



Darwin Initiative – Final Report

DI 14-014

“Conservation of the Bornean elephant (*Elephas maximus borneensis*)”



Darwin project information

Project Reference	14-014
Project Title	Conservation of the Bornean elephant (<i>Elephas maximus borneensis</i>)
Host country(ies)	Sabah, Malaysia
UK Contract Holder Institution	Cardiff University
UK Partner Institution(s)	HUTAN
Host Country Partner Institution(s)	Sabah Wildlife Department, Universiti Malaysia Sabah, WWF-Malaysia
Darwin Grant Value	£239,997
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Project Leader Name	Michael W. Bruford
Project Website	Included in: http://www.cardiff.ac.uk/biosi/contactsandpeople/stafflist/e-h/goossens-benoit-dr.html
Report Author(s) and date	Benoît Goossens (PDRA), Michael W. Bruford (PL), Marc Ancrenaz (PP), 15 July 2008

1 Project Background

The project was located in Sabah, Malaysia, on the island of Borneo. The need for this project was identified by the wildlife authorities in Sabah during a previous DI grant (09-016) and was the result of a common requirement to implement the CBD in Sabah.

The Asian elephant is protected and is classified as endangered under Sabah legislation. The Bornean elephant subspecies has recently been confirmed as a separate taxon, dramatically increasing its importance in terms of biodiversity. In a general survey undertaken in 2002, the Sabah Wildlife Department (SWD) and WWF-Malaysia estimated that about 1,100-1,500 elephants survived in Borneo. They showed that the remnant populations were mainly found in eastern Sabah, and were highly fragmented. The Bornean elephant is therefore the world's most endangered Proboscidean taxon, highlighting the urgent need to undertake sound conservation action in the near future. In 2002, SWD produced a first draft of the State Action Plan for elephants. Following explicit recommendations contained in this State Action Plan, our work provided information that was currently lacking, including the distribution and movement of individuals, genetic differentiation between populations, threats to genetic diversity, and the identification of priority areas for the species that should be kept under forest cover to allow movements of individuals between the different sub-populations.

We have successfully met and achieved all our objectives (although some of them remain in progress) and considerable additional accomplishments are also described in the report. Thanks to a fruitful collaboration with the Sabah Wildlife Department, HUTAN, WWF-Malaysia and Universiti Malaysia Sabah, the International Workshop on the Conservation of the Bornean Elephant in Sabah was the best outcome we could expect from this project and the results surpassed our expectations. Recommendations for the conservation of the Bornean elephant in Sabah were presented to the Minister of Tourism, Culture and Environment, Datuk Masidi Manjun, and will be tabled before the State Cabinet in the near future. The project will continue after the end of the grant since all host country partners will maintain their collaboration and Cardiff University has set up a field centre in the Lower Kinabatangan Wildlife Sanctuary, together with the Sabah Wildlife Department, where overseas and local students will be able to follow tropical biodiversity assessment field courses, and where further research will be based.

2 Project support to the Convention on Biological Diversity (CBD)

This project helped the host country to fulfil its obligations under the CBD and was therefore relevant to the following articles:

Article 6, especially “Develop national strategies which integrate conservation and sustainable use” (10%). At the end of the project, we co-organised an international workshop on the Bornean elephant conservation in Sabah during which several recommendations for habitat management, elephant populations management, human-elephant conflict mitigation, research and education, fundraising and tourism, and a resolution (for Bornean elephant conservation in Sabah) were formulated and presented to the State Minister of Tourism, Culture and Environment Datuk Masidi Manjun during the closing ceremony. MA and BG have been asked to prepare a Cabinet paper that will be presented to the Sabah State Government in the near future.

It is also highly relevant to Article 7, especially “Identify and monitor components of biological diversity, particularly those requiring urgent conservation” (10%). We identified the most vulnerable populations of elephant in Sabah.

It is also relevant to Article 8, especially “Establish systems of protected areas, promote protection of habitats, manage areas adjacent to protected areas (20%). During the workshop, we recommended the declaration of four important elephant areas identified in the Sabah Action Plan 2002 as Managed Elephant Ranges (MERs) with a commitment to natural forest management and connectivity measures.

Article 12 (research and training) was one of the most relevant to the project (30%). We conducted research on the population genetics of the Sabah elephant populations and trained one Malaysian scientist in molecular genetic methods at Cardiff University and Universiti Malaysia Sabah (UMS).

Article 13 (public education and awareness) was also a component of our programme (5%). Through the workshop we raised public awareness in Sabah. We also promulgated necessary measures to conserve elephants through the media in Sabah (several newspaper articles were published through the project and especially during the workshop). We also designed an education poster in English and Malay that is shown in government departments, public schools in elephant range, lodges, Lok Kawi Wildlife Park, Sepilok Orangutan Rehabilitation Centre, etc. We are also currently preparing a brochure on Bornean elephant conservation in Malay and English that will raise awareness in the public and especially in schools.

Finally Articles 15 (access to genetic resources, 5%) – computer-based database on genetic information of elephant populations in Sabah handed over to host country, GIS map of elephants genetically identified in Sabah and establishment of a collection of non-invasive genetic samples from the Bornean elephant; 16 (access to and transfer of technology, 15%) – we trained a Malaysian MSc student at the facilities set up during a previous Darwin grant; and 17 (exchange of information, 5%) – Course on Wildlife Monitoring and International Workshop on the Conservation of the Bornean Elephant in Sabah, were also important elements of the programme.

3 Project Partnerships

Three local partners worked on project activities together in collaboration with Cardiff University: HUTAN, Sabah Wildlife Department and Universiti Malaysia Sabah. Their relationships during the three years of the project were generally very good. Although WWF-Malaysia withdrew their participation during the first year of the project (see first year report, section 4), major efforts were made by PDRA during the second year to restore partnership and we were able to re-establish a good working relationship (see below and fig 2). A partnership with the Sabah Forestry Department was also developed:

1. HUTAN: Collaboration with the directors of HUTAN, Marc Ancrenaz and Isabelle Lackman-Ancrenaz were excellent. The PDRA and Rosdi Sakong, the ex-head of the Elephant Conservation Unit (ECU) of HUTAN, conducted field expeditions in the state of Sabah between October 2006 and November 2007. Field expeditions were planned together with Marc Ancrenaz. Ancrenaz and the PDRA organised two wildlife monitoring training courses in March 2006 and March 2007. Several field assistants from HUTAN attended the courses. Marc Ancrenaz and Isabelle Lackman-Ancrenaz, and a large number of their staff, played a major role in the organisation of the International

Workshop on the Conservation of the Bornean Elephant in Sabah, which was held in Kota Kinabalu, 21-23 May 2008. MA and the PDRA are currently working on an awareness brochure.

2. Sabah Wildlife Department: Patrick Andau (Director, now retired) and Laurentius Ambu (Deputy Director, recently promoted to Director) were very supportive and gave all the authorisations required to sample in the LKWS and in the whole State of Sabah. The PDRA and Marc Ancrenaz are liaising with Ambu on the Kinabatangan Elephant Population Management Plan and are currently preparing a Cabinet paper following the successful workshop on the conservation of the Bornean elephant.
3. Universiti Malaysia Sabah: UMS (and ITBC) provided the PDRA with an office and internet access. The PDRA used the laboratory facilities at ITBC to perform DNA extractions, DNA amplifications and DNA profiling. One UMS student (Nurzahfarina Othman) was working full-time on the project and registered for a Master's degree in October 2006. She will graduate in October 2008. Efforts were made by the PDRA to strengthen the capacity of the UMS partner (ITBC) to secure further funds for additional work. A grant application submitted to US Fish and Wildlife Service in November 2006 was successful and provided extra funding (US\$50,163) for additional work on the population genetics of the Bornean elephant. An additional grant was submitted in February 2008 to US Fish and Wildlife Service (Asian Elephant Conservation Fund) to seek additional funds (US\$24,200) for the workshop, which was approved in June 2008. Two grants have also been obtained to carry out elephant monitoring in the Kinabatangan Wildlife Sanctuary and carry out a behavioural study on the social system of the Bornean elephant in the Kinabatangan (Disney Wildlife Conservation Fund: \$5,000; Columbus Zoo and Aquarium Conservation Fund: \$10,000).
4. WWF-Malaysia: As mentioned above, efforts were made to restore a positive working relationship with WWF-Malaysia. This included a meeting with WWF and SWD involving the PL during his visit to Sabah in September 2006. The Program Officer (Mr Raymond Alfred) of the Sabah Orang-utan, Elephant and Rhinoceros Landscape (SOREL) project was invited to attend our training course in March 2007 and we took the opportunity to discuss about re-establishing our collaboration, particularly in terms of dung collection in the state of Sabah. WWF-Malaysia is currently radio-tracking several elephants in the region. A meeting was scheduled for April 19, 2007, with Dr Arun Ventakaraman, National Programme Director for WWF-Malaysia. A Memorandum of Understanding was signed by all parties (WWF, Cardiff University, UMS and HUTAN) in May 2007 (see Fig 2). We agreed to work together in order to: (1) Establish a model from DNA (dung sampling) analysis to be used in estimating the minimum number of elephants in Sabah (Borneo); (2) Study the habitat use and feeding behaviour by elephants in Sabah based on the satellite tracking activities to support the population estimation mentioned in (1); (3) Provide genetic information on Bornean elephant populations in Sabah; (4) Map important habitat for the elephants in Sabah including the important corridors for the population; (5) Identify the current and future threats for the elephant population and provide to the Sabah Wildlife Department, the conservation and management measures based on spatial modelling, population and habitat viability modelling and population genetics data; and (6) Assist Sabah Wildlife Department in the preparation of the Sabah Elephant Management Plan. WWF-Malaysia was also one of the co-organisers of the recent workshop and co-funded it to the total of £3,000. The PDRA was also invited by WWF-Malaysia to take part in a couple of workshops: (1) Borneo Species Workshop 2007 "Large Mammals and Their Habitat in Borneo", 6-7 December 2007, during which PDRA was invited to present his work on orang-utan (from a previous DI project); (2) Workshop on Prioritizing Areas for Restoration (Forest Restoration and Habitat Management Strategy in Kinabatangan-Corridor of Life), 12-13 and 25 February 2008, during which PDRA was invited to provide valuable information on population genetics and population viability of orang-utans and elephants in the Kinabatangan.
5. Sabah Forestry Department: A partnership has been developed with the Sabah Forestry Department. Approval was given to us to enter all Forest Reserves throughout Sabah with the aim of carrying out sampling of elephant dung. Access to 15 forest reserves was given.

6. Other partnerships: (1) After the submission of a proposal to the US Fish and Wildlife Service Asian Elephant Conservation Fund (AECF) for our work in Sabah, the PDRA has been approached by the Program Officer (Dr Meenakshi Nagendran) for the AECF to establish links and develop collaboration with their grantees in South-East Asia. Dr Nagendran perceived that there is a great need for elephant dung-DNA sampling expertise for population estimates in South-East Asia, and she recognised that our expertise and laboratory at ITBC, UMS appears to be ideal for such collaboration. US Fish and Wildlife have many grantees who need to have their samples analysed and Dr Nagendran has recommended our laboratory in Malaysia. She sent a general email to their grantees (see below) and so far, one grantee from Fauna and Flora International, working on Cambodian elephants has contacted the PDRA to establish collaboration on population size estimation in SW Cambodia using large-scale faecal-DNA survey. We have positively responded and we are currently discussing routes of collaboration.

Email sent by Dr Meenakshi Nagendran on March 26, 2007, to AECF grantees:

“Dear Partners, During my recent trip to Cambodia we discussed the possibility of Dr. Benoit Goossens, a Conservation Geneticist and Senior Research Associate at the University of Malaysia in Sabah, possibly collaborating on elephant dung-DNA analyses to aid in population surveys, etc. Since then I have been in touch with Dr. Goossens and he is very happy to discuss such collaboration directly with all of you. Please establish contact with Dr. Goossens (he has been copied here), and let us know how we can help further. Best wishes, Meenakshi Nagendran, Ph.D., D.V.M., Program Officer, Asian Elephant Conservation Fund”

Another grantee, Dr Bibhab Kumar Talukdar, from Assam, India has also approached the PDRA to establish a collaboration to work on non-invasive population genetics of elephants in Assam and asked him to help in capacity building and training. Dr Talukdar visited the PDRA and Nurzhafarina Othman in May 1-2, 2008, and they agreed to work together. Staff from Dr Talukdar will visit Sabah during the summer 2009 to be trained by Nurzhafarina Othman and the PDRA. The PDRA and Nurzhafarina Othman will then visit the facilities in Assam in November 2009 and will provide training on site.

Finally, Dr Nagendran was invited to our workshop, and she gave a plenary lecture about the Asian Elephant Conservation Fund. She also facilitated the funding working group. We also invited her in the Kinabatangan to have an encounter with the Bornean elephant and we took the opportunity to discuss about funding strategies for Bornean elephant conservation.

(2) Another link has been established with Dr JA Lenstra and Dr Chatchote Thitaram from the Faculty of Veterinary Medicine, Utrecht University, Netherlands who conduct genetic analyses on Thailand elephant populations and would like to compare their data with ours. We have decided to use the same panel of microsatellite markers to be able to compare various populations. We invited Dr Thitaram to take part in the workshop in May and we took the opportunity to discuss our respective data and exchange ideas on how to collaborate in the future.

4 Project Achievements

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The project has made a positive impact on biodiversity conservation and especially on elephant conservation in Sabah by working closely with the Sabah Wildlife Department and all partners, by spending considerable amount of time in the field and therefore providing indirect protection

to wildlife in the areas surveyed, and by producing a resolution and several crucial recommendations for the conservation of the Bornean elephant in Sabah during the International Workshop held at the end of the project, in May 2008. Three of them are (1) the upgrading of the elephant's status to Schedule 1; (2) the declaration of four important elephant areas as Managed Elephant Ranges with a commitment to natural forest management and connectivity measures; (3) the establishment of a Borneo Elephant Conservation Alliance (BECA) to encourage collaboration and communication between all stakeholders in Bornean elephant conservation. These three recommendations were extensively reported in the national press. Moreover, the PDRA and MA are strongly involved in the writing-up of the Sabah Elephant Populations Management Plan and data collected during the project will be included in the plan. We also raised awareness in the country by producing an education poster on the threats to the survival of the Bornean elephant and the solutions to prevent its extinction and we are currently preparing an awareness booklet on elephant in Bahasa Malaysia and English.

Four major elephant areas identified

KOTA KINABALU : Four major elephant areas have been identified as “managed elephant ranges” in Sabah – Lower Kinabatangan, Tabin, Deramakot-Sebuku and Ulu Kalumpang.

An International Workshop on the Conservation of the Bornean Elephant held in Kota Kinabalu on May 21 - 23 made a declaration that the four elephant ranges should ideally be maintained under natural forest management and all necessary measures to re-establish connectivity within and between these ranges need to be investigated.

The participants of the workshop recommended a series of conservation measures to enable the future viability of Bornean elephants in Sabah. Issues such as human-elephant conflict, elephant management, habitat management, research and education, fundraising and tourism were discussed and priority actions were set.

The aims of the workshop were to present the results of the works carried out during last

eight years and to discuss the result with all stakeholders involved in the conservation and the management of elephants in Sabah.

The workshop was hosted by the Sabah State Government and co-organised by the Sabah Wildlife Department, Cardiff University, the NGO HUTAN, Universiti Malaysia Sabah and WWF-Malaysia. Funding was provided by the Darwin Initiative for the Survival of Species (UK), the US Fish and Wildlife Service Asian Elephant Conservation Fund (USA), Borneo Conservation Trust (Sabah) and the Rasa Ria Resort itself.

Around 150 participants from around the globe attended the workshop, including elephant experts from India, Malaysia, Thailand, Gabon in Central Africa, UK and USA.

The Workshop was opened by the Assistant Minister of Tourism, Culture and Environment, Bolkiah Haji Ismail and closed by the Minister of Tourism, Culture and Environment, Datuk Masidi Manjun.

... volume up 110 per cent

Fig 1: Press release following the International Workshop on the Conservation of the Bornean Elephant in Sabah, emphasising one of the recommendations of the workshop.

4.2 Outcomes: achievement of the project purpose and outcomes

The project purpose was to provide data on the population genetics of the Bornean elephant in Sabah through extensive fieldwork and laboratory training and capacity building in the host country.

We have achieved the project purpose and most (some are still on-going) of its outcomes. We spent extensive time in the field, collecting samples from all over the State, covering more than 20,000 km of logging roads in forest management units. We have analysed the samples for a substantial number of microsatellite markers in order to acquire useful genetic information for management purpose. We have increased public awareness and knowledge on the Bornean elephant in the host country and established a strong collaboration and network on elephant conservation in Sabah, which was emphasised during the workshop on the Bornean elephant conservation. We have also managed to attract the interest and obtain strong support from the State government. Finally, we have increased capacity building by training a local MSc student in conservation genetics and molecular ecology, who will get further training when she will register for a PhD at Cardiff University to continue her work on elephant social behaviour.

4.3 Outputs (and activities)

All outputs laid out in the logical framework have been achieved or are in final process:

Output 1 – DNA bank for Bornean elephant in Sabah: By November 2007 we have completed a large elephant dung sampling programme and collected more than 750 samples. We extracted the DNA from 90% of the samples and we genotyped more than 250 (from all forest reserves) for 18 microsatellite markers in order to acquire information on the genetic diversity of the elephant populations in Sabah. A DNA bank for Bornean elephant species in Sabah has been handed over to the host country and is held at the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah. We have also identified conservation issues from our results at the International Workshop on the Conservation of the Bornean Elephant in Sabah that have been included in a resolution. We are currently preparing the Sabah Elephant Populations Management Plan and we will run a Population Habitat and Viability Analysis (PHVA) which will use all data gathered by all partners during the last eight years on elephant ecology, distribution, movement and population genetics.

Output 2 – Training of local MSc student and Sabah field assistants: We have trained one Malaysian student, Miss Nurzhafarina Othman, at MSc level (completion in October 2008), and she will register for a PhD at Cardiff University to continue her work on the Bornean elephant. We have also trained students, NGOs and GOs staff in Wildlife Monitoring during two courses (March 2007 and 2008).

Output 3 – Results disseminated: We organised an International Workshop on the Conservation of the Bornean Elephant in Sabah to present our results to the international and national scientific and conservation communities and to local stakeholders and we have produced a resolution that will be tabled before the State Cabinet. We are in the process of preparing the workshop proceedings (for September 2008). We have also publicised our work in the national press through press releases. We have also produced an awareness poster and we are currently preparing an awareness booklet in English and Malay. We are planning to submit a minimum of three papers during the next six to 12 months.

We also received global publicity for the results of the previous Darwin project on orang-utans (DI 09-016) carried out by the same team, particularly following the publication of a cutting-edge paper in the scientific journal *Public Library of Science Biology* which made the cover of the 2006 February issue. More than 60 web pages and more than 30 local (Sabah), national (Malaysia) and international (UK, France, Spain, Italy, Germany, USA, Brazil, India, Iran, etc) newspaper articles covered the findings of the study. Another article published in June 2006 in *Molecular Ecology* was publicised in the local press (*Daily Express*, *Borneo Post*,...). The fact that the PDRA involved in the elephant project also carried out the orang-utan project and that he was in Sabah at the time of publications was an important factor for the large coverage of

the papers in the press. We also publicised additional results from that project, following a one-day workshop on the Kinabatangan orang-utan population and habitat viability analysis that was held at the Sabah Wildlife Department Headquarters in September 2006. More than ten national, local and international newspaper articles and web pages covered the results obtained. A scientific paper was also submitted to the journal *Conservation Biology* in February 2008 (Bruford, Goossens, Chikhi, Lackman-Ancrenaz, Andau, Ambu, Ancrenaz. *Projecting genetic diversity and population viability for the fragmented orang-utan population in the Kinabatangan floodplain, Sabah, Malaysia*). The orang-utan results were also disseminated during the current grant (2005-2008) at various local (South-East Asia and Malaysia) and international (Portugal, UK, USA) conferences, workshops and seminars by the PDRA and the PL.

We did not encounter problems in achieving the outputs specified. The only problem encountered during the project was when WWF-Malaysia, one of the initial partners, decided to withdraw during the first year of the project. A full explanation for this decision is not tendered here (although it was extensively discussed in previous Annual Reports), but centred around the amount of credit and 'ownership' of the DI project that WWF insisted upon, which the PIs and PDRA (MWB, BG and MA) all judged to be disproportionate to their contribution in the field. This situation was clearly regrettable, and during the second year of the project substantial effort was made to restore working relationship with WWF-Malaysia. A Memorandum of Understanding was then drafted and signed by all parties (WWF-Malaysia, Cardiff University, UMS and HUTAN) on 9 August 2008, witnessed by the Director of the Sabah Wildlife Department, Datuk Mahedi Andau (see Fig 2).



Fig 2: Press release (Borneo Post, 10 August 2007) on the signing ceremony of a MoU between Cardiff University, Universiti Malaysia Sabah, HUTAN and WWF-Malaysia, witnessed by the Director of the Sabah Wildlife Department, Datuk Mahedi Andau.

4.4 Project standard measures and publications

We quantified all the project standard measures in the table in Annex 4 using the coding and format of the Darwin Initiative Standard Measures. We also provided full details in Annex 5 of all publications and material that can be publicly accessed.

We have also included outputs that came out from the previous DI grant (09-016) but during the current one, since these outputs were strongly highlighted in the host country because we were still present after the completion of the first grant.

4.5 Technical and Scientific achievements and co-operation

Research

Sampling – 323 dung samples were collected in the Lower Kinabatangan Wildlife Sanctuary (Zone 4, Map 1) by the PDRA and Rosdi Sakong between October 2005 and February 2006. Samples were mainly collected from the large herd (about 150 individuals) which ranges between Sukau and Abai villages. Sampling in the different forest reserves of the state of Sabah started in October 2006 and was completed in November 2007. More than 400 samples were collected in Zone 1 of Map 1, in the Sepagaya, Ulu Segama, Malua, Kuamut, Gunung Rara, Deramakot and Kalabakan Forest Reserves and in Maliau Basin Conservation Area. Twenty-three samples were collected in Tabin Wildlife Reserve, Zone 3 of Map 1. An expedition was carried out by the PDRA in Ulu Kalumpang Forest Reserve, Zone 3 of Map 1, but was not successful in finding samples. An isolated population of about 16 individuals survives in that forest reserve. According to survey reports, there are no elephants (or only a few scattered individuals) in Zone 5 and therefore, we did not carry any sampling in Zone 5. To summarize, 779 dung samples were collected in the whole State of Sabah and were stored in 50 mL Falcon tubes with 70% ethanol and transported to the laboratory at ITBC, UMS. GPS coordinates were taken for each sample.

DNA extraction – DNA was extracted from more than 90% (738) of the samples in the ITBC non-invasive genetic lab, a facility which was one of the legacies of a previous DI project (09-016). We used the QIAamp DNA Stool Mini Kit (QIAGEN) and we carried out two extracts per sample. We also extracted faecal DNA from nine captive individuals kept in the Lok Kawi Wildlife Park in Kota Kinabalu. All individuals were originating from a known wild location in Sabah.

DNA sequencing – We carried out mitochondrial DNA sequencing for 47 individuals selected from elephant ranges in Sabah as follow: five from Tabin Wildlife Reserve, 25 from Ulu Segama-Malua Forest Reserves, eight from Gunung Rara Forest Reserve, five from the Kinabatangan Wildlife Sanctuary and four of the captive elephants from Lok Kawi Wildlife Park. Sequencing was carried out at Cardiff University by Nurzhafarina Othman, supervised by the PDRA, during her training. We used the same mtDNA region that was sequenced by Fernando *et al.* (2003; the only previous study of Bornean elephant genetics) and we found the same haplotype that was identified in their study, and no haplotype variation was detected in the whole Sabah. It confirmed that the Bornean population is unique in Asia, that it derives from Sundaic stock, and that it has undergone independent local evolution. However, it remains unclear whether the Bornean elephant was native to Borneo, as inferred by Fernando *et al.* (2003). The Bornean population could have been introduced to Borneo by the sultan of Sulu (Cranbrook *et al.* 2008), and produce results consistent with those interpreted as evidence of endemism by Fernando *et al.* (2003). Indeed, it is recorded that two elephants from the Rajah of Java were given to the ruler of Sulu, Rajah Baginda, in c.1400, when elephants (*Elephas maximus sondaicus*) were still roaming Java island. These elephants became naturalised and were the founders of a feral population at the western end of the island of Sulu. Subsequently, the sultan of Sulu is recorded to have translocated some individuals to the northeast of Borneo (Sabah) and these individuals may have become the founder members of the extant population on Borneo. Unfortunately, the date of the introduction is unknown and we are currently analysing the data to provide an estimation of the date of origin of the founding event using

microsatellite data and Bayesian statistics (see Goossens *et al.* 2006, from a previous DI study on orang-utans).

DNA genotyping – Eighteen microsatellite loci published in 2007 by Kongrit *et al.* and isolated from the Asian elephant were used to identify individuals in our sample and to characterise genetic diversity and variability in the Bornean elephant population in Sabah. We selected 273 samples for genotyping, favouring fresher samples: 46 (out of 342) samples from Kinabatangan Wildlife Sanctuary, 34 (out of 38) from Deramakot FR, 78 (out of 272) from Ulu Segama-Malua FR, 37 (out of 42) from Gunung Rara FR, 46 (out of 59) from Kalabakan FR, 9 (out of 9) from Maliau Basin Conservation Area, and 23 (out of 23) from Tabin Wildlife Reserve. Out of the 273 samples genotyped, two samples did not yield reliable results and 256 different individuals were identified (about 25% of the total population of Sabah). We determined the mean number of alleles ($n_A = 2.3$), the mean expected ($H_e = 0.28$) and observed heterozygosity ($H_o = 0.21$) for the Sabah elephant population. We found extremely low genetic diversity and low levels of expected heterozygosity, but substantially higher estimates than previously shown (Fernando *et al.* 2003), indicating that the population is more genetically viable than previously thought. We also identified significant genetic differentiation between currently demographically isolated populations. These results suggest the desirability of re-establishing gene flow between some populations, especially between the Kinabatangan Wildlife Sanctuary and Tabin Wildlife Reserve and between the Kinabatangan Wildlife Sanctuary and the centre of Sabah (Ulu Segama, Malua, Deramakot, etc), because the Kinabatangan population appears to be the most variable sub-population. At least two to three papers are anticipated and will be prepared within the next six to 12 months. The data will also be included in the Sabah Elephant Populations Management Plan that is currently drafted by the Sabah Wildlife Department with the help of the PDRA and the PP.

Training

Nurzhafarina Othman (trainee) registered as MSc student in October 2006. She spent two periods of four months (May 1 to August 31, 2006 and September 1 to December 31, 2008) in Cardiff where she was trained in molecular ecology techniques by the PDRA. She took part in all aspects of the project, including sampling and DNA extraction, sequencing, genotyping and data analyses. She will submit her MSc thesis in November 2008 and will graduate in September 2009. She will then register for a PhD at Cardiff University to work on the social behaviour of the Bornean elephant using satellite telemetry, behavioural observations and genetics. She was also trained in writing grant applications (she was involved in the two grants obtained with Disney and Columbus Zoo and she wrote another grant application that was submitted to the Wildlife Conservation Society in March 2008) and scientific papers (a paper on elephant morphometrics was accepted in the *Journal of Tropical Ecology*). She was also actively involved in the organisation of the International Workshop on the Conservation of the Bornean Elephant in Sabah, she was part of the Organizing Committee and was the Deputy Head of the Secretariat and in charge of the exhibition during the workshop. She also presented the results of our genetic project to the participants and made many contacts within elephant specialists such as Dr Christy Williams (WWF-International) and Professor Raman Sukumar. She has been invited by the latter to spend two weeks in October 2008 at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India to be trained in behavioural science applied to elephant.

Teaching

A one-week field-training course in **wildlife monitoring and censusing** was carried out at the Kinabatangan Orangutan Conservation Project (KOCP) Field Research Station, Sukau, Kinabatangan, March 19-25, 2006. The course was co-organised by the French NGO HUTAN (Marc Ancrenaz), the SWD, and Cardiff University (PDRA), and funded by the Darwin grant and HUTAN. Sixteen staff from governmental (SWD: three staff from Tabin Wildlife Reserve and one staff member from Kinabatangan District; Sabah Parks: one staff member from Crocker Range NP and one staff member from Kinabalu Park) and non-governmental (SOS Rhino: one staff member from Tabin Wildlife Reserve; WWF-Indonesia: two staff; HUTAN: two staff from Red Ape Encounters and two staff from Elephant Conservation Unit) organisations as well as representatives from the private sector (Yayasan Sabah: one staff member from Imbak, one

staff member from Danum Valley and one staff member from Maliau Basin) attended the course.

The course was principally run by several members of KOCP staff, all native from Sukau village and who were mostly trainees during the previous Darwin project (09-016): Ahbam Bin Abulani, Eddie Bin Ahmad, Hanisah Binti Elahan, Azman Bin Sakong, Marlin Bin Suali and Azri Sawang. They gave lectures on wildlife surveys (principally orang-utans, proboscis monkeys, gibbons and other primates, and crocodiles), which were alternated with practical work in the field. Surveys of primates and other wildlife were carried out along the Kinabatangan river, and data were analysed back at the KOCP headquarters.

The students were taught how to estimate densities of orang-utans and gibbons in the KOCP study site, Lot 2, Kinabatangan Wildlife Sanctuary. They were also briefed about elephant surveys (dung collection and line transects). A night survey was carried out on the river to estimate the density of crocodiles in the Kinabatangan. Results of the surveys were then analysed and discussed by the participants, back at the station.

This course was not only the opportunity to gather staff from different organizations working on wildlife in Sabah and in Indonesia, exchange ideas and views; it was also the opportunity for these staff to extend their knowledge in wildlife monitoring. The level of dedication and professionalism showed by the KOCP staff during the course was exemplary and provide proof that effective wildlife conservation and local community involvement are strongly linked.

At the end of the course, we organised a diploma ceremony. The participants were invited to give their impression on the course: "This was an excellent opportunity given by HUTAN, Cardiff University and the Darwin Initiative to apply theory to the field and we now plan to implement surveys on our own, in our own areas" said Fadzilawati Zahrah Hamdan from SOS Rhino and Mustamin Mansah from Yayasan Sabah, Danum Valley.

A one-week training course in **statistical analysis in wildlife monitoring and censusing** was carried out at the Institute for Tropical Biology and Conservation, March 12-16, 2007. The course was co-organised by the French NGO HUTAN (Marc Ancrenaz) and Cardiff University (PDRA), and funded by the Darwin grant and ITBC (provided facilities and computers). Marc Ancrenaz taught the course.

Eighteen staff from governmental (Sabah Forestry Department, two staff from Ulu Segama-Malua Project) and non-governmental (SOS Rhino: one staff member from Tabin Wildlife Reserve; WWF-Malaysia: one staff from project SOREL; WWF-Indonesia: two staff; HUTAN: five staff from Orangutan Research Unit; Sumatran Orangutan Conservation project: one staff; Borneo Orang-utan Survival Foundation: one staff) organisations as well as representatives from the private sector (Sabah Foundation: one staff member from Imbak, one staff member from Danum Valley and one staff member from Maliau Basin) attended the course. Nurzhafarina Othman (DI trainee) also followed the course, as well as one other UMS Master student. Most of the students were already involved in the first training course, which was held in March 2006 in the field site of HUTAN, in the Kinabatangan.

The students were taught basic statistics and the use of SSPS software. They were also introduced to the use of the software DISTANCE, which is used to estimate wildlife densities after line transects have been carried out in the field. Opportunity was taken to analyse data from the field surveys carried out by the Sabah Forestry Department in Ulu Segama-Malua Forest Reserves between August 2006 and March 2007 and orang-utan surveys carried out by WWF-Indonesia in Sebangau National Park.

This course was the opportunity to extend the knowledge of the students in wildlife monitoring and statistics.

All participants received a diploma at the end of the course. Press releases were published in the local press the following week.

From September to December 2007, Nurzhafarina Othman went to Cardiff University to complete the training program as planned in our grant application. The main purpose of that second period of four months spent in the UK was to help her to understand and to learn about the basics of molecular ecology and conservation biology by following lectures conducted by the PL. The modules were "Conservation Biology 3rd year" and "Molecular Biology 2nd year", which were held on Mondays for Molecular Biology and Tuesdays for Conservation Biology. In the Molecular Ecology lectures, she was taught about molecular questions and problems that

are important to answer in conservation either at the community, population, species or individual level. She learnt the theory of how to answer biological/ecological questions using genetic and non-invasive techniques. She also learnt basic genetics including the use of various molecular markers in ecology to measure genetic diversity and to classify species in taxonomic groups. Besides that, she also learnt about behavioural ecology and parentage analysis. In the practical, she was taught on how to use several computer programs to analyze genetic data such as CERVUS, DAMBE, MEGA and GENETIX. In the Conservation Biology lectures, she looked at how conservation biology is influenced by many factors such as biogeography, evolution, ecology, genetics, taxonomy and systematics. She also acquired some knowledge in small population biology (including demographics), anthropology, economics, planning and legislation, politics and sociology. She finally learnt how to carry out Population and Habitat Viability Analysis (PHVA) using VORTEX software. She submitted an essay on the population and habitat viability analysis of the Kinabatangan elephant population which was evaluated and which passed the module.

4.6 Capacity building

We strengthened capacity in conservation in Malaysia via the training of a Malaysian MSc scientist, Miss Nurzhafarina Othman, in population biology and molecular genetics (see above, section 4.5 – Training). She will graduate in October 2008 and will carry out a PhD at Cardiff University to complete her training in elephant conservation. She is likely to become an important voice for elephant conservation in her country.

We also conducted intensive field and theoretical training of staff from Sabah governmental and non-governmental agencies in topics of prime importance for designing and implementing management plans (surveys, monitoring) (see above, section 4.5 – Teaching). It placed the trainees in a better position to conduct further conservation activities and helped to ensure the long-term survival of the Bornean elephant.

The PL went to Sabah for 10 days in September 2006 for 1st year's evaluation, he met with all host country partners, and the project partners held a one-day workshop on PHVA results for the Kinabatangan Wildlife Sanctuary orang-utan project (resulting from DI 09-016) on 16th September 2006.

The PDRA was invited to different workshops in the host country to provide input on conservation genetics and molecular tools for wildlife monitoring (4th Sumatran Rhinoceros Conservation Workshop 2007) and on genetic data for large mammals (orang-utans and elephants) for forest restoration (Kinabatangan-Corridor of Life Workshop 2008 – Prioritizing Areas for Restoration).

The UK lead institution (Cardiff University) has now built (and will continue building) its own capacity in the host country as it became the partner of the Sabah Wildlife Department in the setting up of the Danau Girang Field Centre, a research and training facility located in Lot 6 of the Kinabatangan Wildlife Sanctuary (www.cardiff.ac.uk/biosi/facilities/danaugirangfieldcentre/index.html). A Memorandum of Understanding between Cardiff University and Sabah Wildlife Department was signed on August 7, 2007 (see below, section 4.7) and the field centre will open on July 19, 2008. It will be a focus for biodiversity research and training and for field courses in tropical biodiversity assessment, open to local and international students/scientists and universities.

4.7 Sustainability and Legacy

Which project achievements are most likely to endure? In May 2008, during the workshop on the Bornean elephant conservation, we drafted, presented and adopted by consensus a list of recommendations and resolution for the conservation of the Bornean elephant in Sabah. The resolution and recommendations were presented to the Sabah Minister of Tourism, Culture and Environment, Datuk Masidi Manjun, at the close of the workshop. During the post-workshop press conference, the Minister stated that his Ministry would be tabling the resolution and recommendations at the State Cabinet for Consideration. For this, the Director of the Sabah

Wildlife Department, Mr Laurentius Ambu has recently asked the PDRA and the PP to draft a Cabinet paper that will be submitted to the Minister. The Cabinet paper will be the legacy of this project and the different partners will work hard to ensure its sustainability and that the recommendations are taken in consideration as much as possible. The Elephant Populations Management Plan will also ensure that the project achievements will endure after the completion of the Darwin funding.

What will happen to project staff and resources after the project ends? Our trainee, Miss Nurzhafarina Othman, will register for a PhD at Cardiff University and will continue to work on the Bornean elephant both in the field and in the laboratory. She will use satellite telemetry, behavioural observations and genetic paternity analyses to study the social behaviour and the mating strategies of the Bornean elephant. She will be supervised by the PDRA, the PL and the PP. In July 2008, satellite collars were fit on three elephants (two adult females and one bull) in the Kinabatangan (see press release below) and the individuals are currently followed by Othman and the Elephant Conservation Unit of HUTAN.

We have also set up different projects and collaborations on some other charismatic species such as the Sumatran rhinoceros, the tembadau or banteng, and the estuarine crocodile, for which funding was sought from local and international organisations. We will use the non-invasive genetic lab set up during the first DI grant and upgraded during the current grant.

Are partners likely to keep in touch? Cardiff University has established a long-lasting collaboration with all partners involved in the current DI project (14-014) and the previous one (09-016), especially with the Sabah Wildlife Department and the NGO HUTAN. During the current DI project, the Sabah Wildlife Department and Cardiff University have established a field research and training centre in the forest of the Lower Kinabatangan Wildlife Sanctuary (see Fig 3). The PDRA employed on the current DI project was instrumental in that achievement and will run the centre after the completion of the current DI grant (from 1st July 2008) and will be based in Sabah, allowing more sustainability (since he will still be involved in elephant conservation and research work) for the project and a long-lasting legacy from the DI. Funding will be sought from the Darwin Initiative's round 16 in August 2008.

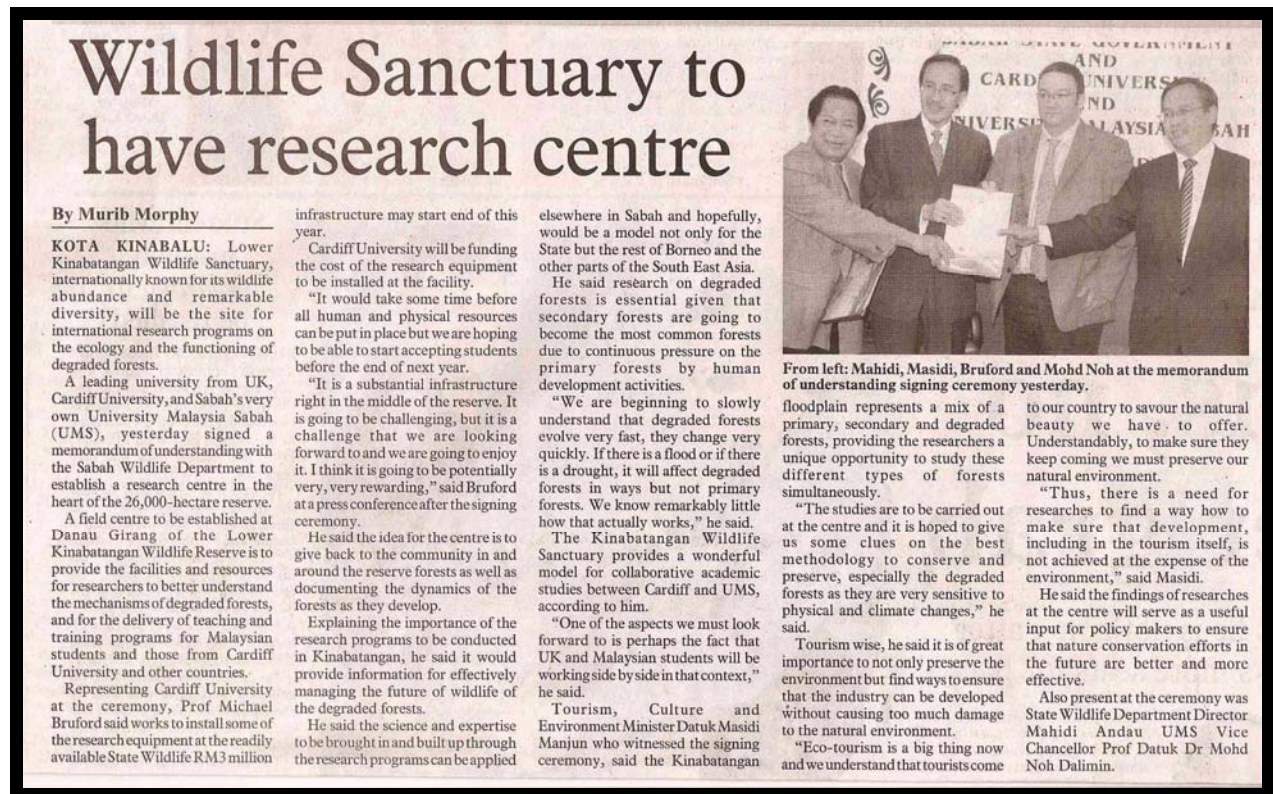


Fig 3: Press release on the signing ceremony of a Memorandum of Understanding between the Sabah Wildlife Department and Cardiff University to set up a field centre in the Lot 6 of the Lower Kinabatangan Wildlife Sanctuary.

The Sabah State Government, in a landmark decision that has positive global implications, approved mid-March 2006 that nearly 300,000 hectares of forest reserves in the East Coast would be managed under Sustainable Forest Management principles and for conservation of biodiversity. The last orang-utan census that was carried out in 2002-2003 by the Sabah Wildlife Department and the NGO HUTAN (our partners in the project), published in Public Library of Science Biology in 2005, and presented/publicised at the 2003 workshop on the conservation of the Bornean orang-utan in Sabah (partly funded by DI 09-016), was instrumental in that decision, as it showed that the area was extremely important for orang-utan conservation (containing more than 35% of Sabah's orang-utan population). We are hopeful that a similar decision is likely to happen for the elephant, following the resolution presented by the workshop participants to the Sabah Minister of Tourism, Culture and Environment.

5 Lessons learned, dissemination and communication

Darwin projects are allocated for building capacity over a relatively short-term period (usually three years), and although British institutions can apply for follow-up funds or for a scholarship for one trainee, having the opportunity for institutions to build on long-term collaborations with host country partners by funding additional projects involving more or less the same group of partners can be extremely valuable. For a project combining research, conservation, training and capacity building, three years can sometimes be very short in order to take maximum profit of the relationships built and the results obtained during that period. We would like to share the experience that we had when our scientific paper (which was a result of our previous Darwin grant, DI 09-016, on the Bornean orang-utan) made the cover of the 2006 February issue of the Public Library of Science Biology. It happened that the PDRA on the orang-utan project was also the one working on the current elephant project and he was in Sabah, Malaysia when the paper came out. Therefore, we were able to attract considerable publicity to that paper and to widely disseminate the information at both national and international levels. Being on the ground, the PDRA was also able to assist the Sabah Wildlife Department Director when he had to explain the results and the consequences of the paper. We believe that capacity building requires planning for the medium to long-term and that British institutions should be given the opportunity to do this. We would like to acknowledge the fact that Darwin gave us that opportunity with the current elephant project, following the previous one on orang-utans.

We disseminated the project achievements in the local press, especially following the International Workshop on the Conservation of the Bornean Elephant in Sabah. The target audience was the public, as well as all stakeholders that were involved in elephant conservation in the country. We will apply our project achievements and especially by submitting to the Ministry of Tourism, Culture and Environment a Cabinet paper on the conservation of the Bornean elephant in Sabah. That paper is being currently prepared by the PDRA and the PP, together with the Director of the Sabah Wildlife Department. We hope that several points from the paper will be approved by the Sabah State Government, as it was done following the one wrote for the orang-utans, five years ago.

We will continue and develop dissemination of our outcomes after completion of the project as the UK-based institution and one of its staff (PDRA) will become Director of the Danau Girang Field Centre in the Lower Kinabatangan Wildlife Sanctuary (see above).

5.1 Darwin identity

Meetings attended included:

1. BBEC 5th International Conference 2006, Biodiversity Conservation: 2006 and beyond?, 5-7 December 2006, Kota Kinabalu, Sabah (PDRA and trainee)
2. 4th Sumatran Rhinoceros Conservation Workshop 2007, 5-6 July 2007, Kota Kinabalu, Sabah (PDRA provided input)

3. European Science Foundation ConGen Workshop “Population genetics modelling and habitat fragmentation: separating recent and ancient events for efficient conservation”, 19-21 September 2007, Lisbon, Portugal (PDRA and PL gave presentations)
4. Borneo Species Workshop 2007 “Large Mammals and their Habitat in Borneo”, 6-7 December 2007, Kota Kinabalu, Sabah (PDRA and PP gave presentations)
5. Workshop on Prioritizing Areas for Restoration “Forest Restoration and Habitat Management Strategy in Kinabatangan-Corridor of Life, 12-13 and 25 February 2008, Kota Kinabalu, Sabah (PDRA and PP provided input)
6. The Association for Tropical Biology and Conservation 2008 Conference “Towards sustainable land-use in tropical Asia”, 23-26 April 2008, Kuching, Sarawak (PDRA gave a presentation)
7. UK Elephant conservation meeting, organised at University College London, 21st February 2007 (PL gave a presentation)

Use of the ‘Darwin Initiative’ logo:

1. Boat for field expeditions and collection of elephant samples in the Kinabatangan Wildlife Sanctuary
2. 4x4 car for field expeditions in all Sabah forest reserves to collect elephant dung samples.
3. Two courses on wildlife monitoring and censusing (certificates)
4. Awareness poster in Malay and English
5. International Workshop on the Conservation of the Bornean Elephant in Sabah (banner, invitation letter, programme book, official dinner menu, poster presented during exhibition, proceedings (in preparation), certificate)
6. Powerpoint presentations during several invited talks at local and international workshops and seminars presented by PDRA and PL (see above), and during talk presented by Nurzhafarina Othman at the International Workshop on the Conservation of the Bornean Elephant in Sabah.

Promotion of Darwin funding and project:

1. Publications in peer-review journals (previous DI grant no 09/016 acknowledged in papers published in 2006 and 2008, during current DI grant no 14/014)
2. Newspaper articles in the host country on the launching of the DI project in September 2005
3. Newspaper articles in the host country on the two training courses on wildlife monitoring and censusing
4. Newspaper articles in the host country and on the web on the International Workshop on the Conservation of the Bornean Elephant in Sabah, May 2008

The Darwin Initiative is extremely visible and recognised among the academic, governmental and non-governmental organisations in Sabah. This is due to the large number of grants allocated to Sabah and the high profile of our projects in the media. Darwin identity is very strong and unambiguous in Sabah.

6 Monitoring and evaluation

Monitoring methods have varied according to the activity being carried out. Laboratory and fieldwork have been monitored through regular (weekly) meetings to discuss progress while in

Cardiff and weekly email consultation between the PL and the PDRA when the latter was in Malaysia. PDRA had also weekly meetings with the Director of the Sabah Wildlife Department and the PP. Overall, communication and monitoring was rigorous in this project and results have been beyond our most optimistic expectations and we expect more outputs to come out of the project in the near future. We would also like to emphasise the exemplary collaboration between Cardiff University, the Sabah Wildlife Department, the NGO HUTAN, Universiti Malaysia Sabah and WWF-Malaysia for the organisation of the International Workshop on the Conservation of the Bornean Elephant in Sabah which led to a very successful exercise, which was extensively publicised through the media in the country, and which also led to the establishment of a strong network of elephant specialists and conservationists willing to work together for the future of the species in Sabah.

6.1 Actions taken in response to annual report reviews

We have taken action in response to annual report reviews. While we are currently preparing a booklet on elephant awareness in Malay and English (an original copy will be sent to Darwin office after completion), we produced two education posters (one in Malay, one in English), which presented the status, distribution and some biological characteristics of the Bornean elephant as well as the threats to its survival and the solutions to prevent its extinction (hard copies will be sent separately to Darwin office). The poster is currently showed at the Wildlife Park in Kota Kinabalu, at the Headquarters of Sabah Wildlife Department, Sabah Forestry Department, Sabah Parks, Yayasan Sabah, Sabah Society,...., at tourist lodges, at the different field research centres (Danum Valley, Maliau Basin,...), at rural schools in the elephant's range, at universities and education/nature centres, etc.

7 Finance and administration

7.1 Project expenditure

	Budget (£)	Spent (£)
Staff:		
B Goossens		
Field assistants		
M Ancrenaz		
N Othman		
Rent, rate, etc		
Field costs		
Consumables		
Postage		
Travel		
Printing		
Conference		
Total		

7.2 Additional funds or in-kind contributions secured

Additional funds were secured over and above the confirmed matching funding identified in the original project document. A grant application was submitted to the US Fish and Wildlife Service (Asian Elephant Conservation Fund) in November 2006 and was successful and provided extra funding (US\$ 50,163) for additional work on the population genetics of the Bornean elephant. An additional grant was also submitted in February 2008 to the US Fish and Wildlife Service (AECF) to seek additional funds (US\$24,200) for the workshop, the application was approved and funds will be allocated in August 2008. Additional funds for the workshop

were also provided by WWF-Malaysia (US\$7,000), HUTAN (US\$7,000), Rasa Ria Resort (US\$13,000) and Borneo Conservation Trust (US\$1,660). Two grants have also been obtained to carry out elephant monitoring in the Kinabatangan Wildlife Sanctuary and carry out a behavioural study on the social system of the Bornean elephant in the Kinabatangan (Disney Wildlife Conservation Fund: \$5,000; Columbus Zoo and Aquarium Conservation Fund: \$10,000). Three additional grants were submitted to continue our work on elephant in the Kinabatangan and to principally look at the social behaviour of the Bornean elephant using satellite tracking, behavioural observations and genetic data. The project will be part of our Darwin trainee's PhD. One grant (July 2008, SeaWorld and Busch Gardens, US\$ 15,000) was recently allocated to the PDRA for that particular project. The two others (Wildlife Conservation Society Small Research Fellowships and American Zoos Association) are pending. This work will be carried out in collaboration with three of our DI partners, the Sabah Wildlife Department, the NGO HUTAN and Universiti Malaysia Sabah. WWF-Malaysia will also be involved in the satellite-tracking component of the project.

7.3 Value of DI funding

Without funding from DI we would not have been able to carry out valuable research on the conservation genetics of the Bornean elephant and provide to the Sabah Wildlife Department crucial information for the conservation of the species in Sabah. The funding enabled us to train one Malaysian MSc student during the two years of her Master and gave her the opportunity to travel to the UK twice to gain molecular training and follow lectures at Cardiff University. Finally, DI provided more than 70% of the funding for the International Workshop on the Conservation of the Bornean Elephant in Sabah, which was the best achievement of the project.

Annex 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements April 2007 - March 2008	Actions required/planned for next period
<p>Goal: 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</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 the benefits arising out of the utilisation of genetic resources 		(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)	(do not fill not applicable)
<p>Purpose Provide data on ecology, genetics, social structure, dispersal and conflict activities of the Bornean elephant <i>E. maximus borneensis</i> in fragmented habitat through extensive field study and laboratory training and capacity building in Sabah.</p>	<p>Population genetic analyses by Malaysian (MSc) student and PDRA by yr 3</p> <p>Ecological data (distribution, movements, population growth, social structure, dispersal) on Kinabatangan elephant population by yr 3</p>	<p>Genetic data for all Sabah elephant populations produced by MSc student and PDRA.</p> <p>Ecological data on Kinabatangan and Sabah populations produced by all partners.</p> <p>Presentation of all data at international workshop on the conservation of the Bornean elephant in Sabah, May 2008</p>	Sabah Elephant Populations Management Plan to be produced by end of 2008
<p>Output 1. DNA bank for Bornean elephant species in Sabah and Cartography of all Bornean elephant populations in Sabah and genetic mapping of all populations.</p>	<p>Elephant populations in Sabah sampled.</p> <p>All populations identified and genetically genotyped.</p>	<p>Genetic analyses performed during third year.</p> <p>All results presented at the International Workshop on the Conservation of the Bornean Elephant in Sabah, May 2008.</p>	
Activity 1.1 Sampling of all elephant populations in Sabah		All elephant populations sampled in Sabah (about 780 samples collected in all forest reserves and protected areas in Sabah)	
Activity 1.2 Genotyping of all populations in Sabah		More than 250 individuals genotyped for 18 microsatellite markers	
<p>Output 2. Training of Sabah field assistant and Training of local MSc student</p>	<p>Training of more than 15 field assistants in wildlife monitoring and one local MSc student trained by year 3.</p>	<p>One Malaysian student, N Othman, trained at MSc level (completion in October 2008). She will register for a PhD at Cardiff University to continue her work on the Bornean elephant. Training of students, NGOs and GOs staff in Wildlife Monitoring during two courses (March 2007 and 2008).</p>	

Activity 2.1. Training of more than 15 NGOs and GOs staff in wildlife monitoring and censusing	Training achieved during the first and second years of the project.	
Activity 2.2. Training of one MSc student	Training in molecular ecology techniques has been carried out at Cardiff University. The trainee is involved in all activities of the project. The trainee has followed lectures in molecular ecology and conservation biology at Cardiff University.	
Output 3. Results disseminated	3 papers published in scientific journals by yr 3, 1 radio broadcast, workshop proceedings published	Results disseminated during workshop in May 2008. Workshop programme produced, proceedings in preparation. One radio broadcast on our elephant work on Radio France International. Papers on elephant project in preparation. Three papers on previous DI on orangutan published during current DI project and publicised in local, national and international press during current project. Large press coverage of elephant project.

Annex 2 Project's final logframe, including criteria and indicators

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve <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 Provide data on ecology, genetics, social structure, dispersal and conflict activities of the Bornean elephant <i>E. maximus borneensis</i> in	Population genetic analyses by Malaysian (MSc) student and PDRA achieved.	Samples collected and populations genotyped. Dissemination of results during international workshop held in	Governmental authorities from host country will use ecological, population demographic and genetic data in long-term management plan for the Bornean elephant populations.

<p>fragmented habitat through extensive field study and laboratory training and capacity building in Sabah.</p>	<p>Ecological data (distribution, movements, population growth, social structure, dispersal) on Sabah elephant populations produced by all partners.</p>	<p>Sabah in May 2008.</p> <p>Publication of results in scientific journals (3 articles in preparation) and local popular press coverage.</p> <p>Inclusion of ecological, population demographic and genetic data in Management Plan for the Bornean elephant in Sabah (in preparation).</p>	
<p>Outputs</p> <p>DNA bank for Bornean elephant species in Sabah</p> <p>Cartography of all Bornean elephant populations in Sabah and genetic mapping of all populations.</p> <p>Training of Sabah field assistants</p> <p>Training of local MSc student</p> <p>Results disseminated</p>	<p>Elephant populations in Sabah sampled.</p> <p>Surveys in Sabah carried out and inclusion of ecological & genetic data.</p> <p>Identification of conservation issues</p> <p>15 local field assistants trained in census & surveys by yr 2</p> <p>1 MSc student trained</p> <p>3 papers published in scientific journals, 1 radio broadcast (BBC), workshop proceedings published</p>	<p>Collection of samples now available in host lab.</p> <p>Results of surveys and research carried out in Sabah presented during workshop in May 2008.</p> <p>Conservation issues identified during workshop in May 2008 and handed over to the Minister of Tourism, Culture and Environment.</p> <p>Certificates obtained by the trainees</p> <p>Master diploma obtained by student (submission in Oct 08).</p> <p>Copies of all publications, recordings, video and proceedings will be sent to Darwin Initiative.</p>	<p>Large sample size obtained in host country.</p> <p>Cooperation between stakeholders for implementation of Action & Management Plans.</p> <p>Trainees motivated for training & for transmission of skills learned.</p> <p>MSc graduate promotes and disseminates skills.</p> <p>MSc graduate will register for a PhD.</p>

Annex 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use	10	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	10	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	20	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation	0	Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity	0	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures	0	Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	30	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts	0	Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources	5	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

Article No./Title	Project %	Article Description
16. Access to and Transfer of Technology	15	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information	5	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol	0	Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution	0	Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1a	Number of people to submit PhD thesis	0
1b	Number of PhD qualifications obtained	0
2	Number of Masters qualifications obtained	1 (Nurzhafarina Othman)
3	Number of other qualifications obtained	0
4a	Number of undergraduate students receiving training	1 (Nurzhafarina Othman)
4b	Number of training weeks provided to undergraduate students	36 (field, laboratory, lectures)
4c	Number of postgraduate students receiving training (not 1-3 above)	N/a
4d	Number of training weeks for postgraduate students	N/a
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	N/a
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	34
6b	Number of training weeks not leading to formal qualification	2
7	Number of types of training materials produced for use by host country(s)	N/a
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	141 by PDRA, 7 by PL
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1 (Sabah Elephant Population Management Plan – under preparation)
10	Number of formal documents produced to assist work related to species identification, classification and recording.	N/a
11a	Number of papers published or accepted for publication in peer reviewed journals	4 (including 3 from previous DI grant published during current DI grant in 2006 & 2008)
11b	Number of papers published or accepted for publication elsewhere	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1 (DNA bank for Bornean elephant in Sabah)
12b	Number of computer-based databases enhanced (containing species/genetic	N/a

Code	Description	Totals (plus additional detail as required)
	information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	1 (collection of dung samples of all elephant ranges in Sabah)
13b	Number of species reference collections enhanced and handed over to host country(s)	N/a
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	1 (International Workshop on the Conservation of the Bornean Elephant in Sabah)
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	5
15a	Number of national press releases or publicity articles in host country(s)	6
15b	Number of local press releases or publicity articles in host country(s)	13
15c	Number of national press releases or publicity articles in UK	
15d	Number of local press releases or publicity articles in UK	2
16a	Number of issues of newsletters produced in the host country(s)	N/a
16b	Estimated circulation of each newsletter in the host country(s)	N/a
16c	Estimated circulation of each newsletter in the UK	N/a
17a	Number of dissemination networks established	N/a
17b	Number of dissemination networks enhanced or extended	N/a
18a	Number of national TV programmes/features in host country(s)	N/a
18b	Number of national TV programme/features in the UK	N/a
18c	Number of local TV programme/features in host country	N/a
18d	Number of local TV programme features in the UK	N/a
19a	Number of national radio interviews/features in host country(s)	N/a
19b	Number of national radio interviews/features in the UK	1 (PL, Radio France International)
19c	Number of local radio interviews/features in host country (s)	1 (press conference at international workshop)
19d	Number of local radio interviews/features in the	N/a

Code	Description	Totals (plus additional detail as required)
	UK	
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	N/a
21	Number of permanent educational/training/research facilities or organisation established	N/a
22	Number of permanent field plots established	N/a
23	Value of additional resources raised for project	US\$118,023
Other Measures used by the project and not currently including in DI standard measures		

Annex 5 Publications

Type *	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal	Goossens B, Chikhi L, Ancrenaz M, Lackman-Ancrenaz I, Andau P, Bruford MW (2006) Genetic signature of anthropogenic population collapse in orang-utans. PLoS Biology 4(2): 285-291.	Public Library of Science		free
Journal	Goossens B, Setchell JM, James SS, Funk SM, Chikhi L, Abulani A, Ancrenaz M, Lackman-Ancrenaz I, Bruford MW (2006) Philopatry and reproductive success in Bornean orang-utans (<i>Pongo pygmaeus</i>). Molecular Ecology 15: 2577-2588.	Blackwell Publishing		free
Journal	Jalil MF, Cable J, Sinyor J, Ancrenaz M, Bruford MW, Goossens B (2008) Riverine effects on mitochondrial structure of Bornean orang-utans (<i>Pongo pygmaeus</i>) at two spatial scales. Molecular Ecology 17: 2898-2909.	Blackwell Publishing		free
Journal	Othman N, Mohamed M, Ahmad AH, Nathan S, Pierson HT, Goossens B (2008) A preliminary study on the morphometrics of the Bornean elephant (in press).	Institute for Tropical Biology and Conservation, Kota Kinabalu		free
Programme	International Workshop on the	Sabah Wildlife Department,		free

book	Conservation of the Bornean Elephant in Sabah	Kota Kinabalu		
Proceedings (in preparation)	International Workshop on the Conservation of the Bornean Elephant in Sabah	Sabah Wildlife Department, Kota Kinabalu		free
CD	Outputs of DI 14-014 Conservation of the Bornean elephant (pictures, awareness posters, press releases, presentations, certificates, etc)	Cardiff University, Universiti Malaysia Sabah, HUTAN, Sabah Wildlife Department, WWF-Malaysia		free

Annex 6 Darwin Contacts

Ref No	14/014
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