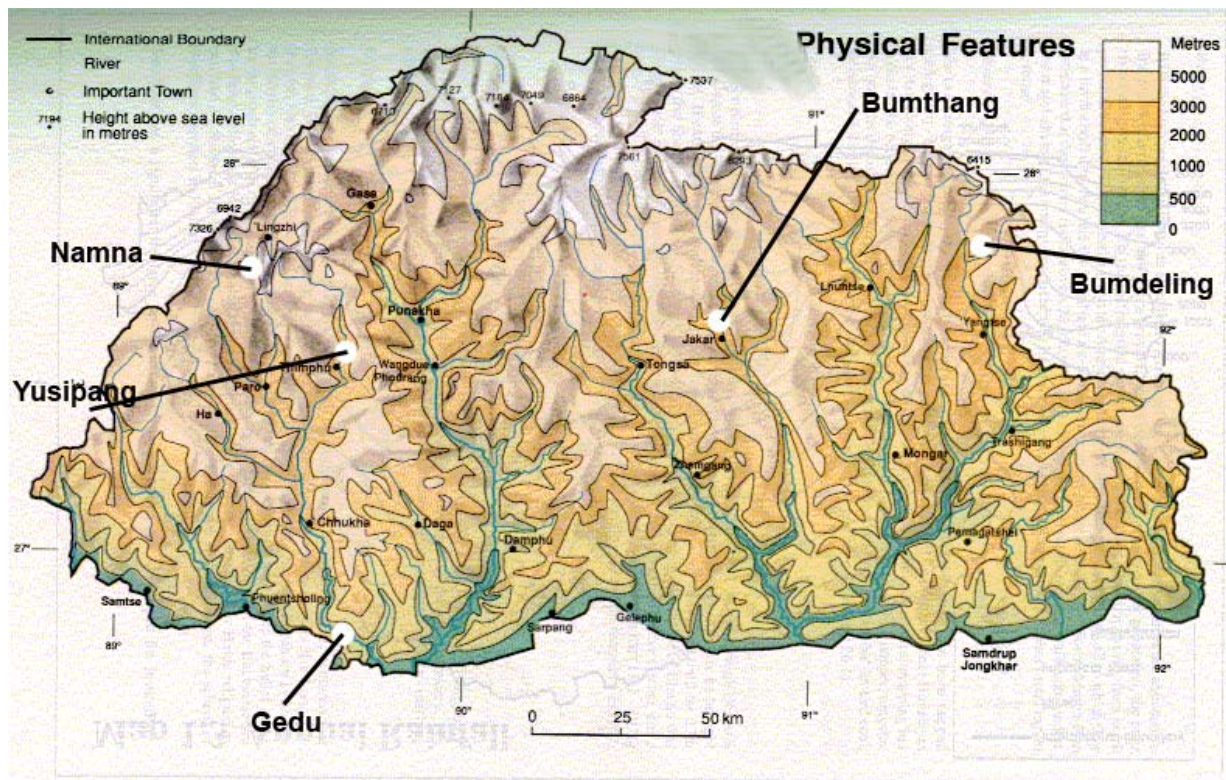
Darwin Project Information

Project Ref Number	14-030
Project Title	Going for Gold – Cordyceps Conservation in Bhutan
Country(ies)	Bhutan
UK Contract Holder Institution	CABI
UK Partner Institution(s)	
Host country Partner Institution(s)	Council for Renewable Natural Resources of Bhutan (CORRB), Ministry of Agriculture, Bhutan
Darwin Grant Value	£204936
Start/End dates of Project	April 2005 – September 2008
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..)	(1 Apr 2007 to 31 Mar 2008), annual report 3
Project Leader Name	Paul Cannon
Project website	http://194.203.77.76/Cordyceps/
Author(s), date	Paul Cannon, April 2008

1. Project Background

Cordyceps sinensis [now considered to belong to the segregate genus *Ophiocordyceps*] is a fungus parasitic on Ghost moth (*Thitarodes*) caterpillars, widely distributed across the Tibetan plateau and adjoining areas of the eastern Himalayas. It is highly prized in Eastern traditional medicine with beneficial effects claimed to improve energy and general well-being, but it is also considered to boost the immune system, improve virility, benefit patients with heart and kidney problems, and it is used to treat hepatitis. The global market is difficult to estimate but probably runs into hundreds of millions of dollars, and it has been claimed that Bhutan supplies around 10% of the total natural market.

The Royal Government of Bhutan has put various conservation measures in place to protect the species and allow for sustainable harvest over the long term. It requested assistance from CABI to investigate the level of sustainable extraction, and other measures to protect the species and the fragile montane grasslands in which *Cordyceps sinensis* grows. The potential for farming using basic methods achievable by indigenous peoples in its natural habitat is also being addressed.



Sketch map of Bhutan showing location of study sites (Namna, Bumdeling and Gedu) and workshops (Yusipang and Bumthang).

2. Project Partnerships

Collaboration between CABI and CORRB, the primary project partners, remains positive and good progress has been made over the past twelve months. Both sides remain strongly committed to the purpose of the project, and the collaboration is expanding with Cordyceps research developing in several directions. The project has good support from the Ministry of Agriculture (the parent Government ministry of CORRB), although delays in transferring funds between the Royal Monetary Authority of Bhutan and CORRB [Government institutions in Bhutan may not operate their own bank accounts] have caused some internal complications. CORRB has liaison with stakeholder groups as a central part of its remit, and we have seen good cooperation with a wide range of other Bhutanese institutions over the past year.

The three-way partnership between CABI, CORRB and BIOTEC (Thailand) has operated very effectively, with the British consultant based at BIOTEC playing a full role in the project. BIOTEC has continued to be supportive of the programme in granting leave of absence [for an extended period in 2008] and providing financial support for two workshops held in Bhutan in late 2007.

It has still not been possible to export specimens of *Cordyceps* or its host moth for research purposes, which has reduced the scientific impact of the project to date. We had hoped that samples would be made available as in previous years by their export under direct control of CORRB staff, but a training programme in Thailand [made possible through matching funding from BIOTEC] has had to be postponed until August 2008 due to changes in CORRB staff complement. The results of this work will of course be made public, but are likely not to be fully available until after the formal completion of the project at the end of the following month.

Other Collaborations:

Synergies continue with the EU-funded project on medicinal plants in Bhutan (BTN/AIDCO/99/0081) referred to in last year's annual report. The CORRB Director is on the steering committee of both projects, and ensures that the objectives of both projects are met without unnecessary duplication. In response to a suggestion from the Darwin project reviewer in 2007, we have added a supplementary component to the project [see below] by carrying out some basic surveys of other insect-associated *Cordyceps* species and their relatives. Funding from the EU project enabled two team members to make a successful survey in the tropical forests of the Gedu region (south-west Bhutan), which is highly complementary to the main objectives of the Darwin project.

A major new collaboration in 2007 led to *Cordyceps* being made a focus of research in Bhutan by an IDRC-funded project on community-based natural resource management. Preliminary results from this have been very helpful to the Darwin project, and we anticipate that further support in 2008 will lead to more useful outcomes. We have also been liaising with this project (and indirectly with a Dutch development agency) regarding a possible regional workshop on sustainable harvest of *Cordyceps*. We are also following up an offer of collaboration in fundraising for this event from a University of California researcher who is working on *Cordyceps* in Yunnan. The workshop would be highly beneficial to the relevant agencies from the *Cordyceps* harvest areas (primarily Nepal, Sikkim, Bhutan, Tibet and Yunnan) but would have to be funded separately from the *Going for Gold* project as it is outside of our original remit.

Another new collaboration was initiated in 2007 with Nature Conservation staff at the Bumdeling Wildlife Sanctuary in eastern Bhutan. This has led to the establishment of a new survey site, focusing especially on seasonality issues.

The project does not currently have formal links on a personal level with the CBD focal point in Bhutan (the National Environment Commission), but communication is maintained by the normal interdepartmental governmental processes.

3. Project progress

3.1 Progress in carrying out project activities

Output 1. Knowledge of *Cordyceps* incidence and harvest, host/parasite relations and host biology.

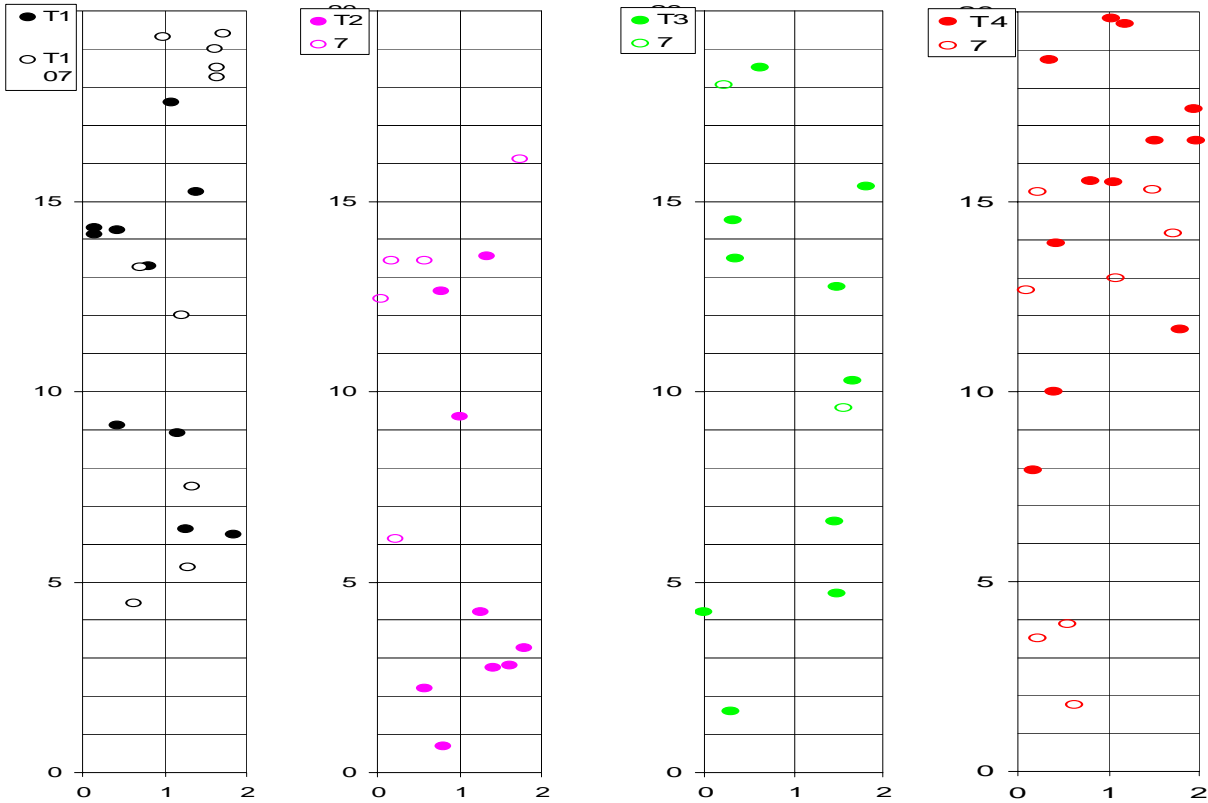
Good progress has been made in a number of areas. The survey work at NamNa has continued as planned, building up baseline data that can be used to establish scientifically validated harvest levels in future years. As for



Setting out transect, May 2007

the first full year of data gathering in 2006, survey work began in early May and continued until early August, to provide a robust picture of incidence and seasonality. For 2007, the first *Cordyceps* stromata were detected in the second week of May (just before the legal collection period of 15 May – 15 June) and took around 6 weeks to reach full maturity. [The fungus is most valuable in an immature state, when the caterpillar cadaver is still filled with fungal tissue]. 2007 was a cold year compared with 2006, with ambient temperatures (i.e. shielded from sunlight in a rock crevice) reaching only 4-5°C in June to August 2007 compared with 6.5-8°C during the same period in 2006. Temperatures in the upper soil layers would be higher than this when exposed to sunlight. Despite the low temperatures in 2007, the overall pattern of emergence was largely similar to that in 2006, suggesting that local environmental conditions may not play a major role in seasonality. The number of stromata observed in the study

site in 2007 [see diagram below] was around 25% lower than in 2006, equating to about 1550/ha compared with 2050/ha in 2006. Our baseline data is certainly not sufficient to draw conclusions from this apparent decline, but we are reasonably certain that increased human collecting was not to blame. Parasites frequently vary significantly in incidence from year to year in response to fluctuations in host populations, and we think that such natural variation is the most important factor.



Sample transects at Namna: filled ellipses represent stromata in 2006, open ellipses those in 2007

Work on understanding the biology of the moth which *Cordyceps sinensis* parasitizes has moved forward significantly. We have characterized the species of moth involved. This appears to be undescribed, though there is

one possible Chinese candidate species that we are continuing to follow up, and there is a manuscript in an advanced state of preparation that includes its formal description. The moth species appears to have a very short adult life span (as do other ghost moths) which has proved a major obstacle to work on the entomology in view of the arduous nature of the field work and the difficulties in planning logistical support. However, we were able to collect substantial numbers of moths during the summer of 2007, substantially later in the season than we had originally expected based on our knowledge of seasonality of other ghost moth species in the Himalayas. This will enable us to understand variation within the species, and will inform future developments in farming research.



Light-trapping of *Thitarodes* moths using a UV lamp attached to a car battery



Male and female *Thitarodes* moths, hosts of *Cordyceps sinensis*

Initial experiments on food plant preference were unsuccessful as described in previous reports, and we have therefore initiated a new in-situ pot-based study. The candidate plants will be inoculated with caterpillars once they are fully established and weight gain will be measured over a period later on this year. We strongly suspect that the *Thitarodes* species is not a specific feeder, and the experiment will provide further support for future farming activities.

We have also worked with the Nature Conservation Division of Bhutan to set up parallel studies in the Bumdeling Wildlife Sanctuary in the far east of the country, in response to reports that the seasonality of *Cordyceps* differs from that in the western region. This has involved two field expeditions to date, and the installation of a data recorder provided by the project to allow environmental comparison between the two sites. The cooperation with NCD has been particularly valuable as the study site at Bumdeling is extremely remote, requiring 7-8 days of travel in each direction from Yusipang where the project is based.

Output 2. Monitoring/impact scheme designed and implemented in consultation with local stakeholders



We have continued to monitor harvest of *Cordyceps* through the Government auctions. This year the quantity offered for sale was substantially lower than in 2006 at most auction sites. This could be for a number of reasons, including natural population fluctuations and/or increased unauthorized trading in addition to exhaustion of the resource. The quality of *Cordyceps* offered was substantially improved, with little offered in a seriously degraded state as in previous years – doubtless due in part to the education programme provided to the harvesters. We are now happy that the messages on sustainability and quality are reaching their audiences, and as suggested by the Year 2 report reviewer, production of the *Cordyceps* leaflet in Dzongka is now regarded as low priority. We shall of course continue to emphasize the need for sustainability through a range of channels.

We have carried out a substantially more detailed survey of the *Cordyceps* harvest in 2007 through interviews with the collectors, in response to the Year 2 project reviewer's suggestion. As predicted it did prove difficult to gain meaningful information on the *Cordyceps* populations due to an understandable reluctance to divulge detailed information on collection sites or population levels. We do now know that the species is widely distributed within Bhutan, and is probably present in all suitable habitats (typically north-facing *Kobresia*-dominated slopes). We are considering using vegetation survey as a proxy to estimate total population numbers in parallel with information from the markets, but need more data before assessing the potential value of this approach. The results of the harvest survey have not yet been fully processed by our Bhutanese counterparts will be made available as soon as possible. The delay is partly due to the main worker on this subject taking up another job outside of CORRB, and also due to concerns over confidentiality that have to be resolved at Ministry level.

The prices obtained in 2007 were higher than ever before, with one small batch sold at an equivalent price of US\$12500/kg. These almost astronomical figures underline the challenge of achieving sustainability of harvest, and the potential for distortion of existing yak-dominated economies in high-montane Bhutan.

Summary of quantities and prices obtained for *Cordyceps sinensis* at Government auctions, 2004-7

Year	2004			2005			2006			2007			
Auction Location	kg	Total value (ng)	Total value (£)	kg	Total value (ng)	Total value (£)	kg	Total value (ng)	Total value (£)	kg	Total value (ng)	Total value (£)	
Bumthang							60.13	4319338	53991	17.32	4639710	57996	
Damshithang										2.783	653229	8165	
Wangdue							370.285	31712023	396400				
	Gangtey	20	1020000	12750	2.415	303794	3797			3.085	780721	9759	
	Nobding									19.63	6401970	80025	
	Sephu	39.4	2401000	30012	13.143	8435177	105440			27.985	8351948	104399	
	Dangchu	96.98	8447132	105589	9.44	4782332	59779						
Paro		0.86	37840	473				4.565	357522	4469	6.145	1864905	23311
Dodena	Naro	2.42	104400	1305	10.38	2411793	30147	46.615	4213996	52675	14.58	5088335	63604
	Lingshi	4.02	156780	1960				25.07	2132708	26659	6.235	2141940	26774
Damji	Lunana	1.7	62900	786							16.65	5470980	68387
	Laya	10.15	375550	4694							13.765	4158800	51985
Trashiyangtse											12.189	1597496	19969
TOTAL		175.53	12605602	157569	35.378	15933096	199163	506.665	42735587	534194	140.367	41150033	514374
Average price in £/kg				898			5630			1054			3665

Year-to-year comparison of quantities and prices is slightly problematic, as auction sites vary from year to year according to demand. Some overall conclusions can be drawn. Firstly, almost all *Cordyceps* (apart from grossly defective collections) are sold, and the buyers appear to have effectively limitless funds available. There is clearly substantial variations from year to year in the quantities available, and these in part correlate with our own field observations. The price obtainable seems to be strongly linked to availability, with very large prices obtained in 2005 resulting from a poor harvest. Information from more than one source (admittedly without hard evidence) suggests that the apparently very large harvest in 2006 (especially in Wangdue) was the result of *Cordyceps* being brought over the border from China and sold via Bhutanese middlemen with the appropriate permits, attracted doubtless by the high prices in 2005. Prices have continued to rise in 2007, with the overall price paid comparable to 2006 in spite of a (apparently) substantially lower yield. Further indications that *Cordyceps* from outside of the Wangdue region was sold at that auction comes from analysis of individual sale lots: these should each legally be harvested by a single family, but one lot of 50kg was sold which is far larger than could be gathered correctly.

Output 3. Regulatory system modified in line with project findings and IP concerns, publication of regulations, best practice for harvest etc.

Changes to the legal harvest period implemented in 2006 were maintained for 2007, with a small modification to allow later collection in the eastern region which has had a minimal impact on a national scale due to the small number of collectors in that part of the country. We appreciate the value of obtaining objective information on the impact on populations of the collection date change (as expressed by the Year 2 project reviewer). However, this is highly problematic due to lack of baseline information and the range of external factors influencing population sizes. The most direct evidence we have of the appropriateness of current conservation measures is that significant numbers of *Cordyceps* in multiple study sites have been observed after the end of the legal collecting period, suggesting that current harvest is not having a major negative impact on the natural populations.

Initial attempts at introducing a pilot community-based management scheme for *Cordyceps* were unsuccessful as recorded earlier (primarily loose community cohesion and distrust of Government mediators). A further attempt was made to establish a community-led scheme with resources provided by a project funded by IDRC. This was based in the Lingshi area of NW Bhutan, to the north of our main study stide at Namna. The villagers who took part obtained over 50% of their annual income from *Cordyceps* collection, and estimated that there was about 400 hectares of "productive" *Cordyceps* pasture in their area. Extrapolating from our own figures for a similar pasture,

that would indicate a potential harvest of 600-800 kg. Only 25 kg was auctioned from this community in 2006, so while these figures are very uncertain due to an unknown level of unauthorized collection and sale, there is no a priori reason for immediate concern over unsustainable harvest.



Decision-making at the Lingshi village meeting on *Cordyceps* (left), captured poachers (right)

The community had major concerns over illegal collection of *Cordyceps*, with poachers both from over the border with Tibet and from other regions of Bhutan. It is difficult to get independent verification of this trend and it might be expected that such concerns might be exaggerated, but similar messages have been obtained from a number of different sources. The community was sceptical regarding the potential for sustainable harvest given these external factors, but were equivocal as to the benefits of increased security as they are dependent on cross-border trade for many of their essential commodities. Community-based management has proved very successful in other parts of Bhutan, notably with watershed management of water, but the resource has to be controllable effectively by the Lingshi community in order to operate effectively. The concept of communal decision-making over joint resources is new for the villagers, and it may take some time to implement.

Output 4. Pilot project for low-tech *Cordyceps* farming in place

Disappointing progress on development of *Cordyceps* farming led to a request in April 2007 to modify the project objectives by reduction of expectations in this area, though we are continuing to gather information that will be useful to achieving this objective in the future. We proposed as an alternative objective the preparation of an

identification manual for montane flowers of Bhutan, as a byproduct of digital images gathered during the survey work. The project reviewer questioned the wisdom of extending the project objectives, and suggested that we carried out further surveys for other *Cordyceps* species as an alternative. We have taken this suggestion on board, and while we are still planning to provide the Bhutanese Government with substantial numbers of illustrations to act as the basis for a book in the future, we carried out an initial survey for other insect-associated fungi this summer in Bumdeling. We found about a dozen species, all of which were previously unrecorded for Bhutan.



Isaria tenuipes, Bumdeling Wildlife Sanctuary

A further survey took place in late October 2007, based on the lowland tropical forests of Gedu to the south-west of the country with external support from an EU-funded medicinal plants project. This resulted in around 50 species being collected, including a species of *Cordyceps* that is new to science. This last resulted in a rather over-enthusiastic report in the local press. A publication is in preparation detailing the collections. During the surveys,

Bhutanese scientists from CORRB, the Nature Conservation Division and the Institute for Traditional Medicine Studies were trained in survey and field recognition techniques. A second visit to Bhutan in March 2008 was funded by the EU project, for further work on description of the new *Cordyceps* species and analysis of the moth specimens collected the previous summer.

Output 5. Training and capacity building (fungal and insect biology, techniques)

The main activity in support of this output during the 2007/8 project year was two two-day workshops held in the central and western regions of Bhutan next month. These put the *Cordyceps*/ghost moth system in perspective with knowledge of fungus and insect diversity and ecology in general, providing the participants with improved understanding of the role of these important organism groups in ecosystem function. There were a number of further presentations by members of the project team on various aspects of the research, and we also used the opportunity to discuss further options for sustainable management of *Cordyceps sinensis*. The workshop delegates were primarily field biologists from the National Park system and the Forestry Division, who have only basic knowledge of the groups concerned, along with representatives from a wide range of stakeholder groups with interests in *Cordyceps*.



Nearly 80 participants were present at one or both of the workshops. Feedback from the meetings was very positive, and there was especially animated discussion on the options for ensuring sustainable harvest and the potential for better security. A senior officer from the Royal Bhutan Army was present at one of the workshops, and he indicated that the Army would be prepared to provide more extensive border controls during the harvest season if requested.

Matching funding was obtained to support the workshops, from the EU and also the Thai Government institution BIOTEC. The Nature Conservation and Forestry Divisions of the Ministry of Agriculture also provided matching funding through payment of travel and subsistence costs for their staff.

3.2 Progress towards Project Outputs

Details are provided in section 3.1 above, but the table below summarizes progress.

Output	Progress	Important assumptions
Knowledge of <i>Cordyceps</i> incidence and harvest, host/parasite relations and host biology	Further solid progress in most areas, on target for achievement. Substantial progress on entomological objectives, which was slower than anticipated in years 1-2. Study of moth feeding habits still problematic, but new experiment should remedy this in 2008.	Plants well established in in-situ pot experiment.
Monitoring/impact scheme designed and implemented in consultation with local stakeholders	On target, but community-based studies show problems with implementation of local management of the <i>Cordyceps</i> resource. Further consultation will occur in 2008.	Good relations maintained with all local stakeholders
Regulatory system modified in line with project findings and IP concerns, publication of regulations, best practice for harvest etc	Achieved and on target	Enforcement of regulations may be problematic due to small numbers of NP staff, addressed through promoting self-policing by harvesters, local management schemes etc.
Pilot project for low-tech <i>Cordyceps</i> farming in place	Abandoned as a separate output, though much of the information on <i>Cordyceps</i> biology feeds into this. Replaced at reviewer's suggestion with surveys of other entomogenous fungi in Bhutan.	
Training and capacity building (fungal and insect biology,	Now largely complete, all targets achieved.	As in proposal

techniques)		
-------------	--	--

3.3 Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	Total to date	Total planned from application
Established codes							
6A/B	1-week training course on insect fungi for 3 Bhutanese scientists	3				3	0
7	Education leaflet, poster, website	3	1			4	3
8	Person/weeks spent abroad on project	17	12	20		51	40
14A	Stakeholder workshop for Cordyceps sustainability for 30 people; 2 workshops on Cordyceps biology and sustainability for 80 people		1	2		3	3
14B	Conservation conference, Cambridge March 2006, Darwin workshop		1			1	0
15A	National press release/article in Bhutan	1	1	1		3	4
15C	National press release/article in UK	2				2	2
18A	News feature on stakeholder workshop		1			1	0
20	Value of assets (£)	1500	500			2000	2000
22	Permanent field plots established	1		1		2	1
23	Matching funding from EU Medicinal Plants project (estimated £)	8000		4000		12000	
23	Matching funds from IDRC-funded CBNRM project (estimated £)			2000		2000	
23	Travel funds from Stapledon Memorial Trust for grassland conservation			2600		2600	
23	Matching funds from BIOTEC (estimated £)			800		800	
New - Project specific							

measures							
----------	--	--	--	--	--	--	--

In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, eg title, name of publisher, contact details, cost. Mark (*) all publications and other material that you have included with this report.

Table 2 Publications

Type *	Detail	Publishers	Available from	Cost £
(eg journals, manual, CDs)	(title, author, year)	(name, city)	(eg contact address, website)	
CD	<i>Cordyceps</i> biology and sustainability (for workshop participants)	CABI (UK)/CORRB (Bhutan)	Paul Cannon (CABI) or Lungten Norbu (CORRB)	Free

3.4 Progress towards the project purpose and outcomes

Good progress has been made towards all components of the Project Purpose, with the exception of the farming aspects of the programme, which were downgraded in 2007 following consultation with the project reviewer. The purpose level assumptions still largely hold true, but dramatic political changes in Bhutan over the past few months, with the introduction of parliamentary democracy and the expected abdication of the King in favour of his son have caused some disruption. For example, a further stakeholder workshop was postponed due to the impending general election but has been rescheduled for May 2008. We have been assured that fieldwork over the 2008 *Cordyceps* season will not be affected, but hoped-for changes at the political level are uncertain.

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

All indications are that both the Royal Government of Bhutan and the project stakeholders (including *Cordyceps* harvesters) remain committed to sustainability of *Cordyceps* production. Establishing population levels and therefore sustainable harvest levels is challenging in a system where natural boom-and-bust cycles probably occur. Ultimately, the project can only put mechanisms in place to ensure long-term sustainability, rather than achieving it by dictat. There are intractable problems which have emerged over the past year regarding the establishment of local management plans (primarily security concerns), but *Cordyceps* will remain a high priority at Government level and we are confident that further efforts will be made beyond the lifespan of the project to introduce these measures.

4. Monitoring, evaluation and lessons

Discussed in detail in sections 3.1-3.4. Some aspects of monitoring and evaluation are problematic for this project (notably the level of poaching and unauthorized trade) but we feel that we have sufficient other indicators and measurements to demonstrate success.

The work during 2007/8 went largely as expected, with solid progress on most fronts. We have seen very good cooperation between COORB and the Nature Conservation and Forestry Divisions, but less obvious progress regarding liaison with the commercial and marketing sector. It would be unreasonable to expect a single Darwin project to fix national institutional failings, but had we known how the project would progress we would have placed higher priority on these aspects at the planning stages of the programme.

5. Actions taken in response to previous reviews (if applicable)

We were content with the 2007 review, and have done our best to address the concerns raised. The principal outstanding issue is detailed analysis from the questionnaire that was used to measure priorities and concerns over *Cordyceps* collection by the harvesters. I have asked for this information from our Bhutanese counterparts and as explained above there have been delays due to change of personnel. I have recently reminded the Bhutanese

project leader of this requirement, and will follow it up in-country next month if needed. The information has been provided in part via other avenues, notably the community-based resource study.

In response to the reviewer's comments, we have scaled back work on the proposed mountain flower book, but we have a large number of digital images that will be given to CORRB and to the staff of the Bhutan National Herbarium to aid in identification. We have instead been surveying *Cordyceps* and similar species in the lowland forests as suggested; two surveys have already taken place and we expect that two further ones will occur in 2008. Substantial numbers of species previously unrecorded from Bhutan have been identified.

The reviewer's comments on monitoring of harvests have been addressed as far as we have been able, and summarized in the report above. With the exception of the 2006 harvest from Wangdue the figures obtained appear to be accurate, and we see no reason why at least the great majority of samples offered at auction might have originated from outside of the general auction area. Long-term monitoring of populations can be continued by CORRB via the auctions, and the costs of maintaining the long-term survey plots are not great. We are also confident that our Bhutanese counterparts will be able technically to carry out these activities and have been adequately trained to do so.

6. Other comments on progress not covered elsewhere

None has been identified.

7. Sustainability

The project has a high profile within the country, due to the widespread interest in *Cordyceps* and the number and variety of stakeholder groups consulted. There is already substantial interest and concern for biodiversity in Bhutan (largely a result of its Buddhist roots) and the Royal Government is active in promotion of sustainable solutions as the economy grows. CORRB, as an agency of the Royal Government, is committed to continuation of the survey work to establish long-term measurements of population and seasonality. It also has a formal remit to work with stakeholder groups within the National Parks and other sensitive areas to preserve biodiversity and manage human impact according to sustainable guidelines. The increasing value of *Cordyceps* as measured by the prices obtained at auction will ensure that the species remains a high priority at national level, but ultimately sustainability must be addressed at community level and this aspect of the work is proving complex. An extension of the project might be considered to focus more closely on this area.

8. Dissemination

The main dissemination event planned for 2007/8 (a further stakeholder workshop) was postponed until May due to the national elections. The project received a high profile in Bhutan as a result of the two training workshops (with nearly 80 attendees from a wide range of institutions) and liaison with other projects has been very positive.

9. Project Expenditure

Table 3 Project expenditure during the reporting period (Defra Financial Year 01 April to 31 March)

Item	Budget (revised budget agreed with Darwin Secretariat 28 Mar 2008)	Expenditure	Balance
Rent, rates, heating, overheads etc			
Office costs (eg postage, telephone, stationery)			
Travel and subsistence			
Printing			
Conferences, seminars, etc			
Capital items/equipment			
Others			

Salaries (specify) Exactly as specified in original budget: actual expenditure was in excess of this figure	
TOTAL	

Highlight any agreed changes to the budget and explain any variation in expenditure where this is +/- 10% of the budget.

10. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

[I agree for ECTF and the Darwin Secretariat to publish the content of this section](#) (please leave this line in to indicate your agreement to use any material you provide here)

You may use text from this report for publicity purposes, but we would like to establish exactly what will be used before formal permission is given.

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2007/08

Project summary	Measurable Indicators	Progress and Achievements April 2007 - March 2008	Actions required/planned for next period
<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, 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>(do not fill not applicable)</i></p>
<p>Purpose</p> <p><i>Cordyceps sinensis</i> harvest in Bhutan protected and montane grasslands conserved through research and capacity building to achieve sustainable production</p>	<p>New knowledge on population and harvest levels, host/parasite relations and host requirements</p> <p>Monitoring/impact scheme in place</p> <p>Local stakeholders in support of conservation</p> <p>Feasibility study and pilot programme for <i>Cordyceps</i> farming</p> <p>Regulatory system in place/modified appropriately, leading to reduction in illegal harvest</p>	<p>Long-term monitoring programme maintained for population studies, much new knowledge on harvest levels, good progress on insect biology; widespread support for conservation and sustainable harvest by all local stakeholders; <i>Cordyceps</i> farming not feasible within the project timeframe; new surveys of <i>Cordyceps</i> spp. in lowland forests; two successful training workshops; some progress on community-based management; large number of plant images obtained</p>	<p>Continuation of population studies and monitoring of harvest levels further emphasis on community based natural resource management for <i>Cordyceps</i>; further surveys for lowland <i>Cordyceps</i></p>
<p>Output 1.</p> <p>Knowledge of <i>Cordyceps</i> incidence and harvest, host/parasite relations and host biology</p>	<p>Reports published and circulated to Government and other stakeholders</p>	<p>Good progress on most aspects, host biology research has continued to prove challenging but life cycle and seasonality of host has now largely been elucidated and alternative feeding experiments have been designed</p>	
<p>Activity 1.1</p> <p>Surveys for incidence and seasonality of <i>Cordyceps</i></p>		<p>Surveys maintained in W Bhutan, programme extended to eastern region, data loggers installed in Namna and Bumdeling National Park</p>	

Activity 1.2 Studies of hepialid caterpillars and their feeding habits		In-situ studies set up, due to be completed in July 2008
Output 2. Monitoring/impact scheme designed and implemented in consultation with local stakeholders	National Park and NCD/CORRB staff trained, harvesters/ traders mobilized, monitoring in place	Achieved in most respects, good support from stakeholders. Monitoring at auction stage maintained.
Activity 2.1. Monitoring and analysis of harvest at auction stage		Many data gathered but further analysis required. In 2008 monitoring will continue. Further studies on setting up community-based management will occur.
Output 3. Regulatory system modified in line with project findings and IP concerns, publication of regulations, best practice for harvest etc	Leaflets and policy documents produced, stakeholder meetings taken place	
1. Leaflets promulgated with messages on sustainability, best practice and quality control		Leaflet in Dzongka not required. Regulatory systems maintained in line with project recommendations.
2. Stakeholder meeting		Postponed until May 2008
Output 4 Pilot project for low-tech <i>Cordyceps</i> farming in place	Experimental farm set up, caterpillars raised successfully, inoculation with fungus achieved	Progress abandoned with agreement from project reviewer, though much of the information gathered on biology etc. will feed into this process in future.
Output 5 Training and capacity building (fungal and insect biology, techniques)	Number of National Park, NCD/CORRB staff participating	Two two-days workshops taken place in November 2007 for a total of nearly 80 staff.
Output 6 Surveys of <i>Cordyceps</i> in lowland forests	Survey results available to Royal Government and other stakeholders	Two surveys taken place in 2007 with around 50 species recorded, mostly new to Bhutan. Two further surveys to take place in 2008.

Annex 2 Project's full current logframe

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 			
Purpose			
<p><i>Cordyceps sinensis</i> harvest in Bhutan protected and montane grasslands conserved through research and capacity building to achieve sustainable production</p>	<ol style="list-style-type: none"> 1. New knowledge on population and harvest levels, host/parasite relations and host requirements 2. Monitoring/impact scheme in place 3. Local stakeholders in support of conservation 4. Feasibility study and pilot programme for <i>Cordyceps</i> farming 5. Regulatory system in place/modified appropriately, leading to reduction in illegal harvest 	<ol style="list-style-type: none"> 1. Reports by National Park, NCD/CORRB and project partners, scientific papers 2. Protocols & survey reports 3. Participation by local population 4. Reports by project partners 5. Regulatory system publicised via meetings, leaflets, liaison with traders etc.; reports from regulatory authorities 	<ol style="list-style-type: none"> 1. Government continues to give high priority to <i>Cordyceps</i> sustainability 2. Local people support sustainability programme 3. Illegal poaching controlled 4. National agencies liaise effectively
Outputs			
<p>Knowledge of <i>Cordyceps</i> incidence and harvest, host/parasite relations and host biology</p>	<p>Reports published and circulated to Government and other stakeholders</p>	<p>Reports sent to Darwin Initiative, scientific papers, habitat management plan</p>	<p>Sufficient information acquired, seasonality issues successfully addressed</p>
<p>Monitoring/impact scheme designed</p>	<p>National Park and NCD/CORRB staff trained, harvesters/ traders mobilized, monitoring in</p>	<p>Reports and feedback from trainees and institutions, monitoring results</p>	<p>Local stakeholders agree to programme, good liaison with</p>

and implemented in consultation with local stakeholders	place	collated /sent to Darwin Initiative	National Park and NCD/CORRB
Regulatory system modified in line with project findings and IP concerns, publication of regulations, best practice for harvest etc	Leaflets and policy documents produced, stakeholder meetings taken place	Records of meeting attendance, documents sent to Darwin Initiative	Appropriate authorities liaise to modify regulation, stakeholders on board, effective enforcement of regulation occurs
Pilot project for low-tech <i>Cordyceps</i> farming in place abandoned as a separate task with agreement from project reviewer	Experimental farm set up, caterpillars raised successfully, inoculation with fungus achieved	Reports of progress, farmed <i>Cordyceps</i> available	Information on food plants available, food plant cultivation achieved, caterpillars successfully transferred to farm, inoculation with <i>Cordyceps</i> successful
Training and capacity building (fungal and insect biology, techniques)	Number of National Park, NCD/CORRB staff participating	Training materials available, student and manager feedback forms	Suitable staff released for training, staff able to put training into practice
Surveys of <i>Cordyceps</i> in low-altitude forests	Survey reports, publication	Reports made available to Royal Government and other stakeholders	Monsoon conditions allow good collecting
Activities			

Design and implement surveys to quantify <i>Cordyceps</i> habitat, distribution and patterns of exploitation. Investigate yak grazing patterns. Develop methods to locate and survey Lepidoptera host. Develop methods to collect and breed / rear Lepidoptera host (from adult, egg or larval stage). Conduct direct observations of Lepidoptera feeding behaviour and life-cycle and study caterpillar / fungus interactions under field / experimental conditions.	Design surveys and evaluate techniques, year 1. Habitat and exploitation survey years 1-4. Collect host adults (for eggs) and caterpillars from year 1 and continue annually through project. Conduct feeding & life-cycle observations years 1-4. Caterpillar / fungus interaction studies years 2-3.
Plan and implement policies to maximise participation of local stakeholders. Publicise concept of sustainability. Set up monitoring team and train field surveyors in stakeholder interview, habitat assessment and Lepidoptera survey techniques.	Participatory programme planned year 1. Project introduction meeting to engage local stakeholders by promoting concept of sustainability and inviting stakeholder discussion of community problems and solutions, year 1. Monitoring team established and trained year 1. Implementation of monitoring, years 1-4
Produce training materials; design and run training days on fungi and insects for stakeholders. Elicit trainee feedback.	Training days on fungi and insects, years 2-3.
Review current regulatory system and modify in the light of research findings, in collaboration with stakeholders at key stages. Develop a strategy to enforce the modified regulatory system.	Current regulatory system reviewed and modifications drafted as agreed/appropriate, year 3. Development of enforcement strategy, years 3-4.