



Tropical Andean Butterfly Diversity
Project
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Proyecto Diversidad de las Mariposas
Andinas Tropicales



**Darwin Initiative Final Report
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Darwin project information

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UK Partner Institution(s)	Natural History Museum (NHM).
Host Country Partner Institution(s)	Venezuela: Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay (MIZA); Instituto de Investigaciones Científicas de Venezuela IVIC. Colombia: Instituto de Ciencias Naturales, Universidad Nacional de Colombia (ICN); Universidad de los Andes, Bogotá. Ecuador: Museo Ecuatoriano de Ciencias Naturales, Quito (MECN). Perú: Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima (MUSM). Bolivia: Museo de Historia Natural Noel Kempff Mercado, Santa Cruz (MHNNKM); Museo Alcides D'Orbigny Cochabamba (MAO) y Colección Boliviana de Fauna de La Paz (CBF). USA: Florida Museum of Natural History, University of Florida, Gainesville (FLMNH). Andes Region: Conservation International (CI).
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1 Project Background

The tropical Andes have the world's richest but most poorly studied butterfly fauna. The Tropical Andean Butterfly Diversity Project is an international collaboration among scientists, institutions and organizations working to establish a foundation for future research on the butterflies of this region. Outstanding achievements include the training of 180 students at 8 training courses in the five tropical Andean countries (Venezuela, Colombia, Ecuador, Peru and Bolivia), the compilation of a database of 145,262 records for 2,187 tropical Andean butterfly species, the identification of 25 high-priority areas for future research, and the identification of the first priority areas for conservation for Andean butterflies.

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

The project has helped the 5 Andean countries to meet their obligations to the CBD and its goals through:

1) Co-operation with Andean nations towards a regional conservation strategy (Art. 5: Co-operation). The project produced the first regional conservation strategy for tropical Andean butterflies by working with institutions in all five tropical Andean countries and experts from

many nations. Data on butterfly distribution were compiled not only for all Andean countries, but for all neotropical countries where Andean country species occur, ensuring that this conservation strategy has global significance. Species conservation status was assessed by project members with input from project partners at a final year workshop in Peru. Andean country coordinators contributed data to a centralized database available online, forming the first large-scale digital database to the butterflies of the region (see 4 below).

2) Identifying and monitoring biodiversity (Art. 7: Identification and Monitoring). The project helped Andean nations to identify their biodiversity by compiling distribution data from multiple collections, by providing digital images of expert-identified specimens to enable reliable identification, through a project to scan images of type specimens deposited in world museums, and by identifying priority taxa for conservation. The type-scanning project will eventually provide images of virtually all primary type specimens online, representing a permanent and invaluable resource for documenting biodiversity. By establishing the first distribution database for Andean butterflies, the project provides a vital baseline of information for future monitoring of changes in range and abundance. By providing the first assessments of IUCN threat status for species at the global scale, and by identifying restricted-range species, the project helped pinpoint priority species for future work and establish protocols for future analyses.

3) International research and training of institution staff and students (Art. 12: Research and Training). The project provided basic resources for research (taxonomy, geographic and distribution databases, type specimen images) to institutions and training in using the project database. The project also provided equipment, including laptop computers, digital cameras and entomological supplies to partner institutions. The eight training courses conducted by the project were attended by 180 students, amateur and professional lepidopterists in the five tropical Andean countries. The project disbursed \$12,000 to fund 19 student-led research projects on tropical Andean butterflies, from which data were received to enhance the project database. The final project publication identifies geographic and taxonomic research priorities based on analysis of the distribution of 721 butterfly species and expert opinion, respectively.

4) Disseminating information via the Project website and database (Art. 17: Exchange of information). The project website serves as a portal for the dissemination of information on tropical Andean butterflies, including: web-pages for each country summarizing research and knowledge of the country's butterflies, including information on institutions, projects and websites; a mailing list with several hundred subscribers; a list of key publications with PDF files for download, in particular containing the comprehensive neotropical butterfly taxonomic checklist (via the database) and bibliography (Lamas, G. 2008. *Bibliography of Butterflies. An Annotated Bibliography of the Neotropical Butterflies and Skippers (Lepidoptera: Papilionoidea and Hesperioidea). Revised Electronic Edition.*); the project database, with c. 150,000 specimen records from 95 collections in 19 countries.

5) Linking partner countries and taxonomic experts (Art. 18: Technical and scientific co-operation). The project established new links between partner countries, institutions, students and international experts by: conducting training courses attended by both students and international experts in each country; by holding workshops in Gainesville, Florida, in 2006 and Urubamba, Peru, in 2008, attended by principal project partners and international experts; and by organizing a the first scientific conference on Andean butterflies in Urubamba, Peru, in 2008, attended by a total of 120 people from 12 countries.

The Project is highly relevant to the CBD's **Thematic Programmes** of Mountain Biodiversity and Forest Biodiversity. The five tropical Andean countries form the world's most biodiverse region, in large part due to the presence of the Andean mountain chain. The great majority of species are confined to forest habitats, and east Andean foothill forests from Colombia to Bolivia have the world's richest butterfly communities. The project has thus significantly enhanced research and conservation capacity in the countries with the world's biologically richest mountains and forests. Butterflies are widely regarded as an indicator taxon for conservation of other invertebrate groups, and this project is the first to use objective and quantitative methodology to identify conservation and research priorities, which should also

apply to other taxonomic groups. The project is thus strongly relevant to the CBD's **Cross-cutting issues** (Indicators).

3 Project Partnerships

During the initial development of the project we were in contact with Andean country institutions by e-mail, telephone and many personal meetings. The Inaugural Meeting in April 2006 in Gainesville brought all project coordinators together for the first time to discuss project activities and goals. Some of the Andean coordinators and other invited specialists brought with them doubts and misgivings that had not been expressed before, allowing us to resolve many issues successfully and develop a new level of trust and understanding. Throughout the project we worked closely with all project members in planning and executing the principal activities. Visits by UK and USA project members to Andean countries to conduct student courses and to the final workshop and conference strengthened these partnerships and established many new partnerships with museums and researchers in each country. These have enabled the project to be publicised more widely and encouraged many to join our international network of several hundred students, researchers and others interested in studying tropical Andean butterflies.

The UK lead institution was responsible for the coordination of principal project activities, for housing the project's online butterfly diversity database, and for assisting in capacity building of host country institutions and students. A strong partnership between the lead institution, other UK and USA institutions, notably the Natural History Museum, London, and the Florida Museum of Natural History, Gainesville (FLMNH), and the Museo de Historia Natural, Lima (MUSM), has been instrumental throughout the project. Researchers from these four institutions led development of the butterfly specimen databases and digital image archives that will be one of the most important legacies of the project, and in providing the majority of training material for the student courses in Andean countries.

Host country institutions supported the project through databasing of specimen information in Andean collections, assisting in the logistics of the student courses, assisting with organization of the final project workshop and conference, provision of data and feedback on the IUCN species assessments, and contributing chapters and material for the final project publication. All Andean coordinators attended at least one of the student courses and gave lectures, in addition to other South American experts.

Wherever possible, all partners were consulted on key planning issues related to their country. The project did not establish an MoU. The greatest strength of the partnerships has been the common desire of all partners to further research and conservation of Andean butterflies, and to work hard to achieve this. The greatest challenge has been the lack of time available to Andean country partners in particular, virtually all of whom worked on an entirely voluntary basis for the project and with the goodwill of their employer. Our initial concept that each country would have at least one professional lepidopterist able to officially donate work time to the project proved unrealistic. Future projects of this kind should definitely seek funding to contribute to the salaries of host country collaborators and thus justify their time commitment. A further challenge has been attempting to ensure that all collaborators feel that they are receiving suitable recognition for data that they contributed, in the form of authorship on project publications. We have addressed this challenge by developing a final project publication with multiple chapters, with different project coordinators being the lead authors of individual chapters.

The project also benefited from the assistance of several former course students from 2006, who played a key role in running courses in Colombia, Ecuador, Peru and Bolivia in 2007, and in organizing the conference in 2008. Such assistance included identification and reservation of venues, reservations of hotels and transport, loan of equipment, recruitment of volunteers, provision of facilities and assistance with daily logistics during these events. A number of local companies, people and institutions and foundations contributed through generous discounts in accommodation, food and transport.

The project also received important contributions from Dr André Freitas (Universidad Estadual de Campinas), Dr Mathieu Joron (University of Edinburgh), Dr Jorge Bizarro (Mariposario "Reserva Ambiental Serelepe", Brazil), and Fernando Guerra (Colección Boliviana de la Paz), who assisted with lectures, practicals and logistics during the week-long courses in Peru and

Bolivia. Perhaps most importantly, numerous institutions have contributed researchers, curators and lecturers who have spent significant periods managing the project and attending student courses, without reimbursement from the grant. The FLMNH (USA) and MUSM (Peru) allowed Dr Keith Willmott and Dr Gerardo Lamas, respectively, substantial time to prepare lectures and practicals, assist with the organisation of courses and other project activities, attend the courses to help with training, and spend time in partner institutions to assist with curation. Other significant contributions of time of staff and curators towards organisation of courses and databasing were received from the MHNNKM and the CBF (Bolivia) (3 researchers), the Museo Ecuatoriano de Ciencias Naturales (1 researcher), the ICN, CENICAFE and Universidad de los Andes, Bogotá (ULA; Colombia) (4 researchers). Universidad de los Andes provided a substantial contribution towards the transport for the 2006 Colombia course. The MIZA and the ICN also allowed us to use their scientific research stations for the 2006 student courses for a substantial discount. The major institution for science in Venezuela, IVIC, provided the time of its subdirector Dr Angel Viloria, also contributing with transport of lecturers within Venezuela in 2006. Two owners of major private collections, Jean François LeCrom (Colombia) and Padre Francisco Piñas (Ecuador) have contributed by allowing us to database their personal collections, while the former also gave lectures at the 2006 course in Colombia at his own time and expense.

The project has built new collaborations with individual researchers who provided specimen locality data and digital images from collections. These researchers include Luis Constantino (Cali, Colombia), José Salinas (Mexico), Fabio Vitale (Lecce, Italy) (provision of distribution data for certain Ithomiinae), Maurizio Bollino (Lecce, Italy) (provision of photographs of type specimens of *Catantacta*) and Stéphan Attal (Paris, France) (provision of type specimens of Biblidinae).

A number of students from the training courses in 2006 and 2007 requested copies of our Andean butterfly database to record the data in their own private collections, and returned these data to the project to be disseminated via the online database. Finally, the project is a key collaborator in the IUCN Red List Sampled Approach, the first attempt to assess the global IUCN conservation status of ten invertebrate groups, of which butterflies are one such group. This project is described further elsewhere in the report.

4 Project Achievements

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

The project's impact is likely to be realized only after the end of the project. Project outcomes (described below) should result in a positive change in biodiversity conservation through two main mechanisms. Firstly, if at least some students from the project go on to become professional researchers in biodiversity conservation, then they are likely to train and inspire others, and thus expand the research community. Evidence of the success of such training is now being seen as at least 4 students have begun to pursue graduate degrees. Secondly, the project clearly identifies priority regions for the conservation of threatened and restricted-range butterflies, representing the first study of its kind for butterflies in the world's most biodiverse region. Based on discussion with conservation bodies such as Conservation International, we expect this study to result in a real increase in conservation funds and activities in priority regions. Securing the conservation of the priority areas identified will not only protect species of threatened and restricted-range butterflies, but also several thousand other more widespread species.

4.2 Outcomes: achievement of the project purpose and outcomes

The project should achieve three major outcomes. Firstly, access to information resources on Andean butterflies has been greatly improved. The project's website provides free access to information on research projects underway in each country and a mailing list to which several hundred students and researchers have so far subscribed and links to publications. Most importantly, the website gives access to four major resources for butterfly research and conservation. The complete (to end 2007) bibliography of works on neotropical butterflies

(Lamas, G. 2008. *Bibliography of Butterflies. An Annotated Bibliography of the Neotropical Butterflies and Skippers (Lepidoptera: Papilionoidea and Hesperioidea). Revised Electronic Edition*) is provided for download. The complete synonymic list of neotropical butterflies is provided via the project's database. The database also provides the only extensive compilation of distribution data for the region's butterflies. Finally, the digital archive of type photographs which we are currently producing will be the most comprehensive collection of its kind for any butterfly group anywhere in the world. This archive will greatly reduce the burden on students and researchers to wade through the often inaccessible or expensive primary literature to identify Andean specimens, and result in much greater data quality and reliability.

Secondly, the number and quality of South American students of butterflies have increased significantly. Students trained by the courses have not only increased resources, but also better links with other researchers, both within and outside Latin America.

Thirdly, there is now a clear direction for future research and conservation in the tropical Andean region. The project's final publication provides the only assessment of conservation priorities at an international level for any tropical butterfly fauna, and represents one of very few assessments for an Andean insect group. Such priorities should not only guide the allocation of resources for conservation, but also help students and other researchers choose regions for field work. Conservation priority areas are identified using objective methods and such methods are readily employed by any researcher with access to the project's data. We thus expect to see this type of analysis extended through studies of additional taxa.

4.3 Outputs (and activities)

The project achieved or surpassed three of its six original outputs (student training, Andean butterfly database, regional research and conservation strategy). Full details of progress and achievements for each of these outputs are provided in Annex 1.

Two of the remaining outputs (curated national collections, taxonomic revisions) are likely to be achieved only after the project has officially ended. We eventually expect to surpass our initial goal of 5 major, well-curated national collections, but this process will take time since none of the Andean country coordinators is a dedicated butterfly curator, and thus all have other time commitments. Although visits to such collections by UK and USA project members were important for demonstrating identification methods, we have also assisted numerous requests for identifications by email, and our project to scan and make available online images of neotropical type specimens should provide a very significant resource for future collections curation. We will continue to visit all the major national collections in addition to other important collections, and assist in their curation.

We have completed fewer taxonomic papers than initially envisaged, partly due to the greater emphasis that training and databasing activities received, and partly due to the fact that Andean country databases were not received until the last few months and have only recently been compiled into a single source. We expect this source to provide data for publications for many years to come, however, exceeding our initial goal of ten taxonomic revisions.

The final output, enhanced institution staff capacity for butterfly research, was completed only to some extent. The only full-time Lepidoptera curator, at the MECN in Quito, left that institution soon after the project started. The assumption that the project could contribute training to relatively junior curators at national museums subsequently proved incorrect, since no institution employed such a staff member. Instead, project coordinators were often senior members of institutions, or worked largely on a voluntary basis, and among them had an enormous range of taxonomic and biological knowledge and experience, though not necessarily in Lepidoptera. Project activities, such as workshops and courses, instead proved to be mutual learning experiences through which project members (including those from UK and USA) benefited from interaction with all other project members, rather than training being unidirectional from UK to Andean countries. Nevertheless, all project partners received our project database, together with photographs of type specimens, and we expect that these physical contributions will significantly enhance institutional capacity for future research (see also 4.6, below).

4.4 Project standard measures and publications

See Annex 4, Annex 5.

4.5 Technical and Scientific achievements and co-operation

The project has two principal scientific achievements: the identification of priority areas for future field work, and the identification of priority areas for conservation. Both form the foundation for individual chapters in the final project publication, "Priorities for Research and Conservation of Tropical Andean Butterflies".

Priority areas for field work (analysis and first draft of chapter by KW; data provided by TABDP project; comments on first draft to be provided by other co-authors, including all Andean country coordinators and other important data contributors; data not yet subject to peer review)

One approach is to simply map collecting localities for tropical Andean butterflies and to target areas that have no records for future field work. Certainly it is important to fill such gaps in our knowledge, but many poorly sampled regions are also likely to contain faunas largely similar to those from regions already well known. For example, the lowland fauna of *Adelpha* in eastern Ecuador is largely the same as that found at the mouth of the Amazon, 3000km to the east (Willmott, 2003). Nevertheless, expert knowledge of climate, topography, habitats and local faunas may be used to effectively predict which unexplored regions merit field research, and such priority areas are discussed within individual country chapters in the final project publication.

Our goal in this analysis was to provide an objective, quantitative measure of the potential significance of particular regions for future field studies. Our approach was to use data available for certain well-studied groups to provide a variety of measures of geographic research priority. We then used a combination of these measures to identify the top 25 priority areas at the level of the tropical Andean region. Our expectation is that these areas will also prove to be particularly interesting for research on more poorly known groups.

We included all genera for which we were able to obtain databased records for all tropical Andean country species from throughout the neotropics. Records from throughout the species' range are necessary to accurately estimate range size, and inclusion of groups without records for all species could bias the results towards those Andean countries or sub-regions with more extensive data. This resulted in a total of 721 species from 82 genera, with 96,691 valid, georeferenced records.

Scale of analysis: We used a 1-degree grid as an objective way to delineate areas for analysis in the tropical Andes.

Criteria for Area Selection: We used two indicators of the extent of knowledge of species: the year of description of the species name, and geographic range size. We converted the year of description of each species (Lamas, 2004) to an index ranging from 0 (described in 1758) to 1 (described in 2008 or undescribed).

A number of possible measures of geographic range-size exist, including occupancy of sites or grid cells (the Area of Occupancy, AOO), the envelope surrounding known localities (the Extent of Occurrence EOO), or the absolute area of a range predicted by experts (e.g. Expert-predicted Range Area) or by ecological niche-modelling (e.g. Niche-modelled Range Area, NRA). The AOO is strongly affected by under-sampling, particularly in inaccessible regions like the tropical Andes, and rather than representing only those sites where the species occurs, typically represents only those which have been visited by collectors. In addition, it is strongly affected by the scale of analysis. The EOO over-compensates by including within its boundaries areas of obviously unsuitable habitat. The ERA or NRA are the most accurate measures, and the latter was used in assessing IUCN status of tropical Andean butterflies, as described further below. However, the NRA requires substantial expert knowledge and exhaustive verification of georeferenced localities, and was not available for the large sample of species selected here.

Instead, we used a modified EOO, by generating minimum convex polygons (MCP) for each species using DIVA-GIS software, and clipping each polygon to remove areas of ocean,

using ArcGIS. Finally, we classified species as "montane" if the minimum reliable elevation at which they had been recorded was less than 400m, and removed areas of the MCP below this elevation. Areas of the final clipped MCPs were calculated in ArcGIS and exported to an Access database. To calculate an index of range size we rescaled the \log_{10} value of area between 0 and 1, so that species with the smallest ranges were scored as 1, and that with the largest as 0. Species known only from one or two localities were scored 1.

We then calculated the mean area index and year index for species in each 1-degree grid cell, and finally summed these to produce a measure representing both of these variables. We excluded grid cells with fewer than 20 recorded species as likely to be too strongly affected by sampling artifacts. We decided to choose the 25 priority areas by selecting the top 25 grid cells from the remaining set of cells based on this summed measure, with the condition that at each country contains at least one PA. We used mean values, rather than absolute values, of measures of species interest to identify PAs because these are less sensitive to undersampling.

None of the top 25 cells occurred in Venezuela, but since we had fewer data from that country than for other countries, and our goal was to identify at least one priority area in each Andean country, we chose the top 24 cells from the remaining Andean countries and one from Venezuela. These top 25 grid cells are referred to as Priority Areas for Butterfly Investigation and assigned names based on important butterfly collecting sites or regions, or appropriate administrative divisions.

Prioritization Among Areas: To prioritize among the 25 grid cells selected, we considered a number of other parameters of interest for each cell, including total species richness, the richness of species with restricted ranges ($< 50,000\text{km}^2$), the richness of species undescribed in 1980, the proportion of habitat modified, the mean range area index and the mean year of description index. Priority cells were ranked according to each of these measures, with higher values representing higher priority for all measures. We then calculated a mean of these ranks and a final rank of areas by this mean.

Geographic patterns of richness and endemism: The richest cell, with 299 species, is at the base of the eastern Andes in Napo Province, central Ecuador (1-2S, 77-78W) (Annex 8), also the richest cell for the two largest genera included in the analysis, *Adelpha* (Willmott, 2003) and *Theope* (Hall, 1999). A total of 92 species (13%) were classed as restricted-range, having an EOO less than $50,000\text{ km}^2$. Species known only from a few localities which have low abundance and are likely to be more widespread were excluded from this classification. Of these restricted-range species, 61 (8.4% of the 721 species studied) had a range less than $20,000\text{ km}^2$, the threshold for consideration for assessment as threatened under IUCN criteria. Restricted-range species were concentrated overwhelmingly in the mountains; 68 species (74%) were classed as montane and only 24 as lowland, despite montane species forming only 29% of the species sampled. For restricted-range species, the richer cells (8-16 species) are concentrated in the Andes between 4N and 11S, with the four richest cells in Ecuador (Annex 8). For recently-described species, five of the six richest cells (7-10 species) coincide with cells rich in all species or in restricted-range species in Ecuador and Peru (Annex 8). The sixth cell contains the Chaparé region, Cochabamba, Bolivia. All of the richest cells are in the Andes, only a handful of lowland cells contain any recently described species.

There is a clear hotspot of cells with the smallest average ranges in southwestern Ecuador (El Oro, Loja) and northern Peru (Piura, Amazonas, Cajamarca). This hotspot coincides in part with the Tumbesian region of endemism in birds and other taxa, and contains some of the most threatened habitats in the neotropics.

An obvious question is how broadly applicable are these results. The Ithomiinae comprise 40% of the included species and are unusual in maintaining similar community diversity from lowland forests to over 2000m (Willmott & Hall, unpubl.). However, the remaining groups are mostly characteristic of lowland areas, while some (e.g., *Theope*, Riodinidae) have low diversity in montane areas. Other diverse taxa not included, such as the highly diverse Pronophilina, are even more abundant and diverse in montane habitats than the Ithomiinae. It seems reasonable to conclude, therefore, that the studied species probably provide a broad sample of all butterflies and therefore that the principal results are likely to be sustained with inclusion of additional taxa.

Location of Priority Area for Butterfly Investigation and conservation implications: When measures of range size and knowledge are summed to identify the top 25 Priority Areas (PAs) for Butterfly Investigation (Annex 9), the results are similar to those for range size alone. PAs capture grid cells that are both rich in restricted-range and recently described species, as well as those that have high proportions of both of these groups, and are concentrated in a band extending from northern Peru to western Colombia, with more scattered cells outside these regions (Annex 8). Peru contains 9 PAs, Colombia and Ecuador have 7 each and Venezuela and Bolivia have 1 each. Species richness ranges from 22 to 264, with those PAs with lower numbers undoubtedly being poorly sampled. PAs are located overwhelmingly in the Andes, with 89% of the area contained within PA 1-degree grid cells being over 400m in elevation. To some extent the clustering of PAs is a result of spatial auto-correlation, or the tendency of co-occurring restricted-range species to extend across more than one grid cell, although restricted-range species occurred in an average of only two PAs.

How well do existing protected areas coincide with PAs? Protected areas cover 22% of the five tropical Andean countries, but only 11% of PAs, while 12 priority areas (almost half) have **less than 5% of their area protected**, and 4 areas (Loja, Tingo María, Cajamarca Este and Manizales) have **less than 1% protected**. Well-protected PAs include Mérida, Alto Río Pastaza, Zamora, Lita and Chaparé, with more than 22% of their area protected (Table 2).

A total of 70 out of 96 restricted-range species occur in PAs, with up to 16 occurring in a single PA (Alto Río Pastaza). The proportion of habitat modified within the PA grid cells ranged from 0% (Zamora) to 75% (Arcabuco), with an average of 28%. The average figure is higher than that for the entire tropical Andes over 400m (26%), which in turn is higher than that for all tropical Andean countries (19%), showing that **PAs tend to be located in areas of higher than average habitat loss**. Six PAs, Arcabuco, Medellín, Tolima Sur, Loja, Manizales and Nariño, have **lost more than half of their natural habitat**, of which **five are in Colombia**, the country with overall greatest habitat loss over 400m (51%).

Field work recommendations: Although our method implies that at least some data are available from a PA, this does not mean that all areas of interest within the PA have been explored. Unexplored regions within PAs are thus high priorities for exploration, to add to our knowledge of the distribution of restricted and poorly known species. Only 8% of all PAs lies within 2.5km of a known collecting site and can thus be considered "sampled" at this scale of resolution, approximately that used by us (see below) for modelling Andean butterfly species ranges. Obviously, not all unsampled regions contain suitable habitat, but even within Arcabuco, the PA with the least remaining natural habitat, 23% of the area (2900 km²) is still unsampled, natural habitat.

Aside from adding distributional data, PAs are key locations for studying populations of restricted and poorly known species. For virtually all such species there is little or no published information on abundance, population trends and phenology, habitat and microhabitat requirements, adult ecology, immature stages or hostplants. Annex 10 provides a preliminary list of restricted range species and the PAs where they are known to occur, as priority taxa for biological field studies, but clearly there are many other such taxa in groups not included in this study.

Priority areas for conservation (analysis and first draft of chapter by BH; data provided by TABDP project; comments on first draft to be provided by other co-authors; data not yet subject to peer review)

We decided to use the "Key Biodiversity Area" approach to identifying priority areas for Andean butterflies, after consultation in particular with several members of Conservation International. The KBA approach identifies sites of global conservation significance using methods applicable in all geographical regions and taxonomic groups.

Areas are delimited using global criteria and thresholds, based on the occurrence of species requiring protection at national levels. KBAs can also be defined as areas of overlap between protected areas and potential areas to protect. The criteria for identifying KBAs are very similar to those used in identifying priority areas in other groups of organisms, such as Important Bird Areas (IBAs). IBAs have been identified at hundreds of locations in many parts of the world, including the tropical Andes, but to date there is no assessment as to how effective these areas are at protecting other groups, such as butterflies. The designation of KBAs takes into account

the presence of species assessed as threatened under the quantitative criteria of the IUCN, which includes Critically Endangered (CR), Endangered (EN) or Vulnerable (VU), as well as those that are classed as range-restricted, with a range size of less than 50,000km².

IUCN Threat Assessment: To date, there are no assessments of the degree of threat available for all species of butterflies in the world. However, the IUCN is making an assessment of threat status for species in ten invertebrate groups, of which butterflies are one, as part of their Red List Index project. Their approach with these diverse groups, for which it is currently unfeasible to assess all species, is to draw a random sample of species as a representative of the conservation status of all species in the group. This Sampled Red List Index (SRLI) will be used to monitor trends in the risk of extinction, in part designed to achieve the goal set for 2010 to reduce the current rate of biodiversity loss as part of the strategic plan adopted at the Convention of Biodiversity (2002), decision VI/26 (<http://www.cbd.int/2010-target/>).

Based on studies in completely assessed groups, the IUCN decided to select random samples of 1500 species from these more diverse groups. Of these, a total of 631 species are neotropical, with TABDP responsible for all species in tropical Andean countries. However, due to data limitations in some groups, for the identification of priority areas we included only the 336 species in the families Papilionidae, Pieridae and Nymphalidae.

To analyze the distribution of selected species we used the GIS program DIVA-GIS Version 5.2 (Geographic Information System for the Analysis of species distribution, Hijmans et al 2005). This program was selected because it is easy to use (with manuals available in English and Spanish), provides several different tools for analysis and is freely available (www.diva-gis.org). Thus, the methods we have developed here may be easily replicated in future by students and researchers on Andean butterflies.

Firstly, we obtained the species Extent of Occurrence (as described above) by calculating the minimum convex polygon that contained all locality points. We then used the BIOCLIM algorithm to model species ranges based bioclimatic models supplied with the software and our compiled locality data. Bioclimatic variables selected were the average values of annual temperature and precipitation, both known to be meaningful in terms of butterfly species ranges. The area predicted to be bioclimatically suitable for each species was then clipped by hand by drawing a polygon around predicted areas lying within the known geographic range (as defined by actual locality records). Finally, we used a vegetation layer to further categorize the range by modified and unmodified habitat. The area of the final range within unmodified habitat was calculated and treated as equivalent to the Area of Occupancy.

Only two of the criteria provided by the IUCN (B and D) were usable for assessing threat status of tropical Andean butterflies. These criteria are based on the Extent of Occurrence (Criterion B1) or Area of Occupancy (Criterion B2), and the number of localities where the species has been recorded (D2). In addition, we used the number of locations from which a species was known, and the extent of habitat loss throughout its range, as additional criteria to determine final threat status.

The first criterion for selection of a KBA, that of vulnerability, requires the presence of at least 30 individuals or 10 couples of a Vulnerable species (VU) for an area to be considered as a KBA. Since we have virtually no population data for butterflies, we assumed that the presence of a species was likely to indicate at least this size of population. The second, alternative, criterion requires the presence of 5% or more of the species global range within an area for the area to qualify as a KBA. We used DIVA-GIS to calculate the area of each species range occurring within each potential KBA (see below) to determine whether that area qualified based on that species.

It is recommended that an initial set of KBAs be selected by evaluating existing protected areas for KBA status, with the rationale that it is easier to increase protection for an area that already has at least some protection. We therefore initially evaluated all protected areas in the tropical Andes as included within the 2007 World Database on Protected Areas (www.wdpa.org/Default.aspx). Subsequently, for the first criterion of Vulnerability, we also evaluated Important Bird Areas, because these sites have been established for the Andean region and have good information concerning the limits of threats and habitat. Using established sites, which have already been tested with other groups, avoids duplication of effort

in setting priorities for conservation, which is important in times when resources for research are becoming increasingly limited.

A preliminary list of 90 priority areas for the conservation of Andean butterflies was selected based on the KBA methodology. The highest concentration of KBAs is in Colombia (27.7%), Peru (25.5%) and Ecuador (23.3%), countries that also have the greatest diversity of butterfly species, while Venezuela (15.5%) and Bolivia (7.7%) had the lowest percentages respectively.

Almost half of the KBAs have also been proposed as IBAs. It is notable that several sites are conservation priorities for both butterflies and birds. These sites that are important for both groups can now justify increased conservation attention, especially those that are not yet protected (9 of the 90). A number of KBAs have no formal protection, and we are currently working to define the limits of these areas.

Most importantly, the list of suggested KBAs is dynamic, and we expect others to use the methods that we have developed to propose additional areas as new distribution data and species assessments become available. Designated areas should also be priorities for field work to establish the continuing presence of species often inferred from modelled ranges or historical records, as well as to add knowledge of additional priority species which might help strengthen the case for conservation of an area.

4.6 Capacity building

Building the capacity of host countries to conduct research on tropical Andean butterflies has been the primary goal of this project. Partner institutions benefited from their members assisting at workshops, conferences and courses, from the receipt of equipment for butterfly research (laptop computers, digital cameras, field and museum supplies), from the receipt of information (project database, taxonomic checklist, locality gazetteer, type specimen images), and from co-authorship on chapters in the final project publication. Students benefited from the training courses, materials supplied at these courses, funding for field work, and interaction with project members and other international contacts established through the project. All of these activities are described more fully in Annex 1, Annex 4 and in previous annual reports.

4.7 Sustainability and Legacy

The project achievements most likely to endure are the digital information resources developed by the project, and the results of student training. The complete checklist of neotropical butterfly names previously compiled by GL and made available online by the project will remain a vital resource for all future taxonomic research. The development of an image archive of type specimens means for the first time since the start of zoological nomenclature in 1758, it will be possible for virtually any researcher anywhere in the world to examine critical name-bearing types of almost all neotropical butterflies, specimens that are otherwise scattered among dozens of museums around the world. KW, GL and BH will continue to update these digital resources as part of their long-term research programs.

We are extremely encouraged by the breadth of interest in neotropical butterflies as evidenced through the student courses. We believe that these courses have provided key opportunities for students to make life-long contacts, and have served to encourage them to pursue graduate degrees and maintain their interests in butterfly research. The impact of new researchers on tropical Andean butterflies will be realized only after years, or even decades, but is likely to endure.

All of the project coordinators remain committed to research on tropical Andean butterflies. We were very pleased that BH secured the position of curator of Lepidoptera at the Natural History Museum in London, a prestigious position at the world's largest collection. This should enable her to continue to pursue research on neotropical butterflies as well as train new researchers. All other project coordinators have academic or museum positions in Entomology, and will hopefully continue to be involved in butterfly research, with the exception of the Bolivian coordinator, José Luis Aramayo (JLA). JLA is exploring the possibilities of setting up a live butterfly exhibit in Santa Cruz, Bolivia, and we are trying to find funding to enable him to spend 1-2 weeks at the McGuire Center's butterfly exhibit at the University of Florida for him to learn

essential techniques. Project partners will definitely remain in contact in future, and we are working actively to seek funding for further collaborative projects.

5 Lessons learned, dissemination and communication

Lessons learned:

Two most important lessons were learned. Firstly, whatever the background of staff members of Andean country institutions, both UK project members and Andes country project members were able to learn from one another during project activities such as the student courses and workshops. Future projects should focus on conducting activities that are scientifically valuable and simultaneously develop skills and knowledge of both UK and foreign participants. For example, rapid inventory surveys to priority regions could also serve to demonstrate field techniques and develop identification skills, curatorial methods and data management practices, while also achieving a real goal in increasing scientific knowledge. Secondly, virtually all Andean country coordinators worked on an entirely voluntary basis for the project and with the goodwill of their employer, and were thus constantly short of time. Our initial concept that each country would have at least one professional lepidopterist able to officially donate work time to the project proved incorrect. Future projects of this kind should definitely seek funding to contribute to the salaries of host country collaborators and thus justify their time commitment.

Dissemination and communication:

The project website remains our primary means of disseminating information and resources resulting from the project to the worldwide audience. The website contains links to publications by project members, country profile pages that provide information about current projects in each Andean country, and links to download manuals and other project publications.

The online database is of course the main point of access to the specimen locality data digitised by the project, as well as digital images of type and other specimens. During its first ten months online, when records were kept, a total of 136 people registered to use the project database, representing 24 countries (8 South American countries [75 users, of which 67 are from the five host countries], 12 European countries [36 users], USA [19 users], Russia [2 users], Canada [2 users]). These users consist of 77 university students, 62 non-students, and 2 school students.

The TABDP network in our website has been a key space to exchange ideas and questions between Andean butterfly enthusiast and experts, and new members continue to join. We have advertised job opportunities, scholarships, butterfly related events and project activities.

A poster detailing progress and achievements of the project to date was presented at the second International Conference on Neotropical Butterflies ELEN in the city of Panama in May, 2007, at the 5th International Conference on the Biology of Butterflies in Rome, Italy, in July 2007, and at the 1st International Conference on Andean Butterflies in Urubamba, Peru, in September 2008. The poster has generated considerable interest and a number of new student links and other collaborations have been established. The poster is now permanently displayed in the Natural History Museum, Department of Entomology, to provide visitors to the world's largest butterfly collection with information on the project.

A substantial amount of information on tropical Andean butterfly research and the results of the project to date were disseminated during the 2007 student courses and on CD-ROM to participating students, as described elsewhere in this report.

The project's final workshop in Urubamba, Peru, in 2008, provided a key opportunity for project members to describe activities undertaken during the project. BH and KW gave a talk summarizing project activities and achievements within UK and partner institutions outside the tropical Andes. Talks were given by national coordinators on the project's results, with recommendations for each country (see <http://www.andeanbutterflies.org/news.html>). Talks and discussion sessions on identifying priority areas and on the IUCN Red List assessments also described major project activities.

The conference organized by the project in Urubamba, Peru, 2008, began with a talk by BH and KW describing the project's activities and achievements to the 120 conference registrants.

BH gave a talk about assessing prioritizing and conserving neotropical butterfly faunas, based on the project's work.

BH presented the results of the project's analysis of conservation priorities for Andean butterflies as a talk at the International Congress for Conservation Biology (23rd Annual Meeting of the Society for Conservation Biology) in Beijing, China, 11-16 July 2009.

The project's final publication "Priorities for Research and Conservation of Tropical Andean Butterflies" will summarize and present all of the project's main findings and conclusions. This book will contain 10 chapters identifying geographic priorities for research and conservation, and identifying priority groups for taxonomic and biological research. The book will be bilingual, in English and Spanish, and free copies will be given to country coordinators to distribute among institutions and agencies. A free PDF copy of the book will also be available via the project website.

All of the UK and USA project members, and most of the South American coordinators, have been committed to research on tropical Andean butterflies for their entire professional careers. There is thus no doubt that we will continue to gather and disseminate information on tropical Andean butterfly diversity beyond the lifespan of the project. Indeed, our main hope is that this project will provide a foundation for project members and students to apply for funding to greatly expand future research on Andean butterflies. The FLMNH has agreed to host the project's website and provide server space for data and images for the foreseeable future, thus providing us with a permanent platform for dissemination of information.

5.1 Darwin identity

The project has publicised the Darwin Initiative in diverse ways, as detailed below. The project supported by DI was a distinct project with a clear identity, although we received funding from other sources for certain project activities. As a result of the project, the identity and mission of the Darwin Initiative is now very familiar to the several hundred students, institutional staff and lepidopterists who attended the workshops, training courses and conference organized by the project, in addition to all those who visit the project website and use the mailing list.

Efforts to publicise the Darwin Initiative include:

1. The project's website bears the DI logo at the top of each page, and the project's online database is named the "Darwin Database of Andean Butterflies".
2. A poster detailing progress and achievements of the project to date was presented at the second International Conference on Neotropical Butterflies ELEN in the city of Panama in May, 2007, and at the 5th International Conference on the Biology of Butterflies in Rome, Italy, in July 2007. The poster is now permanently displayed in the Natural History Museum, Department of Entomology. BH gave a talk on the project's conservation results at the International Congress for Conservation Biology (23rd Annual Meeting of the Society for Conservation Biology) in Beijing, China, 11-16 July 2009.
3. All eight student courses, with 180 students registered, began with an introductory talk on the project and its prime funding agency, the Darwin Initiative.
4. The international conference, with 120 registrants, began with a summary of the project, including recognition of the role of the Darwin Initiative. All printed materials at workshops, courses and the conference prominently carried the Darwin Initiative logo.
5. The competition for small-project grants in 2007-2008 was supported entirely by the project. All projects were required to acknowledge DI for support in any resulting publications, which so far include one journal article and one book (see Annex 5).
6. Other publications by project members which have benefited from project activities acknowledge and will continue to acknowledge DI's support (see Annex 5).
7. The final project publication should be of international significance, and will prominently display the DI logo and acknowledge the support of DI.

6 Monitoring and evaluation

The project had three main aspects: training, data gathering and data analysis. These were monitored in several ways.

Tangible outputs

Progress on training was assessed by the numbers of students registering for courses and for the competition for student-led field research grants. Progress in compiling information on distribution of tropical Andean butterflies was evaluated via the number of records in the project database, the number of species represented and number of distinct localities represented. The number of butterfly images and species with images permitted assessment of progress towards a complete taxonomic digital archive for the region, discriminating between type and non type specimens. Ultimately, whether the database contributes towards an increased knowledge of Andean butterflies may only be judged in the long-term from the number of publications that use its information.

Written reports

All national coordinators were requested to provide an annual written report to us on their activities and progress in the project. In addition, Conservation International required a 6-monthly report to assess progress in databasing. In practice, reports were received only from some countries, and addressing only to some extent the questions posed in the guidelines that we sent out. As discussed elsewhere, without official time allocated to project activities most coordinators did not have time to complete reports on annual progress. Instead, physical meetings such as the workshop in 2008 were much more effective means to assess more qualitative aspects of the project. Coordinators did suggest the inclusion of additional collections in future data gathering activities, inclusion of additional groups, and the creation of distribution maps for species (which will be completed for restricted range species).

The logframe indicators were useful in providing targets for project activities, though in practice fail to capture important additional information. For example, our original goal to train 250 students was not achieved, but nevertheless the original assumption had been that the great majority of such students would have no prior or subsequent interest in butterflies, and that such a number would be needed to ensure at least some students continued in this field. In practice, the majority of students did have prior experience and showed commitment to continue with research after the courses, thus exceeding our expectations. The M&E system is time-consuming but did provide a useful guide of the types of information to present in the project website as indicators of progress to project coordinators as well as others.

The only evaluation of the project was that done by DI based on the annual reports. In general, evaluations were useful in highlighting aspects of the project which would require special emphasis in the future (see 6.1).

6.1 Actions taken in response to annual report reviews

We responded to all issues raised in reviews of the annual reports. Reviews were discussed with partners in USA (KW) and the Andes region coordinator (GL), but not other South American collaborators, principally because of the time constraints on those project members.

7 Finance and administration

7.1 Project expenditure

Tabulate grant expenditure using the categories in the original application. Please provide details of the Capital items and also provide a breakdown of salaries. If the budget was changed following the Stage 2 application, please clarify this and highlight agreed changes to the overall budget. Explain any variation in expenditure where this is +/- 10% of the approved budget lines (note 'other' is not an approved category).

DEFRA Darwin Initiative Funding

	CLAIM PERIODS	Apr-Sep 05	Oct -Dec 05	Jan-Mar 06	Apr-Jun 06	Jul-Sep 06	Oct-Dec 06
Staff Costs							
Rent, rates, heating, lighting, cleaning							
Postage, telephone, stationery							
Travel and subsistence							
Printing							
Conferences, seminars etc							
Capital items							
Others							

TOTAL SPEND

ADJUSTMENTS BY DEFRA

TOTAL INCOME

Jan-Mar 07	Apr-Jun 07	Jul-Sep 07	Oct-Dec 07	Jan-Mar 08	Apr 08-Mar 09	Apr-Jun 09	TOTAL	% orig
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These figures have been provided by Research Grants at UCL, who have kept full records of all expenditures for the project. (Ref: Priya Gajiparia, 22 July 2009).

Breakdown of staff costs

Total:

Blanca Huertas H.:

Prof. Gerardo Lamas M.:

Breakdown of capital costs

Capital Items:	£
HP Printer/Acer travel laptop/hard-disk	
Camera	
Expenses notified by Biology Dept	
Jessops colour and monochrome standard card	
Laptops	
Samsung R40 laptop	
Computer accessories	
Field work equipment various	
Toshiba Satellite PRO	
Expenses notified by Biology Dept	
Canon DR Scanner	
Satellite Pro U400 10H Laptop	
Samsung X65 C2D Laptop	
TOTAL	

Breakdown of "Other" costs

Other Costs:	£
NHM Bench Fees	
Miscellaneous expenses for TABDP courses	
NHM Bench Fees	
Website Design and Analysis	
NHM Bench Fees	
Propionic Acid	
NHM Bench Fees	
University of Florida -- initial database setup costs	
TOTAL	

Justification of overspends and underspends

Some expenditure categories proved less or more than originally predicted (see "% orig." column on RH side of table). Large items, such as staff costs typically deviated by an acceptable <10%, while most of the deviations >10% were in the smaller categories, and were therefore in total monetary terms not very significant. The major exception is travel and subsistence (see (b) below).

a) Postage, telephone, stationery (74%) was less than predicted. However, some of these costs can be considered to have taken place on the budget item "Others," which was overspent.

b) Travel and subsistence (122%) became much more expensive during the lifetime of this grant, due to fuel costs and other vagaries in the prices of air and land travel, and this was not predictable at the time of the original budgeting.

c) Capital items (129%) differed due to agreed purchase of some different items of equipment than originally predicted, particularly a bulk scanner for photographs of type specimens in Lima, Peru. The scanner remains in Peru. "Expenses noted by biology Dept." consist of items such as miscellaneous chemicals from the Biology Store, and toner for laser printers. Thus, some of these might be considered to come out of Postage, telephone, stationery, or Conferences, Seminars.

d) "Others" (119%) also differed somewhat, but most of this difference can be assumed to be expenditure that could have been assigned to other categories such as Postage etc., and Rent, Rates etc. (see also (a), above).

7.2 Additional funds or in-kind contributions secured

The project secured an additional £32,529 above the confirmed matching funding identified in the original project proposal (£139,081, including salary costs and waived overheads on personnel costs at UCL, University of Florida, bench fees at Florida, etc., as per original proposal). These extra funds include FLMNH contribution for the workshop in 2006 [£5882]; additional travel costs [£250]; overheads [£8,007] and salary time of principal project members [£12,361] resulting from the extended duration of the project; contributions towards the courses from AndinoNET [£1110], WWF Bolivia [£890], BioQuip [£140], and Universidad de los Andes [£500]; additional contribution from Conservation International above original agreed total [£390]; FLMNH contribution towards publication costs [£3000]. Numerous volunteers and researchers contributed unquantified time in helping with the student courses, workshop and conference, and in databasing specimens.

7.3 Value of DI funding

The entire project would not have taken place without DI funding. DI funding was critical to conducting the student courses and workshops and to providing the impetus to begin the databasing in South American collections.

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

Project summary	Measurable Indicators	Progress and Achievements August 2005 – June 2008	Actions required/planned for next period
<p>Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve</p> <ul style="list-style-type: none"> • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources 		<p>The project has achieved the goal of provision of data and training to staff and students in the five tropical Andean countries, which contain the world's richest butterfly faunas. The first identified set of priority areas for research and conservation should be of real value to conservation agencies seeking to prioritise and justify use of resources.</p>	<p>(do not fill not applicable)</p>
<p>Purpose To establish a regional research programme and conservation priorities for tropical Andean butterflies, through improved knowledge of their diversity, distribution and abundance.</p>	<p>Enhanced institutional capacity for butterfly research and conservation</p> <p>Synthesised knowledge of butterfly diversity, distribution and abundance</p> <p>Current and future priorities for research and conservation identified.</p>	<p>Enhanced institutional capacity: Because our assumption that institutions would employ curatorial-level staff directly involved in butterfly research proved incorrect, the project's contributions to training institution staff has been less extensive than anticipated. Nevertheless, important resources, such as data (taxonomic, distribution, locality) and images (of type specimens) will remain a permanent legacy which should significantly enhance the ability of staff to conduct butterfly research. In addition, the project's contributions to training students have been extremely successful, with at least four former students now pursuing graduate degrees. We are optimistic that these researchers will have a strong future impact in their own countries.</p>	<p>The project website and database will continue to be maintained and updated by KRW, hosted at the FLMNH. BH, KRW and Andean collaborators will be actively seeking funding to capitalise on the project's achievements, in particular by conducting field work in priority regions, gathering data on priority species, and seeking to advance the training of the most promising students.</p>

		<p>Synthesised knowledge: The project has been very successful in achieving its goal of synthesising distribution data for key groups of Andean butterflies. The project database is the most extensive online source of distribution data for South America. The archive of type photographs represents an invaluable resource for research.</p> <p>Priorities for research and conservation: Data gathered by the project have been used to identify the first set of geographic priorities for research and conservation of tropical Andean butterflies. In addition, the project has identified a number of threatened or restricted-range species, which should be targets for future study. With the large and enthusiastic body of students trained by the project, we expect that these priorities will have real value in guiding future research.</p>	
<p>Output 1. Enhanced institution staff capacity for butterfly research.</p>	<p>10 staff from 5 partner institutions trained in identification, curation, databasing and grant proposal writing.</p>	<p>Our project coordinators and other partner institution staff have an enormous range of taxonomic and biological knowledge and experience. Our goal has been for all to understand basic aspects of butterfly systematics, biology and conservation, and practical aspects such as databasing protocols and photography techniques. Project activities have contributed substantially towards this goal, but, most importantly, these activities have been mutual learning experiences through which project members (including those from UK and USA) have benefited from interaction with all other project members, rather than training being unidirectional from UK to Andean countries. Our indicator thus proved to be somewhat inappropriate. Nevertheless, all project partners received our project database, together with photographs of type specimens, and we expect that these contributions will significantly enhance institutional</p>	

		capacity for future research.
Activity 1.1. Project planning and training workshop		The project planning workshop took place in Gainesville, April 2006, and presented lectures on many aspects of butterfly biology and systematics to 12 Andean country project members, 1 representative from CI, 2 UK project members and 1 USA project member. Specimen databasing and running of student courses was discussed.
Activity 1.2. Work with Andean country project members in Andean countries		Keith Willmott and Gerardo Lamas spent at least 3-5 days (often much more) in each tropical Andean country working at major public and private collections to identify and curate collections, during the process helping project partners and students to learn new techniques for identification of difficult groups.
Activity 1.3 Student courses		All attendants at the eight student courses, including project leaders and country coordinators, learnt new skills and improved their knowledge of tropical Andean butterflies through interacting with colleagues and students.
Activity 1.4. Data analysis workshop		The workshop in 2008 involve project coordinators and other taxonomic experts to analyse data gathered in the project towards producing the regional strategy. Interested attendants were taught methods for assessing species conservation status using IUCN criteria and methods for analysing and modelling species ranges using bioclimatic data in DIVA-GIS. We hope that these skills will be invaluable to our project partners in conducting similar, more focused studies in each Andean country, in part using data compiled by the project.
Output 2. Students trained in butterfly systematics, field survey methods and data analysis.	Field survey manual; 1 student-training workshop of 1 week per country per year (25 students per course, total 250 students). 40 students receive further training and support for dissertation research.	One-week student courses were conducted in 4 Andean countries in both 2006 and 2007, at which 180 students attended, in addition to project coordinators. A total of 19 student-led research projects and 36 students were supported by the project, with many conducting dissertation research. Although we trained fewer students than initially envisaged, the level of training has been much higher. Two Ecuadorian students and two Colombian students have subsequently been admitted to graduate degree programmes at the University of Florida (3 students) with one of the project leaders, and at the Universitat Autònoma de Barcelona in Spain (1 student). A draft of the field survey manual is complete, but still requires some work before being made available online. This remains a goal of KW and BH.
Activity 2.1. Training courses		A total of eight 1-week training courses were conducted, in Venezuela (2006), Colombia (2006, 2007), Ecuador (2006, 2007), Peru (2007) and

	<p>Bolivia (2006, 2007). In 2006, a total of 104 participants attended. These included 49 undergraduate students, 9 MSc students, 3 international PhD students, 4 Andean PhD students, and 39 other professional and amateur lepidopterists. In 2007, a total of 76 participants attended, including 54 undergraduate students, 7 MSc students, and 15 other professional and amateur lepidopterists. Courses in 2006 were introductory, those in 2007 were introductory, intermediate or advanced, depending on the perceived need in each country.</p>
Activity 2.2. Production of training materials	<p>The project has produced two manuals for museum research: one for use of the Darwin Butterfly Database and one for photography of butterfly specimens. A total of c.35 Powerpoint presentations were produced for the student courses and distributed to students on CD. In addition, these CD's contained a table of grant opportunities, a list of contacts of other course participants, protocols for field work, two computer programmes for data analysis (available free from the Internet), and c. 600 scientific articles (PDF) on butterfly systematics and biology, and related topics.</p>
Activity 2.3 Website and Lepidoptera specialist network	<p>Our website (www.andeanbutterflies.org, www.mariposasandinas.org) (live in May 2006) is available in English and Spanish, with background information on the project, research projects underway in each country, student courses and links to publications. It offers a mailing list to which several hundred students and researchers have so far subscribed, with several messages exchanged each week concerning requests for information, help with identification, job and grant opportunities, and the website's periodic photo identification competition. The website's URL has just been renewed by KW (until 2012) and he will continue to maintain the site as a general portal for information on tropical Andean butterflies, including the project's Darwin Andean Butterfly Database.</p>
Activity 2.4 Butterfly data supplied to students	<p>A total of 77 university students registered to access data at the project's online butterfly taxonomy and distribution database during the first ten months of these data being accessible. User statistics are no longer being collected.</p>
Activity 2.5 Student research projects	<p>We announced a competition for small grants (\$300-700) to assist with student research projects. We received applications from 36 groups of students, the great majority of whom attended the training courses, from Colombia (21), Ecuador (2), Peru (5), Bolivia (6), Chile (1) and Guatemala (1). A total of 19 projects were supported with small grants totalling c. \$12,000 in 2007-2008. Students received feedback on their project proposals, development of survey methods, data analysis and identification of specimens, both via e-mail and during the training</p>

		<p>courses. A number of students gave presentations on their findings at the courses and conference. Students also provided project reports and data to be made available on the project website.</p>
Activity 2.6. I International Conference on Andean Butterflies		<p>Partly in response to overwhelming interest among students at the courses conducted by the project over the last 2 years, and partly to encourage international experts to also attend the workshop, the project organized the First International Conference on Andean Butterflies in Urubamba immediately after the workshop. Although our DI grant provided no financial support to the conference (instead, we received contributions from Conservation International and other research grants, as well as some payments by the conference participants themselves), we nevertheless feel it is an important outcome of the project and acknowledged the Darwin Initiative throughout. A total of 120 participants registered at the conference, from 12 countries, including 87 from the five tropical Andean countries, the great majority students. This provided an invaluable opportunity for students to meet with international researchers and establish new collaborations. There were 50 talks and c. 20 posters presented, with prizes for the best poster, best undergraduate and best graduate student talk. See Annex 12 for the programme and abstracts.</p>
Output 3. Curated national collections.	National collections (minimum of 5, 1 per country) curated and identified.	<p>We expect to surpass our initial goal of 5 major, well-curated national collections, though only after the completion of the project, given that none of the project coordinators is a dedicated butterfly curator and thus all have time constraints. While visits to such collections have been important for demonstrating identification methods, we have assisted numerous requests for identifications by email, and our project to scan and make available online images of neotropical type specimens should provide a very significant resource for collections curation.</p>
Activity 3.1. Curation of lead institution collections		<p>Project members visited to help curate collections at the MIZA (Venezuela), MECN (Ecuador), MHNNKM (Bolivia) and ICN (Colombia), curating particular problematic groups of butterflies and teaching such skills to curators and assistants. GL works full-time at the MUSM (Peru) and maintains this as the best curated collection in the Andean region. We will continue to assist curators to update these collections by providing type specimen images and distribution data from other museums which help in identification.</p>
Activity 3.2. Curation of other important collections		<p>We have been assisting in the curation of four additional important collections. JM has identified the Heliconiinae and KW has been identified Ithomiinae in the collection of Jean LeCrom (Colombia). KW also spent 2</p>

		days working in the collection of Padre Francisco Piñas (Ecuador) and 2 days at the collection of Yuvinka Gareca (Bolivia – to be deposited in the MHNNKM).
Output 4. Darwin Andean Butterfly Database.	Taxonomic and photographic database established; NHM, MCLB and partner collections databased (3500 species, 150,000 specimens).	The project has established a complete (as of 2004) taxonomic database for neotropical butterflies, and an extensive locality database. For the final project analysis, a database containing 235,000 records of 3350 tropical Andean butterfly species was compiled, from records databased as part of the TABDP project (c. 147,000 records, 2583 species) and additional contributions from collaborators (c. 90,000 records). The data are especially extensive for Papilionidae, Pieridae and some Nymphalidae (Ithomiinae, Limenitidinae, Melitaeini. Species with potentially restricted ranges that were being assessed using IUCN criteria (see Output 6) were also databased at the NHM and FLMNH. A virtually complete collection of print photographs of neotropical type specimens in Lima has been scanned (27,000 images) and is being digitized. All project data will be available via the project website.
Activity 4.1. Taxonomic database		The complete synonymic checklist of neotropical butterflies (Lamas, 2004) was converted into a Microsoft Access database table, and currently contains 28,134 names applicable to 7846 species . The database is available in copies of the project database distributed to collaborators and on the project's website.
Activity 4.2. Locality database		The locality database contains 14,304 records from all neotropical countries, of which 6,441 are georeferenced . Georeferencing focused on localities for restricted-range species in particular.
Activity 4.3. Databasing of specimens at NHM (London)		Papilionidae, Nymphalidae (Melitaeini), select Pieridae and and priority IUCN list species were databased as part of the TABDP project (26,805 records).
Activity 4.4. Databasing of specimens at FLMNH (Gainesville)		A total of 23,942 records were available for specimens at the FLMNH, from multiple groups, but especially Pieridae, Ithomiinae, Heliconiinae, Biblidinae. The great majority of these records were compiled by project members through the course of the project and from collaborators.

<p>Activity 4.5. Databasing of Andean country collections</p>	<p>A total of 96,651 records were databased by project members in Andean country collections throughout the project, as follows:</p> <p>Venezuela (7333 records):</p> <ol style="list-style-type: none"> 1. Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay: 1100 records 2. Romero family collection, Maracay: 6233 records <p>Colombia (6870 records):</p> <ol style="list-style-type: none"> 3. Collection not recorded (TABDP student grant databases): 2934 records 4. Instituto de Ciencias Naturales, Museo de Historia Natural, Bogota: 1889 records 5. Jean F. Le Crom collection, Bogotá: 2047 records <p>Ecuador (26,687 records):</p> <ol style="list-style-type: none"> 6. Museo Ecuatoriano de Ciencias Naturales, Quito: 5292 records 7. Francisco Piñas collection, Quito: 21,395 records <p>Peru (10,858 records):</p> <ol style="list-style-type: none"> 8. Collection not recorded (TABDP student grant databases): 1268 records 9. Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima: 9590 records <p>Bolivia (44,903 records):</p> <ol style="list-style-type: none"> 10. Centro de Biodiversidad y Genética, Universidad Mayor de San Simón, Cochabamba: 909 records 11. Colección Boliviana de Fauna, La Paz: 14,493 records 12. Museo de Historia Natural, Noel Kempff Mercado, Santa Cruz: 28,044 records 13. Museo de Historia Natural Alcide d'Orbigny, Cochabamba: 1457 records
<p>Activity 4.6. Other records</p>	<p>An additional 90,000 records were obtained for analysis by the project from the personal research databases of KW, GL, Jason Hall, and Neil Rosser, mainly comprising Ithomiinae, Limenitidinae, Heliconiinae and Ecuadorian butterflies.</p>
<p>Activity 4.7. Online database</p>	<p>The project's online Darwin Database of Andean Butterflies (www.mariposasandinas.org/database.html) is the most extensive online source for distribution data of South American butterflies, and features: "species summary search", a summary of distribution data and type photographs of all subspecies for any given species; "taxonomic list search", capable of reproducing any part of the entire neotropical butterfly checklist complete with higher taxa, synonyms, authors, original genus of</p>

	<p>description and type locality; “specimen and image search”, which will return data or images from the database according to geographic and taxonomic criteria; and a “species name search”, allowing searches for any species or subspecies name and providing taxonomic and type specimen information and images. During its first ten months online when user-statistics were recorded, a total of 136 people registered to use the project database, representing 24 countries (8 South American countries [75 users, of which 67 are from the five host countries], 12 European countries [36 users], USA [19 users], Russia [2 users], Canada [2 users]). These users consist of 77 university students, 62 non-students, and 2 school students. At present, the database contains only part of the project's data. Unfortunately we have been unable so far to update the database due to additional security measures put in place by UCL (where it is housed), that now virtually prohibit external updating. With the move of former project employee Blanca Huertas to the NHM, and the fact that project leader Jim Mallet is out of the country, we are currently unable to update the database. We are instead working to move the entire database to FLMNH servers where it will be permanently updated and maintained by KW, and hope to have this accomplished by September 2009.</p>		
Activity 4.8. Type specimen image archive	<p>Some 10,000 digital photographs have been taken or obtained through collaboration, including many type specimens, mainly in Papilionidae, Pieridae, Biblidinae and Ithomiinae. Work in photographing type specimens was stopped in favour of databasing, however, when GL offered to allow the project to scan his virtually complete collection of print photographs of neotropical butterfly types, in Lima, Peru. All 27,000 photographs have now been scanned with the aid of a high-speed scanner bought by the project. We are still in the process of digitizing the associated data, minimally the photograph number and the name of which the specimen is a type, which will allow us to make these images available on the project website. Approximately 9,000 images have been digitized to date. While these images are often of inferior quality in comparison with modern digital images, they provide the means to identify the great majority of names, and can be gradually replaced where necessary by new photographs of particular type specimens.</p>		
5. Taxonomic revisions.	<table border="1"> <tr> <td data-bbox="595 1302 1088 1447">10 taxonomic papers submitted to peer-reviewed journals.</td> <td data-bbox="1088 1302 2080 1447">The project has directly contributed to a total of 11 publications (excluding the final project publication), including 5 Journal Articles, 2 field guides, 1 report, 2 manuals and 1 scientific meeting abstract (see Annex 5). An additional 33 articles produced by project members have</td> </tr> </table>	10 taxonomic papers submitted to peer-reviewed journals.	The project has directly contributed to a total of 11 publications (excluding the final project publication), including 5 Journal Articles, 2 field guides, 1 report, 2 manuals and 1 scientific meeting abstract (see Annex 5). An additional 33 articles produced by project members have
10 taxonomic papers submitted to peer-reviewed journals.	The project has directly contributed to a total of 11 publications (excluding the final project publication), including 5 Journal Articles, 2 field guides, 1 report, 2 manuals and 1 scientific meeting abstract (see Annex 5). An additional 33 articles produced by project members have		

		<p>contributed to knowledge of tropical Andean butterflies. We have completed fewer taxonomic papers than initially envisaged, partly due to the greater emphasis that training and databasing activities received, and partly due to the fact that Andean country databases were not received until the last few months and have only recently been compiled into a single source. We expect this source to provide data for publications for many years to come, and these data will continue to be acknowledged as resulting from a Darwin Initiative project.</p>
<p>Activity 5.1. Work on taxonomic revisions and other scientific articles promoting research on tropical Andean butterflies</p>		<p>Project members continue to work on a variety of taxonomic revisions, especially in the Ithomiinae and Satyrinae, the most poorly studied of our focal groups (see Annex 7). Two taxonomic revisions (Prieto <i>et al.</i>, 2008; Willmott & Maller, 2008) acknowledge DI support, the first of which was through a student project. Two field guides were produced, the first by the Colombian coordinator and co-authors (Andrade <i>et al.</i>, 2007), which used equipment provided by this project to produce the plates for the book. The second (Checa, 2009) was based in part on field work funded as part of a student project.</p>
<p>6. Regional research and conservation strategy, with 50 Key Butterfly Areas identified.</p>	<p>Workshop (Yr 3) in Gainesville; data analysis complete; publication detailing regional research and conservation strategies.</p>	<p>The workshop in Peru, 2008, resulted in a detailed plan for the final project publication, "Priorities in the Research and Conservation of Andean Butterflies". This book will contain 10 chapters summarizing knowledge of tropical Andean butterflies, identifying geographic priorities for research and conservation, and identifying priority groups for taxonomic and biological research. Analyses to identify priority areas for research and conservation have been completed, pending final comments from co-authors. We expect the book to be published in September 2009. The book will be bilingual, in English and Spanish, and free copies will be given to country coordinators to distribute among institutions and agencies. A free PDF copy of the book will also be available via the project website.</p>
<p>Activity 6.1. Training in assessing IUCN threat categories</p>		<p>BH and KW took a 1-day course in assessing IUCN categories in July 2007. A talk on methods was given to country coordinators and other attendees of the workshop in 2008.</p>
<p>Activity 6.2. Workshop in yr 3</p>		<p>Our final project workshop "Priorities in the Research and Conservation of Andean Butterflies" was held in Urubamba (Cuzco, Peru) in September 2008. There were 15 participants (UK: 1, USA: 2, Colombia: 4, Ecuador: 1, Peru: 2, Bolivia: 3, Poland: 1, France: 1), with another 5 invitees only</p>

	<p>being able to attend the subsequent conference (see below) due to work commitments. All of the country coordinators (except Venezuela) attended, in addition to other experts on principal groups of Andean butterflies and regions. Invitees who expressed an interest in contributing but were unable to attend have been invited to contribute to the final project publication. The workshop included the following main topics: report from Andean coordinators on the project's activities, achievements, problems and recommendations; content of the final project publication; methods for selection of priority areas for research and conservation; results to date for the IUCN Red List assessment and description of methods used, including the use of DIVA-GIS for ecological niche modelling; feedback from participants on current IUCN assessments, including compilation of additional locality data; compilation of databases and preliminary data verification; agreement of timetable and responsibilities for contributions to the final project publication; ideas for future projects and potential sources of funding. See Annex 13 for the programme.</p>
<p>Activity 6.3. Data analysis: IUCN assessments</p>	<p>Project members are assisting with assessing the IUCN conservation status of 631 species of neotropical butterflies as part of the IUCN's Red List project. This list is part of a randomly sampled list of 1500 global species of butterflies, one of ten groups currently being assessed for the new IUCN Global Invertebrate Red List. We concentrated on the three families for which we had best data, Papilionidae, Pieridae and Nymphalidae. KRW and BH led assessments for tropical Andean species in these groups. Potentially restricted or threatened species were initially identified for more detailed study. These species have now been assessed using a combination of range size, locations occupied and habitat loss, based on ranges modelled using BIOCLIM software and specimen records from the project database. The distributions of threatened or restricted-range (< 50,000km²) have been used to identify Key Biodiversity Areas, areas that contain either at least one threatened species, or at least 5% of the range of a restricted species. The final list is being prioritized using a combination of numbers of key taxa and other criteria.</p>
<p>Activity 6.4. Data analysis: Priority areas for future field work</p>	<p>One important goal of the project is to identify areas that are priorities for future field work, preferably using an objective, quantitative method. We discussed many options at the workshop, such as proximity to range edges of multiple species, areas with no current knowledge, areas under</p>

	<p>particular threat, etc. Ultimately, we decided to use a combination of range-size and the year of description of species as measures of the extent of knowledge in any given region. This method is able to identify priorities only where at least some data are already available, so individual country chapters include priority regions at the national level which have hitherto been poorly surveyed but might contain faunas of interest. We identified a set of 25 priority 1-degree grid cells, which are clustered in the Andes from western Colombia to northern Peru. These areas should be priorities for future field work.</p>
<p>Activity 6.5. Data analysis: Priority areas for conservation</p>	<p>A key topic of debate at the workshop was how best to prioritise areas for research and conservation. With input from Conservation International we eventually decided to primarily adopt their "Key Biodiversity Area" approach, because of ease of application, and because this is the approach that they favour, thus results will be of practical value to our main target audience. "Key Biodiversity Areas" (KBAs) are areas defined initially based on existing land use, typically existing protected areas, that contain either IUCN threatened category species, or restricted range species (those with a global range of < 50,000 km²). Compilation of data for restricted range species is much more straightforward than for all species and is already being done as part of the IUCN Red List assessment that we are conducting (see above). A large number of KBAs is an almost inevitable result, so are prioritising such areas based on number of key species, threat, number of additional species, and other criteria, to produce a target list of the 50 most important areas. Based on these areas, a Gap Analysis can be conducted in future to identify areas in most need of future research and/or conservation.</p>
<p>Activity 6.6. Writing and publication of project results</p>	<p>The project's final publication "Priorities for Research and Conservation of Tropical Andean Butterflies" was discussed and agreed at the workshop in Peru in 2008, and will contain 10 chapters. Chapter 1: Introduction to the tropical Andean region, its butterflies, the TABDP project, and the purpose of the publication. Chapters 2-6: review of the state of knowledge of butterflies in each of the tropical Andean countries, written by country coordinators and/or experts on the country's fauna. Chapter 7. Geographic priorities for conservation of tropical Andean butterflies. Chapter 8: Geographic priorities for field research on tropical Andean butterflies. Chapter 9: Priorities for research on the taxonomy and biology of tropical Andean butterflies; Chapter 10: Priorities for capacity building in the tropical Andean countries. First drafts of Chapters 4, 6-9 are complete,</p>

with a partial draft of Chapter 10. We are still awaiting drafts from lead authors/country coordinators for Chapters 2, 3 and 5, and expect to have those by the end of August. This delay is due to the unexpectedly high number of authors involved - **42 authors have so far contributed or agreed to contribute, from 13 countries**, including the five tropical Andean countries, Brazil, USA, France, Italy, Poland, Spain, Sweden and the United Kingdom. An Ecuadorian graphics designer has produced several alternative designs for the cover and contents of the book, and is assisting with proof-reading, translation, and layout of the text to produce a print-ready document, estimated to be c. 100-150 pages. The McGuire Center of Lepidoptera and Biodiversity, where KRW works, has agreed to pay for the final printing costs (c. £3000).

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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p><i>Goal:</i></p> <p><i>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 the conservation of biological diversity,</i></p> <p><i>the sustainable use of its components, and</i></p> <p><i>the fair and equitable sharing of benefits arising out of the utilisation of genetic resources</i></p>			
<p>Purpose.</p>			
<p>To establish a regional research programme and conservation priorities for tropical Andean butterflies, through improved knowledge of their diversity, distribution and abundance.</p>	<p>Enhanced institutional capacity for butterfly research and conservation.</p> <p>Synthesised knowledge of butterfly diversity, distribution and abundance.</p> <p>Current and future priorities for research and conservation identified.</p>	<p>Institutions capable of securing funding and conducting research into butterfly diversity and conservation.</p> <p>Distribution and taxonomic data from collections and literature compiled into a single database.</p> <p>Published "Regional Strategy for Butterfly Research and Conservation in the Tropical Andes".</p>	<p>Partner institutions and taxonomists remain committed to research and conservation work on tropical Andean butterflies.</p>
<p>Outputs.</p>			

Enhanced institution staff capacity for butterfly research.	10 staff from 5 partner institutions trained in identification, curation, databasing and grant proposal writing.	Annual report by national co-ordinators.	Andean institutions continue to employ staff who pass on knowledge.
Students trained in butterfly systematics, field survey methods and data analysis.	Field survey manual; 2 student training workshops of 1 week per country (30 students per course, total 300 students). 40 students receive further training and support for dissertation research.	Annual student supervisor reports and national co-ordinator reports.	At least some students use knowledge gained to take higher degrees and become next generation of butterfly researchers.
Curated national collections.	National collections (minimum of 5, 1 per country) curated and identified.	Six-monthly reports by national coordinators; data in database.	Institutions maintain collections.
Darwin Andean Butterfly Database.	Taxonomic and photographic database established; NHM, MCLB and partner collections databased (3500 species, 150,000 specimens).	Six-monthly reports by national coordinators; database online and CD, also sent to DI.	Data quality sufficient for achieving conservation and research goals; database maintained in future.
Taxonomic revisions.	10 taxonomic papers submitted to peer-reviewed journals.	Pre-prints/reprints at project website.	-
Regional research and conservation strategy, with 50 Key Butterfly Areas identified.	Workshop (Yr 3) in Gainesville; data analysis complete; publication detailing regional research and conservation strategies.	Published strategy in hard copy and CD, sent to DI, and available on project website.	Strategy is followed by major research institutions and conservation organisations within the region.
Activities.	Activity Milestones (Summary of Project Implementation Timetable)		
Institution staff training and student workshops.	Project planning workshop to establish methods, goals and develop training programme (Yr 1, Apr 06). 1 st student training courses completed (Yr 1, Aug 06). 2 nd student training courses completed (Yr 2, Aug 07). Staff training in identification, curation and databasing complete (Yr 2, Aug 07).		
Databasing, development of digital products.	Database structure complete. WORLDMAP software developed. Website established. Digital photograph collection established (30% complete) (Yr 1, Mar 06). Online database with Ithomiinae, Limenitidinae (Yr 1, Dec 2006). Photography complete (Yr 2, Jul 07). Database complete (Yr 3, Feb 08) and online (Dec 08).		
Curation of collections.	MCLB complete (Yr 1, Jun 06). Preliminary curation of Andes collections complete (Yr 1, Jul 06). NHM complete for focal groups (Yr 2, Jul 07). Andes countries curation complete (Yr 2, Jul 07).		
Taxonomic revisions.	5 papers submitted to peer-reviewed journals (Yr 2, Jul 07). 5 papers submitted (Yr 3, Nov 08).		
Data analysis and development of long-term research and conservation strategy.	Analysis of results (Yr 3, Apr 08). Strategy planning workshop with project members, taxonomists and conservation organisations (Yr 3, May 08). 50 Key Butterfly Areas identified (Yr 3, May 08). 2 papers submitted on Andean butterfly diversity and conservation. "Regional Strategy for Butterfly Research and Conservation in the Tropical Andes" published (Yr 3, Dec 08).		

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
7. Identification and Monitoring	60	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.
12. Research and Training	20	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).
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
Other Contribution	10	Art. 5, Co-operation, Art. 18, Technical and scientific cooperation.
Total %	100%	Check % = total 100

Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
4a	Number of undergraduate students receiving training (Colombia, Ecuador, Peru, Bolivia, UK, Chile, New Zealand)	103 (attendees at training courses)
4b	Number of training weeks provided to undergraduate students (each course involved 6 days x 12 hrs per day, total 72 hrs per course, equivalent to 2 training weeks)	16 (TABDP training courses)

Code	Description	Totals (plus additional detail as required)
4c	Number of postgraduate students receiving training (not 1-3 above) (Ecuador, Colombia, Bolivia, Venezuela, Mexico, USA)	23 (attendees at training courses)
4d	Number of training weeks for postgraduate students	16 (TABDP training courses)
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	1 (main project employee, Blanca Huertas, at UCL and NHM, London)
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	30 (volunteers, mostly students, associated with curating and databasing collections)
6b	Number of training weeks not leading to formal qualification	30 (approximately 1 week per person in 6a)
7	Number of types of training materials produced for use by host country(s)	7 (10 Powerpoint lectures; 2 manuals; 1 poster; 1 CD containing scientific articles and computer software, more than 20 Powerpoint lectures, more or less 5 different per country; CD containing scientific articles and computer software, c. 35 Powerpoint lectures per country; 2 colour plates for identification of S. Ecuadorian Ithomiinae, Satyrinae)
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	11
11a	Number of papers published or accepted for publication in peer reviewed journals	5 (acknowledging DI), + 33 (Annex 7)
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	3 (Taxonomic database, locality database, specimen database)
13b	Number of species reference collections enhanced and handed over to host country(s)	8 (MIZA, MECN, MHNNKM, ICN, MUSM, JFL, FDPR, YG)
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2 (Priorities in the Research and Conservation of Andean Butterflies, 1 st International Conference on Andean Butterflies)
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	3 (International Conference on Neotropical Butterflies, International Conference on Biology of Butterflies, International Congress for Conservation Biology)
15a	Number of national press releases or publicity articles in host country(s)	3

Code	Description	Totals (plus additional detail as required)
15c	Number of national press releases or publicity articles in UK	3
16a	Number of issues of newsletters produced in the host country(s)	1 (news page on project website, continually updated and circulated via mailing list)
16b	Estimated circulation of each newsletter in the host country(s)	300 (readership of website/ mailing list)
16c	Estimated circulation of each newsletter in the UK	60 (readership of website/ mailing list)
17a	Number of dissemination networks established	6 (1 website mailing list; 5 contact lists of students and researchers attending courses in each of 5 Andean countries)
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	£5455 (field equipment, books [£800]; laptop computers and printers [£2163]; digital cameras [£1605]; field equipment [£887])
23	Value of additional resources raised for project	£169,217 (FLMNH contribution for workshop in 2006 [£5882]; contributed travel expenses [£2500]; overheads [£51,996]; salary time of principal project members [£86,559]; AndinoNET [£1110]; WWF Bolivia [£890]; BioQuip equipment discount [£140]; Universidad de los Andes course transport [£500]; Conservation International [£15,890]; FLMNH printing costs [£3000]; NHM London waived bench fees for KW, GL [750])
Other Measures used by the project and not currently included in DI standard measures		
	Number of individual student-led research projects supported financially and intellectually by the project	19

Annex 5 Publications

Additional publications are listed in Annex 7. Publications listed here are only those that were produced either specifically as a result of this project, or that acknowledge Darwin support. Those marked with * are provided in Annex 11. Those marked ** were provided with previous annual reports.

Type *	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Report	2006. Huertas, B., and T. Donegan (editors). Investigación y Evaluación de las Especies Amenazadas de la Serranía de los Yariguíes, Santander, Colombia. (Serranía de los Yariguíes Assessment and Research of Endangered species). Informe Final 2005-2006. BP Conservation Programme Premio de Plata, Proyecto Código 505505. Colombian EBA Project Report Series 7. 131 pp.	Fundación ProAves	http://www.proaves.org/breve.php?id_breve=26	0
Manual **	Manual para la toma de fotografías digitales del proyecto TABD. Huertas, B., Willmott, K.R. 2006.	TABDP	http://www.mariposasandin as.org/supporting_files/manual_fotos_TABDP.pdf	0
Manual **	Manual para el manejo de las bases de datos el proyecto TABD. Willmott, K.R., Huertas, B. 2006.	TABDP	http://www.mariposasandin as.org/supporting_files/manual_basededatos_TABDP .pdf	0
Scientific meeting abstract	Registro fotográfico de las mariposas del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia. Pulido, H., Andrade, G. 2006.	II Congreso Colombiano de Zoología, Colombia, memorias.		0
Book (field guide)	<i>Santa María – Mariposas Alas y Color – Guía de Campo</i> . Andrade, M. G., Campos-Salazar, L. R., González-Montaña, L. A., Pulido, H. W. 2007.	Instituto de Ciencias Naturales, Universidad Nacional		unknown

		de Colombia, Bogotá		
Book (field guide, in part)	<i>Mariposas de Canandé. Sus Amenazas, Potencial y Futuro.</i> Checa, M. F. 2009.	Tramaediciones, Quito, Ecuador. 72 pp (incl. 39 plates).		\$20
Journal article **	Dasmahapatra, K. K., Silva, A., Chung, J.-W., & Mallet, J. Genetic analysis of a wild-caught hybrid between non-sister <i>Heliconius</i> butterfly species. 2007.	Biology Letters 3: 660-663.	http://www.ucl.ac.uk/taxome/jim/jimpubs.html	0
Journal article **	Natural hybridization in heliconiine butterflies: the species boundary as a continuum. Mallet, J., Beltrán, M., Neukirchen, W., & Linares, M. 2007.	BMC Evolutionary Biology 7: 28.	http://www.ucl.ac.uk/taxome/jim/jimpubs.html	0
Journal article **	Hybrid speciation. Mallet, J. 2007.	Nature 446: 279-283.	http://www.nature.com/nature	0
Journal article *	A review of the "browni group" of <i>Penaincisalia</i> with notes on their distribution and variability (Lepidoptera: Lycaenidae: Eumaeini). Prieto, C., Bálint, Z., Boyer, P., Mico, E. 2008.	Zootaxa 1941: 1-24.	www.mapress.com/zootaxa	unknown
Journal article *	A revision of the genus <i>Megoleria</i> (Lepidoptera: Nymphalidae, Ithomiinae). Willmott, K. R., Lamas, G. 2008.	Tropical Lepidoptera Research 18(1): 46-59.	http://www.flmnh.ufl.edu/butterflies/neotropica/pubs.html	0
Book	<i>Priorities for Research and Conservation of Tropical Andean Butterflies.</i> Willmott, K. R., Lamas, G., Huertas, B. (eds.) 2009. [in preparation]	McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA	www.andeanbutterflies.org , www.mariposasandinass.org	0 (PDF) To be determined (printed copy)

Annex 6 Darwin Contacts

Ref No	14-047
Project Title	Tropical Andean Butterfly Diversity Project
UK Leader Details	
Name	Professor James Mallet
Role within Darwin Project	Leader
Address	Galton Laboratory, Department of Genetics, Evolution and Environment, University College London, 4 Stephenson Way, London, NW1 2HE
Phone	
Fax	-
Email	
Other UK Contact (if relevant)	
Name	Blanca Huertas
Role within Darwin Project	Coordinator of student courses and conference; coordinator of databasing and analysis of conservation priorities; final publication co-editor.
Address	Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD
Phone	
Fax	-
Email	
Partner 1	
Name	Keith Willmott
Organisation	University of Florida
Role within Darwin Project	Project co-leader; analysis of research priorities; final publication co-editor.
Address	McGuire Center, FLMNH, Powell Hall on Hull Road, University of Florida, Gainesville, FL 32611, USA
Fax	
Email	

Annex 7 Additional Publications

Other publications by project members that contribute significantly to knowledge of Andean butterfly diversity and classification, the main goal of this project, but that have not resulted from data collected by the project or acknowledge DI for support.

Type *	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal article	2006. Brower, A. V. Z., Freitas, A. V. L., Lee, M.-M., Silva Brandão, K. L., Whinnett, A., and K. R. Willmott. Phylogenetic relationships among the Ithomiini (Lepidoptera: Nymphalidae) inferred from one mitochondrial and two nuclear gene regions. <i>Systematic Entomology</i> , 31(2): 288-301.	Royal Entomological Society	http://www.ucl.ac.uk/taxome/jim	0
Journal article	2005. Whinnett, A., Willmott, K.R., Brower, A.V.Z., Simpson, F., Lamas, G. & Mallet, J. Mitochondrial DNA provides an insight into the mechanisms driving diversification in the ithomiine butterfly <i>Hyposcada anchiala</i> (Lepidoptera: Nymphalidae, Ithomiinae). <i>European Journal of Entomology</i> 102: 633-639.	Institute of Entomology of the Czech Academy of Sciences	http://www.ucl.ac.uk/taxome/jim	0
Journal article	2005. Whinnett, A., Zimmermann, M., Willmott, K.R., Herrera, N., Mallarino, R., Simpson, F., Joron, M., Lamas, G. and Mallet, J. Strikingly variable divergence times inferred across an Amazonian butterfly 'suture zone'. <i>Proceedings of the Royal Society B</i> 272: 2525-2533.	The Royal Society	http://www.ucl.ac.uk/taxome/jim	0
Journal article	2005. Whinnett, A., Brower, A.V.Z., Lee, M.-M., Willmott, K.R., & Mallet, J. (2005). Phylogenetic utility of Tektin, a novel region for inferring systematic relationships amongst Lepidoptera. <i>Annals of the Entomological Society of America</i> 98: 873-886.	The Entomological Society of America	http://www.ucl.ac.uk/taxome/jim	0
Journal article	2005. Hall, J. P. W., and K. R. Willmott. A new species of <i>Paiwarria</i> (Lepidoptera: Lycaenidae: Eumaeini) from western Ecuador. <i>Proceedings of the Entomological Society of Washington</i> , 107(4): 960-967.	The Entomological Society of America		0
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