

Darwin Initiative – Final Report

(To be completed with reference to the Reporting Guidance Notes for Project Leaders
(<http://darwin.defra.gov.uk/resources/reporting/>) -

it is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Darwin project information

Project Reference	162/14/054
Project Title	Training the next generation of Papua New Guinean conservation biologists
Host country(ies)	Papua New Guinea (PNG)
UK Contract Holder Institution	University of Sussex
UK Partner Institution(s)	The Natural History Museum, UK
Host Country Partner Institution(s)	Binatang Research Centre, Papua New Guinea Wildlife Conservation Society, Papua New Guinea
Darwin Grant Value	£197, 555
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Project Leader Name	Dr A.J.A Stewart
Project Website	http://waterbeetles.info/Darwin/DarwinHTMLs/DarwinBackground.html
Report Author(s) and date	AJA Stewart, D Wright, V Novotny, K Sagata. 30 th October 2008

1 Project Background

Acronyms used in report:

PNG	Papua New Guinea
UoS	University of Sussex
NHM	The Natural History Museum, London
WCS	Wildlife Conservation Society, Goroka, Eastern Highlands Province, PNG
BRC	Binatang Research Center, Madang, PNG ('Binatang' means 'insect' in the most widely spoken local language in PNG, Tok Pisin).
IBR	Papua New Guinea Institute of Biological Research Inc (new NGO formed by former employees of WCS)
NGO	Non-government organisations
UPNG	University of Papua New Guinea
NARI	National Agricultural Research Institute
DEC	PNG Department of Environment and Conservation
DI	Darwin Initiative

This project was implemented in Papua New Guinea, a biodiversity hot spot extremely deficient in biological data and national expertise. Our purpose was: (1) to train eight conservation biologists to become future conservation leaders and (2) in the process of that training, gather data that can be used to guide conservation planning and policy. Outputs include ten Honours degrees, two Masters degrees, one PhD pending, numerous conservation related research projects and publications, numerous training events for PNG students and conservation professionals, and a new national NGO formed to continue this work.

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

PNG lacks well educated conservation biologists and biodiversity data. This project has trained ten new conservation biologists and advanced the training of many professional biologists whose work has positively contributed to the protection of PNG species. These students and staff are committed to biodiversity conservation and the sustainable use of biological resources in PNG and to training more individuals to multiply their efforts. Without well educated, competent national biologists PNG will not be able to achieve its CBD directives; this program has gone a long way in propelling PNG towards this goal.

Further, the research conducted by students and staff under this grant has provided crucial data for management decisions. For example, the positive confirmation of the Critically Endangered CITES listed Bulmers Fruit Bat (*Aproteles bulmerae*) by Kore Tau in the Crater Mountain Wildlife Management Area has raised awareness of this species and prompted villagers in the Crater community to stop hunting this bat. The re-discovery by Katayo Sagata of a diving water beetle (*Rhantus papuana*) once thought to be extinct has prompted IUCN to list this species as threatened.

3 Project Partnerships

The partnerships between UoS and BRC and WCS/IBR have been excellent. All partners have worked together to accomplish our shared goals and are committed to continuing their collaborations. UK and PNG institutional partnerships were based on host country need and all partners have been equally involved in planning, decision making, and reporting for this project. Host country partners carried out student selection and Honours mentoring including hypothesis formulation, experimental design, data collection, analysis, write up and thesis defense, and NHM and UoS trained Darwin Supervisors and aided with short courses to enhance student skills and knowledge.

UoS established MoUs with both WCS and BRC at the beginning of the project, as did WCS and UPNG, the national university awarding Honours degrees (the new IBR is in the process of finalizing an MoU with UPNG). BRC and the partially DI funded PNG National Aquatic Insect Survey & Reference Collection project both have MoUs with NARI, and BRC has an MoU with DEC.

Over the life span of the project (2005-2008), our partnerships have worked very well. With Darwin funds, BRC and WCS/IBR have trained ten honours students with two currently pursuing Masters degrees overseas. Two PNG project co-ordinators were awarded Masters degrees and one is currently pursuing a PhD in Australia. We have conducted many joint training events as partners and have found that we work well together. We are establishing an MoU to share a research station near BRC, with WCS/IBR contributing steel modules for the buildings. UoS continues to provide instructors for short term visits to PNG and training. We feel our partnerships are very strong and effective.

Additional collaborations by UK institutions:

The Natural History Museum facilitated insect taxonomic and systematic training for PNG co-ordinators (Katayo Sagata and Darren Bito) for two months in 2005, trained primarily by Drs. Neil Springate, Michael Monaghan, Michael Balke and Alfried Vogler. While attached to the Museum as a research fellow, Dr. Michael Balke made several visits to PNG and conducted short courses in aquatic insect taxonomy and systematics, both at WCS and BRC. In 2007 Dr Frank Clarke, associated with the University of Aberdeen, was employed as a UK co-ordinator and was based in Goroka where he assisted in student training and advising.

Additional collaborations by PNG institutions:

BRC and WCS/IBR have developed strong collaborations and networking with many PNG national institutions. BRC and WCS/IBR collaborate to conduct short courses, train students and oversee student data collection. The University of PNG is our main training partner as they assess our honours students and award degrees; we have a decade-long excellent partnership with this institution. The PNG Department of Environment and Conservation (DEC) has been very helpful in granting research permits and specimen export licenses for resident and visiting expatriate trainers and researchers and in turn WCS/IBR and BRC have provided biodiversity data and research results and training for DEC staff. BRC and WCS/IBR have an agreement with the largest insect repository in PNG, the National Agricultural Research Institute (NARI), to house the PNG National Aquatic Insect Survey & Reference Collection formed under this grant, and also provide NARI with biodiversity data and training opportunities. BRC and WCS-IBR work in close collaboration with the PNG Forestry Research Institute (FRI), depositing herbarium specimens with this institution, training their staff (including an Honours student) and paying them for plant identification work. WCS/IBR staff and students also give guest lectures for conservation education students of the University of Goroka and the Research and Conservation Foundation of PNG.

The project benefited greatly from collaboration with other projects based at BRC. The five students based at BRC were assisted in the more practical aspects of their Honours research by BRC parataxonomists employed in the later stages of Darwin post-project EIDP09/10-030 (*Consolidating local capacity for biodiversity surveys in Papua New Guinea*; Project Leader: Alan Stewart). This project finished in July 2007, but the parataxonomists trained by that project remained at BRC and continued to be an invaluable source of local information and assistance for the students. Similarly, the students were able informally to educate the parataxonomists in the more theoretical aspects of biology. We have been impressed at how this synergy between parataxonomists and university students remains a very fruitful one with tangible benefits for both sides.

Darwin-funded research and training based at BRC also benefited greatly from synergy with the concurrent NSF-funded project on plant-insect food webs and tropical rain forest succession (NSF-00515678). This project has been studying the differences in host specificity and species richness of insects feeding on young and mature trees (as models of the effects of rainforest disturbance) in four 1ha plots (two each in pristine and cleared forest) at one of BRC's main field study sites at Wanang (Madang province), in which all mature trees have been inventoried and all insects on the vegetation are being reared for species-level identification. This has been a very substantial logistic undertaking that has provided ideal training opportunities for the Darwin-funded students, especially Kipiro Damas. It also fits in well with the objective of the Darwin project to build student projects around the comparison of pristine and disturbed rainforest habitats.

4 Project Achievements

Major project achievements include:

The training and increased supervisory capacity of four DI coordinators:

Four PNG nationals (Katayo Sagata, Darren Bito, Miriam Supuma, Chris Dahl) have acted as Darwin research supervisors and training co-ordinators during the lifetime of this project (see Annex 7 for details). All of them have come up through the PNG university system and have been keen to avail themselves of opportunities for further education and training. The three more senior ones have spent time overseas working towards postgraduate higher degrees, but have nevertheless returned to PNG (or are pledged to do so) to pursue a career in biodiversity conservation. It is testament both to the ability of these young scientists, and the training that they have received within this Darwin project, that they have been accepted on overseas postgraduate programmes in the face of stiff international competition. Furthermore,

the fact that they are prepared to forsake potentially more lucrative career paths in favour of conservation biology is proof of their dedication and commitment to PNG and its rich biodiversity. All of them have grown considerably as managers, student supervisors and researchers. We are confident that they will quickly become the senior conservation professionals that our project had hoped to produce as its most significant long-term legacy.

The training of ten DI funded Honours students:

We pledged to train eight Honours students but have managed to train ten. Synopses of student research projects, their results and the current destinations of the students are given in Annex 8. All of them have produced research theses (or are close to doing so at the time of writing) of universally high standard and within the expected timeframes. Most of these will result in publications in peer-reviewed scientific journals.

The students themselves have gained enormously from the experience of planning, executing and writing up a proper research project. All have expressed strong interest in taking their research studies further. Two of the first cohort have already embarked upon Masters programmes overseas in order to further their scientific careers; the other two would like to have pursued a similar path but have been prevented from doing so due to family commitments. Of the six students in subsequent cohorts, two have applied for scholarships for overseas Masters programmes and are awaiting decisions, while four others are keen to initiate MSc research projects if the opportunity arises in the near future.

Research results:

Research projects by the ten postgraduate students studying for Honours degrees (see Annex 8 for details) all focused on various aspects of PNG biodiversity and rainforest ecology, whilst also spanning a wide range of topics, focal taxa (plants, insects, vertebrates) and analytical approaches. This variety is important in order to train biologists for a wide range of careers in PNG. A majority of the student projects addressed ecological questions of urgent applied significance, focused under two over-arching themes:

- Four of the five projects based at WCS/IBR attempted to quantify and assess the impact of hunting by indigenous people on mammal populations (bats, rodents, small mammals). A clear understanding of the reproductive capacity and seasonal phenology of these animals is essential for determining sustainable levels of hunting that can be recommended to conservation decision makers.
- Three of the five projects at BRC were focused on comparisons of pristine and secondary rainforest ecology (plants, butterflies, moths). Studies of community structure and habitat preferences of moths (Geometridae) and butterflies (Papilionoidea) along a succession gradient from secondary to primary rainforest have helped to identify species that are particularly likely to suffer or benefit from habitat change due to selective logging. Improved and expanded data on the successional sequence from cleared to primary forest will ultimately give us better tools for assessing the progress of forest rehabilitation after disturbance by logging, mining or slash-and-burn agriculture.

Other BRC projects focused on documenting host specificity patterns in sap-sucking insects in lowland rainforests and found large differences between extremely specialised cell-sucking leafhoppers (Cicadellidae: Typhlocybinae) and much less specific phloem- and xylem-sucking species (Auchenorrhyncha). These results are important for understanding the evolution of plant-herbivore interactions, as well as practical conservation, because host specificity determines the response of herbivores to vegetation change.

The Darwin project has also been supportive to BRC's work on documenting beta diversity (species turnover between sites) in lowland rainforests (funded largely by NSF). Such studies are particularly important for informing decisions on priorities for biodiversity conservation. Beta diversity of herbivorous insects was shown to be unexpectedly low in lowland PNG forests. Species turnover for PNG tropical amphibians was higher than for insects or for temperate zone amphibians, but lower than in amphibian communities of Amazon rainforests. These results suggest that major taxa differ in their patterns of beta diversity, which

in turn dictate the density and size of protected areas in lowland rainforests that would be required to conserve a diversity of species.

4.1 Outcomes: achievement of the project purpose and outcomes

One of the significant impacts of this project has been the change in mind set of the students regarding the conservation of fauna and flora in PNG. Almost all of the students that WCS and BRC trained are recent undergraduates who had not really made a commitment to biodiversity conservation in PNG. As a result of their training they developed a strong commitment to conservation as evidenced by their pursuit of further training to become even better future role-models, mentors and researchers. Former students Enock Kaledimimo and Eunice Dus and co-ordinator Darren Bito are currently undertaking masters and PhD studies in conservation biology overseas and most of the other students have applied to do so. Two Darwin Supervisors, Katayo Sagata and Miriam Supuma, upon the withdrawal of WCS from capacity building (see section 4.2) took it upon themselves to form a new national NGO with their other colleagues instead of pursuing higher paying positions. This shows true dedication and commitment. These actions attest to the crucial role that this Darwin grant has had in changing and reinforcing peoples' values regarding biodiversity conservation, with Darwin supervisors now leading a new fully national NGO dedicated to biological research and training of PNG conservation biologists.

4.2 Outputs (and activities)

The principal outputs were to be: (i) trained PNG coordinators, (ii) trained students, (iii) other students trained on short courses, (iv) enhanced collections and (v) biodiversity surveys. Please see Annex 1 for a summary of our accomplishment of each of these outputs laid out in the logical framework. In all cases, the project achieved or exceeded original expectations. It should especially be noted that we trained more Honours students than initially intended.

Training Events and Courses

- Oct 05—four week course on proposal writing, project design, data analysis, report writing and oral presentation for 19 PNG students.
- Apr 06-- four day course on taxonomy, species concepts, how to make and curate collections and how these issues affect conservation, for 33 participants from NGOs and PNG government departments.
- Jul 06-- three day course for eleven participants on how to use GPS and what its limitations are, how to enter this data into ArcView Software and calculate home ranges, and how to create and use Access databases.
- Aug 06-- four day course on population dynamics models for fourteen participants from NGOs and PNG government departments. The course focused on no-take zones, source-sink models, reproductive outputs and sustainable yields for hunting, and demonstrated the use of Distance and Access Software.
- Feb 07—four week field course for 23 students and conservation professionals on survey techniques, data analysis, report writing and oral presentation.
- Jul-Aug 08—four week field course for nine European and 19 PNG students and conservation professionals on survey techniques, project design, project analysis and write-up and project presentation (see below).
- Additional one day courses during the grant period include Phylogenetics and Taxonomy, Molecular Phylogenetics, and literature database searches and the use of bibliography EndNote Software; fifteen participants on average for each course.
- Throughout the grant period we also continued our weekly paper discussions with a different peer-reviewed paper each week relevant to conservation in Papua New Guinea,

and our weekly skills testing using sample tests of the Graduate Record Exam. This exam is the standard used by U.S. Universities for admission to postgraduate degree programs.

Field course in tropical ecology:

BRC hosted a field course in Tropical Ecology from 17 July to 12 August 2008, organised jointly by BRC, IBR and the University of South Bohemia (USB) from the Czech Republic. The course was led by four instructors: Professor V. Novotny (BRC), Professor J. Leps (USB), P. Igag (IBR) and C. Dahl (BRC) and trained nine BSc and MSc European students from USB, ten Papua New Guinean Honours students from BRC and IBR, and nine Papua New Guinean research technicians (parataxonomists) from BRC. The PNG participants were sponsored by DI funds to BRC and IBR, whilst the Czech participants were sponsored partly by USB and partly self-financed. The course brought together participants from a variety of backgrounds and cultures, as exemplified by the 22 languages spoken by the cross-section of course participants.

The course was based at BRC's remote lowland rainforest field station in Wanang Village. The participants were given four days of introductory training on rainforest ecology, plants and animals and then worked on practical research projects in teams, each combining one PNG student, one European student and one PNG parataxonomist. Results from all nine projects, including studies on plants, birds, and insects, were presented at a mini-conference at the end of the course at BRC. The course also included field trips to coral reef and mangrove ecosystems, an altitudinal forest gradient (including two days stay at the timber-line and climbing the summit of Mt. Wilhelm at 4,507m asl.), and an active volcano at Manam island to see a primary successional series.

Course assessment: This was our first training course combining PNG students, PNG parataxonomists and European students. It was deemed a great success by the instructors as well as course participants, who universally rated it as excellent in the anonymous course questionnaire.

Exposure to international researchers in PNG

- Dr. Paige West (anthropologist and professor at Barnard College, Columbia University, 8 months) lectures and discussions
- Dr. Jack Dumbacher (Bird and Mammal Curator, California Academy of Science, 4 months) lectures and discussions
- Mr. Stephen Richards (herpetologist, Conservation International, 4 months) lectures and discussions
- Dr. Leo Salas (mammalogist and modeller, University of Massachusetts, 4 months) short training courses and discussions
- Prof. Jan Leps (statistician and botanist, University of South Bohemia, Czech Republic, 3 months) 3 lectures on statistics, 1 lecture on plant ecology
- Dr George Weiblen (botanist, University of Minnesota, 4 months) 2 lectures of plant phylogeny and ecology
- Dr. Milan Janda (entomologist, Czech Academy of Science, 4 months) practical field training, ant ecology
- Dr. Michael Balke (entomologist, Natural History Museum, 6 months) practical field training, water beetles
- Mr. Jan Svankmajer (surrealist film director, Czech Republic, 2 months) commented screening of his films
- Mr. Richard Ctvrticka (PhD student in entomology, of South Bohemia, Czech Republic, 12 months) practical training, beetle taxonomy and ecology
- Mr. Petr Klimes (PhD student in entomology, of South Bohemia, Czech Republic, 12 months) practical field training, ant ecology
- Mr. Jan Hrcek (MSc student in entomology, of South Bohemia, Czech Republic, 12 months) practical field training, parasitoid

- Mr. Tim Whitfeld (PhD student in botany, University of Minnesota, 3 months) practical field training, plant ecology
- Ms. Annika Moe (PhD student in botany, University of Minnesota, 3 months) practical field training, plant and pollinator ecology
- Ms. Wendy Clement (PhD student in botany, University of Minnesota, 2 months) practical field training, plant ecology
- Jiichiro Yoshimoto (postdoctoral researcher, entomology, Kyoto University, 1 month) 1 lecture on insect community ecology
- Eben Goodale (US National Science Foundation postdoctoral fellow, University of Colombo, ornithology, 2 months) practical field training, bird surveys
- Professor Vojtech Novotny (in-country partner, BRC) on-site student supervision for 20 months, a series of 10 lectures on tropical ecology
- Dr Alan Stewart (UK Project Leader) training in taxonomy and ecology of leafhoppers (Auchenorrhyncha) for BRC student projects, laboratory techniques etc; Employment skills course: training in presentations, job applications, interviews, constructing a CV, report writing; 2 weeks)
- Dr. Andrew Mack (in-country partner, WCS) on-site student supervision for 20 months, numerous lectures and software and field training
- Dr. Debra Wright (WCS) on-site student supervision for 12 months, numerous lectures and software and field training

Conferences Attended

- Darwin sponsored Honours students Kore Tau, Enock Kaledimimo, and Eunice Dus presented their work at the 8th Annual New Guinea Biological Conference in Port Moresby.
- Darwin sponsored Katayo Sagata presented his work at the 9th Annual New Guinea Biological Conference in Jayapura, Indonesia.

Specimens and Databases

We have provided:

- Roughly 1,000 specimens from ~400 plant species for the PNG National Herbarium at FRI
- Roughly 6,000 specimens from ~500 species for the PNG National Insect Collection at NARI
- Data and images on geometrids for online database at www.entu.cas.cz/png/caterpillars/

Training Manuals:

WCS/IBR continued to update and revise its conservation research training manual that has been used since 1996. It includes sections on survey techniques, project design, data analysis, report writing, and oral presentations.

WCS/IBR staff and students also contributed heavily to the editing and writing of *Conservation Biology Module 1* which will be used to teach this course as part of the Postgraduate Diploma program in Conservation Management at UPNG beginning in 2009. IBR staff will assist in teaching this course at UPNG.

Problems encountered and resolved:

Over the course of this three year project we did encounter certain problems, some of which were quite major. However, we were able to overcome them without compromising the achievement of the project's main objectives.

At the beginning of the project, our two PNG co-ordinators travelled to the NHM for training. Unfortunately, the UK Project Co-ordinator who supervised the students and who was supposed to travel subsequently to PNG to continue full-time training on the project, was not suited for interactions with PNG students and the trainees' experience was not all that it should have been. The UK Project Co-ordinator's departure from the project meant that there was no UK trainer during 2006. However, this did not hamper efforts as Drs. Andrew Mack and Debra Wright at WCS and Professor Vojtech Novotny at BRC supervised in-country training efforts. Further, Dr. Michael Balke visited PNG and conducted several short courses in insect

taxonomy and systematics, along with several other visiting scientists. We hired a replacement UK Project Co-ordinator and trainer in January 2007. He participated in the WCS 4-week annual training course but had to resign shortly thereafter due to persistent eye infections and other medical complications.

Thus, after two essentially unsuccessful attempts to make this component of the project work, and with only 3 months worth of full-time funding left for this post, we decided to re-direct the remaining funds to recruiting further students to conduct research projects for their honours degrees (now successfully completed). We believe that none of these problems could reasonably have been anticipated, but that they were handled both sensitively and efficiently in the difficult circumstances. All the other project personnel involved made considerable efforts to ensure that these problems did not impact adversely on the students' experience or the achievement of their research goals.

At about the same time as the above problems, in March 2007, WCS headquarters in New York decided that they no longer wanted to pursue capacity building in PNG and told Drs. Andrew Mack and Debra Wright they were closing the program and were laying them off. This shock announcement resulted in considerable confusion and uncertainty. Wright and Mack convinced WCS to allow the national staff to continue the program and training efforts until existing funds ran out. WCS decided to support the national staff until June 2008 in order not to renege on grant contracts. Ms. Miriam Supuma (then Supervisor for the Darwin project) and Mr. Banak Gamui were made Acting Co-Directors and in July 2007 Mr Sagata returned from New Zealand having completed his Masters and resumed his former job as Darwin Supervisor and student trainer. Wright and Mack have continued to aid the national staff and students, although from the USA. Additional staff members have since returned with overseas degrees and in March 2008 the former staff of WCS formed their own national NGO, the PNG Institute of Biological Research, to carry on the important work of training future conservation leaders and carrying out much needed biodiversity research. PNGIBR now has five national staff with Masters degrees and Mack and Wright are on their Advisory Board.

4.3 Project standard measures and publications

Please see Annex 4 for table of project standard measures.

Annex 5 provides details of all publications arising out of the project. The project has already led directly, or contributed substantially, to eight publications in peer-reviewed scientific journals, two internal reports and two articles in magazines aimed at the general public. We are also expecting the main results from the ten student projects to be published in the scientific literature in the near future. Although the field work for Bito (2007) was supported by our previous project (162/10/030), the analysis and writing of the paper was done during the project reported here. Likewise, although Sagata & Lester (2008) was the product of Katayo Sagata's MSc studies in New Zealand, it demonstrates the high level of achievement by our PNG Project coordinators. Some of the fieldwork for certain water beetle papers by Dr Michael Balke were supported by pre-project funding that preceded this project, although again the writing was mostly done within the lifetime of the main project.

The publication in the highest profile journal was our 2007 paper in *Nature*, reporting on patterns of beta-diversity across PNG in three insect groups, an area of very active current research in tropical ecology. This paper was the subject of a *News & Views* article in the same issue of the journal (Stork, N. E. (2007) *World of Insects. Nature* 448: 657-8). This paper has been cited six times since its publication last year, including in the high profile journals *Ecology Letters* (twice) and *Science* (once).

We are pleased to have published a short article on Katayo Sagata's and Darren Bito's experiences when visiting the UK for training at the NHM in Air Niugini's in-flight magazine, *Paradise*. This article was available throughout 2006 to all passengers on the airline's internal and international flights, so will have been an excellent advertisement for the Darwin Initiative and the project.

4.4 Technical and Scientific achievements and co-operation

Please see Annexes 7 and 8 for our research and scientific accomplishments during this project and Annex 5 for a list of peer reviewed papers. All student theses are subject to peer review by the UPNG faculty and outside committee members.

4.5 Capacity building

The aim of this project was to train PNG university students and conservation professionals to become future conservation leaders. Ten honours students and four professional conservation biologists have been trained under this grant. In addition dozens of other students and conservation professionals have been trained in short courses over the past three years. Please see section 4.2 for further details.

This Darwin project has helped enormously in building the capacity of BRC and WCS/IBR in terms of their overall scientific and technical scope, the professional capabilities of their staff and students, their reputation as the main biological research organisations within PNG, and the networking between them and with other relevant organisations in PNG and around the world. It has made a real difference to these organizations and to the students and staff that comprise them.

The Darwin project was instrumental in the formation of the new national NGO that has replaced WCS - The PNG Institute of Biological Research (see section 4.2) – through its support and training of the two PNG Project Co-ordinators (Sagata and Supuma) who have now become the new organisation's Senior Scientist and co-Director respectively.

4.6 Sustainability and Legacy

The knowledge, skills and experience gained by all of the students and staff participating in this program will continue to contribute to biodiversity conservation for the lives of these individuals. These staff and students are committed to being role models and mentors for the next generation, training more conservation biologists over their lifetimes. The Darwin Initiative has fostered an educational legacy in PNG. By definition, the ultimate goal of this project is long-term in that it may be some years before the students that we have trained are in positions of authority and influence in PNG, perhaps after having received some further training. In the meantime, the research that they have conducted will have tangible benefits, through better understanding of PNG biodiversity and better informed conservation policy.

The staff of IBR and BRC will continue to work for their respective organisations in order to continue the work of this project. Both organizations are already planning recruitment of new Honours students in January 2009, funding permitting. Many of the students will go on to pursue higher degrees and then return to work in the biodiversity conservation field in PNG. All equipment provided to these organisations under DI will remain the property of the respective organisations.

The UK and PNG partners will be in close contact for a long time to come as they share research and conservation interests. This Darwin project has allowed their collaboration to flourish and it continues to grow, as evidenced by the fact that US, BRC and IBR have submitted a proposal for a new joint project to the current round of the Darwin Initiative.

5 Lessons learned, dissemination and communication

We have learned many lessons over the past three years:

We found that there is a large pool of prospective Honours students in PNG but a shortage of opportunities for study as we had an average of eight qualified candidates for each position offered. Furthermore, some of the established researchers at research institutes and universities in PNG are also suitable candidates for further postgraduate education as shown by our student Kipiro Damas. Mr. Damas is probably the best expert on the taxonomy of New Guinean flora working in PNG, but he had no postgraduate training. His Honours work provided him with improved analytical tools and theoretical background for further work as a botanist at the PNG National Herbarium. All ten graduating students plan to pursue further postgraduate training or to have research-oriented positions. Thus, there is a strong proven need for postgraduate training both for fresh graduates and for mid-career researchers. Our experience showed a clamouring of interested and able students in the country with a dearth of opportunities for them.

All students were resident at either WCS/IBR or BRC and closely interacted with staff research technicians (parataxonomists), research supervisors, senior research staff and visiting overseas researchers and PhD students. This arrangement was exceptionally conducive to training as it created a diverse environment where people with different skills and backgrounds could share their experiences and knowledge.

All PNG DI Supervisors made important contributions to student training and supervision whilst also advancing their own training with international publications and further graduate degrees. Some were able to participate in training overseas in the UK, France and New Zealand. All of our Supervisors were products of past training at WCS and BRC, but this is not a coincidence. There are no other field research training centres in the country and no other NGOs specializing in training conservation biologists. We contend that the training of national research supervisors was as important a part of this project as the training of Honours students.

A very important lesson learned from this project is that UK trainers and PNG students must learn how to appreciate and overcome cultural differences so that they do not become an obstacle to learning. In the early stages of this project, the UK training of two PNG Supervisors did not turn out well because of cultural misunderstandings with their UK based trainer. Future UK trainers need to combine advanced knowledge of biology with teaching skills, cultural sensitivity and willingness to spend extended periods of time in PNG – this is a combination not easy to find when offering a short-term contract. Hiring postgraduate students working simultaneously on their dissertation research is a possibility as they would by definition wish to spend long periods of time in PNG. The only concern would be that they might not spend enough time mentoring if they are concentrating on their own dissertations. In any case, it is clear that in order to transfer UK expertise to PNG, either PNG students need to spend more time at UK institutions or UK trainers need to spend more time training students in PNG. The level of research training PNG students have before entering our programs is quite low and mentoring students to become internationally qualified researchers is extremely time demanding. Most students take two to three years to complete their honours studies although officially they are supposed to finish within one year. This is because we keep training them until they are fully ready to succeed in a Masters programs overseas. PNG students especially need training in field techniques, library and software skills, data analysis and essay and scientific writing.

Through our various training courses (see section 4.2) we have tested the model of joint field courses for (i) overseas and PNG participants, for (ii) students and parataxonomists, and for (iii) students and conservation professionals. The participants have all worked well together and have enjoyed their mutually enriching interactions. Parataxonomists have extensive field experience and detailed knowledge of particular taxa and sampling methods, university

students have a broad theoretical background, and conservation professionals have real-life experience. Each group has something to contribute and many things to learn from other participants. The courses also offered a learning experience to PNG instructors, as they were able to work alongside overseas instructors with more teaching experience. PNG offers a variety of habitats and BRC and IBR have mastered the local logistics to reach them. Not many student courses can offer visits to coral reefs as well as rainforests stretching from the sea coast to the timber-line, or successional gradients on an active volcano. These possibilities attract overseas students (and universities), providing additional opportunities for PNG trainees to work with colleagues from other countries.

Dissemination of information from the project:

Staff and student research findings have been disseminated through conferences (annual New Guinea Biological Conferences, Society for Conservation Biology), seminars (UPNG thesis defences), guest lectures (University of Goroka, RCF, DEC), publications in peer reviewed journals, teaching materials at UPNG and awareness in the local communities where our research was performed. Thus, our target audience is wide: professional scientists and conservationists, university lecturers and students, primary school teachers, government policy makers and local communities.

IBR and BRC are dedicated to scientific research and conservation in PNG. Therefore, all findings arising from this project and future projects will continue to be used to educate PNG communities, students, landowners, conservationists, and policy makers.

5.1 Darwin identity

All student and staff conference talks and seminars use the DI logo on their slides; this included talks at the Annual New Guinea Biological Conferences in Port Moresby and in Jayapura, Indonesia, and at the PNG Department of Environment and Conservation. All training workshops conducted by UK trainers and PNG staff use the DI logo in their slide presentations. The DI website (see title page) has a DI logo on the front page. All journal publications arising from DI supported research have the DI acknowledged. In the in-flight magazine (*Paradise*) of the PNG national airline, DI was particularly mentioned as the sponsor of the PNG Supervisors' trip to the UK for training.

Although WCS/IBR and BRC were already training Honours students before this current project began, we chose specific students and supervisors for the project very carefully so that it would be distinct from other projects with independent, individual outputs. Although obviously there were interactions with other concurrent projects (for example, see section 3), Darwin support was distinct and recognised as such.

Our experience is that the Darwin Initiative is well known to, and very popular with, conservation NGOs in PNG, but there is less familiarity among government institutions like DEC and the universities. This project has helped considerably to raise the profile of the Darwin Initiative amongst these organisations.

6 Monitoring and evaluation

The project remained as outlined in the proposal and the output indicators were useful and kept us on track.

External evaluation by UPNG grading of student essays and theses showed that the program was a success. Some students in the program have already received their Honours degrees and the rest have had very favourable comments on their essays and presentations at UPNG so far. Research articles have been published in peer reviewed journals and many more will be published as students complete their work.

We also asked students to fill out anonymous course evaluations and have used these to adapt future courses; all of the comments were highly enthusiastic and many students say that this was the first time they had been exposed to many of the topics we are teaching.

6.1 Actions taken in response to annual report reviews

All reviews were discussed with project partners and any specific issues raised by reviewers were addressed in the next report. An early comment was that it would be helpful to have more information on the research projects. This was supplied in the next report (and commented upon favourably by the reviewer) and we have repeated this approach with enhanced and up-to-date information on the projects in this final report.

The main reviewers' comments centred on reporting the problems experienced with employing the UK Project Co-ordinators, how their intended work programme was covered in their absence and whether this impacted significantly on the project. As these problems took some time to resolve, early reports were necessarily inconclusive. However, we have since provided a full account of the problem and its final resolution, evidently to the satisfaction of one of the reviewers who commended the way in which these sensitive issues had been handled and the problem overcome without adverse impact on the main goals of the project.

7 Finance and administration

7.1 Project expenditure

Item	Budget (please indicate which document you refer to if other than your project application)	Expenditure	Balance
Rent, rates, heating, overheads etc			
Office costs (eg postage, telephone, stationery)			
Travel and subsistence			
Printing			
Conferences, seminars, etc			
Capital items/equipment			
Others – Honours Students			
Others – Trainers			
Others – Audits			
Salaries Mirium Supoma			
Salaries- Katayo Sagata			
Salaries- Andrew Mack			
Salaries- Neil Springate			
Salaries- Frank Clark			
TOTAL			

Budget agreed with Lisa Spencer by email 20/03/08

7.2 Additional funds or in-kind contributions secured

Additional funding and in-kind support secured for use by WCS/IBR and BRC enabled the training of a further five Honours students in addition to those included in this report. Other sources of funding were:

- Organizational development of the Papua New Guinea Institute of Biological Research, grant to IBR from the Christensen Fund (US\$60,000)
- Mapping, Flora and Fauna Documentation and Long-Term Monitoring of Mount Gahavisuka Provincial Park, grant to IBR from the Mama Graun Conservation Trust Fund (US\$9,000)
- Training the future conservation leaders of Papua New Guinea, grant to WCS from The Christensen Fund (US\$253,000)
- The Mekil Conservation Initiative, grant to WCS from the New England Biolabs Foundation (US\$10,000)
- Flying Fox research in Papua New Guinea, grant to WCS from the Lubee Foundation (US\$3,700)
- Wildlife and Eco-forestry in Papua New Guinea, grant to WCS from the European Union (US\$240,000)
- Biodiversity Conservation and Capacity Building for PNG, grant to WCS from Conservation International (US\$195,000)
- Training the future conservation leaders of Papua New Guinea, grant to WCS from Diane Christensen, (US\$90,000)
- The Mekil Conservation Initiative, grant to WCS from the New England Biolabs Foundation (US\$10,000)
- Kipiro Damas field work, grant to BRC from US National Science Foundation grant DEB0211591 (£5,000)
- US National Science Foundation grant no DEB0211591 partly funded the cost of fieldwork for Kipiro Damas (£5,000)
- Field work by L. Baje and F. Dem, grant to BRC from Czech Ministry of Education grant LC06073 (£6,000),
- Logistics for field ecology training course, grant to BRC from the University of South Bohemia (Czech Republic) (£4,000)
- 2005-2008 Vojtech Novotny (BRC) contributed time for student supervision, free of charge
- Debra Wright and Andrew Mack contributed time for student supervision and financial oversight after release from WCS jobs, free of charge, \ .

7.3 Value of DI funding

This Darwin grant has enabled the host country partners to train ten Honours students, several staff interns, conduct numerous research projects, expand collaborations, and conduct numerous training courses for students, staff and conservation professionals. Most significantly, it has helped to change the face of biological and conservation research in PNG from expatriate led to nationally led. Such a change would not have taken place without the injection both of external funding and the unique Darwin Initiative approach.

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

Project summary	Measurable Indicators	Progress and Achievements during project	
<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 		<p>(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)</p>	
<p>Purpose</p> <p>To enhance the in-country capacity of PNG to implement the CBD by postgraduate training of outstanding PNG students to become local leaders in biodiversity conservation and research.</p>	<p>a) PNG students better trained in conducting biodiversity research & monitoring</p> <p>b) Enhanced capacity to conduct and communicate biodiversity research & implement conservation policy by PNG nationals.</p> <p>c) Better characterisation of aquatic and terrestrial biodiversity associated with different land use patterns in PNG forests.</p>	<p>a) Ten honours students have either completed studies or have degrees pending. Favourable reports have been received from UPNG thesis defences, from conferences and from students attending short biological training courses.</p> <p>b) WCS/IBR and BRC DI Supervisors published research results in peer-reviewed scientific journals, and Supervisors and students presented results at conferences.</p> <p>c) Several research projects completed and results published on the topic of the impact of land-use change.</p>	
<p>Output 1.</p> <p>a) 2 training courses for PNG students</p>	<p>a) 30 participants trained in biology and biodiversity sciences</p>	<p>We held three four week long major training courses with a total of 61 participants in addition to many shorter courses.</p>	
<p>Output 2.</p> <p>b) 8 BSc. Honours students trained (18 months each)</p>	<p>b) 8 students trained</p>	<p>10 students trained (5 in first cohort; 5 in second cohort); all students submitted their research dissertations and successfully defended them in vivas; first cohort of 5 students received their Honours degrees.</p>	

<p>Output 3. c) 2 PNG local coordinators trained, including in UK</p>	<p>c) 2 PNG local coordinators receive UK-based training in taxonomic & DNA methods to implement future training courses in PNG</p>	<p>2 PNG local coordinators spent 8 weeks in UK, receiving training in taxonomy, molecular techniques & scientific method; seminars delivered by one of co-ordinators at University of Oxford and NHM. In addition they received on the job training by international instructors in PNG.</p>
<p>Output 4. d) Insect reference collection enhanced with specimens and databases</p>	<p>d) Collections enhanced at WCS, BRC, UPNG, NARI, databases online.</p>	<p>Specimen collections at WCS/IBR, BRC, and NARI were substantially added to. Database established online by BRC.</p>
<p>Output 5. e) Baseline biodiversity surveys in lowland and montane disturbed and undisturbed forests conducted.</p>	<p>e) Samples collected, sorted and analysed, museum specimens prepared, data analysed.</p>	<p>10 survey projects completed of plant, insect, bat and small mammal species and communities, including comparisons of disturbed <i>versus</i> undisturbed forests. Mammal specimens collected and housed at WCS/IBR. Research results analysed, written up and presented.</p>

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 To enhance the in-country capacity of PNG to implement the CBD by postgraduate training of outstanding PNG students to become local leaders in biodiversity conservation and research.	a) PNG students better trained in conducting biodiversity research & monitoring b) Enhanced capacity to conduct and communicate biodiversity research & implement conservation policy by PNG nationals. c) Better characterisation of aquatic and terrestrial biodiversity associated with different land use patterns in PNG forests.	a) Honours degrees awarded b) Student course reports, theses and presentations at NG Biological Conferences c) Research publications on biodiversity patterns by students and researchers	a) There are enough talented and interested students for the postgraduate training programme b) Government & local landowners will consult with and trust scientists & policy makers. b-c) Majority of participants in training courses will take up careers relevant to CBD implementation in PNG
Outputs a) 2 training courses for PNG students b) 8 BSc. Honours students trained (18 months each) c) 2 PNG local coordinators trained, including in UK d) Insect reference collection enhanced with specimens and databases e) Baseline biodiversity surveys in lowland and montane disturbed and undisturbed forests conducted	a) 30 participants trained in biology and biodiversity sciences b) 8 students trained c) 2 PNG local coordinators receive UK-based training in taxonomic & DNA methods to implement future training courses in PNG d) Collections enhanced at WCS, BRC, UPNG, NARI, databases online. e) Samples collected, sorted and analysed, museum specimens prepared, data analysed	a) Attendance lists, exam results b) 8 BSc degrees awarded; theses and reports, 8 conference presentations c) 2 seminars at NHM, 2 research publications; d) Specimens receipt acknowledged by the institutions, database evaluation by users e) 4 research publications, report to DEC	a) Active participation of students b) Students are dedicated and capable of carrying out and completing ambitious research work independently c) the PNG local coordinators is interested in broadening his experience overseas. d) sufficient time and facilities for collecting, design of ID tools, collections facilities supported by PNG institutions e) research is cutting-edge

Activities	Activity Milestones (Summary of Project Implementation Timetable)
Training: Honours programmes.	Yrs 1-2: Cohort 1, Yrs. 2-3: Cohort 2 of students enrolls, completes research, writes and defends theses
Training: Research and training coordinators	Yrs. 1-3: Training, project co-ordination and student supervision duties in PNG; Yr. 1: Two PNG local co-ordinators trained in UK
Information products & reference collections.	Yrs. 1-2: Fieldwork, databasing; Yrs 2-3: Identification tools created, reference collections and databases enhanced
Field research programme & work with landowners.	Yrs 1-3: Research conducted, Yrs. 2-3 research results summarized in technical papers but also in accessible materials to be distributed to schools & village communities; conservation recommendations to Government.

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		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	20	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation		Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	60	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	10	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		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State

Article No./Title	Project %	Article Description
Impacts		boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
16. Access to and Transfer of Technology		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	10	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution		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	BRC-1 (Darren Bito)
1b	Number of PhD qualifications obtained	
2	Number of Masters qualifications obtained	WCS- 1 obtained (Katayo Sagata) WCS- 2 pending (Eunice Dus and Enock Kaledimimo) BRC- 1 obtained (Darren Bito)
3	Number of other qualifications obtained	WCS- 2 honours degrees awarded (Kaledimimo, Dus), 3 to be completed by end of 2008 (Tau, Sagolo, Asigau) BRC- 5 Honours degrees completed with awards expected by end of 2008 (Baje, Dem, Damas, Pagi, Legi)
4a	Number of undergraduate students receiving training	WCS courses-50 BRC courses-6
4b	Number of training weeks provided to undergraduate students	WCS courses-12 weeks BRC courses-8
4c	Number of postgraduate students receiving training (not 1-3 above)	WCS-4 staff members and 5 additional Honours students BRC-2 staff members
4d	Number of training weeks for postgraduate students	WCS constant training- 3 years WCS courses- 12 weeks BRC constant training- 3 years
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	3 (Katayo Sagata and Darren Bito attended insect taxonomy and systematics training at the NHM and Kore Tau from WCS attended summer tropical biology course in

Code	Description	Totals (plus additional detail as required)
		Borneo in 2007) Approx. 20 non-student professional biologists on short term WCS courses
6b	Number of training weeks not leading to formal qualification	12 weeks
7	Number of types of training materials produced for use by host country(s)	3 (Endnote biological reference libraries at WCS and BRC, conservation biology course module for UPNG)
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	4
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	
10	Number of formal documents produced to assist work related to species identification, classification and recording.	
11a	Number of papers published or accepted for publication in peer reviewed journals	8
11b	Number of papers published or accepted for publication elsewhere	2 (Report to UNEP; Report to Coffee Industries Corporation)
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	4 main databases: BRC Lepidoptera database; NARI specimen database; FRI specimen database; PNG Aquatic Insects Collection database. Also, 10 datasets from Honours projects.
13a	Number of species reference collections established and handed over to host country(s)	2 (PNG Aquatic Insects Collections at WCS and BRC)
13b	Number of species reference collections enhanced and handed over to host country(s)	1 (aquatics insect specimens to be handed over to NARI)
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from	10 (UPNG honours theses defence by 1 st and 2 nd cohort students)

Code	Description	Totals (plus additional detail as required)
	Darwin project work	1 <i>Tropical Biology Field Course</i> seminar
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	4 (3 New Guinea Biological Conferences, 1 Society for Conservation Biology)
15a	Number of national press releases or publicity articles in host country(s)	1 (Article to <i>Paradise Magazine</i>)
15b	Number of local press releases or publicity articles in host country(s)	
15c	Number of national press releases or publicity articles in UK	2 (Article in Imperial College's newsletter, <i>I sScience</i> , Spring 2006, about Sagata & Bito's training at NHM; University of Sussex press release on <i>Nature</i> paper, 17 August 2007)
15d	Number of local press releases or publicity articles in UK	
16a	Number of issues of newsletters produced in the host country(s)	
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host	

Code	Description	Totals (plus additional detail as required)
	country (s)	
19d	Number of local radio interviews/features in the UK	
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	WCS/IBR- £3400 BRC- £3500
21	Number of permanent educational/training/research facilities or organisation established	1 (PNGIBR)
22	Number of permanent field plots established	1 BRC study site established (Wanang) 1 BRC study site maintained (Ohu)
23	Value of additional resources raised for project	
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	Novotny, V. , Miller, S.E., Hulcr, J., Drew, R.A.I., Basset, Y, Janda, M., Setliff, G.P., Darrow, K., Stewart, A.J.A. , Auga, J., Isua, B., Molem, K., Manumbor, M., Tamtai, E., Mogia, M. & Weiblen, G.D. (2007) Low beta diversity of herbivorous insects in tropical forests. <i>Nature</i> 448: 692-6.		pdf from BRC website	N/A
Journal	Bito, D. (2007) An alien in an archipelago: geographic variability in moth (Lepidoptera) communities colonizing <i>Spathodea campanulata</i> in the New Guinea and Bismarck Islands. <i>Journal of Biogeography</i> , 34, 769–778		pdf from BRC website	N/A
Journal	Balke, M. , Kinibel, A., & Sagata, K. (2007) <i>Rhantus elisabethae</i> sp.n. – a new diving beetle from Papua New Guinea highlands. <i>Mitteilungen der Münchner Entomologischen Gesellschaft</i> 97, 17-21.		pdf from authors	N/A
Journal	Balke, M. , Pons, J., Ribera, I., Sagata, K. and Vogler, A. P. (2007) Infrequent and unidirectional colonization of megadiverse <i>Papuadytes</i> diving beetles in New Caledonia and New Guinea. <i>Molecular Phylogenetics and Evolution</i> 42(2) 505-516.		pdf from authors	N/A
Journal	Sagata, K. & Lester, P.J. (2008) Behavioural plasticity associated with propagule size, resources, and the invasion success of the Argentine ant, <i>Linepithema humile</i> . <i>Journal of Applied Ecology</i> , in press; doi: 10.1111/j.1365-2664.2008.01523.x		pdf from authors	N/A
In-flight magazine	Sagata, K. (2006) From PNG to London: my stint at the British Natural History Museum. <i>Paradise Magazine</i> (in-flight magazine for Air Niugini), 5: 52-58.		pdf from authors	N/A
Report	Gilman, E., Van Lavieren, H., Ellison, J., Jungblut, V., Wilson, L., Areki, F., Brighthouse, G., Bungitak, J., Dus, E. , Henry, M., Kilman, M., Matthews, E., Sauni, I., Teariki-Ruatu, N., Tukia, S., and Yuknavage, K. (2006) Pacific Island mangroves in a changing climate and rising sea. <i>UNEP Regional Seas Reports and Studies</i> No. 179, United Nations Environment Programme, Regional Seas Programme, Nairobi, Kenya.	UNEP	WCS	N/A
Journal	Shaverdo, H. V., Sagata, K. , Balke, M. 2005. Five new species of the genus <i>Papuadytes</i> Balke, 1998 from New Guinea (Coleoptera: Dytiscidae). <i>Aquatic Insects</i> 27(4): 269 – 280.		pdf from authors	N/A
Journal	M. Balke , Hendrich, L., Sagata, K. & Wewalka, G. 2005. <i>Hydaticus dintelmanni</i> sp. N. from Papua New Guinea			N/A

	highlands (Coleoptera: Dytiscidae). <i>Linzer. Beitr.</i> 37(2): 1251-1255.			
University magazine	Bito, D. & Sagata, K. (2006) Research on the last frontier. <i>I Science</i> (Imperial College magazine) Spring 2006: 16-17.		pdf from authors	N/A
Journal	Dahl, C., Novotny, V., Moravec, J. & Richards, S. J. (in press) Beta diversity of frogs in the forests of New Guinea, Amazonia and Europe: contrasting tropical and temperate communities. <i>Journal of Biogeography</i> .			N/A
Internal report	Sagata, K. 2008. Ant species diversity, abundance and distribution and their association with Coffee Green Scales and effect of this association on coffee in Eastern Highlands Province.	Coffee Industry Corporation of PNG.		
Thesis	Kaledimimo, Enock. 2007. <i>Density, diversity and reproductive patterns of mammals in a Papua New Guinean rainforest: Implications for conservation.</i>	Honours thesis, UPNG	UPNG and IBR	N/A
Thesis	Dus, Eunice. 2007. <i>A study of carbon production of mangrove forests by measuring standing aboveground biomass and litter fall accumulation in Central Province, Papua New Guinea.</i>	Honours thesis, UPNG	UPNG and IBR	N/A
Thesis	Tau, Kore. 2008. <i>Abundance, reproduction and roost selection of the Greater Bare-Backed Bat (Dobsonia moluccensis) and the critically endangered Bulmer's Fruit Bat (Aproteles bulmerae) in Papua New Guinea.</i>	Honours thesis, UPNG	UPNG and IBR	N/A
Thesis	Sagolo, Aileen. 2008. <i>A spatial analysis of interactions between hunters and wildlife populations in Sokamin, Sandaun Province, Papua New Guinea; integrating GPS and GIS tools.</i>	Honours thesis, UPNG	UPNG and IBR	N/A
Thesis	Asigau, Samoa. 2008. <i>Impacts of subsistence agriculture on the abundance of small rodents and its relation to hunting practices in the sub-montane forest of Papua New Guinea.</i>	Honours thesis, UPNG	UPNG and IBR	N/A
Thesis	Baje, Leontine. 2008. <i>Host specificity and species richness of sap-sucking insects (Auchenorrhyncha, Hemiptera) in a lowland rainforest in Papua New Guinea</i>	Honours thesis, UPNG	UPNG and BRC	N/A
Thesis	Dem, Francesca. 2008. <i>Host specificity and species richness of phloem-sucking insects (Auchenorrhyncha, Hemiptera) in a lowland rainforest in Papua New Guinea.</i>	Honours thesis, UPNG	UPNG and BRC	N/A
Thesis	Damas, Kipiro. 2008. <i>Floristic composition and structure of lowland rain forest in Papua New Guinea</i>	Honours thesis, UPNG	UPNG and BRC	N/A
Thesis	Pagi, Toko. 2008. <i>Species richness and community composition of moths (Lepidoptera) in a lowland rainforest in Papua New Guinea</i>	Honours thesis, UPNG	UPNG and BRC	N/A
Thesis	Legi, Sam. 2008. <i>Composition of butterfly communities (Lepidoptera) along a successional gradient in lowland rainforests of Papua New Guinea</i>	Honours thesis, UPNG	UPNG and BRC	N/A

Annex 6 Darwin Contacts

Ref No	162/14/054
Project Title	Training the next generation of Papua New Guinean conservation biologists
UK Leader Details	
Name	Dr Alan J A Stewart
Role within Darwin Project	Project Leader
Address	School of Life Sciences, University of Sussex, Falmer, Brighton, BN1 9QG, UK
Phone	
Fax	
Email	
Other UK Contact (if relevant)	
Name	Prof. Alfried Vogler
Role within Darwin Project	Collaborator
Address	Natural History Museum
Phone	
Fax	
Email	
Partner 1	
Name	Ms Miriam Supuma & Mr Banak Gamui (Co-Directors)
Organisation	Papua New Guinea Institute of Biological Research
Role within Darwin Project	Host-country partner
Address	P.O. Box 1550, Goroka, EHP, Papua New Guinea
Fax	
Email	
Partner 2 (if relevant)	
Name	Prof. Vojtech Novotny (Director)
Organisation	Binatang Research Center
Role within Darwin Project	Host-country partner
Address	New Guinea Binatang Research Center, P.O. Box 604, Madang, Papua New Guinea
Fax	
Email	

Annex 7 Training and increased supervisory & managerial capacity of four Darwin co-ordinators

Mr Katayo Sagata

Katayo completed his First Class Honours degree from UPNG as a WCS intern in 2003. He has acted as the WCS/IBR Darwin Student Project Supervisor and co-ordinator since the start of the project, apart from 12 months when he was awarded a scholarship to pursue his Masters at Victoria University in New Zealand. In his Darwin role, Katayo oversaw student research projects and their general progress, co-ordinated grant activities in general and organised visits by overseas researchers and trainers. With Dr. Michael Balke, he also conducted his own research within the national aquatic insect survey, partially funded by DI. Katayo received Darwin-supported training in the UK at the NHM and digital macro-photography training at BRC. Darwin funds enabled him to attend the 9th New Guinea Biological Conference in Jayapura, Indonesia where he gave a talk on the effect of invasive ants on coffee in the highlands of Papua New Guinea. The Darwin project has enabled Katayo to grow into a confident and effective manager, supervisor, and researcher. This is amply demonstrated by his pivotal role in setting up the new NGO (PNGIBR) after the demise of the WCS-PNG programme.

Ms Miriam Supuma

Miriam completed her First Class Honours degree from UPNG as a WCS intern in 2004 and in 2006 received her Masters in Tropical Ecology from James Cook University, Australia. She had presented her work on forest demography at two international biological conferences in the US in 2004. While Katayo was studying in New Zealand, Miriam acted as the Darwin Student Project Supervisor. The experience that this supervisory role gave Miriam proved to be very useful when she needed to take over as Acting Director of WCS-PNG in March 2007. She is now Co-Director of IBR.

Mr Darren Bito

Darren was a resident student at BRC and graduated with an MSc from UPNG. He was the BRC Darwin Supervisor until he was awarded a scholarship to pursue his PhD on rainforest insect diversity at Griffith University in Brisbane in 2007. As Darwin Supervisor he oversaw all research projects, parataxonomists and PNG students at BRC. Together with Katayo Sagata, Darren received Darwin-supported training in the UK at the NHM. The opportunity that this Darwin project has given him has greatly enhanced his managerial and supervisory experience and capabilities.

Mr Chris Dahl

Chris worked as a research technician (parataxonomist) at the Christensen Research Institute (Madang) and then at BRC from 1994 to 1998, subsequently finishing his BSc in Biology at the University of PNG, and completing his Honours study sponsored by Conservation International as a resident student at WCS. He returned to BRC as the Darwin Supervisor in 2008, replacing Darren Bito, and continues to supervise research and training programmes. He is also applying to complete an MSc by research at UPNG, while remaining resident at BRC, working towards a thesis entitled: *Distribution and diversity of frogs along an altitudinal gradient in Papua New Guinea*.

Annex 8 Darwin-funded students: research project results and current placements

Mr Enock Kaledimimo (WCS/IBR)

Enock was awarded an Honours degree from UPNG in 2007 for completing an ambitious study of small mammals based on trapping, entitled: *Density, diversity and reproductive patterns of mammals in a Papua New Guinean rainforest: Implications for conservation*. Large game animals are missing in PNG, but small mammals are an important food resource for many subsistence hunters in PNG, so it is vital to learn more about their population biology in order to ensure that this resource can be sustainably managed. Enock trapped mammals for a full year in a 6.7 ha grid and along an 850m transect in undisturbed rain forest at 900-1100m asl in Crater Mountain Wildlife Management Area, Eastern Highlands Province. This was the first study of its kind in PNG and has shed light on many poorly known mammals. In addition to the expected rodents, he captured wallabies, cuscus, and quolls. He recorded 12 species from 2 families and estimated population densities per hectare for the four most common species: 43 *Stenomys verecundus*, 17 *Melomys platyops*, 14 *Uromys caudimaculatus* and 7 *Melomys rufescens*. By trapping for a full year, he was able to observe the pattern and seasonal phenology of breeding in each species. His findings indicate that random harvesting by local hunters in space and time of the four common small mammal species which occur at relatively high densities and are highly fecund may perhaps be sustainable. Research is now needed on how the hunting style of the local people impacts upon the reproductive biology of other larger mammals with lower population densities and fecundity.

Enock presented his work at the 8th Annual New Guinea Biological Conference in Port Moresby. He won a scholarship from the Christensen Fund and is currently pursuing studies for his Masters degree at the University of Missouri, St. Louis, USA.

Ms Eunice Dus (WCS/IBR)

Eunice completed her Honours degree with a project entitled: *A study of carbon production of mangrove forests by measuring standing aboveground biomass and litter fall accumulation in Central Province, Papua New Guinea*. Carbon absorption by plants is important for reducing excess carbon in the atmosphere. Therefore, studies of carbon productivity by plants are critically important for developing strategies for mitigating climate change. Mangrove trees are known to be an important carbon sink, but no previous studies in PNG have related carbon productivity to biomass production and litter fall in mangroves. Eunice conducted a study in 2005 at two sites (Brakau and Motupore Island) in Central Province, Papua New Guinea, estimating carbon cycles of mangrove forests by measuring standing above-ground biomass and litter fall accumulation. She found that the two sites differed in standing aboveground biomass and litter fall production, indicating that one site (Motupore Island) was more disturbed than the other (Barakau). Although the exact amount of carbon released into the atmosphere from disturbance to mangroves is unknown and warrants further study, disturbed forests release more carbon into the atmosphere and sequester less, thereby contributing more towards global warming. Eunice's results have shown that, compared to other forest types, mangrove forest appears to produce more carbon in leaf litter fall, demonstrating that mangroves are important for reducing atmospheric carbon, and lending support to the argument that they should be protected from disturbance.

Eunice presented her work at the 8th Annual New Guinea Biological Conference in Port Moresby. She was awarded a scholarship and is currently pursuing her Masters degree in conservation biology at James Cook University, Australia.

Ms Kore Tau (WCS/IBR)

Kore studied flying foxes (Megachiroptera) living in conspicuous communal roosts, culminating in a thesis entitled: *Abundance, reproduction and roost selection of the Greater Bare-Backed Bat (Dobsonia moluccensis) and the critically endangered Bulmer's Fruit Bat (Aproteles bulmerae) in Papua New Guinea*. These bats are extremely vulnerable to over-exploitation by subsistence hunters as an easy source of protein and in some parts of PNG cave entrances are blocked by hunters and emerging bats are killed, resulting in entire populations being exterminated in a few days. Kore spent seven months in the rugged hills of Crater Mountain surveying for bats in 14 caves and sinkholes (10 with bats and 4 without), mist-netting them for identification and reproductive information, and measuring cave parameters to see if any of the parameters affect bat selection for roosting caves. Kore's data provide population estimates and reproductive frequency patterns for montane flying foxes in PNG and identify the site parameters that will help conservationists identify which caves are most suitable for roosting bats of several species. She has also positively confirmed via mist-netting the presence of an extremely rare species of flying fox, Bulmer's Fruit Bat (*Aproteles bulmerae*) in a sinkhole at Crater Mountain; this is only the second known population of *Aproteles* in the world. On this basis, Kore recommends the imposition of a total ban on hunting of *Aproteles* bats that use sinkholes. She also suggests that Megachiroptera are important pollinators and seed dispersers in the forests of New Guinea, so local hunters need to be educated on the importance of these species for ecosystem services other than as potential food items.

Kore will complete her Honours degree in December 2008. She presented her work at the 8th Annual New Guinea Biological Conference in Port Moresby. She won a Christensen Fund scholarship to attend a Masters program in the US, but had to decline the offer due to family problems. She hopes to continue her studies in the future.

Ms Aileen Sagolo (WCS/IBR)

Aileen is using GIS to run spatial analyses of a geo-referenced wildlife dataset from WCS/IBR's large hunting study. Her study is entitled: *A spatial analysis of interactions between hunters and wildlife populations in Sokamin, Sandaun Province, Papua New Guinea; integrating GPS and GIS tools*. PNG rural communities obtain most of their protein from wildlife by hunting or fishing. Prehistoric man caused the extinction of some of New Guinea's charismatic species like the *Diprodoton*. After habitat destruction, hunting is the second most important factor in PNG leading to species extinction, so the development of sustainable harvesting methods is vital. Aileen is part of WCS/IBR's larger hunting survey team that is attempting to quantify the level of wildlife hunting in PNG and the effect it is having on biodiversity. She is using GPS and GIS to map the clan boundaries of twelve hamlets in Sokamin village (Sandaun Province), the wildlife killed within the clan boundaries over two years, and the distances travelled by villagers to kill the game. This will demonstrate whether the local people in the different hamlets have overlapping hunting grounds or not, and what this means for commonly hunted wildlife, as well as for local food security. GIS tools allow Aileen to put her data into maps that can be easily understood and utilized by villagers and can be used by conservation managers to predict hunting pressure with greater precision and manage harvests more sustainably for the Sokamin people and other communities in PNG.

Aileen aspires to become skilled at applying GIS in conservation science and is currently writing up her thesis; she plans to complete it by December 2008. Aileen has applied for a New Zealand Aid Scholarship and expects to hear the result in November 2008.

Ms Samoa Asigau (WCS/IBR)

Samoa is studying the effects of habitat fragmentation by different agricultural regimes on the distribution of rodent populations. Her research topic is entitled: *Impacts of subsistence agriculture on the abundance of small rodents and its relation to hunting practices in the sub-montane forest of Papua New Guinea*. Subsistence agriculture has been practiced by indigenous Papua New Guineans for at least 5000 years and is likely to remain the economic base of a large portion of the country's population. In the past, shifting agriculture has had limited environmental impact, so much primary forest has survived. However, the rapidly increasing human population coupled with forest destruction and unsustainable hunting practices are currently posing major threats to many small mammal species. Rodents in particular are easily caught in subsistence 'gardens' and make up a large part of the overall off-take. Samoa is investigating the abundance of rats and mice in different habitat mosaics formed by new gardens, current gardens, abandoned gardens and adjacent forests. She will also investigate whether other variables such as vegetation, hunting practices/technology and socio-economic factors such as age, wealth and education of villagers have an effect on rodent captures in garden habitats. This study is crucial for addressing food security issues in remote areas in PNG, the principles from which can be extended to other mammals whose populations are threatened by anthropogenic effects.

Samoa will complete her Honours work in December 2008. She is currently short-listed for a prestigious US Fulbright Masters Scholarship, the final outcome of which will be known in November 2008.

Ms Leontine Baje (BRC)

Leontine has been studying the diversity and host-plant relationships of typhlocybinae leafhoppers in primary rainforest habitats, working at the well-studied Ohu preservation area in Madang province. Her thesis is entitled: *Host specificity and species richness of sap-sucking insects (Auchenorrhyncha, Hemiptera) in a lowland rainforest in Papua New Guinea*. The Auchenorrhyncha (cicadas, leafhoppers, planthoppers, treehoppers etc.) are an under-worked but important group of herbivorous insects in tropical rainforest. Leontine concentrated on the Typhlocybinae, a sub-family of small, delicate leafhoppers that feed on the mesophyll sap of their hosts, and which are relatively straightforward to rear from the nymphal to adult stage to establish accurate species identity and host-plant associations. She collected quantitative samples of these sap-sucking insects from 75 rainforest tree species, enabling her to build a detailed picture of host specificity patterns. She found that most species are rather narrowly specific (to single tree species or closely-related species within genera), in contrast to the greater generalism found in phloem-feeding Auchenorrhyncha by Francesca Dem (see below). This information will be essential for assessing the extent of recovery of insect faunas after major disturbance events such as rainforest clearance.

Leontine's studies were interrupted twice by the arrival of her two babies. Although taking slightly longer than the other students because of this, she has nevertheless managed to complete and defend her thesis. She is currently working part-time at the University of PNG in Port Moresby where her family lives, but she is contemplating MSc studies.

Ms Francesca Dem (BRC)

Francesca has also been studying the diversity and host-plant relationships of sap-sucking insects in primary rainforest at Ohu, but in her case working on a taxonomically different group of Auchenorrhyncha. Her thesis is entitled: *Host specificity and species richness of phloem-sucking insects (Auchenorrhyncha, Hemiptera) in a lowland rainforest in Papua New Guinea*. She has also been rearing large numbers of hand-collected nymphs on caged tree saplings to establish their host plant associations and preferences. These phloem-feedings groups turn out to be far less host-specific than their typhlocybine relatives. They are an important component of rainforest insect diversity and merit more detailed research attention.

Francesca is presently applying for an MSc programme at UPNG as a prospective student based at BRC, with a proposed dissertation title of: *Alpha and beta diversity of sap-sucking insect communities (Auchenorrhyncha) along an altitudinal rainforest gradient in Papua New Guinea*.

Mr Kipiro Damas (BRC)

Kipiro is a Senior Botanist at the PNG National Herbarium of the PNG Forestry Research Institute in Lae. He took study leave to be resident at BRC and, with Darwin funding, he has completed his thesis entitled *Floristic composition and structure of lowland rain forest in Papua New Guinea* in 2008. He has been comparing the composition of the plant community in primary forest with that in secondary forest, using the 1ha logging plots that BRC set up as part of its NSF-funded research programme at its focal lowland rainforest field site at Wanang. All vegetation is felled in these plots, enabling a complete inventory of all plant material, including above- and below-ground biomass and total leaf area measurements. He was able to survey the species richness of the communities and the spatial distribution of all tree and sapling species with trunk diameters greater than 5cm. He found major contrasts in vegetation composition and structure, including lower diversity and lower root volume in the secondary compared to the primary forest plots.

Kipiro has returned to his position at the Herbarium, but is planning to enrol in an MSc programme in the near future.

Mr Sam Legi (BRC)

Sam used the method of standardised timed transect walks to study the composition and diversity of butterflies in lowland rainforest at the BRC field site at Wanang, specifically in relation to succession of the plant community from secondary to primary forest. Recording over 100 species, he was able to identify assemblages of butterflies that responded positively either to primary or secondary forest habitats. Apart from drawing attention to the effects of forest clearance on this insect group, such results will enable conservationists to use the composition of butterfly assemblages as surrogate measures of the level of success of programmes designed to restore primary forest after clearance.

Sam has completed his thesis *Composition of butterfly communities (Lepidoptera) along a successional gradient in lowland rainforests of Papua New Guinea* in 2008. He is presently applying for the MSc programme at UPNG as a prospective student based at BRC, with a proposed dissertation title: *Altitudinal gradient in beta diversity of butterfly communities (Papilionoidea) along an altitudinal rainforest gradient in Papua New Guinea*.

Mr Toko Pagi (BRC)

Toko has also been studying insect communities along a successional gradient. In his case, he has been recording geometrid moths caught by light trapping at night. Many geometrid species are comparatively delicate moths with relatively weak powers of flight. Previous work by BRC at other sites in PNG has shown that certain species strongly favour primary forest compared to

more open secondary forest and post-disturbance restoration sites. Pagi has recorded some 250+ species in his study, with certain species showing strong preferences for either primary or secondary forest. As with the butterflies, it is hoped that it will be possible to use the composition and structure of these geometrid moth assemblages as indicators of the successional progress of cleared forest back to primary forest.

Toko has completed his thesis *Species richness and community composition of moths (Lepidoptera) in a lowland rainforest in Papua New Guinea* in 2008. He is presently applying for the MSc programme at UPNG as a prospective student based at BRC, with a proposed dissertation topic of: *Altitudinal trends in the community structure and composition of geometrid moths (Geometridae) along an altitudinal rainforest gradient in Papua New Guinea*.

Annex 9 Photo gallery

Annual WCS biological training course



Learning to mist-net, measure and band birds.



Using sweep nets to teach mark-recapture methods for estimating population density.



Beetle marked with white nail polish for mark-release-recapture studies.

PNG co-ordinators visit Europe, Sept-Nov 2005



Katayo Sagata (left) and Darren Bito (right) being shown insect drawing techniques by David Lees (lepidopterist) at NHM.



Darren Bito (left) and Katayo Sagata (right) in molecular systematics lab at NHM.

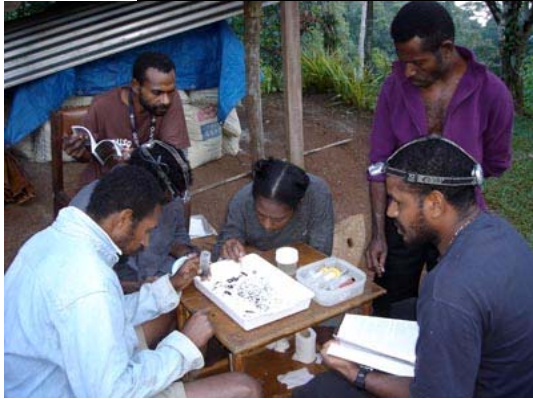


Katayo Sagata visiting ancient deciduous temperate forest in West Sussex.



Darren Bito visiting temperate forest in the Czech Republic

Aquatic Insects Field Techniques course:



Studying catches at Keki lodge



Dr Michael Balke (right) demonstrating water beetle sampling techniques.



Aquatic sampling at Madang Town Cleland Park attracting local interest



Trainees by Madang golf course pool

Leafhoppers and planthoppers (Auchenorrhyncha) **course, BRC, March 2007**



Alan Stewart discussing curation of BRC insect collection with Leontine Baje (Honours student)



Maling Rimandai (parataxonomist), Leontine Baje (Honours student), Alan Stewart and Francesca Dem (Honours student) working on identification and curation of leafhoppers at BRC.

PNG Honours students' projects



Aileen Sagolo taking GPS fix



Samoa Asigau recording field data



Samoa Asigau removing trapped rodent



Measuring leaf area and herbivore damage



Aileen Sagolo with field assistants



Taking measurements of trapped rodent



Francesca Dem sampling leafhopper nymphs



Caged saplings used for rearing sap-sucking insects



Francesca Dem processing samples in Ohu village laboratory



Enock Kaledimimo processes a *Melomys* rat caught in one of his live traps

Tropical Ecology field course, July-Aug 2008



Course participants (students, instructors, parataxonomists)



Surveying birds



Sorting light trap samples of geometrid moths



Sorting samples from project on ant feeding preferences



Analysing field data at BRC



Sharing information



Surveying vegetation plots



Sam Legi (Honours student) presenting project results to other participants on *Tropical Ecology Field Course*, at BRC seminar.

Annex 10 Publications and press release

The following papers are appended:

1. **Novotny, V.**, Miller, S.E., Hulcr, J., Drew, R.A.I., Basset, Y, Janda, M., Setliff, G.P., Darrow, K., **Stewart, A.J.A.**, Auga, J., Isua, B., Molem, K., Manumbor, M., Tamtiai, E., Mogia, M. & Weiblen, G.D. (2007) Low beta diversity of herbivorous insects in tropical forests. *Nature* 448: 692-6.
2. **Bito, D.** (2007) An alien in an archipelago: geographic variability in moth (Lepidoptera) communities colonizing *Spathodea campanulata* in the New Guinea and Bismarck Islands. *Journal of Biogeography*, 34, 769–778
3. **Balke, M.**, Kinibel, A., & **Sagata, K.** (2007) *Rhantus elisabethae* sp.n. – a new diving beetle from Papua New Guinea highlands. *Mitteilungen der Münchner Entomologischen Gesellschaft* 97, 17-21.
4. **Balke, M.**, Pons, J., Ribera, I., **Sagata, K.** and **Vogler, A. P.** (2007) Infrequent and unidirectional colonization of megadiverse *Papuadytes* diving beetles in New Caledonia and New Guinea. *Molecular Phylogenetics and Evolution* 42(2) 505-516.
5. **Sagata, K.** & Lester, P.J. (2008) Behavioural plasticity associated with propagule size, resources, and the invasion success of the Argentine ant, *Linepithema humile*. *Journal of Applied Ecology*, in press; doi: 10.1111/j.1365-2664.2008.01523.x
6. **Sagata, K.** (2006) From PNG to London: my stint at the British Natural History Museum. *Paradise Magazine* (in-flight magazine for Air Niugini), 5: 52-58.
7. Shaverdo, H. V., **Sagata, K.**, **Balke, M.** 2005. Five new species of the genus *Papuadytes* Balke, 1998 from New Guinea (Coleoptera: Dytiscidae). *Aquatic Insects* 27(4): 269 – 280.
8. **Bito, D. & Sagata, K.** (2006) Research on the last frontier. *I Science* (Imperial College magazine) Spring 2006: 16-17.
9. Press release by University of Sussex, 17th August 2007.