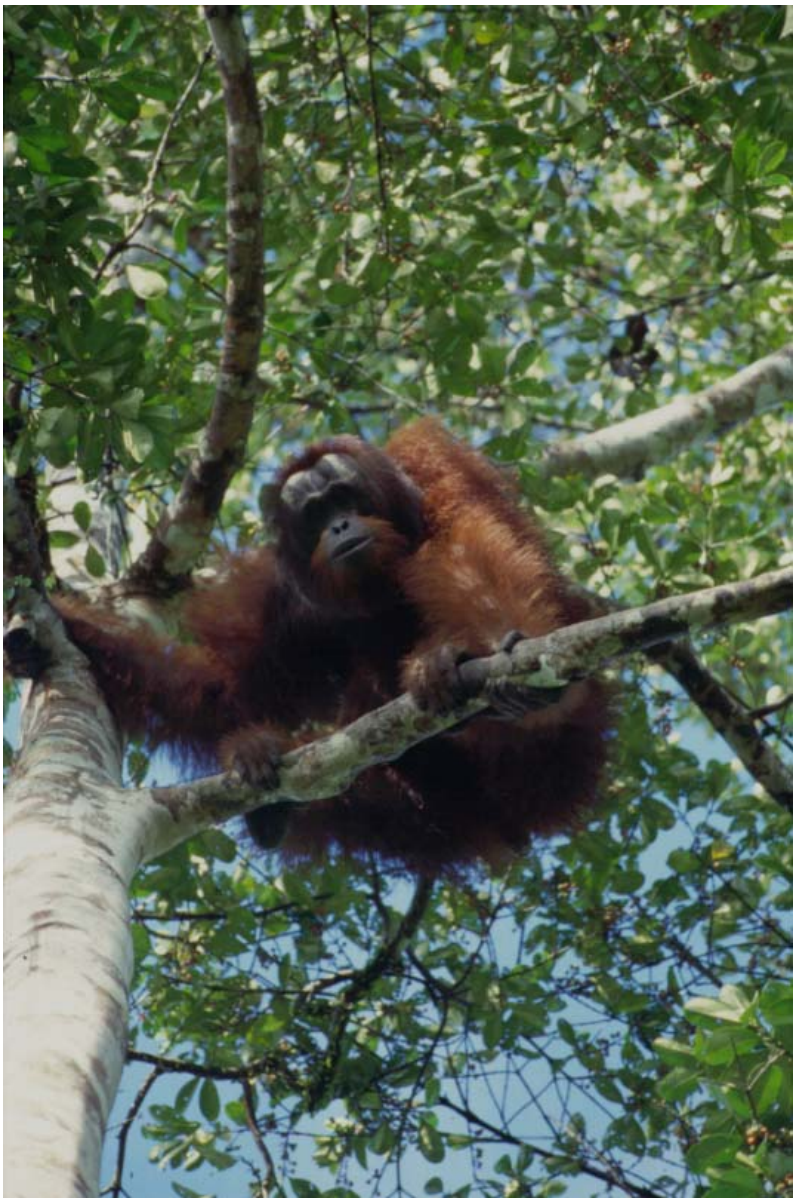

Evaluation of Closed Darwin Initiative Projects in Sabah, Malaysia

Final report - February 2007

Final Report

The Darwin Initiative

The Darwin Initiative is a UK Government small grants programme whic was launched at the Rio Earth Summit in 1992. It aims to assist countries rich in biodiversity but constrained by financial resources to implement the Convention on Biological Diversity (CBD). The Initiative is funded and managed by the UK Department of Environment, Food and Rural Affairs (Defra). This is the UK Government's main support to other countries (including the UK's Overseas Territories) in their implementation of the CBD, and more recently the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS), through the funding of collaborative projects which draw on UK biodiversity expertise.

Monitoring and Evaluation

The Darwin Initiative has a comprehensive Monitoring and Evaluation (M&E) programme in place which is central to informing on the progress of the Darwin Initiative against its goal – 'to support countries that are rich in resources but poor in financial resources to meet their commitments under one or more of the major biodiversity conventions: the Convention on Biological Diversity; the Convention on Migratory Species; and the Convention on International Trade in Endangered Species'.

The M&E programme is used in a number of ways to help inform on best practice, to support ongoing projects in their delivery, to strengthen the Darwin Initiative itself, and to demonstrate the gains Darwin Initiative projects have made in conserving biodiversity through partnerships between the UK and developing countries.

The Darwin Initiative M&E programme is essentially centred on performance monitoring and impact evaluation. The M&E programme assesses legacy and impact at different levels with lessons drawn out from each level:

- At the project level – in terms of host country institutions and local partners and beneficiaries, and in terms of conservation achievements;
- At the national and ecoregion level – in terms of host country policies and programmes, and, if relevant, at a cross-boundary and eco-region level;
- At the international level – in terms of emerging best practices, and the conventions themselves;
- At the UK level – in terms of legacy and impact within UK institutions.

This report was undertaken by Dr Glen Reynolds on behalf of the Darwin Initiative

Cover Photo Credit: *Mature male orang-utan in the Lower Kinabatangan Wildlife Sanctuary*

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Contents

Acronyms

BBEC	Borneo Biodiversity Ecosystem Conservation
CBD	Convention on Biological Diversity
DANIDA	Danish Government International Funding Department
FSC	High Conservation Value Forests
HCVF	High Conservation Value Forests
ITBC	Institute for Tropical Biology and Conservation
JICA	Japanese Government International Funding Department
KOCP	Kinabatanan Orang-utan Conservation Programme
NGO	Non Government Organisation
SEARRP	South East Asia Rainforest Research Programme
SFD	Sabah Forestry Department
UMS	Universiti Malaysia Sabah
WWF	Worldwide Fund for Nature
YS	Yayasan Sabah
YSFMA	Yayasan Sabah Forest Management Area

Executive Summary

- **Species & habitat conservation:** The projects have had a remarkable impact on both habitat and species conservation in Sabah particularly by a) contributing to the establishment of two new protected areas of global importance, and b) demonstrating the conservation and biodiversity value of even very small forest fragments.
- **Conservation planning:** The three projects under review, and other Sabah-based Darwin Initiative projects, have made a direct and highly significant contribution to conservation, forest management and land-use planning in Sabah.
- **Capacity building:** Significant capacity has been built within in-country partner institutions; academics and researchers have been trained at Universiti Malaysia Sabah, research officers from the Sabah Forestry Department and full-time research assistants from the Kinabatangan Orang-utan Conservation Project, Yayasan Sabah and the Royal Society SEARRP.
- **Collaboration & cross-linkages:** The projects have integrated effectively with, and added significant value to, a number of existing, long-term research and conservation programmes.
- **Scientific output:** The projects have resulted in at least 12 publications in internationally refereed journals, including several high profile and highly-cited publications. Projects 7-040 and 10-025 will form the basis of a display at the Royal Society's 2007 Summer Exhibition.
- **Value for money:** Given the outputs achieved, the projects under review represented exceptional value for money.
- **Legacy:** The projects have created a legacy of a highly skilled staff base within in-country project partners (especially UMS), conservation and forest management plans and, perhaps most importantly, the protection of globally important habitats.

Recommendations

Future directions: Consideration could usefully be given to

a) funding proposals that build upon previous and related projects and give clear additional, incremental benefits;

b) synthesising and disseminating the collective findings of the Sabah-based Darwin Initiative projects in a form accessible to conservationists, forest managers and land-use planners.

1. Background

The review was carried out as part of ECTF evaluations of closed projects. The three most recently closed projects were included as the earlier three projects had closed some ten years earlier and although there was residual legacy the information available was insufficient for an effective review. As the three projects to be evaluated focus on rainforest species, this section places the review in context by outlining the current status of forest conservation and management in Sabah. Background information is also included on the main in-country project partners. The three projects were also reviewed against the CBD programme of work on Island Biodiversity as part of the ECTF Thematic review of this subject (Annex 5)

1.1 Project partners

University Malaysia Sabah

The main collaborating department within Universiti Malaysia Sabah (UMS) is the Institute for Tropical Biology and Conservation (ITBC). ITBC was formed in 1995 and now includes a full time academic staff of over 20 under the directorship of Professor Maryati Mohamed. ITBC currently has 80 post-graduate and 300 undergraduate students. ITBC has been a key in-country partner on all of the Darwin Initiative projects to have been based in Sabah – and has been involved in numerous collaborative projects with internationally recognised research and conservation organisations including JICA, DANCED/DANIDA and The Royal Society.

Sabah Forestry Department

The Sabah Forest Department (SFD) is the custodian of the State's permanent forest estate. This totals some 3.6 million hectares (ha) and is divided into 7 classes. The total area* under each class are as follows (SFD, 2005):

Class I – Protection Forest Reserves (343,900 ha)

Class II – Commercial Forest Reserves (2,682,600 ha)

Class III – Domestic Forest Reserves (7,400 ha)

Class IV – Amenity Forest Reserves (20,900 ha)

Class V – Mangrove Forest Reserves (320,600 ha)

Class VI – Virgin Jungle Reserves (95,300 ha)

Class VII – Wildlife Reserves (132,700 ha)

** Rounded to the nearest 100 ha*

SFD maintains a well-respected and active research and development division, the Forest Research Centre, which has been a key collaborating agency on several of the Sabah-based Darwin Initiative projects.

Note: In addition to the 3.6 million ha of forest administered by the Sabah Forest Department, the Sabah Parks Department is responsible for the management of several national parks covering a total of over 243,000 ha. The largest and most important of these are the Kinabalu (75,400 ha), Tawau Hills (28,000 ha) and Crocker Range (139,900 ha) National Parks. These comprise almost entirely upland and sub-montane forest types.

Yayasan Sabah

Yayasan Sabah (YS) was formed in 1966 shortly after Sabah's independence from Britain. YS, which is a para-governmental organisation, aims to improve the lives of Malaysians living in Sabah through the provision of welfare, educations and conservation services. As a revenue raising base it was granted management rights over extensive timberlands in central/south-eastern Sabah; the area is known as the Yayasan Sabah Forest Management Area (YSFMA) and at just over 1 million ha is by far the largest forest concession in Sabah and one of largest in SE Asia. The majority of the YSFMA is under management for timber production (mostly selective harvesting from natural forests) but also includes agricultural and exotic timber plantations, one of the region's largest forest rehabilitation projects and a network of primary forest protected areas including the Danum Valley (43,800 ha), Maliau Basin (58,840 ha) and the proposed Imbak Canyon (±30,000 ha) Conservation Areas. Yayasan Sabah has been a major in-country project partner on several Darwin Initiative projects – particularly those based at Danum Valley.

Kinabatangan Orang-utan Conservation Project

The Kinabatanan Orang-utan Conservation Project (KOCP) was founded in 1998 by the French NGO Hutan. The project is managed by Dr Isabelle Lackman and Dr Marc Acrenaz and includes a highly trained, experienced and motivated team of 35 research assistants drawn mainly from villages along the Kinabatangan river. KOCP aims to study the impacts and conservation implications of major habitat change (forest fragmentation, clearance and degradation) on orang-utan populations. KOCP has played a key role in the protection and management of the Lower Kinabatangan Wildlife Sanctuary.

1.2 Sabah – biodiversity status

Sabah covers a total area of approximately 74,000 km^2 (Figure 1). It is the eastern most state of Malaysia and occupies the northern portion of the island of Borneo.

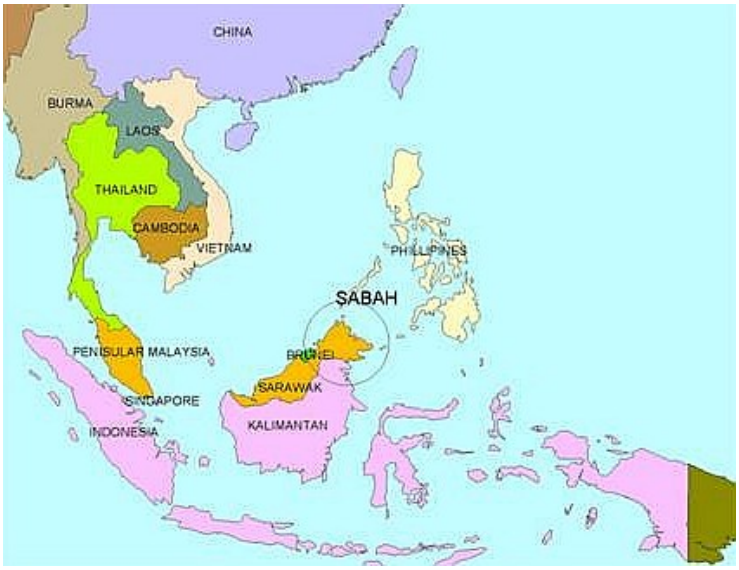

Figure 1 SE Asia with Sabah highlighted

Due to a unique and complex geological history and stable climate with abundant rainfall, the rainforests of Sabah are exceptionally species-rich, show a high degree of endemism and are among the most complex and diverse terrestrial ecosystems which ever existed; of the 25 global biodiversity 'hotspots' 4 overlap in tropical SE Asia (Whitmore, 1984; Walsh & Newbery, 1999; Myers *et al.*, 2000; Sodhi *et al.*, 2004).

Although the number of species extinctions in SE Asia, including Borneo, is not currently alarming this situation is unlikely to remain (IUCN, 2003). Recent work based on the island of Singapore, the most deforested nation in SE Asia having lost 95% of its original forest cover in less than 200 years, indicates that future biodiversity losses in the wider region will be catastrophic. Extrapolating from the observed effects of deforestation on Singapore, and inferred extinction rates over the region, it has been estimated that up to 42% of species in SE Asia will be lost during the next century. Due to the high levels of endemism at least half of these losses would represent global extinctions (Brook *et al.,* 2003; Sodhi *et al.,* 2004).

1.3 Sabah – forest management

Until the mid-20th century Sabah remained almost entirely forest covered, with only small-scale clearance and low-intensity timber harvesting associated with coastal and riverside communities (MacKinnon *et al*., 1997). However, with the mechanisation of the timber industry in SE Asia following WWII, the rate of exploitation of the lowland rainforest of Borneo increased dramatically. The timber industry on Borneo, concentrated primarily in Sabah and Sarawak, reached its destructive peak in the 1970s and 1980s when the volume of timber exported from Borneo alone exceeded all exports from south/central America and equatorial Africa combined (FAO, 2001).

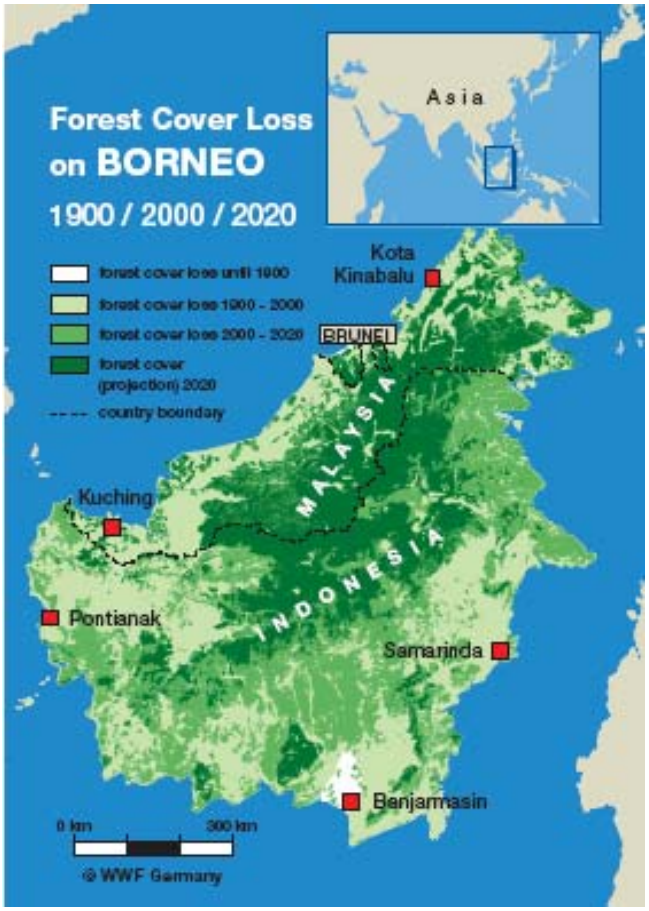

Figure 2 Forest cover & projected loss on Borneo 1900 – 2020

Almost all the accessible lowland forests on Borneo have now been heavily logged, often repeatedly, and timber production has long since shifted to upland forests (Appanah, 2001). Projections for future forest conversion on Borneo are alarming and predict, at current rates of clearance, almost complete los of the island's lowland forests by 2020 (Figure 2; Rautner *et al*., 2005).

Despite large scale forest clearance over recent decades, forest cover in Sabah remains at over 3.8 million ha – slightly more than 50% of the total land area of the state. The bulk of this area (±2.68 million ha) is accounted for by the Class II Commercial Forest Reserve. These comprise mostly lowland forests which, having been repeatedly logged over the past 40+ years, are generally in a highly degraded condition. However, it is the commercially managed lowland forests which support much of Sabah's biodiversity. To cite just one example, it has been estimated that 72% (±9,400) of the ±13,000 orang-utan remaining in Sabah inhabit the commercial forests with only ±3,600 individuals (28% of the population) residing in protected areas (Acrenaz *et al*., 2005).

Although significant areas of Sabah's forests are under some form of protection (±587,000 ha), including relatively large areas of primary forest, these comprise mainly upland forest types at elevations over 700 m asl. The only significant area of fully protected primary *lowland* forest remaining in Sabah is the 43,800 ha Danum Valley Conservation Area.

2. Evaluation of Closed Projects

2.1 Biodiversity of butterflies in tropical rainforests of Sabah, Borneo (7-040)

Project leader: Dr Keith Hamer

UK institution: University of Durham

Main in country partners: Universiti Malaysia Sabah & the Sabah Forestry Department

Project purpose:

To develop strategies that balance conservation of rainforest biodiversity with local community requirements, monitoring changes in butterfly communities as an indicator of habitat change.

Figure 3 Dr Suzan Benedick (Darwin fellow) & Nasir Majid (Royal Society SEARRP research assistant) with some of the butterflies collected as part of the project

Relevance:

The project was highly relevant - particularly in its evaluation of the biodiversity value of logged forest. This is of critical importance given that most of the remaining forest in Sabah has now been seriously degraded through logging, has limited commercial value and hence is often threatened with conversion to plantation. Project findings have made a significant contribution to forest management and conservation planning in Sabah.

The project contributed to CBD articles 6, 7, 8, 10, 11, 12, 14 and 18 and to the Malaysian National Policy on Biodiversity objectives iii, iv and v and strategies 1, 2, 7, 10, 13 and 14 (see Annex 2).

Efficiency:

- The project operated efficiently and within its budget of £108,912 – this represented remarkable value for money given the project outputs
- It established what have proved to be lasting collaborative relationships with Universiti Malaysia Sabah (UMS), the Sabah Foresty Department (SFD) and Yayasan Sabah

Effectiveness:

- Fours students were trained to MSc level though the University of Durham. Three of these students (Suzan Benedick, Nazirah Mustafa and Mahadi Dawood) were associated with UMS and one (Joseph Tangah) with SFD
- A number of full-time research assistants from the Royal Society SEARRP were trained as part of the project. They have subsequently assisted on a series of entomological studies at Danum Valley
- The project directly resulted in three refereed journal articles and contributed to a further four articles including three well regarded and cited papers in the Journal of Applied Ecology (Hamer *et al*., 2003; Hill & Hamer, 2004; Benedick *et al*., 2006).
- The main research findings demonstrated the biodiversity value of even highly degraded logged forest
- The project established and catalogued butterfly reference collections at UMS (ITBC) and SFD

Impact:

The most important impact of this project flowed from the finding that even highly degraded logged forest retained significant biodiversity value. This has contributed directly to forest management and conservation planning in Sabah, specifically:

- *The 25-year Danum Valley Conservation Area management plan*
- *Strategic management for the Maliau Basin Conservation Area and surrounding buffer zones*
- *A conservation plan for the 1 million+ ha Yayasan Sabah Forest Management Area (including strategic recommendations for targeted forest rehabilitation)*
- *The Imbak Canyon Conservation Area management plan (a proposed ±30,000 ha primary forest conservation area located to the north-west of Danum Valley)*
- *The formulation of guidelines for the identification and management of High Conservation Value Forests within the 2.68 million ha Class II commercial forest reserve (as part of Yayasan Sabah and the Sabah Forest Department's efforts towards FSC certification of their forestry operations)*

Sustainability:

- The project's most important legacy is the contribution of the four Darwin fellows trained as part of this project to biodiversity conservation in Sabah. Suzan Benedick and Nazirah Mustafa went on to complete PhD degrees as part of Darwin Initiative project 10-025 and are now both employed at UMS (ITBC) in full-time research posts. Joseph Tangah heads a biodiversity unit at SFD and Mahadi Dawood joined the staff at UMS and is currently completing a PhD at Kyoto University, Japan
- The key research findings of this project have made a significant contribution to long-term forest management, conservation and land-use planning in Sabah
- The project formed the basis for two further Darwin Initiative projects, a Darwin Initiative scholarship and an associated NERC studentship.

2.2 Conservation of the orang-utan in Kinabatangan Wildlife Sanctuary, Sabah (9-016)

Project leader: Professor Mike Bruford

UK institution: Cardiff University

Main in country partners: Universiti Malaysia Sabah & the Kinabatangan Orang-utan Conservation Project

Figure 4 Mohd. Fairus Jalil carrying out molecular analysis of orang-utan hair samples

Project purpose:

To provide a range of essential information on the genetic structure of the Kinabatangan orang-utan population to create a conservation strategy

Relevance:

This project contributed to the conservation of a) a highly threatened and iconic species, and b) habitats of exceptional biodiversity value. It had direct relevance to CBD articles 6, 7, 8, 12, 13, 15, 16 and 17 and to the Malaysian National Policy on Biodiversity objectives iii, iv and v and strategies 1, 2, 7, 10, 13 and 14.

Figure 5 Participants on a 2002 project expedition to the Kinabatangan River

Efficiency:

- The project achieved (and exceeded) its main objectives, within the available budget of £147,264, and represented exceptional value for money
- Close collaborations were developed with several key agencies in Sabah including the Sabah Wildlife Department, UMS, SFD and, perhaps most importantly, the Sabah Government
- It established a long-term molecular research programme at UMS (ITBC) and extensive field-based monitoring programmes
- Research findings have resulted in several key articles in refereed journals that have made a significant contribution to the scientific basis for orang-utan conservation in Sabah and the wider region (Acrenaz *et al*., 2004; Acrenaz *et al*., 2005; Goossens *et al*., 2005; Goossens *et al*., 2006). Most of these papers are in open-access on-line journals
- Two Malaysian scientists were trained as part of the project, and numerous research assistants from in-country project partner and associated organisations
- Research findings demonstrated the crucial importance of conserving the Lower Kinabatangan flood plain and Ulu Segama/Malua Forest Reserves under natural forest cover (Acrenaz *et al*., 2004; Acrenaz *et al*., 2005)
- The project achieved an extremely high profile and has been widely featured in national, regional and international media

Impact:

- This project made a key contribution to the decision by the Sabah Government to conserve the ±237,000 ha Ulu Segama and Malua Forest Reserves and to formalise the protection of the ±27,800 ha Lower Kinabatangan Wildlife Sanctuary (see section 3.1). These are areas of global biodiversity importance
- One of the papers resulting from this project demonstrated the catastrophic reduction in the population of orang-utan in Sabah over the past 50 years (Goossens *et al*., 2006) and highlighted the pressing need to arrest this decline. This paper was rated by the US magazine “Discover” as one of the most important research publications of 2006
- The project continues to make a highly significant contribution to forest management, conservation and land-use planning in Sabah including management plans for the Danum Valley Conservation Area, Ulu Segama and Malua Forest Reserves and Lower Kinabatangan Wildlife Sanctuary

Sustainability:

- This project has achieved an exceptional degree of sustainability through its development of State-wide conservation action plans for orang-utan and management plans for the critically important Ulu Segama and Malua Forest Reserves and Lower Kinabatangan Wildlife Sanctuary. These plans have achieved wide acceptance and high-level endorsement from the Sabah Government (*Daily Express (Sabah), Thursday 28th August 2003, Page 2*)
- The project has formed the basis of several follow-up grants and studentships – including a PhD scholarship at Cardiff University for one of the project trainees (Mohd. Fairus Jalil). Mr. Jalil recently submitted his thesis and has been engaged by UMS (ITBC) to head its molecular laboratory

2.3 Molecular tools for promoting biodiversity in rainforest fragments of Borneo (10-025)

Project leader: Dr Keith Hamer

UK institution: University of Durham

Main in country partners: Universiti Malaysia Sabah & the Sabah Forestry Department

Project purpose:

Data gathering and capacity building to assist conservationists, ecologists and forest managers in Sabah with promoting responsible economic growth that maximises the development of agriculture and silviculture whilst minimizing the impacts of loss and fragmentation of rainforests on biodiversity. This will be achieved by providing clear practical advice on the size and placement of forest patches necessary to preserve species richness and genetic diversity; and assisting conservationists in establishing priorities for the conservation of species by using genetic techniques to identify butterfly species of high conservation value and determine their vulnerability to habitat fragmentation. The project will focus on butterflies, which are highly diverse in Sabah with many endemic species.

Figure 6 Fragmentation of forest following clearance & conversion to oil palm plantation

Relevance:

This project addressed a pressing need to evaluate the biodiversity of forest fragments, especially small fragments imbedded within oil palm plantations, and their potential conservation value. It also highlighted the importance of maintaining the integrity of degraded forest fragments by enrichment planting and, where possible, re-establishing connectivity.

The project contributed to CBD articles 6, 7, 8, 10, 11, 12, 14 and 18 and to the Malaysian National Policy on Biodiversity objectives iii, iv and v and strategies 1, 2, 7, 10, 13 and 14.

Efficiency:

- This project built upon the success of project 7-040 – and as a result benefited from significant efficiency savings and additionality
- Two of the Darwin fellows and several research assistants from project 7-040 were reengaged, thus maximising the value of previous training, and existing relationships with UMS, SFD and YS were maintained
- The outputs of this project have made a substantial contribution to conservation and land-use planning in Sabah; the relatively modest grant of £106,796 therefore represents excellent value for money

- The two Darwin fellows engaged, Suzan Benedick and Nazirah Mustafa, completed PhD degrees as part of the project
- The project led to four articles in refereed journals (Hamer *et al*., 2003; Hill & Hamer, 2004; Hamer *et al*., 2006; Benedick *et al*., 2006) and will form the basis of a display at the Royal Society's 2007 summer exhibition (www.royalsoc.ac.uk/exhibition).

Impact:

- The project showed that species diversity was significantly higher in continuous lowland rainforest than in large, small or medium forest fragments – though there was no difference in genetic diversity among fragments of different sizes
- However, even the smallest fragments contained species with restricted geographic ranges and of high conservation value. Molecular analysis showed that these populations were viable
- Project findings are making a significant contribution to the identification and management of High Conservation Value Forests (HCVFs) within the 2.68 million ha Class II Commercial Forest Reserve (as part of SFD and YS moves to certify forest production to Forest Stewardship Council standards for sustainable timber production)
- The project highlighted the need to undertake rehabilitation of the smallest, most degraded forest fragments (probably by enrichment planting) in order to maintain their conservation value

Sustainability:

- Findings are making an important and ongoing contribution to conservation, forest management and land-use planning in Sabah – particularly by providing a strong scientific basis for the identification and management of HCVFs in Sabah (report and assessment in preparation by WWF-Malaysia)
- The training given to the two Darwin fellows in molecular analysis has added significantly to the capacity of UMS to conduct research in this area – both are now full-time employees of UMS (ITBC)
- The project has formed the basis of a NERC studentship and a Leverhulme grant which will extend the research by investigating the impacts of forest fragmentation on bird communities

3. Wider Contributions of the Darwin Initiative in Sabah

The Darwin Initiative has supported 13 projects based solely or partly in Sabah (see Annex 1). Collectively, these have made a remarkable contribution to biodiversity conservation and conservation, forest management and land-use policy and planning in Sabah.

3.1 Species & habitat conservation

The most significant, practical contribution to species and habitat conservation in Sabah of the three projects under review (and projects 9-003, 14-014, 14-016 and 14-022) is the protection of two areas of global conservation and biodiversity value – the Ulu Segama and Malua Forest Reserves and the Lower Kinabatangan Wildlife Sanctuary – and to their subsequent management:

Ulu Segama & Malua Forest Reserves

In March 2006, the Sabah State Government gave an undertaking to protect, and retain under natural forest cover, the Ulu Segama and Malua Forest Reserves in Eastern Sabah – both of which are part of the Yayasan Sabah Forest Management Area (Figure 7).

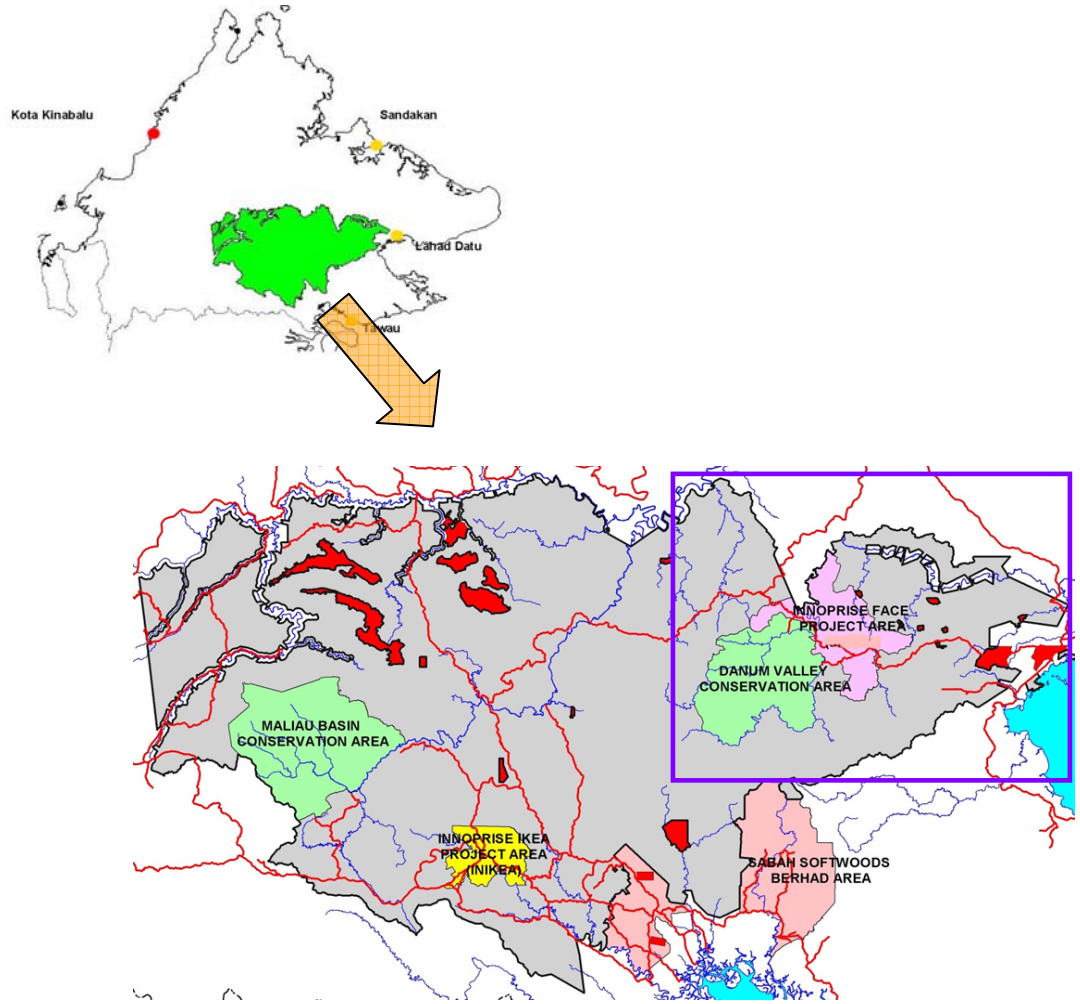

Figure 7 Sabah (with the Yayasan Sabah Forest Management Area (YSFMA) highlighted) and a detailed map of the YSFMA – the area indicated by the purple bordered box are the ±237,000 ha Ulu Segama & Malua Forest Reserves

The two reserves, which together cover ±237,000 ha (2,370 sq km), comprise almost entirely lowland forest and are contiguous with the Danum Valley Conservation Area. Although the Ulu Segama and Malua Forest reserves have been heavily logged they represent by far the most important remaining habitat in Sabah (probably the whole of Borneo) for orang-utan, Asian pygmy elephant, Sumatran rhino and numerous other species which depend upon lowland forest for their survival. Having been under serious threat of conversion to plantation for over 10 years, the protection of the Ulu Segama/Malua area is perhaps the most significant contribution to the conservation of biological diversity in Sabah's history. As stated by the President of WWF (Carter Roberts) **"*This is one of the most important actions ever taken to protect Borneo's endangered wild mammals*"**

(see: www.worldwildlife.org/wildplaces/borneo/updates/wwfpraise.cfm).

Darwin project 9-016 and associated research involving KOCP/Hutan made a particular contribution to the protection of this area by demonstrating its critical importance as a habitat for orang-utan. It is estimated that over 4,500 orang-utan live in the Ulu Segama and Malua Reserves, representing almost 1/3rd the total population remaining in Sabah (Acrenaz *et al*., 2005).

Figure 8 Logged forest of the Ulu Segama Forest Reserve

Projects 7-040 and 10-025, both partly based in the Ulu Segama/Malua Forest Reserves, also made a significant contribution by showing a) that even degraded forest was capable of supporting high levels of biodiversity, and b) the importance of maintaining large areas of contiguous forest (Hill *et al*., 2001; Hamer *et al*., 2003; Hill & Hamer, 2004; Benedick *et al*, 2006).

Lower Kinabatangan Wildlife Sanctuary

In 1999 the Sabah Government announced that it intended to set aside 27,800 ha of the Kinabatangan flood plane as a protected area – the Lower Kinabatangan Wildlife Sanctuary (see: www.wwfmalaysia.org/features/special/Archive/Pfw/wildlifesanc).

The Kinabatangan flood plane comprises some of Borneo's richest and most important habitats including shallow freshwater lakes, seasonally flooded forest, sandstone and limestone outcrops and open swamps. The area supports remarkable levels of biodiversity including 10 species of primate including orang-utan, proboscis monkey, slow loris and Western tarsia, the Asian pygmy elephant, Sumatran rhino and well over 200 species of bird including the highly endangered storm stork and all of the 8 species of hornbill found on Borneo.

Figure 9 The Kinabatangan River at dawn

In collaboration with the Sabah Wildlife Department and various conservation NGOs, particularly KOCP and WWF-Malaysia, project 9-016 underscored the need to formalise the protection of the lower Kinabatangan, especially in view of the 1,000+ orang-utan and several other high conservation value species that inhabit the area.

3.2 Conservation planning

The Sabah-based Darwin Initiative project have collectively provided a strong scientific basis and made key contributions to the following conservation, forest management and land-use plans:

- *The 25-year Danum Valley Conservation Area management plan*
- *The Maliau Basin Conservation Area strategic management plan*
- *A conservation plan for the 1 million+ ha Yayasan Sabah Forest Management Area (including strategic recommendations for targeted forest rehabilitation)*
- *The Imbak Canyon Conservation Area management plan (a proposed ±30,000 ha primary forest conservation area located to the north-west of Danum Valley)*
- *The Deramakot Forest Management Plan (Deramakot is the only forest concession in Sabah certified to FSC standard for sustainable timber production)*
- *The formulation of guidelines for the identification and management of High Conservation Value Forests within the 2.68 million ha Class II commercial forest reserve (as part of Yayasan Sabah and the Sabah Forest Department's efforts to achieve FSC certification of their forestry operations)*
- *State-level assessment of HCVFs and land classification status (currently in preparation by WWF-Malaysia)*
- *WWF's Heart of Borneo initiative*

3.3 Collaboration & cross-linkages

A highly successful aspect of the Sabah-based Darwin Initiative projects has been the additionality achieved through collaboration with existing, and in most cases long-standing, research and conservation programmes. Notable among these are KOCP, the Royal Society SEARRP and its associated projects, the JICA funded Borneo Biodiversity and Ecosystem Conservation programme (BBEC), DANCED and latterly DANIDA's various initiatives, SOS Rhino and WWF-Malaysia's Asian Rhino and Elephant Action Strategy and other species and habitat conservation projects.

The relatively small number of governmental and para-governmental agencies involved in land and natural resource management in Sabah (primarily the Sabah Forestry Department, Sabah Parks Department and Yayasan Sabah) keeps lines of communication short, facilitates close working relationship with the NGO and research communities and allows for project findings to feed directly into policy, conservation and land-use decision making.

This combination of factors has added exceptional value to the Sabah-based Darwin Initiative projects.

4. Future Directions & Opportunities

When prioritising future directions for Darwin Initiative funding, consideration could usefully be given to proposals that build upon previous and related projects giving clear additional, incremental benefits – and which operate from existing centres of research excellence in Sabah. A useful model is provided by the sequential projects 7-040, 10-025 and 14-022 (plus a recently awarded Darwin Initiative scholarship) which have made a contribution far beyond that which would be expected from individual projects of this size.

Consideration might also be given to means by which results from the Sabah-based Darwin Initiative projects could be synthesised and disseminated in a form that would be accessible to conservationists, forest managers and land-use planners in Sabah and the wider region. It would be particularly valuable to develop an evidence-based toolkit for decisions relating to the conservation and rehabilitation of forest fragments and the value of retaining even highly degraded logged forest – especially in the face of continued and rapid land use change in SE Asia.

Figure 10Sunrise over the Ulu Segama Forest Reserve

Annex 1 References

(Papers resulting directly from Darwin Initiative projects indicated by an asterisk)

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Annex 2 The Darwin Initiative in Sabah

(linked to Darwin Initiative homepage):

4-059 *Dr Paul Eggleton, Natural History Museum, Termite Biodiversity and Greenhouse Gas Production in southeast Asian Rainforest*

4-082 *Sarah Fowler, IUCN, Elasmobranch Biodiversity Project*

4-117 *Dr Barrie Blewett, RBG Kew, Darwin Initiative Herbarium Techniques Course - Malaysia*

7-040 *Dr Keith Hamer, University of Durham, Biodiversity of butterflies in tropical rainforests of Sabah, Borneo*

9-003 *Dr David Jones, Natural History Museum, Tools for monitoring soil biodiversity in the ASEAN Region*

9-016 *Prof. Mike Bruford, Cardiff University, Conservation of the orang-utan in Kinbatangan Wildlife Sanctuary, Sabah*

10-025 *Dr Keith Hamer, University of Durham, Molecular tools for promoting biodiversity in rainforest fragments of Borneo*

13-009 *Dr Gary Martin, Global Diversity Foundation, Ethnobiology of proposed traditional use zones of Crocker Range Park*

13-023 *Andrew Mitchell, Global Canopy Programme, Tropical Forest Canopy Training Programme for the ASEAN Region*

14-014 *Prof. Mike Bruford, Cardiff University, Conservation of the Bornean Elephant*

14-016 *Dr Rogier deKok, RBG Kew, Assessing and Conserving Plant Diversity in Commercially Managed Tropical Rainforests, Sabah*

14-022 *Dr Jane Hill, University of York, Predictive Tools for Targeting Conservation Effort in Bornean Forest Reserves, Sabah*

15-026 *Katherine Secoy, Global Canopy Programme, Bornean Wild Cat and Clouded Leopard Project*

Annex 3 The Malaysian national policy on biological diversity

Darwin Initiative-funded activities in Sabah are fully consistent with Malaysia's National Policy on Biological Diversity and have contributed, in particular, to the following objectives and strategies:

Objectives

i. To utilise economic benefits from sustainable utilisation of the components of biological diversity

iii. To maintain and improve environmental stability for proper functioning of ecological systems

iv. To ensure preservation of the unique biological heritage of the nation for the benefit of present & future generations

v. To enhance scientific and technological knowledge…of biological diversity

Strategies

1. Improve the scientific knowledge base:

1.4 Intensify research on the functional aspects of biological diversity

1.8 Evaluate the economic contributions of biological diversity to the value of goods and services in the national economy

2. Enhance the sustainable utilisation of the components of biodiversity:

2.5 Undertake research and monitoring of the impacts of resource utilisation on biological diversity

7. Enhance skill, capabilities and competence:

7.1 Identify critical skill requirements and undertake programmes to develop the human resource base

7.3 Enhance research, planning and management capabilities through collaborative programmes amongst local organisations and between local organisations and established foreign institutions

7.5 Develop or re-orientate education and training programmes with specific reference to conservation and sustainable use of biological diversity

10. Minimise impacts of human activities on biological diversity:

10.5 Rehabilitate degraded habitats where biological diversity has been reduced, in particular those within conservation areas and their adjacent areas

13. Promote international cooperation and collaboration:

13.1 Identify areas of research and technology requirements where cooperation and collaboration are needed

13.2 Identify and develop collaboration with relevant international and national institutions involved in biological diversity which would promote mutual benefits

13.3 Develop bilateral and multilateral arrangements…for technology transfer and technical and scientific information exchange

13.4 Promote regional collaboration in biological diversity

14. Exchange of information:

14.2 Establish or strengthen systems for the exchange of such information at national & international levels through networking and by establishing databases and information centres

Annex 4 Outline Terms of Reference for the ECP – Local Consultant

CLOSED DARWIN PROJECTS IN MALAYSIA

Post Project Evaluation Title	Evaluation of Closed Darwin Initiative Projects located in Malaysia					
Project No's.	4-059	4-082	4-117	7-040	9-016	10-025
UK Institution and Project Leader/Contact	NHM Paul Eggleton	IUCN Sarah Fowler	RBG Kew Barrie Blewett	University of Durham Keith Hamer	Cardiff University Mike Bruford	University of Durham Keith Hamer
Partner Institution(s)/ Contact(s) per project	Biology Dep, Universiti Kebangsaan Malaysia, Sabah (UKMS), Bag Berkunci No. 62, 88996 Kota Kinabalu, Sabah (Dr Maryati Mohamed). Fieldwork at Danum Valley Field Centre.	Fisheries Department, Sabah University of Malaysia Sabah (Mabel Majaji, Darwin Project Officer)	Dr Saw Leng Guan, Forest Research Institute of Malaysia, Kepong, W Malaysia. Dr Wong Khoon Meng, Forest Research Centre of Sandakan, Sabah, E Malaysia	Prof. Maryati Mohamed, Professor of Biology, University of Malaysia in Sabah. Dr Chey vun Khen, Chief Entomologist, Forest Research Centre, Sabah. Danum Valley Research Station	University of Malaysia-Sabah and the Kinabatangan Orangutan Conservation Project	Institute of Tropical Biology and Conservation Universiti Malaysia Sabah, Forest Research Centre Sabah and the Yayasan Sabah
Project Grant Values/project	£75,000	£133,900	£14,850	£108,912	£147,264	£106,796
Project's Start / End Date:	1/4/95 – 31/3/97	1/4/95 – 31/3/99	1/4/95 - ????	1/4/98 – 31/3/01	1/12/00 – 30/11/03	1/7/01 – 30/6/04
Reviewer	Pat Hardcastle, ECTF					

INTRODUCTION

The Darwin Initiative seeks to help the safeguard of the World's biodiversity by drawing on UK biodiversity expertise to work with local partners in countries that are rich in biodiversity but poor in financial resources. Particular emphasis is placed on:

- Conserving biological diversity within the context of the Convention on Biological Diversity, including sustainable use and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources;
- Improving collaboration with host country/ies and strengthening their capacity to carry forward Darwin funded initiatives;
- Enhancing the overall legacy of Darwin projects.

The Darwin Initiative supports projects led by UK institutions, in partnership with host country institutions, which support biodiversity conservation over a range of ecosystems and locations. Five priority areas for Darwin funding include:

- Institutional capacity building.
- Training
- Research
- Work to implement the Convention on Biological Diversity
- Environmental education and awareness

In order to inform on the impact and legacy of the Darwin Initiative, the Darwin ECTF Monitoring and Evaluation component is commissioning evaluations of projects that previously received funding from the Darwin Initiative (ie "closed" Darwin projects). Issues of sustainability are also integral components in the analysis of impact and legacy.

The approach applied by the Darwin Initiative M&E component is to select *clusters* of "closed" projects based on either a country, theme or eco-region. Such missions shall be undertaken in close consultation with UK based and host country institutions, and involve relevant in-country beneficiaries and stakeholders.

Objectives for the Evaluation of Closed Darwin Initiative Projects

The Evaluation of Closed Projects (ECP) is primarily intended to provide an external perspective on the legacy and impact of Darwin Projects, and to draw out lessons learned and best practices that account for positive legacy and impact.

Legacy and impact shall be accessed at different levels:

- At the **project level** – in terms of host country institutions and local partners and beneficiaries, and in terms of conservation achievements.
- At the **national & eco-region level** – in terms of host country policies and programmes, and if relevant at cross-boundary and eco-region level.
- At the **international level** – in terms of emerging best practices, and the CBD itself.
- At the **UK level** – in terms of legacy and impact within UK institutions.

Within the context of the above, the evaluation shall comment on how the clusters of projects evaluated have contributed towards achieving Darwin Initiative objectives.

Background of Projects to be evaluated

Malaysia (Sabah) has been the focus of a number of Darwin projects (see above). Of these, 3 recently completed projects present an opportunity to evaluate the long-term impact and legacy of Darwin projects in Malaysia.

Project No.	Title	Purpose
7-040	Biodiversity of butterflies in tropical rainforests of Sabah, Borneo	To develop strategies that balance conservation of rainforest biodiversity with local community requirements, monitoring changes in butterfly communities as an indicator of habitat change.
9-016	Conservation of the orang-utan in Kinbatangan Wildlife Sanctuary, Sabah	To provide a range of essential information on the genetic structure of the Kinabatangan orangutan population to create a conservation strategy.
10-025	Molecular tools for promoting biodiversity in rainforest fragments of Borneo	Data gathering and capacity building to assist conservationists, ecologists and forest managers in Sabah with promoting responsible economic growth that maximizes the development of agriculture and silviculture whilst minimizing the impacts of loss and

Project No.	Title	Purpose
		fragmentation of rainforests on biodiversity. This will be achieved by providing clear practical advice on the size and placement of forest patches necessary to preserve species richness and genetic diversity; and assisting conservationists in establishing priorities for the conservation of species, by using genetic techniques to identify butterfly species of high conservation value and determining their vulnerability to habitat fragmentation. The project will focus on butterflies, which are highly diverse in Sabah with many endemic species.

Issues to be evaluated

The Evaluation of Closed Projects (ECP) shall review outcomes of Darwin Initiative funded projects against the original logical framework and Darwin proposal, Project reports and products, and through the following evaluation criteria:

Relevance: The extent to which the project outcomes correctly addressed identified problems and needs at the time of design, and whether these problems and needs were addressed as a result of the project. Guiding issues include:

- Appropriateness of the project design to the identified problems and towards supporting the implementation of the CBD.
- Complementarity and coherence with other related programmes and activities at national or local levels.
- Overall design strengths and weakness as reflected in the original logical framework.
- Extent of participation by host country institution and beneficiaries in initial consultations, and identification of problems and needs.

Efficiency: An assessment of how well the projects transformed their available resources into intended outputs in terms of quantity, quality and timeliness. Guiding issues include:

- Appropriateness and suitability of the technical methodology applied by the project and overall delivery of the technical assistance
- Review of project costs and value for money.
- Level of Partner country contributions in the project
- Extent of monitoring systems to assess progress and impact.
- Extent of the project's ability to adapt its programme and approach in response to changing assumptions and risks.

Effectiveness: To what extent the project outputs were achieved and to what extent they contributed to achieving the project purpose. In other words what difference the project has made in practice with the intended beneficiaries. Guiding issues include

- Extent of the technical advances made by the project.
- Extent of institutional change within beneficiary institutions as a result of the project outputs and purpose.
- Validity of the assumptions and risks of the project at the purpose level, and how did these change during the course of the project
- Extent of the project's ability to adapt its programme and approach during the course of implementation in response to changing assumptions and risks.

Impact: To what extent the project purpose was achieved and thus contributed to the overall project goal (*i.e.* to work with local partners in countries rich in biodiversity but poor in resources to achieve the conservation of biological diversity, the sustainable use of its components, and

the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.). Guiding issues include:

- To what extent has conservation of biological diversity benefited (or expected to benefit) from the achievements of the projects.
- Have there been unplanned impact resulting from the projects and what have been their consequences.
- Have there been gender-related or poverty related impacts rising from the project.
- Have there been impacts on host country ability to implement the Convention on Biological Diversity.

Sustainability: Extent to which the outcomes of the projects, at either output or purpose level, have continued on after the end of the project. Guiding issues include:

- Extent of the ownership of the project purpose and achievements, and means for ensuring this ownership.
- Extent of the policy environment being in support of the project purpose and achievements.
- Extent of the institution capacity of host country and beneficiary institutions to carry forward project outcomes post project support, at the level of scientific, technological and financial considerations
- Extent of the socio-cultural factors being in support of project outcomes, and whether the project outcomes are well grounded.

Methodology

The ECP shall be undertaken in close collaboration with Darwin Team Leaders and host country institutions, and engage with project stakeholders and beneficiaries. Wherever possible, ECP consultants should consultant with National CBD focal points.

The ECP consultant shall ensure that the ECP is informed through consultative and participatory work sessions and semi-structured interviews with project team members, project beneficiaries and other project stakeholders. Use of participatory assessment tools should be used where ever possible (eg timelines, mapping, stakeholder analysis)

Timetable

The ECP in Malaysia shall be undertaken according to the following schedule:

- Preparation and review of documentation – 1 day
- Field mission and travel - 5 days
- Report preparation – 2 days

The task will be discussed during the visit of Pat Hardcastle, the ECTF reviewer. The format and structure of the reporting required will be agreed during contract discussion.

The indicative timing for the visit of Pat Hardcastle is mid December, probably around 14/15 December.

Thematic Review of Darwin Island Projects

The consultant will also examine the material learnt from the ECP reviews in the light of a Thematic Review on Island Biodiversity. This will include a brief review Malaysian DI project against the Programme of Work on Island Biodiversity, and the write up of one or two more interesting case studies that show how the DI projects have supported the Programme of Work.

- Report (4-5 pages max) preparation – 2 days

Submission date of the work should be 18th February 2007.

Annex 5 Thematic Review of Darwin Initiative Island Projects

A Brief Review of Sabah-based Projects and their Contribution

to the

CBD COP-8 Islands Programme of Work

Dr Glen Reynolds

The Royal Society SEARRP, Danum Valley Field Centre

24 February 2007

The Imbak Canyon Conservation Area (ICCA) – a recently gazetted protected area and one of the last significant areas of primary lowland forest remaining in Sabah. Darwin Initiative project 14-016 involving the Royal Botanic Gardens Kew and Yayasan Sabah has contributed directly to the protection and management of ICCA.

1. Background & conservation context

Borneo is one of the world's largest islands with a total land area of *c.* 745,000 km^2. It is shared by 3 states: Indonesia, Malaysia and Brunei. The Indonesian part of Borneo, Kalimantan, is by far the largest and covers *c.* 540,000 km^2. The Malaysian states of Sabah (*c.* 74,000 km^2) and Sarawak (*c.* 125,000 km^2) occupy the northeast and northern parts of the island respectively with the tiny sultanate of Brunei (*c.* 6,000 km^2) lying between Sabah and Sarawak on the northwest coast. Until the mid-20th century the island was almost completely forest-covered including extensive lowland rainforests in Sabah, Sarawak and northeast and southwest Kalimantan. Upland, hill and sub-montane forests dominated in the mountainous spine running from central-west Kalimantan though to Mount Kinabalu in Sabah with extensive swamp forests extending inland from the coastal plains of southern and eastern Kalimantan (MacKinnon *et al*., 1997).

Over the past 40 years the forests of Borneo have been severely degraded and fragmented by industrial-scale logging operations and shifting cultivation and cleared for agricultural and exotic timber plantations (Mayaux *et al.*, 2005; Rautner *et al*., 2005). Protected areas have not escaped this general degradation and recent research has shown that Kalimantan's designated lowland forest conservation areas declined by over 50% from 1985 to 2001, mainly as a result of illegal logging and shifting cultivation (Curran *et al.*, 2004).

Projections for future forest conversion on Borneo are alarming and predict almost complete loss of the island's lowland forests by 2020 (Rautner *et al*., 2005). By extrapolating from observed extinctions following deforestation on the island of Singapore, forest loss on this scale would have a dramatic impact on Borneo's biodiversity, including the likely extinction of many endemic species[1] (Brook *et al.,* 2003; Sodhi *et al.,* 2004).

Evidence also suggests that the now largely degraded and fragmented forests of Borneo, particularly the island's lowland forests, are being increasingly impacted by El Nino droughts which, as a result of climate change, appear to be becoming more frequent and severe (Whitmore, 1998; Walsh & Newbery, 1999; Curran *et al*., 1999; Kohler & Huth, 2004). This may have serious implications for the long-term viability of Borneo's forests and the biodiversity they support.

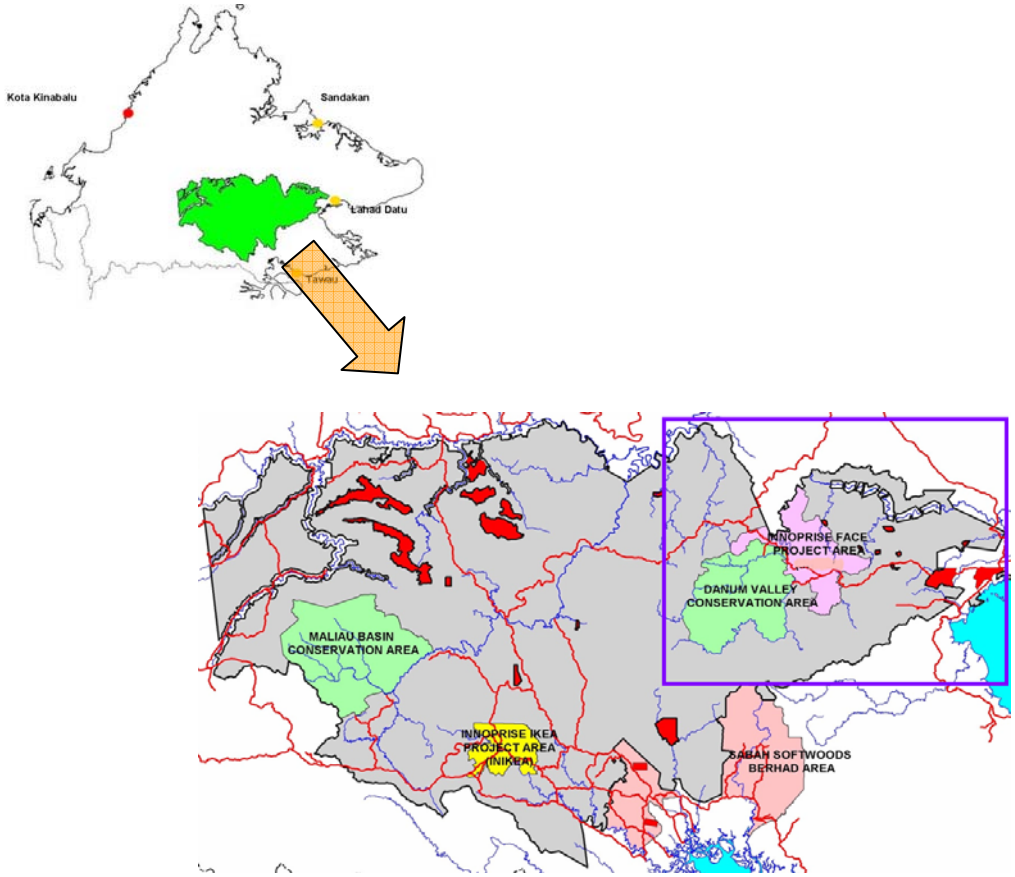
2. General contribution of DI projects towards the CBD COP-8 Islands Programme

Thirteen Darwin Initiative projects have been based either partly or wholly in Sabah. These have made a significant contribution towards the goals of the CBD COP-8 Islands Programme – particularly Goal 1 '*To promote the conservation of the biological diversity of island ecosystems, habitats and biomes*', Goal 2 '*To promote the conservation of island species diversity*' and Goal 4 '*To promote sustainable use and consumption*'. Perhaps the most important, collective, impact of these projects in the context of COP-8 Islands Programme has been their key (and ongoing) contribution to the protection and management of the *c.* 1 million hectare Yayasan Sabah Forest Management Area (YSFMA).

[1] As all but one of the Sabah-based Darwin Initiative projects have focussed on terrestrial biodiversity, forest conservation and management this review will not consider marine biodiversity or ecosystems.

Nine of the Sabah-based Darwin Initiative projects have involved research in the YSFMA, mostly in the Danum Valley Conservation Area and adjacent Ulu Segama and Malua Forest Reserves, but also the Maliau Basin and Imbak Canyon Conservation Areas (see Figure 1).

Figure 1: *Sabah (with the Yayasan Sabah Forest Management Area (YSFMA) highlighted) and a detailed map of the YSFMA – the area indicated by the purple bordered box are the ±237,000 ha Ulu Segama & Malua Forest Reserves*



These projects have demonstrated the critical importance of retaining this contiguous expanse of forest to the maintenance of biodiversity in Sabah, particularly in the context of global environmental change.

The forests of the YSFMA form the last intact gradation from coastal forests through lowland to inland higher-elevation rainforest remaining in Sabah, and one of the only examples on the entire island of Borneo. This broad forest corridor, which runs for over 200km from Darvel Bay close to the town of Lahad Datu on Sabah's east coast through the Ulu Segama Forest Reserve and inland to the Danum Valley, Imbak Canyon and Maliau Basin Conservation Areas, also constitutes a gradation from more drought-prone (and hence drought-resistant) east-coast rainforest to less drought-prone interior rainforest. In view of the prospect of increasingly frequent El Nino droughts on Borneo, such a corridor could provide a biodiversity 'refuge' by preserving, on an extensive scale, a range of critically important forest habitats – including an exceptionally large area of lowland forest. The relatively intact forests of the YSFMA could prove particularly important if, as in 1982-83 and 1997-98, future El Nino droughts were to result in widespread fires (Leighton & Wirawan, 1986; Sodhi *et al.*, 2004; Mayaux *et al.*, 2005). Such fires would likely have a much greater impact on the generally more degraded and fragmented forests outside the YSFMA.

In March 2006, the Sabah state government announced that the c. 237,000 hectare Ulu Segama and Malua Forest Reserves (which have been threatened for many years with conversion to plantation) would be retained under natural forest cover – a major step towards achieving COP-8 Island Programme Target 1.1, and a decision described by the President of WWF as "*…one of the most important actions ever taken to protect Borneo's endangered wild mammals*"

(see: www.worldwildlife.org/wildplaces/borneo/updates/wwfpraise.cfm).

Darwin Initiative projects continue to make an important contribution to management planning in the Danum Valley and Maliau Basin Conservation Areas, the Ulu Segama and Malua Forest Reserves and to the formalisation of the protection status of the Imbak Canyon Conservation Area.

3. Contributions of specific projects:

Four projects have made a particular contribution to the protection and management of the YSFMA and hence COP-8 Island Programme Goals; Project 7-040 '*Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo*', Project 9-016 '*Conservation of the Orang-utan in the Kinabatangan Wildlife Sanctuary, Sabah*', Project 14-016 '*Assessing and Conserving Plant Diversity in Commercially Managed Tropical Rainforests, Sabah*' and Project 14-022 '*Predictive Tools for Targeting Conservation Effort in Bornean Forest Reserves, Sabah*'

3.1 Project 7-040 'Biodiversity of Butterflies in Tropical Rainforests of Sabah'

Project leader: Dr Keith Hamer

UK institution: University of Durham

In-country partners: Universiti Malaysia Sabah, Sabah Forestry Department, Yayasan Sabah

Key reference:

Hamer, K.C., Hill J.K., Benedick, S., Mustaffa, N., Sherratt, T.N., Maryati, M., Chey, V.K. 2003. Ecology of butterflies in natural and selectively logged forests of northern Borneo: the importance of habitat heterogeneity Journal of Applied Ecology, 40, 150-162.

This project has made a particular contribution to Goal 1 (Targets 1.1 and 1.2):

- It clearly demonstrated the biodiversity value of even highly degraded logged forest. These findings have been supported by a number of subsequent studies (particularly Darwin Initiative Project 9-016) which, collectively, have been largely responsible for the decision to retain the Ulu Segama and Malua Forest Reserves under natural forest cover
- The project is making a direct contribution to the 25 year Danum Valley Management Plan and management planning for the Ulu Segama and Malua Forest Reserves – both currently in preparation
- It is also contributing to the development of criteria for the identification and management of High Conservation Value Forests in the YSFMA

3.2 Project 9-016 'Conservation of the Orang-utan in the Kinabatangan Wildlife Sanctuary, Sabah'

Project leader: Prof. Mike Bruford

UK institution: University of Wales Cardiff

In country partners: Universiti Malaysia Sabah, Sabah Wildlife Department, Kinabatangan Orang-utan Conservation Project

Key references:

Ancrenaz, M., Gimenez, O., Ambu, L., Ancrenaz, K., Andau, P., Goossens, B., Payne, J., Sawang, A., Tuuga, A., Lackman-Ancrenaz, I. 2005. Aerial surveys give new estimates for orangutans in Sabah, Malaysia. PLOS Biology, **3**, 1, e1.

Goossens, B., Chikhi, L., Ancrenaz, M., Lackman-Ancrenaz, I., Andau, P., Bruford, M.W. 2006. Genetic signature of anthropogenic population collapse in orang-utans. PLOS Biology, **4**, 2, e25.

The main contribution of this project has been to Goal 2 (Targets 2.1 and 2.2) and, by extension, Goal 1 (particularly Target 1.2).

- It showed the catastrophic decline in the orang-utan population of Sabah during recent decades – and highlighted the pressing need to conserve and restore the lowland forest habitats which are essential for the survival of this species
- Scientists involved with this and associated projects demonstrated that the Ulu Segama and Malua Forest Reserves represented by far the most important habitat for orang-utan remaining on the island of Borneo
- This finding was the major factor underlying the Sabah State Government's decision to conserve this area under natural forest cover – and reverse an earlier decision to convert the Ulu Segama and Malua Forest Reserves to exotic timber and agriculatural plantations

3.3 Project 14-016 'Assessing & Conserving Plant Diversity in Commercially Managed Tropical Rainforests, Sabah'

Project leader: Dr Rogier deKok

UK institution: Royal Botanic Gardens, Kew

In-country partners: Yayasan Sabah, Sabah Forestry Department

This project is making a major contribution to Goal 4 and Goal 1, Target 1.2.

- As a direct result of this project, Yayasan Sabah has now developed criteria for the identification and management of High Conservation Value Forests (HCVFs) within its 1 million hectare timber concession. Conservation and timber harvesting plans based on these criteria are currently in preparation – and Yayasan Sabah has given an undertaking to certify its forestry operations to High Conservation Value Forests (FSC) standards for sustainable timber production
- It is also likely that the criteria developed as part of the project will be adopted by the Sabah Forestry Department for the identification, protection and management of HCVFs in all of Sabah's commercial forest reserves (covering a total of over 2.6 million hectares)
- By demonstrating its unusual floristic composition and diversity, this project also contributed directly to the decision to formalise the protection of the *c.* 30,000 hectare Imbak Canyon Conservation Area – one of the last remaining areas of pristine lowland forest on the island of Borneo

3.4 Project 14-022 'Predictive Tools for Targeting Conservation Effort in Bornean Forest Reserves, Sabah'

Project leader: Dr Jane Hill

UK institution: University of York

In-country partners: Universiti Malaysia Sabah, Sabah Forestry Department, Yayasan Sabah

Key reference:

Benedick S., Hill J.K., Mustaffa N., Chey V.K., Maryati M., Searle, J.B., Schilthuizen, M., Hamer, K.C. 2006. Impacts of rain forest fragmentation on butterflies in northern Borneo: species richness, turnover and the value of small fragments Journal of Applied Ecology, **43**, 967 - 977

This project contributed to Goal 1 (Target 1.2), Goal 2 and also to Goal 3.

- The project demonstrated that even small, isolated forest fragments retained considerable biodiversity value – but indicated that rehabilitation may be necessary, or connectivity re-established if forest fragments are to retain their conservation values in the long term
- It also highlighted the crucial importance of retaining large, contiguous areas under natural forest cover

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