Darwin Initiative Annual Report

Important note:

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

Darwin Project Information

Project Ref Number	Darwin Ref. 16-001; UEA Ref. R15176
Project Title	Community-based sustainable management of forest resources in Amazonian extractive reserves
Country(ies)	UK, Brazil
UK Contract Holder Institution	University of East Anglia, UK
Host country Partner Institution(s)	(1) Secretaria do Estado do Meio Ambiente e Desenvolvimento Sustentável (SDS), State of Amazonas, Brazil; (2) Brazilian Institute of the Environment and Natural Renewable Resources (IBAMA), Brazil
Other Partner Institution(s)	n/a
Darwin Grant Value	£97,140 (total awarded to UEA on 08 April 2009)
Start/End dates of Project	1 Sept 2007 – 30 April 2011
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..)	22 May 2009 – 30 April 2010 Annual Report No. 3
Project Leader Name	Prof Carlos Peres
Project website	http://www.tropicalforestresearch.org/projects/jurua.aspx
Author(s) and main contributors, date	Carlos Peres, Whaldener Endo, Joseph Hawes, Peter Newton, Elizabeth Nichols, Rômulo Batista and Henrique Santiago - 7 May 2010

1. Project Background

This project seeks to understand a number of increasingly pressing issues related to natural resource management in a growing number (and aggregate area) of Amazonian extractive reserves and sustainable development reserves that are legally inhabited by hundreds of thousands of native Amazonians. In general, these reserves have been affected by very low deforestation rates but many natural resources extracted by often burgeoning human populations for subsistence or sale are likely to become overexploited in the future. The semi-subsistence non-timber resources harvested in these reserves are sourced from both forest environments (e.g. game vertebrates, fibres, medicinal oleo-resins, other therapeutic and cosmetic plant products) and freshwater bodies (e.g. fish and turtles from oxbow lakes, rivers and streams), and sustain the basic livelihoods of both reserve occupants and the surrounding populations. The project is taking place at two contiguous sustainable development forest reserves, which were created by the Brazilian Government in the last decade and are located along the Rio Juruá of western Brazilian Amazonia (Figure 1): the 632,949 hectare Uacari Sustainable Development Reserve (RDS), and the 253,227 hectare

Médio Juruá Extractive Reserve (ResEx). According to our preliminary survey, these two reserves are legally occupied by approximately 3,080 people, who are willing participants in this research and management programme, and currently experience a human population growth rate of ~2.5% per year. All of these reserve occupants are second to fourth generation descendents of local indigenous groups and Brazilian rubber tappers (*seringueiros*) of northeastern Brazil, who initially colonised this region of southwestern Amazonia from around 1892 during the first rubber boom. However, the rural population of the Rio Juruá and other major white-water tributaries of the Amazon have experienced a period of pronounced economic transition marked by the collapse of the rubber boom and significant rural exodus to major urban centers (e.g. Carauarí, Tefé, Manaus). These reserves are nominally managed by two government agencies, which in itself presents a major challenge in terms of communication and integration of management objectives. The Uacari Sustainable Development Reserve is under the jurisdiction and formally managed by the state-level Environmental Agency of Amazonas (SDS), whereas the and the Médio Juruá Extractive Reesrve is managed by the federal Protected Areas Agency of Brazil (IBAMA/ICMBio). These two agencies comprise our formal execution partners in deploying and implementing this project, and disseminating the project results both within and outside these target reserves. However, the geographic extent of the areas managed on paper by these (severely underfunded and understaffed) agencies within Brazilian Amazonia is truly vast, and they are unable to allocate a sufficient number of qualified and well equipped personnel to all of the reserves they oversee, including our target reserves. The project aims to develop an ambitious work program by identifying and examining a number of population ecology and population management issues that are relevant to real-world harvesting systems in spatially structured tropical forest landscape mosaics that are often highly heterogeneous in resource productivity and yields. We aim to develop feasible yet effective management strategies at the landscape scale that can be adopted by other Amazonian extractive and sustainable development reserves to help maximise the sustainable use of key resource populations and the long term persistence of forest biodiversity.

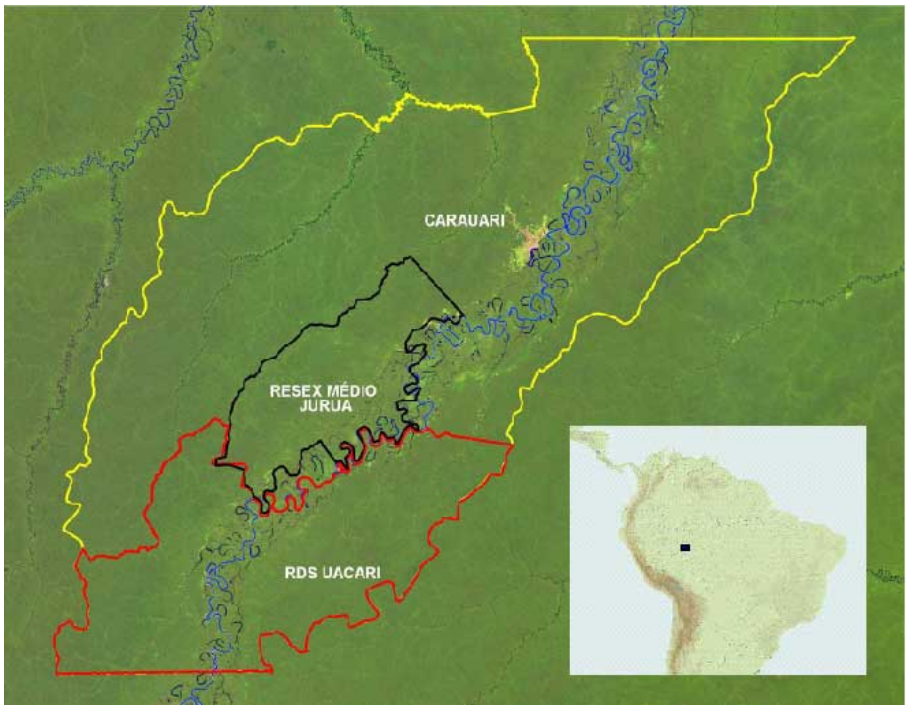

Figure 1. Map of the 253,227-ha Médio Juruá Extractive Reserve (black polygon) and the 632,949-ha Uacari Sustainable Development Reserve (red polygon) along the meandering Juruá River of western Brazilian Amazonia, showing the wider region of project influence (yellow boundaries). Area of satellite image corresponds to the small rectangle in the inset map of South America.

2. Project Partnerships

Project partnerships:

The project is a formal partnership between the University of East Anglia and the Environmental Secretariat (*Secretaria do Estado do Meio Ambiente e Desenvolvimento Sustentável*; hereafter, SDS) of the largest and most forested Brazilian state (Amazonas); and the Brazilian Institute of the Environment and Natural Renewable Resources (IBAMA). Both of these administrative agencies maintain permanent offices in Carauari, a town located 37 km from the nearest boundary of the target reserves, and we have continued to maintain regular contact and consultation with these administrative offices and their envoys between May 2009 and April 2010 by means of monthly visits to Carauari or radio contact from the reserves. Our relationship is very cooperative in terms of how project activities interact with, or can be facilitated by these agencies. Given the high prices of fuel in remote parts of Amazonia, government funding available for fluvial transport is in scarce supply, and this is one of the areas in which we have been able to cooperate with our local partners. There has also been increased cooperation on the joint-organisation of workshops for monitors. The project is also helping to develop technical capacity within the local communities of the two reserves and these reserve agencies. In particular, we are contributing to refining and implementing the management plans of the two reserves under the auspices of the local representatives of these agencies and the reserve management councils.

Other Collaboration:

On a regional scale, the project collaborates with ProBUC (*Programa de Monitoramento da Biodiversidade e do Uso de Recursos Naturais em Unidades de Conservação Estaduais do Amazonas*), a resource use and biodiversity monitoring programme managed by SDS. Whilst similar in approach, our project activities and associated sampling protocols are more detailed, more extensive, and the data acquisition and verification processes are more frequent. Our project is continuing to maintain a good partnership with ProBUC which will ensure a larger sampling effort, an economy of scale in deploying this sampling, and good prospects for future data sharing, data processing, and data presentation in the interest of enhancing natural resource management practices in human-occupied protected areas throughout the State of Amazonas initially, and subsequently across Brazilian Amazonia.

External collaborations now include two partnerships with the Federal University of Amazonas (UFAM) in Manaus. Fruit pulp specimens have been deposited with Dr. Lídia Medina Araujo, who is conducting analyses of fruit nutrition. Forest environments in the Brazilian Amazon support the highest diversity of tree and liana species bearing fleshy fruits, yet the nutritional value of fruiting plants for either wildlife or humans remains poorly understood, and this is one area of the project that has been developed in the last 12 months. Secondly, Dr. Valdir Veiga Junior is analysing the physical and chemical properties of samples of *Copaifera* oil. Oils from two of the species collected have never previously been analysed, and so this collaboration represents an exciting opportunity to expand our knowledge of these important medicinal oils. Botanical specimens, including dried fruit, have been deposited at the Instituto Nacional de Pesquisas da Amazônia (INPA), in Manaus for formal identification and reference. Mr Agenor Bentes Azevedo, an experienced herbarium technician from INPA visited our study sites at the two reserves for three weeks in February 2010 to aid tree identification. The project is working closely with Cláudia Ohanna Araújo da Silva from the Instituto de Desenvolvimento Agropecuario e Florestal Sustentavel do Estado do Amazonas (IDAM) both to monitor the offtake of *Copaifera* oil by reserve residents recently trained and equipped by IDAM, and in the publication of a *Copaifera* species identification guide for reserve residents.

The dung beetle community ecology sub-project principally collaborates with the Federal University of Lavras (UFLA), in Minas Gerais state, with Dr. Júlio Louzada who is a co-PI with C.A. Peres and E. Nichols on the CNPq grant currently funding the dung beetle work. UFLA operates the entomology laboratory where the specimens are currently being sorted, counted and identified. Also at UFLA is Rodrigo Braga (PhD student) and Gustavo Schiffler (post-doctoral fellow) who participated in intensive field collections between October 2009 and February 2010.

The project has developed substantial additional work on the avifauna of the Rio Juruá. Following initial sampling by Andrew Whittaker and Alexander Lees, we have carried out an intensive programme of understorey bird sampling in both terra firme and várzea forests on both banks of the Juruá River to understand the effects of river barriers and forest types on the structure of avifaunal assemblages. During this reporting period (Oct – Nov 2009), additional net-lines (of 20 nets of 12m each) were deployed at sites on both reserves by C.A. Peres and W. Endo, with further work at different sites farther upriver expected to take place in the dry season of 2010. In total, we have sampled a total of 30 net-lines at different sites along the Juruá River, which amounts to the most comprehensive study of bird communities in seasonally flooded and unflooded Amazonian forests conducted to date.

In addition, Dr Flávia Costa (INPA, Manaus), Dr Hanna Tuomisto (Turku University, Finland) and their joint Brazilian PhD student Gabriela Zuquim (INPA) are set to sample the herbaceous flora across a large number of terra firme and várzea forest transects within the two reserves. This work had been planned to take place during the dry season (Aug – Oct) of 2009, but had to be postponed because Gabriela was unable to commence this work before the várzea sampling sites became inaccessible due to the last inundation period. This study will however take place before the project comes to an end, thereby substantially boosting the plant community data available from this poorly known part of the Amazon.

Other local partnerships, within the municipality of Carauarí, include collaboration with the National Council of Rubber Tappers (CNS), the Association of Rural Producers of Carauari (ASPROC) and the Association of RDS Uacari Inhabitants (AMARU). Despite lack of funding due to DEFRA-approved changes in the project budget, spatial modelling of the hunting sustainability component of the project is still expected to go ahead in collaboration with Taal Levi of University of California at Santa Cruz (see Levi et al. 2009). This collaboration builds on results from a previous project funded by the Leverhulme Trust (of which CAP is a participant) conducted with Matsigenka native communities of Manu National Park, Peru, which successfully modelled the spatial dynamics of game population depletion and renewal using source-sink dynamics (Levi et al. in review). The project will therefore take advantage of a previously tested and verified spatial modelling approach at no extra costs, to provide a landscape-scale understanding of the degree to which populations of the most vulnerable vertebrate game species in these two extractive reserves and neighbouring areas can co-exist with typical levels of subsistence hunting offtakes under different scenarios of human population growth and settlement diffusion. This will be of enormous assistance in the analytical approaches used to model game availability and harvest data – as well as establish parallels with other exploited landscapes in neotropical forests.

3. Project progress

3.1 Progress in carrying out project activities

Output 1. Assessment of forest and aquatic resources extracted, and levels of offtake.

Activity 1.1. Household interviews

A total of 14 local monitors are now collecting data from weekly household level interviews in 13 local communities (10 households per community or all households in communities where the total number of households is ≤ 10, amounting to a total of 109 houses). This total excludes other monitors working for ProBUC (14 additional monitors in 14 additional communities). These interviews assess levels of extraction for timber, all non-timber forest products (NTFPs), game meat and fish, different metrics of catch-per-unit effort (CPUE), in addition to an assessment of agricultural activities. Collectively, we have been monitoring all the major livelihood components for either subsistence or commerce of a large, representative sample of the human population of the two reserves. Details are recorded for all activities of the proportions of products consumed locally or sold, including information on income generation. The assessment of game harvest also records the weight, sex, and reproductive condition of all animals and fish. By May 2010, over 3000 interviews will have been conducted in these 13 communities. These interview data are entered on a regular basis, on a project desktop based in our project office in Carauarí, by a project field assistant.

During June 2009 and January 2010, additional interviews were conducted by project members on three tiers.

i) Household-level interviews secured detailed demographic and socio-economic profiles of 181 of the households currently being interviewed on a weekly basis, providing important background variables against which to assess patterns and variation in agro-extractivist behaviour.

ii) Community-level interviews were conducted with leaders and senior residents of 30 communities, recording data regarding demographic trends, resources (health, education, energy) and access to different forest types and markets.

iii) Focus-group interviews probed more deeply into the motivations for agro-extractivist behaviours of residents of 28 of these communities, explaining variance in both quantitative and qualitative terms.

Means of Verification: Photographs of household-level and focus-group interviews (Figures 2-3) and data sets.

Activity 1.2. GIS mapping of the reserves and habitat types

This activity has been successfully completed (see Annual Report 2).

Activity 1.3. GIS analysis of hunting catchments

This activity started in August 2008 and has continued during Year 3 of the project. All four of the different activities mentioned in the previous report were successfully accomplished and will allow a better understanding of the extent, intensity and selectivity of hunting activities and game harvest areas in the wider study landscape. Nonetheless, to acquire an even more robust result, the weekly household interviews are still being carried out to provide information about hunters' catchment areas, and information on all hunted animals that arrive in villages are still being recorded. The hunters selected to map hunting trips using GPS receivers are still collecting data although some of them had to be replaced over the course of the year. Among the main causes for this turnover are low hunting activity during the sampling period and the fact that one of the selected hunters decided to move out of our

study area. The GPS mapping activity is, nonetheless, being carried out by 10 active hunters at the moment and is expected to provide robust data to support the assessment of spatial patterns of hunting across those villages.

Due to fear of suffering any kind of commercial retaliation, the collaboration with commercial fishermen in Carauari, to track the movements of the commercial fleet of fishing boat, has so far turned out to be harder than expected, which was also experienced by ProBUC staff in their attempts to obtain monitoring agreements with the Fishermen Cooperative of Carauarí. As a result, the project has decided to postpone the idea of tracking the activities of commercial fishing boats in the study area until we are able to build more trust in our relationship with commercial fishermen.

Means of Verification: Map of hunting trips mapped from four villages (Figure 4).

Activity 1.4. Weighing and measuring hunted animals

This activity started in March 2008 and has continued during Year 3 of the project. By June 2009, data from 1400+ game specimens killed was already available and we expect, by the end of the project, to have information on ca. 3500-4000 game vertebrates consumed in the continuously monitored villages. Overall, 27 monitors from 26 different communities are still carrying out this activity and are expected to continue recording data until September 2010.

Means of Verification: Photograph of local monitor measuring game vertebrate (Figure 5).

Output 2. Quantitative assessment of the demographic sustainability of forest resource extraction.

Activity 2.1. Faunal censuses

With the exception of a few transects that were partially cut but later abandoned for different reasons (e.g. quasi-permanent flooded patches preventing transect expansion; unwillingness of monitors to census those transects; village displacement, etc), this component of the project ended up with 90 active transects (4 to 5 km in length), including 15 ProBuc transects, that will undoubtedly provide strong additional data support for our study.

In addition to the previously established transects along the Rio Juruá, the project succeeded in reaching some of the remotest areas in the region to establish six new transects. These new transects, up the Eré, Bauana and Marari tributaries of the Juruá, are mostly (5) located in upland terra firme forest sites and their inclusion in our sampling design will provide a more balanced sampling effort, encompassing all forest types available for sampling as well as a better understanding of the effects of a wider spectrum of hunting pressure in our vast study area.

Monthly data collection by previously trained transect monitors began in April 2008 and has continued to be conducted successfully in Year 3 of the project. The census protocol consists of starting each transect at 0630h and walking slowly (1.25 km per hour) and recording all target animals observed (visually or acoustically), the number, age and sex of individuals, the time of observation, distance along the transects (measured using flagging tape placed at 50m intervals), perpendicular distance from the transect, and the group size (of social species) and a measure of group spread. By August 2009, a total of over 5,815 independent individual (or group) sightings had been recorded along a cumulative total of ~2,800 km of line-transect census walks.

Means of Verification: Map of survey transects established for this project (Figure 6); Fluvial expedition to reach a remote upland terra firme transect along the Rio Eré (Figure 7).

Activity 2.2. Map NTFP population density

In addition to the 34 terra firme transects censused in 2008, a further three terra firme transects and 26 várzea transects were censused between July and September 2009. Key NTFP species (*Copaifera* spp., *Carapa guyanensis* and several arborescent palm species) were mapped along the length of each of these 4-5 km transects. The additional terra firme transects were located in upland forest far from the main river, ensuring a representation of all forest types. The várzea transects were distributed throughout the extent of the two reserves.

Means of Verification: Figure of *Copaifera* population structure in várzea and terra firme (Figure 8).

Activity 2.3. Experimental harvest and monitoring of *Copaifera* oil

The sampling program which is monitoring *Copaifera* extraction by reserve residents is continuing successfully. A total of 97 trees, including individuals of four different species across both main forest types, have now been harvested and their oil yields recorded. A local field assistant was trained to revisit harvested trees and he recorded the species and diameter of each tree, whilst additionally georeferencing them with a GPS unit. In April 2010 we harvested an additional 18 trees, to assess inter-annual variation in oil yields. In the same month, we re-harvested 25 trees that were originally harvested in 2009 and 17 that were harvested in 2007, to begin to quantify the sustainability of this harvest practise. This now represents the largest study of *Copaifera* harvesting undertaken anywhere, in terms of both spatial extent and numbers of individual trees.

Means of Verification: Photographs of monitor drilling trees (Figure 9) and local field assistant collecting data (Figure 10).

Activity 2.4. Develop a *Copaifera* population spatial model

A final recensus of the twenty-seven 20m x 20m *Copaifera* seedling plots is being conducted during May 2010, to determine the growth or mortality of *Copaifera* seedlings and saplings. Sapling and seedling surveys were also conducted along the three new terra firme and 17 of the várzea transects (five 10m x 10m plots per 5km transect) between July and September 2009.

Means of Verification: N/A - Not yet available.

Activity 2.5. Introduce reserve-wide harvest zoning agreements

The need to zone these large reserves has been repeatedly instigated by our project and ProBUC during a range of interactions with both local leaderships and the reserve management agencies. Although formal no-take (terrestrial) areas are yet to be set aside within heavily used zones, a total of six wildlife refugia are now widely accepted in sparsely settled segments of the Juruá within both terra firme and várzea forest. The degree to which numerical responses to hunting pressure in these areas in terms of forest wildlife abundance is yet to be tested, but the project will eventually have sufficient data to explore these questions. The same can be reported in relation to aquatic resources within oxbow lakes that are protected from commercial fisheries, as agreed with both individual communities and the reserve-wide management councils.

Means of Verification: Map of wildlife refugia within the Uacari reserve (Figure 10a).

NEW ACTIVITY 2.6. Quantitative ethnobotany of terra firme and várzea forests.

A new quantitative ethnobotany study, conducted by a Brazilian MSc student (Débora Peterson), has been underway since the end of this reporting period. This project aims to assess the formal and vernacular (local) taxonomy of trees >10cm DBH within a minimum of 20 forest plots (10 x 100 m) in terra firme and várzea forest, as well as understand the degree to which these plant assemblages serve known extractive uses, including oils, latex, resins, fruits, fibres and a range of therapeutic purposes. The project will quantify the degree to which this arborescent flora is known by traditional users at the species or genus level, and the community-wide extractive value of the main forest types. Previously identified number-tagged trees within each plot will be exposed independently and during different consecutive trials to at least 4 local informants to assess the floristic congruence of these forest types between the local and Latin nomenclature of tree species, and the taxonomic resolution of the local nomenclature. The project will also yield new data on the range of NTFPs exploited in our reserves, and the potential market and nonmarket value of these products across a much wider spectrum of tree species.

Means of Verification: Not yet available – DP's MSc thesis will be completed in August 2010.

Output 3. Local monitors, field technicians and students able to assess and monitor forest biodiversity using quantitative methods.

Activity 3.1. Conduct training workshop(s)

A third annual project workshop was held at the Bauana field station between the 14th and 16th September 2009. The event was well attended, with the majority of local participating assistants and representatives of several of our partner institutions present. The majority of the project team were present, including the project leader Carlos Peres. The workshop combined the goals of providing ongoing training and support for the monitors, reaffirming the aims of the project, disseminating provisional results and consolidating databases by checking data queries with monitors, and standards of our data-quality control. The occasion was also used to promote discussion concerning some of the rarer species of interest amongst participants, providing a valuable qualitative data resource.

Means of Verification: Photographs of workshop presentations, attendees and training (Figures 11-15).

Activity 3.2. Maintenance of post-workshop training activities

Visits by the project members to monitors in their local communities and/or households has continued during Year 3 of the project. This has continued to be effective in ensuring the continuation of high quality data collection despite the difficulties of maintaining direct contact with such remote communities within our vast study area.

Means of Verification: Photograph of project member reinforcing training of line transect survey monitor (Figure 16).

Activity 3.3. Conduct line transect surveys

Line-transect surveys for fruit and fauna, as detailed in Annual Report 2, have continued on a monthly basis throughout Year 3 of the project. Fruit collected to date from transect surveys have now been transported to the INPA Herbarium for identification.

Means of Verification: Photograph of monitor conducting line transect survey for fauna and fruit (Figure 17).

Activity 3.4. Conduct 100 ha plot surveys

Monthly surveys of the permanent plots for fruit and fauna continued successfully between May 2009 and April 2010. Trap collections of leaf-litter and fruits also continued successfully after restarting in May 2009. Both of these methodologies are detailed in Annual Report 2. The principal investigator of this component (Joseph Hawes) was present for the entire year and, with the extensive monitor training conducted, surveys and trap collections will hopefully be continued successfully under remote supervision until the conclusion of the project. Fruit collected to date from plot surveys have now been transported to INPA for identification.

During this reporting year, surveys were also carried out in two of the 100ha plots (one terra firme, one várzea) for tree fall gaps, recording the location, size and age of all gaps along all 1 km transects. In addition, trees were identified and measured in circular plots (all stems with DBH ≥ 10cm within a radius of 5m; all stems with DBH ≥ 30cm within a radius of 10m) established around each leaf-litter/fruit trap. This will be used to assess forest basal area within the plots as well as relate forest structure and composition to seed and fruit-fall into the traps.

Means of Verification: Photograph of monitor collecting material from fruit/leaf-litter traps (Figure 18).

Activity 3.5. Conduct plant phenology surveys

Two more transects were established in July 2009 to yield a final total of eight 1 km transects (four terra firme; four várzea), with all trees with DBH ≥ 30 cm and lianas (DBH ≥ 10 cm) within 5 m of the transect marked with an uniquely numbered tree-tag (533 tagged trees or lianas in terra firme forest; 456 in várzea). Methodology is as described in Annual Report 2. The principal investigator of this component was present for the entire year and with the extensive monitor re-training conducted surveys will hopefully be continued successfully under remote supervision until the conclusion of the project.

During February 2010 an experienced technician from INPA visited the reserves to identify *in situ* all tagged phenology trees monitored on a monthly basis. Voucher plant specimens were collected whenever necessary and are currently being identified at INPA.

Means of Verification: Photograph of INPA technician and local assistant identifying tagged trees used in monthly phenology surveys (Figure 19).

Activity 3.6. Conduct dung beetle surveys

Extensive dung-beetle surveys were conducted in three phases, between July 2009 and February 2010. These surveys included: sampling of 30 transects during the dry season (Phase 1), repeat sampling of the same 30 transects during the flood pulse (Phase 2) and five-monthly samples across both 100 ha *terra firme* plots from October-February (Phase 3). Phase 1 and 2 surveyed beetles in várzea and terra firme forests, and within the communities themselves. Every transect was sampled for dung beetles with 15 standard human-dung baited pitfall traps placed every 50 m. Additional relevant environmental data were collected in tandem with every individual trap. These data will be linked in a GIS to transect-level information on mammal density estimates from the faunal surveys and hunting pressure estimates from household surveys, to assess the impacts of subsistence hunting on dung beetles. Additionally, during Phase 1, measurements on four dung beetle-mediated ecological functions were taken in each *terra firme* transect. These data will be used to link hunting-mediated shifts in dung beetle community composition and structure, to changes in secondary seed dispersal, pest fly suppression, waste removal and bioturbation (e.g. through moving large quantities of earth to the soil surface during nesting). Fieldwork during Phase 3 collected dung beetles in 96 points across each 100 ha *terra firme* plot,

during the first two weeks of each month between October and February. These months were selected, as they represent a period before (October, November), during (December) and after (January, February) the largest, synchronous fruiting event for the western Amazon. The aim of this work is to link monthly fruit, faunal and dung beetle surveys in a spatially explicit grid system, to understand the fine-scale relationships between dung beetle and mammal presence and abundance.

Fieldwork during Phase 1 trained two local hunters (Antonio and Bola), one Brazilian PhD student (R. Braga) and one American PhD student (E. Nichols). Local hunters gained marketable skills in using handheld GPS and digital cameras, and basic scientific collection techniques. Following this training, fieldwork during Phases 2 and 3 was independently and successfully conducted by Antonio and Bola, under supervision from J. Hawes. The beetle specimens collected during this phase are currently being sorted and identified at a collaborative institution (UFLA: the Federal University of Lavras, Minas Gerais) by E. Nichols and R. Braga under the support of UFLA collaborator J. Louzada.

Means of Verification: Photographs of traps being baited by a local hunter (Figure 20) and by Brazilian PhD student (Figure 21).

Activity 3.7. Conduct 0.1 ha tree plot surveys

Between November 2009 and March 2010 vegetation surveys were continued from work started during Year 2 of the project, with the methodology used as described in Annual Report 2. The current total number of forest plots sampled stands at 170 plots of 0.1ha (100 x 10m) each (90 in várzea and 80 in terra firme) dispersed throughout the reserves, with half of each on either river bank. The value of this work has been further enhanced by the identification of trees within a selection of these plots by an experienced technician from INPA. We are expected to carry out a comprehensive assessment of forest structure and composition in the study area, which will include an analysis of aboveground biomass (AGB) and carbon retention across the two reserves amounting to ~886,000 hectares.

Means of Verification: Photograph of monitor measuring tree DBH during survey of 0.1 ha plot (Figure 22).

NEW ACTIVITY 3.8. Conduct bone and leaf decomposition experiments

To investigate varying rates of nutrient cycling in várzea and terra firme forest the project introduced a new activity to record rates of organic matter decomposition. A total of 186 bovine cattle femurs were experimentally spread across six transects (three várzea, three terra firme) and monitored weekly between July and September 2009. Thereafter, monitoring continued monthly until January 2010, with a final check planned for July 2010. Monitoring consisted of (wet and dry) weighing, measuring, photographing, and recording any signs of arthropod, fungal or scavenger activity. For further methodological details see Annex 3.

Similarly, decomposition rates of dried leaf-litter samples are being monitored on a monthly basis. Ten stations were placed 100m apart along six transects (three várzea, three terra firme) with 12 mesh bags containing 4g of dried leaves (from a single tree species) at each station. One bag is removed monthly from each station (October 2009 to September 2010), dried and reweighed. Bags placed in seasonally flooded várzea forest during the inundation pulse are weighted to the ground and retrieved by pulling up a string. These experimental studies are important to our further understanding of the role of contrasting habitat productivity in terra firme and várzea forests, which affects all aspects of resource exploitation and reserve management.

Means of Verification: Photographs of bone and leaf decomposition experiments (Figures 23-24); Abstract of resulting undergraduate thesis (In Annex 3).

NEW ACTIVITY 3.9. Conduct surveys of scavenger vertebrate fauna

Five camera traps were used to monitor scavenging at a selection of the same cattle femurs used in Activity 3.8. Camera traps took three photos at one second intervals for every target animal and motion detected. Camera trapping was conducted at sites in várzea forest for one week, and in terra forest for five weeks. For further methodological details see Annex 3. This work will be amalgamated with the wider camera-trapping work carried out in the Médio Juruá region as part of our project.

Means of Verification: Photograph from camera trap (Figure 25); Abstract of resulting undergraduate thesis (In Annex 3).

NEW ACTIVITY 3.10. Avifaunal surveys

We have conducted an intensive programme of understorey bird sampling in both terra firme and várzea forests on both banks of the Juruá River to understand the effects of fluvial barriers and forest types on the structure of understorey bird assemblages, which was not included in our original proposal. During this reporting period (Oct – Nov 2009), additional net-lines (each of which consisting of 20 nets of 12 m each) were deployed at sites on both reserves by C.A. Peres and W. Endo, with further work at different sites farther upriver expected to take place in the dry season of 2010. In total, we have sampled a total of 30 net-lines at different sites along the Juruá River, which amounts to the most comprehensive study of bird communities in terra firme and várzea forests conducted to date anywhere in the Amazon.

Means of Verification: Photograph of bird identification and measurement (Figure 26); Poster of bird species of the Médio Juruá region of western Brazilian Amazonia (Figure 30).

Output 4. Local communities in RDS Uacari and RESEX Médio-Juruá, and other reserves are able to effectively apply large-scale management recommendations.

Activity 4.1. Analyse long-term data collected from all project components

Two full years of data collection have already been completed by the monitors and project members. Data entry has continued by our local assistant in Carauari, who works five mornings a week to transcribe into Microsoft Excel the weekly household interviews (currently more than 5,000 completed household questionnaires for each product category—cultivated products, non-timber forest products, fishing and hunting—have been entered).

Data from the *Copaifera* harvest (activity 2.3) have been largely analysed and written into a draft paper which it is hoped will be submitted for publication in June 2010. Data from the spatial study of *Copaifera* tree and distribution of other NTFPs (activities 2.2 and 2.4) have been partially analysed.

The principal investigator for activities 3.4, 3.5, 3.7 and the fruit component of 3.3 has just completed a year's fieldwork in the reserves and will now be concentrating data entry, analysis and preparing publications. The principal investigator for activity 3.6 is currently identifying specimens and will be soon entering the data analysis and publication phase too.

Means of Verification: Photograph of data entry assistant conducting data consolidation (Figure 13).

Activity 4.2. Conduct meetings with all local stakeholders

From 14th to 16th September 2009, we organized the 3rd Médio Juruá Workshop for the project participants (monitors and collaborators) at the Bauana Field Station, with the attendance of two thirds of all the invited people. The three-day meeting was again important in developing project activities, including: reinforcing and retraining the different data-collection tasks currently being undertaken by them, presenting preliminary results, receiving feedback from the monitors and further promoting the concept of a team working together to reach common goals. In particular, the project continually reinforced the commonalities in management objectives between the RDS Uacari and RESEX Médio-Juruá for both the local communities of these reserves and the government management agencies responsible for these reserves (SDS and IBAMA, respectively), who often do not communicate with one another. As such, regular contact has also been maintained with our stated partners at these agencies both in Carauari and Manaus.

Means of Verification: Photographs of Bauana workshop (Figures 11-15).

Activity 4.3. Write publications and presentations

The initial results of the *Copaifera* harvest (activity 2.3) and spatial model (activity 2.4) were presented to approximately 100 delegates at the Annual Conference of the Centre for Ecology, Evolution and Conservation (CEEC) at the University of East Anglia on 25th February 2010. A similar presentation was delivered to 300 international delegates at the Student Conference on Conservation Science (SCCS) hosted by the University of Cambridge on 23rd March 2010.

A preliminary look at the fruit productivity and phenology component will be presented at the International Symposium on Frugivores and Seed Dispersal in Montpellier 13-18th June 2010.

In addition, lessons and/or preliminary results from this project have also been presented by the project leader in the following international meetings (*titles of talks in parentheses*): LBA-GEOMA-PPBIO Meeting promoted by the Brazilian Ministry of Science and Technology, Manaus, Brazil, 12 November 2008 (*Scales of disturbance and biodiversity erosion in Amazonian forests*); the Association for Tropical Biology and Conservation Annual Meeting – Marburg, Germany, 28 July 2009 (*The hunting footprint of Amazonian forests*); Cascading Effects of Defaunation symposium – Stanford University, USA, 12 March 2009 (*The hunting footprint of Amazonian forests*); Monitoring Biodiversity in Protected Areas, Ministry of Environment of Brasil, Brasília, Brazil. 10 Feb 2009 (*Quantifying biodiversity conservation performance in Amazonian protected areas*); Duke University Nicholas School of the Environment, Durham, North Carolina, 29 January 2010 (*Bottom-up control of mammal biomass in hunted and nonhunted neotropical forests*); Brazilian Congress of Zoology, Belém, Brazil, 9 Feb 2010 (*Pervasive effects of hunting pressure in Amazonian forests*); Monitoring the sustainability and value of wild meat harvest: What are the current limitations and how can we overcome them? A Zoological Society of London (ZSL) Workshop, London, 22-23 April 2010 (*Monitoring the Wild Meat Harvest in Neotropical Forests*).

Means of Verification: Presentations at CEEC (Figure 27), and SCCS (Figure 28); web announcements of the above conferences.

Activity 4.4. Interpret findings to develop recommendations

The most fundamental findings of the *Copaifera* component of the project have been developed into a simple guide to the genus within the reserves, containing information regarding species identification and relative oil yields. This guide, which will become very useful in the sustainable management of this NTFP, was produced in collaboration with IDAM, and distributed amongst reserve communities in April 2010. Interpretation of further

project findings and subsequent recommendations will continue to emerge as individual components of the project reach completion.

Means of Verification: *Copaifera* guide (Figure 29).

Activity 4.5. Publish, print and distribute a CBWM handbook

An illustrated community-based wildlife management handbook (in Portuguese) has not yet been written up. As originally anticipated, this will be developed following assessments of the various components of the project, and begin to be distributed internally and externally as the project reaches its end. This handbook is still on schedule to be materialized and will represent the first “manual” in Brazil of how to implement an elementary sustainable hunting programme under a local community co-management structure.

Following the general aim to promote nature conservation by strengthening environmental bonds between local inhabitants and their surrounding environment, the project is also developing material for local schools, which might be used to increase local student awareness in biodiversity and environmental protection. Posters depicting different taxonomic groups, with photos provided by the project authors, are being developed and will soon be distributed to primary/secondary schools in virtually all the villages and surrounding areas of the two reserves, as well as in the Carauari urban area.

Means of Verification: Poster guides for birds, fish and reptiles (Figure 30).

Activity 4.6. Organise workshop in Manaus to present findings and recommendations

A final technical workshop in collaboration with SDS in Manaus is still expected to take place but will now be scheduled after September 2010.

Means of Verification: N/A

3.2 Progress towards Project Outputs

Output 1. *Assessment of forest resources extracted, and levels of offtake.*

Good progress has continued on all activities contributing towards Output 1. Weekly interviews recording the types and amounts of resources extracted, the frequency of extraction, the spatial structure of harvesting activities, and the relative contributions that these forest resources make to the income of households and communities have continued to be conducted throughout the year in 13 communities (with an additional 14 communities monitored by our ProBUC partners). These have now been complemented by questionnaires investigating demographic and socio-economic profiles, access to services and markets, and motivations for particular agro-extractivist behaviours.

The species, identity, weight, sex and reproductive condition of all game animals consumed are also still being recorded at 27 communities by local field monitors trained by the project, independently of ProBUC. Spatially-explicit mapping of hunting forays, assisted with GPS receivers, continues to complement the household interviews which also record locations of kills and hunting routes according to the cognitive map of the hunter and key landmarks across individual catchment areas. Successful completion of the output is very likely but will only be achieved after further consolidation of these data sets.

Indicator 1a: Daily records of the identity, weight, sex and reproductive condition of animals consumed, including game vertebrates and fish.

Means of verification: Photograph of monitor measuring hunted animal (Figure 5).

Indicator 1b: Spatially-explicit mapping of hunting trips and resources harvested.

Means of verification: Map of hunting trips mapped from four villages (Figure 4).

Output 2. *Quantitative assessment of the demographic sustainability of forest resource extraction.*

Good progress has continued on most activities contributing towards Output 2. In particular the project has successfully opened the planned transects in the most remote high terra firme areas and some additional unprotected sites outside the reserves. The system of transects is therefore complete, with a total of 90 transects (including 15 monitored by ProBUC) on both banks of the Rio Juruá in both várzea and terra firme forest.

The spatial distribution of key NTFP populations were successfully mapped along várzea transects in July-September 2009, to compare with previous surveys conducted along terra firme transects. The study of the demographic impact of extraction of *Copaifera* oil was adapted to become an experimental harvest, and trees are currently being re-harvested to assess the sustainability of this practise. The development of a population ecology model for *Copaifera* is also progressing well with fieldwork for this activity now complete.

Successful completion of the output is very likely but is still dependent upon the completion of hunting catchment area mapping and experimental oil extraction in the short term, and further long term accumulation of faunal censuses and household interviews. We also plan to generate a spatially-explicit sustainable harvest model for key game species in the reserves but this will be done in collaboration with a competent spatial modeller using a previously tested approach (Levi et al. 2009. *J Appl Ecol* 46:804-814) which will take place in late 2010 (see correspondence of Jan, March and August 2009 with LTS on the revised schedule for these project activities). However, there is little point in attempting to do this until all the data we need are already available.

Indicator 2a: Seasonally repeated census data from at least 100 line-transects of 5 km in length in both hunted and non-hunted várzea, paleo-várzea, and terra firme forests, on both banks of the Rio Juruá.

Means of verification: Map of established transects (Figure 6); Monitor conducting line transect (Figure 17).

Indicator 2b: Mapping of the spatial distribution of key NTFP populations, including Copaifera *and* Carapa *trees.*

Means of verification: Figure of Copaifera *species surveyed throughout the reserves (Figure 8).*

Indicator 2c: A study of the demographic impact of extractive practices on key NTFP resource populations.

Means of verification: Local monitor drilling Copaifera *tree (Figure 9).*

Indicator 2d: Sustainable harvest models under different source-sink scenarios.

Means of verification: Not yet available for this project to date, but see probability surface map of hunting pressure across the entire study region (Figure 31) and *Levi, T. et al 2009. Modelling the long-term sustainability of indigenous hunting in Manu National Park, Peru: Landscape-scale management implications for Amazonia. Journal of Applied Ecology: 46 804-814.*

Output 3. *Local monitors, field technicians and students able to assess and monitor forest biodiversity and socioeconomic responses to reserve implementation using quantitative methods.*

Good progress has been continued on most aspects contributing towards Output 3, particularly on the training of local monitors. At the present moment, most communities within the two study reserves have, at least one trained person monitoring the local forest biodiversity, using scientifically tested methods. For example, 29 monitors are now conducting monthly line transects for fauna and fleshy or sclerocarpic fruits. A further five monitors are trained to survey the three 100-ha plots (containing a 100 x 100m trail grid) for fauna and fruit, and to collect material from the 192 fruit/leaf-litter traps every two weeks, with an additional two monitors trained in the drying and weighing of this material.

Reinforcement of training for phenology monitors has continued, four monitors have now been trained to survey the 0.1 ha vegetation plots and two monitors have been trained to sample avifauna using mist-nets. Two further monitors were trained in dung beetle surveys, which were conducted between July 2009 and February 2010, and two additional monitors are now very competent in setting up net-lines and processing birds captured in mist-nets.

The majority of the trained monitors have already been assisted closely with their work by the project team for more than 2 years. To increase the effectiveness of their monitoring, each monitor has also had the chance to participate in three different training workshops promoted by the project, which has facilitated communication between different communities across the two reserves. Amongst other skills, monitors have been trained or are being trained to: follow methodical proceedings, identify all target-species found in the area, quantify animal encounter rates (using analogic counters), weigh hunted animals (read spring scales), measure hunted animals (read rulers), map hunting areas (using GPS units), measure trees (using DBH measuring tapes), weigh dried fruits and leaves (using digital scales), record hunted animals and fallen fruit (using digital cameras), sample dung-beetle and avifauna communities, discriminate units for each product recorded in household interviews, measure water levels, and record climatic data.

The 59 vegetation plots have been supplemented by a further 111 plots to yield a current total of 170 plots along existing transects, which will be used to assess forest structure and composition, and tree and sapling density. A number of these plots are being used by a Brazilian MSc student working on an ongoing quantitative ethnobotany study.

The Brazilian project investigator who served as a field coordinator for near 3 years (Whaldener Endo), is now a funded PhD student at the Norwegian University of Life Sciences, Aas - Norway, where he will analyse project data in relation to game hunting and related topics under the co-supervision of the project leader. Furthermore, Mr Endo will continue to work in this section of the Juruá River for his PhD work, but expanding the comparative analysis to extractive activities of seven communities of native Amazonians from the neighbouring Deni-Kanamari Indigenous Reserve. This subsidiary project will thereby extend the wider project objectives to capture management issues in all of the protected areas from the Médio Juruá region.

In addition, the project offers some logistical support and access to our trail system and data to Brazilian MSc students enrolled in the INPA Ecology & Conservation program, Manaus (Instituto Nacional de Pesquisas da Amazônia), or elsewhere, who have conducted relevant studies in areas related to project goals. Examples of completed dissertation projects include (1) a comparative study of camera trapping vs. line-transect censusing of large mammals and a study of the competitive interaction between fishermen and Giant River Otters (*Pteronura brasiliensis*) which are often culled under the perception of a “problem animal” by river dwellers; and (2) two MSc dissertations on the socioeconomic and institutional changes associated with reserve creation and implementation in the Médio Juruá region (see below). Further ecological work by Brazilian MSc and PhD students on three different areas of the project, which will be supported partly or entirely by the project logistics, is expected to take place in the 2009-10 reporting year. In summary the training of local monitors is progressing very well but successful achievement of the output will require additional recruitment of Brazilian students.

Indicator: Minimum of 49 local monitors and 10 Brazilian students trained in quantitative biodiversitysurveys, and harvest assessments.

Means of verification: Photograph of training workshop (Figure 11); Photograph of Brazilian PhD student conducting dung-beetle sampling (Figure 21); Citations of three Brazilian student dissertations:

P.F. Rosas-Ribeiro. 2009. Conflitos entre pescadores e ariranhas (Pteronura brasiliensis) na Reserva de Desenvolvimento Sustentável Uacari, rio Juruá, Amazonas. MSc Thesis, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil

G. Calixto Scelza. 2009. Desobriga: o movimento de contra-opressão ao sistema dos seringais no Médio Juruá – AM (1970-2008). MSc Thesis, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

W. Itaborahy. 2009. Terras, florestas, barcos e barracões: "patrões" e "fregueses" no Médio Juruá. MSc dissertation. Universidade Federal Rural do Rio De Janeiro, Rio de Janeiro, Brazil.

Output 4. *Local communities in RDS Uacari and RESEX Médio-Juruá, and other reserves are able to effectively apply large-scale management recommendations.*

Progress will only commence following assessment of the various long-term project components, which are currently entering the last stage of data collection. Regular contact and good relationships are maintained with the local communities and the government agencies formally managing the reserves (SDS and IBAMA). The original assumptions hold true and the output is likely to be achieved by the project close.

Indicator 4a: A user-friendly, illustrated community-based wildlife management (CBWM) handbook that can be distributed to rural communities of lowland Amazonia.

Means of verification: N/A to date.

Indicatory 4b: Publications, presentations and SDS workshop, Manaus.

Means of verification: N/A

3.3 Standard Measures

Project Standard Output Measures

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	Total to date	Number planned for this reporting period	Total planned from application
6A	Local community 'monitors' trained in resource monitoring field techniques	30	30	5	0	65	0	60
6B	Field-course and/or workshop delivered to local community 'monitors'	1	1	1	1	3	1	3
4A	Brazilian undergraduate or graduate students trained in resource monitoring field techniques	0	3	2	2	7	2	12
6A	Full-time MSc-level project staff members, who will help to manage the project, receive the above training plus extensive training in project management	0	1	0	1	1	1	2
6A	Brazilian wildlife biologists trained in line-transect census and camera trapping techniques, and correspondent data analysis	0	2	2	0	2	2	4
6A	Reserve personnel in Carauarí trained in reserve spatial mapping, including the use of a GIS	2	2	0	0	4	0	2
8	A minimum of 32 weeks to be spent by UK project staff (C Peres and Spatial Modeller) at the two focal reserves. This excludes advisory, administrative and political meetings to be held in Manaus and Brasília.	4	4	5	4	13	4	20
12A	Datasets and dynamic databases to be established and shared with SDS and IBAMA.	2	2	2	2	6	8	15
20	Bauana Field Station at RDS Uacari refurbished and equipped (costing ~£3,000)	33%	33%	33%	0%	100%	33%	100%

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	Total to date	Number planned for this reporting period	Total planned from application
20	One laptop and a desktop, equipped with the appropriate software, handed over to reserve office in Carauari.	1	1	0	0	2	0	2
20	Two 8-m aluminium boats powered by 30HP outboard engines to be handed over to reserve office in Carauari.	1	1	0	0	2	0	2
21	Bauana Field Station adequately developed and equipped to serve as a permanent research station and logistical base for future Amazonian forest ecology field courses	33%	33%	33%	0%	100%	33%	100%
22	Three hundred 0.1-hectare (30 ha) permanent tree plots (established according to RAINFOR guidelines) to be recensused over many years after the project is discontinued.	0	5.9ha	11.1ha	3.0ha	20 ha	14.1ha	30ha
22	Approximately 4,000 number-tagged trees included in phonological monitoring available for future studies	500	750	1250	1200	3700	2000	4000
22	'No-take areas' in subcatchment basins >5,000 ha, established within 20 community territories, to be monitored post-project.	2	3	0	0	5	0	10
23	A substantial support in kind in terms of fluvial transport coordination, office and laboratory facilities at SDSManaus, IBAMA-Manaus, INPA-Manaus, the SDS and IBAMA offices in Carauari, and the field station of Bauana (value cannot be estimated at present).	20%	20%	30%	20%	70%	30%	100%
New - Project specific measures	Preparation (cutting, measuring, marking, georeferencing, and mapping) of 60 forest transects of 4 to 5 km in length in várzea and terra firme forest	37	43	10	0	90	0	60
New - Project specific measures	Allocation of harvest categories to 30 oxbow lakes which will be monitored in terms of CPUE (catch per unit effort) of freshwater resources (mostly fish)	10	10	10	0	30	10	30
New - Project specific measures	Avifaunal net-lines in várzea and terra firme forest	0	0	4	12	4	4	0
New - Project specific measures	Sample floristic plots as part of a new quantitative ethnobotany study	0	0	20	0	20	20	0

Publications

Most publications relating to current activities specifically deployed by this project are still unavailable at this early stage but this table highlights a few of our recently published papers that are directly relevant to project objectives.

Type	Detail	Publishers	Available from	Cost £
Book chapter	Peres, C.A. 2009. Overexploitation. In Conservation Biology for All (eds. N. S. Sodhi & P. R. Ehrlich), pages 107-130.	Oxford University Press, Oxford.	C.Peres@uea.ac.uk	0
Journal	Peres, C.A., Gardner, T.A., Barlow, J., Jansen, J., Michalski, F., Lees, A.C., Vieira, I.C.G., Moreira, F.M.D., Feeley, K., 2010. Biodiversity conservation in human-modified Amazonian forest landscapes.	Biological Conservation online 1 Feb 2010	C.Peres@uea.ac.uk	0
Book chapter	de Thoisy, B., C. Richard-Hansen and C.A. Peres (2009). Impacts of Subsistence Game Hunting on Amazonian Primates, In Developments in Primatology: Progress and Prospects,	Springer, New York. 389:389-412. DOI 10.1007/978-0-387-78705-3.	C.Peres@uea.ac.uk	0
Journal	Levi T, GH Shepard Jr, J Ohl-Schacherer, CC Wilmers, C.A. Peres, DW Yu. 2010. Spatial tools for assessing the sustainability of subsistence hunting in tropical forests.	Ecological Applications. In press	C.Peres@uea.ac.uk	0
Journal	Levi, T., Shepard Jr, G.H., Ohl-Schacherer, J., Peres, C.A., Yu, D.W. 2009. Modelling the long-term sustainability of indigenous hunting in Manu National Park, Peru: Landscape-scale management implications for Amazonia.	Journal of Applied Ecology: 46 804-814.	C.Peres@uea.ac.uk	0
Journal	Stork, N.E., Coddington, J.A., Colwell, R.K., Chazdon, R.L., Dick, C.W., Peres, C.A., Sloan, S., Willis, K. 2009. Vulnerability and resilience of tropical forest species to land-use change.	Conservation Biology 23: 1438-1447.	C.Peres@uea.ac.uk	0
Journal	Endo, W., C.A. Peres, E. Salas, S. Mori, G.H. Shepard, V. Pacheco, D.W. Yu. 2010. Game vertebrate densities in hunted and nonhunted forest sites in Manu National Park, Peru.	Biotropica 42(2): 251–261.	C.Peres@uea.ac.uk; neotropical@gmail.com;	0
Journal	Bicknell, J. and C.A. Peres. 2010. Vertebrate population responses to reduced-impact logging in a neotropical forest.	Forest Ecology and Management, in press.	C.Peres@uea.ac.uk	0
Journal	Parry, L., C.A. Peres, B. Day and S. Amaral. 2010. Rural-urban migration brings conservation threats and opportunities to Amazonian watersheds.	Conservation Letters, in press.	C.Peres@uea.ac.uk	0
Journal	Palminteri, S., Powell, G.V.N., Endo, W., Kirkby, C.A., Yu, D. & Peres, C.A. 2010. Usefulness of species range polygons for predicting local primate occurrences in southeastern Peru.	*American Journal of Primatology*, in press.	C.Peres@uea.ac.uk	0
Journal	Tabarelli, M., Lopes, A.V., L.C. Girão, B.A. Santos and C.A. Peres. 2010. Pervasive pioneer hyper-abundance drives floristic shifts in long-term Atlantic Forest isolates.	Conservation Biology, in press.	C.Peres@uea.ac.uk	0
Journal	Sampaio R, AP Lima, WE Magnusson and C.A. Peres. 2010. Long-term persistence of midsized to large-bodied mammals in Amazonian forest fragments.	Biodiversity and Conservation, DOI: 10.1007/s10531-010-9848-3	C.Peres@uea.ac.uk	0
Journal	Tabarelli T, AV Aguiar, MC Ribeiro, JP Metzger, C.A. Peres Prospects for biodiversity conservation in the Atlantic Forest: Lessons from aging human-modified landscapes.	*Biological Conservation, online 1 March 2010*	C.Peres@uea.ac.uk	0
Journal	Michalski F, JP Metzger and C.A. Peres. 2010. Rural property size drives patterns of upland and riparian forest retention in a tropical deforestation frontier.	Global Environmental Change, in press. doi:10.1016/j.gloenvcha.2010.04.010	C.Peres@uea.ac.uk	0
Journal	Gardner TA, J Barlow, N. Sodhi and C.A. Peres. 2010. Biodiversity conservation in human-dominated tropical forests.	*Biological Conservation*, in press.	C.Peres@uea.ac.uk	0
Journal	Louzada J, TA Gardner, C.A. Peres, J Barlow. 2010. A multi-taxa assessment of nestedness patterns across a multiple-use Amazonian forest landscape.	*Biological Conservation, online 21 February 2010*	C.Peres@uea.ac.uk	0

Type	Detail	Publishers	Available from	Cost £
Journal	Tuck, J.M., T. Haugaasen, C.A. Peres, R. Gribel and P. Wegge. 2010. Brazil nut seed dispersal by scatter-hoarding rodents in a central Amazonian forest.	Journal of Tropical Ecology, 26:251–262.	C.Peres@uea.ac.uk	0
Journal	Barlow J, TA Gardner, J Louzada, C.A. Peres. 2010. Measuring the Conservation Value of Tropical Primary Forests: The Effect of Occasional Species on Estimates of Biodiversity Uniqueness.	PLoS ONE 5(3):1-8.	C.Peres@uea.ac.uk	0
Journal	Chazdon, R.L., C.A. Peres, D. Dent, D. Sheil, A.E. Lugo, D. Lamb, N.E. Stork and S. Miller. 2009. Where are the wild things? Assessing the potential for species conservation in tropical secondary forests.	Conservation Biology. 23: 1406-1417.	C.Peres@uea.ac.uk	0
Journal	Lees, A.C. and C.A. Peres. 2010. Habitat and life history determinants of antbird local extinction in variable-sized Amazonian forest fragments.	Biotropica XX:XXX-XXX.	C.Peres@uea.ac.uk	0
Journal	Nichols, E., Gardner, T.A., Peres, C.A., Spector, S. 2009. Co-declining mammals and dung beetles: An impending ecological cascade.	Oikos 118: 481-487.	C.Peres@uea.ac.uk	0
Journal	Silva-Júnior, W.M., Meira-Neto, J.A., Silva Carmo, F.M., Melo, F., Moreira, L., Barbosa, E., Dias, L.G., Silva, Peres, C.A. 2009. Habitat quality of the woolly spider monkey (*Brachyteles hypoxanthus*).	Folia Primatologica 80: 295-308.	C.Peres@uea.ac.uk	0
Journal	Galetti, M., R.S Bueno, SCS Bernardo, RS Bovendorp, CA Steffler, P Rubim, SK Gobbo, RM Marques, RA Nobre, CI Donatti, RA Begotti, F Meirelles, HC Giacomini, AG Chiarello and C.A. Peres. 2009. Conservation priorities and regional scale determinants of medium and large mammal abundance across the Atlantic forest.	Biological Conservation 142: 1229-1241	C.Peres@uea.ac.uk	0
Journal	Lopes, A.V., L.C. Girão, B.A. Santos, C.A. Peres and M. Tabarelli. 2009. Long-term erosion of tree reproductive trait diversity in edge-dominated Atlantic forest fragments.	Biological Conservation 142: 1154-1165.	C.Peres@uea.ac.uk	0
Journal	Lees, A.C. and C.A. Peres. 2009. Gap-crossing movements predict species occupancy in Amazonian forest fragments.	Oikos 118:280-290.	C.Peres@uea.ac.uk	0
Journal	Parry, L., J. Barlow and C.A. Peres. 2009. Allocation of hunting effort by Amazonian smallholders: Implications for conserving wildlife in mixed-use landscapes.	Biological Conservation 142: 1777-1786.	C.Peres@uea.ac.uk	0
Journal	Parry, L., J. Barlow and C.A. Peres. 2009. Hunting for sustainability in tropical secondary forests.	Conservation Biology. 23: 1270-1280.	C.Peres@uea.ac.uk	0
Journal	Haugaasen, T. and C.A. Peres (2009). Interspecific primate associations in Amazonian flooded and unflooded forests.	Primates 50:239-251.	C.Peres@uea.ac.uk	0

3.4 Progress towards the project purpose and outcomes

At this stage in this large-scale project, only part of the project outcomes have been achieved, and therefore progress towards the defined project purpose is still limited. The purpose level assumptions still hold true and the indicators still appear adequate for measuring outcomes at this stage. The active and willing participation of all our partners, including focal communities, to date has been very encouraging and the project continues to provide regular support and discussion to ensure this continued participation. No other two adjacent sustainable use reserves across the entire Brazilian Amazon (which contains over 550 protected areas) are moving towards an integrated natural resource management regime that explicitly considers spatial issues in relation to both harvesters and resource populations. It is our expectation that the lessons learned in the Médio Juruá region will be applied to other reserves across Amazonas and other Brazilian states within the Amazon.

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

It is not possible at this stage in the project to provide properly substantiated evidence upon progress at the goal level. However, many key large-bodied terrestrial and aquatic species that had been overharvested for decades in this part of the Amazon are now showing clear signs of population recovery within the boundaries of the two reserves where we have been working. In the aquatic realm (rivers and oxbow lakes), these include freshwater manatee (*Trichechus inunguis*), giant river otter (*Pteronura brasiliensis*), arapaima fish (*Arapaima gigas*) and giant freshwater turtles (*Podocnemis expansa*); as well as controversial species that present lethal or sublethal threats to reserve inhabitats (e.g. 4-6m long Black caimans, *Melanosulchus niger*). In forest areas, these include white-lipped peccaries (*Tayassu pecari*) and almost certainly woolly monkeys (*Lagothrix cana*) and Wattled currasow (*Crax globulosa*). The project intends to conduct a detailed analysis of population trends and recovery of the key game and commercially harvested fish species, as well as local attitudes towards the recovery and sustainable management of these populations.

4. Monitoring, evaluation and lessons

Project members with responsibilities for different project activities have continued to stay in constant discussion when in the field with each other to ensure optimal coordination, an economy of scale, and to monitor the combined progress of these complementary aspects of the project. As a result of lessons learnt from previous years, at least one project member has been on the ground (within any of the two reserves) in the field all year round, to maintain face-to-face contact with all field assistants and to report on progress back to the project leader and other project members. Monitoring of project activities throughout the vast area of the two reserves involve bimonthly visits to each of the monitored communities (along a 400-km section of the Juruá River) to both make payments to field assistants, discuss progress in data collection, and ensure data quality control. These visits are also reinforced by our annual meeting with all project 'monitores' on the occasion of our training and confraternization workshop. Our government partners in Brazil (Manaus and Carauarí) are reasonably satistied with project progression, even though most of our outputs will be delayed to coincide with the final semester of the project and beyond. We expect to fully contribute to the expansion and enhancement of the Management Plan of each reserve, while integrating key implementation goals. Project briefings and face-to-face discussions are also held with partners at SDS and IBAMA every time project members come through Manaus and Carauarí, respectively. Our office in Carauarí and/or meetings at the Bauana Field Station also ensure regular contact with the SDS-Carauarí office in relation to ProBUC activities.

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

The PL and the research team have carefully considered the Review Report of 20th June 2009 concerning our last Annual Report. Most of the concerns expressed therein were rather minor. However, there were more fundamental concerns about (1) communicating project results to local community partners; (2) progress with data analysis of field data and (3) the impact of the diminished role of the Spatial Modeller (originally a 10-month PDRA position at UEA) in the overall project output. I therefore address each of these concerns as following:

Local communication: Project members have been repeated contact with local community leaders; local field assistants who often occupy key positions of influence in their villages; the leadership of CNS (National Rubber-Tapper Council); the reserve managers in Carauari; and state-level management agency personnel in Manaus. We agree that face-to-face

contact is irreplaceable, which has been a challenge given the scale of the project and number of communities involved, yet we have managed to maintain regular exchanges with all our local partners and focal communities. The project members are not overly concerned about this issue, and we shall invite all parties concerned for the final meeting (now most likely in 2011) that will present a 3-day summary of project results and outputs.

Data processing and dissemination: One of the greatest challenges of this project has been to be able to deliver the project outputs in a timely fashion, and we are all keenly aware of this lag in the outputs, not least because of our partners in Brazil. However, given the sheer spatial scale of the project, extreme seasonality of várzea forests and inter-annual variation in many aspects of forest ecology, early problems in transect access and preparation, particularly in the most remote upstream areas, and the fact that most of our sampling protocols require monthly continuity for nearly the duration of the entire 3-year project, we are only now beginning to turn to data analysis and integration. All core members of the project are research-led academics committed to publishing project results in the most appropriate outlets. We are confident therefore that we will complete the vast majority of the deliverables, even if this falls slightly outside the project period. On the plus side, several of our data sets are now reaching sufficient maturity to stand alone in any robust analytical treatment, and we look forward to being able to do this in the foreseeable future.

Spatial modelling of hunting sustainability: This change from the proposed project was explained in some detail in an email to Eilidth Young (Darwin) of 11 August 2009; the subsequent Change Request on our budget was approved later that month (ref LTS035) when we were told that LTS was “happy” to agree with our request. I here summary this position again.

Because of the various financial difficulties encountered by the project team, not least the relentless devaluation of the British Sterling (£) against the Brazilian Real (R$) and sinking of our main diesel-powered boat, the PL formed a strategic collaborative partnership with a experienced Spatial Modeller based at University of California - Santa Cruz (Dr Taal Levi), rather than hiring a postdoctoral fellow to execute this component of the project. This collaboration brings the dual advantage of (1) costing the project nothing and (2) bypassing the early teething problems that any postdoctoral candidate in the UK or overseas -- who would be unlikely to have previously modelled source-sink population dynamics in the context of vertebrate game hunting catchment areas in tropical forests -- would encounter within the first two months after joining the project. Clear evidence that this collaboration will be successful comes from Dr Levi’s willingness to become involved in the project in a timely fashion, and his successful modelling of tropical forest game harvesting in a similar landscape context in Manu National Park, southern Peru, of which the PL is a co-author (see Levi et al. 2009. Mapping and managing the landscape sustainability of indigenous hunting in a tropical park. Journal of Applied Ecology 46: 804 - 814). The funds from those 4 months of post-doc salary, which had been previously allocated to this modelling exercise [as agreed by Darwin as per communication from *Eilidh Young* of 12 March 2009] could then be reallocated to quintessential local project logistics (incl. transportation, spiralling fuel costs, boat repairs and maintenance, and local wage costs). Short of reducing the total duration of the field component of the project, which is undesirable, the PL saw this as the only option in solving our severe budget shortfall, as a successful request for additional funds from Darwin would seem unlikely.

Since this Change Request approval from Darwin, we are pleased to report that the spatial modelling component of the game harvest part of the project will indeed go ahead. This will complement the an accessibility analysis of extractive activities across the two reserves in which, for example, the spatial allocation of hunting pressure is predicted (see Figure 22). We might add that this now tried-and-tested computationally intensive modelling approach will take advantage of 3 years of work covered by another project. We will therefore still be

able to produce this modelling component without any major impacts on the delivery of the project outputs.

6. Other comments on progress not covered elsewhere

Very briefly, the design of the project has not been significantly enhanced over the last year, but we were able to consolidate on our proposed design and finish setting up transects in new census sites and develop a range of new project activities. There have been a number of financial and logistical difficulties encountered [not least because the GPB(£) has been devaluated from £1≈R$4.5 to £1≈R$2.6 since this project was initially proposed] but these have been discussed elsewhere. In sum, we are pleased to report that despite these difficulties the project does not face any particular risk of being discontinued prematurely, and our cooperative agreements with local communities, government authorities and reserve managers have gone from strength to strength.

7. Sustainability

The profile of the project has increased further during this year, both in Brazil and internationally. Presentations at UEA, Cambridge and London have increased the project's profile in the UK, while work conducted at INPA and UFLA in relation to fruit and dung-beetles respectively have served to spread knowledge of the project within Brazil.

A brief introduction about the project was presented at the Norwegian University of Life Sciences, as an attempt to link our project with a new study proposal for the Rio Xeruã Indigenous Territories, an area adjacent to our focal reserves, in which successful project activities will be replicated for a minimum of 3 yrs after the project end date, thereby promoting an even stronger basis for a comprehensive understanding of the socio-ecological processes that govern natural resource management in the Médio Juruá region.

The project has also been further advertised by the project leader Carlos Peres at the following meetings: LBA-GEOMA-PPBIO Meeting, Brazilian Ministry of Science and Technology, Manaus, Brazil, 12 November 2008; the Association for Tropical Biology and Conservation Annual Meeting – Marburg, Germany, 28 July 2009; Cascading Effects of Defaunation symposium – Stanford University, USA, 12 March 2009; Monitoring Biodiversity in Protected Areas, Ministry of Environment of Brasil, Brasília, Brazil. 10 Feb 2009; Duke University Nicholas School of the Environment, Durham, North Carolina, 29 January 2010; Brazilian Congress of Zoology, Belém, Brazil, 9 Feb 2010; Monitoring the sustainability and value of wild meat harvest. Zoological Society of London (ZSL), London, 22-23 April 2010.

The project study sites and trail system have now been firmly advertised and incorporated into the PPBio biodiversity science network coordinated by the Brazilian Ministry of Science Programme of Biodiversity Research (see http://ppbio.inpa.gov.br). The project entry into the PPBio website can be viewed at http://ppbio.inpa.gov.br/Port/inventarios/mediojurua; and we are attracting some interest from postgraduate students and researchers alike, despite the remoteness of our study sites.

There is also increasing interest in the Project and the project sites from new Brazilian researchers and postgraduate students who are due to work with us in the next year. For example, Regina de Souza Yabe (MSc, University of Brasília) is due to begin her PhD fieldwork working with the PL on bird community structure and the role of rivers in maintaining beta-diversity of vertebrates, in September 2010. The same can be said of Fernando Figueiredo, Dr Flávia Costa and Gabriela Zuquim of the Instituto Nacional de Pesquisas da Amazônia, Manaus, who are due to work on the Maranthaceae and other herbaceous plant communities within our reserves.

The most logical exit strategy for the project is through its natural succession via the ProBUC programme, which on paper will be funded by the State of Amazonas Environmental

Secretariat for many years to come well beyond the lifetime of this project. The project therefore continues to fine-tune long-term integration of objectives with this programme, and both PMJ (our project) and ProBUC has learned from one another in implementing monitoring activities in situ. Recent discussions have focused on data sharing and analytical aspects of this cooperative venture.

8. Dissemination

Dissemination work in Brazil during the past year includes most notably the workshop in Bauana (14th -16th September 2009), which was attended by local reserve residents as well as staff from local institutions including SDS, IBAMA/ICMBio, CNS, ASPROC and AMARU.

In addition, a guide to the *Copaifera* species found in the reserves has been produced in collaboration with IDAM and has been distributed to partner institutions and reserve residents.

Dissemination activities will continue throughout the next year and also following the end of the project. This is very important as complete analysis of the results from many components of the project will not be possible before the official end date. Project members are already considering how to raise external funding for these activities.

9. Project Expenditure

Project expenditure <u>during the reporting period</u> (Defra Financial Year 1 April 2008 to 31 March 2009)

Item	**Budget** (Research Award Notification, University of East Anglia; RGN1 of 08 April 2009)	**Expenditure**	**Variance**
Rent, rates, heating, overheads etc (UEA Overheads)			
Office costs (eg postage, telephone, stationery)			
Travel and subsistence			
Printing			
Conferences, seminars, etc			
Capital items/equipment (specify)			
Others (specify)			
Salaries Research Staff (Spatial Modeller) to be hired as PDRA at Univ East Anglia PI Allocated Staff Cost (Prof C Peres) Exceptional Staff (including all project monitors, community leaders, field assistants and field coordinator)			
TOTAL			

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

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

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2009/10

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
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* *The conservation of biological diversity,* *The sustainable use of its components, and* *The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources*		*(report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity eg steps towards sustainable use or equitable sharing of costs or benefits)*	*(do not fill not applicable)*
Purpose To design appropriate guidelines to manage game vertebrates and other key NTFP resource populations in large multiple-use tropical forest reserve, helping the Brazilian federal and state governments in developing, stimulating and implementing effective community-based forest resource management programmes that are grounded in the socioeconomic reality of Amazonian Sustainable Development and Extractive Reserves, and Indigenous Territories.	*New and unique knowledge on the spatial structure of extractive activities in tropical forest reserves, and how these relate to natural mosaics of habitat productivity.* *Quantitative estimates of sustainable harvest quotas of target species, assuming both a closed and an open population scenario where depletion can be balanced by immigrants from source areas.* *An experimental study of the source-sink dynamics of game populations using multiple large no-take areas mapped with the assistance of and enforced with the help of local communities.* Results that provide the State of Amazonas and the Brazilian federal government with practical management information helping them fulfill commitments to the Convention on Biological Diversity.	Very good progress towards achieving the project purpose has been made on all outputs. Particular improvements have been made by the completion of fieldwork in a number of areas including the aspects of the *Copaifera* study and the extensive dung-beetle surveys. In addition, there has been a great increase in the number of 0.1 ha vegetation plots mapped and surveyed, and continuous surveys recording fruit productivity and phenology have been maintained for a full year. An important advance is the identification of trees tagged for phenology monitoring. The good start has been maintained in reinforcing the training of monitors and in monitoring households, transects, 100ha plots, tagged phenology trees, mapping hunting locations, and experimentally harvesting *Copaifera* trees. Continued progress on all fronts remains reliant on the assumption of the continued high	Continued monitoring of all households, transects and permanent plots. Continued regular support for all monitors to ensure the continuation of high quality data collection.

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
		levels of active participation by focal communities.	
Output 1. Assessment of forest resources extracted, and levels of offtake.	*1a. Daily records of the identity, weight, sex and reproductive condition of animals consumed, including game vertebrates and fish.* *1b. Spatially-explicit mapping of hunting trips and resources harvested.*	Good progress has continued on assessing extraction of forest resources. Weekly interviews have been continued to be conducted throughout the reporting year in 13 communities (with an additional 14 communities monitored by ProBUC). The identity, weight, sex and reproductive condition of game animals has been recorded in all 27 communities. Spatially-explicit mapping of hunting trips has also continued and may be introduced for fishing trips associated with the commercial fleet of fishing boats in Carauari. The output will only be achieved after further long term accumulation of these data. Indicators are appropriate.	
Activity 1.1 Household interviews		14 local inhabitants are now fully trained to conduct weekly household interviews in 13 local communities assessing terrestrial and aquatic resource extraction. All monitors have continued to receive regular support and further training where necessary during this period, and this will be maintained during the next period. Existing interviews have been complemented during this year by additional questionnaires on three tiers (in 181 households and 30 communities) to provide demographic and socio-economic profiles, to record access to services and markets, and to investigate motivation for agro-extractivist behaviours.	
Activity 1.2 GIS mapping of the reserves and habitat types		This has been successfully completed and is available to be used by all other components of the project.	
Activity 1.3 GIS analysis of game harvest areas		Household interviews by 14 monitors in 13 communities are recording specific place names where the hunts occur. The 10 active hunters who use a GPS to record each of their hunting trips, have been revisited regularly during this year to reinforce their training. Hunt location will continue to be recorded during the next year, with regular support and further training for monitors where necessary.	
Activity 1.4. Weighing and measuring hunted animals		27 monitors in 26 communities are still identifying, sexing, weighing and measuring the hunting kills arriving in each community. This activity will continue during the next year, with regular support and further training where necessary.	

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
Output 2. Quantitative assessment of the demographic sustainability of forest resource extraction.	*2a. Seasonally repeated census data from at least 100 line-transects of 5 km in length in both hunted and non-hunted várzea, paleo-várzea, and terra firme forests, on both banks of the Rio Juruá.* *2b. Mapping of the spatial distribution of key NTFP populations, including Copaifera and Carapa trees.* *2c. A study of the demographic impact of extractive practices on key NTFP resource populations.* *2d. Sustainable harvest models under different source-sink scenarios.*	Good progress has continued towards this output. Progress has been made by completing the planned extra transects in remote high terra firme areas and the transect system is now complete, with a total of 90 (including 15 monitored by ProBUC) transects evenly spread on both backs of the Rio Juruá in both várzea and terra firme forest. The spatial distribution of key NTFP populations was mapped along várzea transects in July-September 2009. Indicator 2c is no longer appropriate as this aspect has changed from a study of the demographic impact of extraction to an experimental harvest of *Copaifera* oil. This and the development of a population ecology model for *Copaifera* are progressing well, with fieldwork now completed for both activities. The output will be achieved with analysis of the NTFP mapping and extraction in the short term, and further long term accumulation of faunal censuses and household interviews. All indicators apart from 2c are appropriate.	
Activity 2.1. Census faunal transect		A total of 90 transects are now comprising the whole project sampling design. 28 monitors have conducted >2500 km of census data from March 2008 to September 2009. Included in the 90 transects, 6 remote upland terra firme transects were opened and 3 of them have already provided wildlife census data. No further transects will now be opened but transect censuses will continue during the next year, with regular support and further training where necessary.	
Activity 2.2. Map NTFP population density		Surveys for key NTFP species were conducted on 26 várzea transects and three additional terra firme transects. Fieldwork for this activity is now successfully completed.	
Activity 2.3. Experimental harvest of *Copaifera*		Assessing the impact of oil harvest on tree fecundity has been dropped from this activity. To date, 97 adult *Copaifera* trees of four different species have been experimentally harvested, to analyse oil yield in relation to species, DBH and location, and to help predict the potential for extraction on a reserve-wide scale. Oil harvest has been conducted by reserve residents and harvested trees have been revisited by a trained local assistant. During April 2010, this activity will re-harvest some trees to quantify the sustainability of this practise.	

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
Activity 2.4. Develop population ecology model for *Copaifera*		Adult trees, saplings and seedlings from three *Copaifera* species have been censused four times (July 2008, November 2008, April 2009, and finally in April 2010). Fieldwork for this activity is now successfully completed.	
Activity 2.5. Introduce reserve-wide harvest zoning agreements		SDS is completing the final zoning agreement for the RDS Uacari, and the project has already been granted permission to continue censuses in all areas that have been effectively set aside, including total restriction zones.	
NEW ACTIVITY 2.6. Conduct a quantitative ethnobotany survey		Based on floristic plots conduct a comprehensive survey of the extractive uses of trees and woody lianas in both várzea and terra firme forest, including an investigation of the local plant taxonomy and the range of species used for a wide variety of domestic and commercial purposes.	
Output 3. Local monitors, field technicians and students able to assess and monitor forest biodiversity using quantitative methods.	*3. Minimum of 49 local monitors and 10 Brazilian students trained in quantitative biodiversity surveys, and harvest assessments.*	Good progress has been maintained in the reinforcement of training for all local monitors. 28 monitors are now conducting monthly line transects for fauna and fruit. Five monitors received further training to survey the three 100 ha plots for fauna and fruit, and to collect material from the 192 fruit/leaf-litter traps every two weeks, with an additional two monitors trained in the drying and weighing of this material, and another monitor trained to conduct the phenology work. Four monitors were trained to survey the 0.1 ha vegetation plots and two monitors were trained to use mist-nets to sample birds. Two monitors were trained in dung beetle surveys conducted between July 2009 and February 2010. The dung beetle surveys also contributed to the training of one Brazilian PhD student. A Brazilian MSc student is currently being trained in tree identification and ethnobotany as part of New Activity 2.6. Training of local monitors is continuing very well but achievement of the output will still require the recruitment of further Brazilian students . The indicator is appropriate.	
Activity 3.1. Conduct training workshop(s)		A third training event (workshop/field course) was held at Bauana Field Station (14-16th September 2009) directed by the project leader Carlos Peres. Basic training has been completed but reinforcement and encouragement is still important for the duration of the project.	
Activity 3.2. Continue post-workshop training		All monitors and interviewers have been revisited regularly to check any problems, answer any questions or doubts, and to provide extra training if necessary. This regular support aims to assure the continued long-term collection of quality data. Additional/replacement monitors have been trained during this year in a few cases where substitutions became necessary.	

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
Activity 3.3 Conduct line transect surveys		90 line-transects have now been opened. 28 monitors are still visiting those transects monthly to census wildlife populations and fruiting trees.	
Activity 3.4 Conduct 100 ha plot surveys		Monthly censuses for fauna, residual fruit-fall, and fruit-feeding observations, have been conducted successfully and continuously in the three 100 ha plots for most months between May 2009 and April 2010. Assistants have been trained in the use of digital cameras to record the fruit collections made. In addition, bi-weekly collections of material from leaf-litter/fruit traps in two of these plots has continued between May 2009 and April 2010.	
Activity 3.5. Conduct plant phenology surveys		Two more transects were added to yield a final total of eight 1 km transects (989 tagged trees or lianas (456 in várzea, 533 in terra firme) observed monthly. Monthly surveys of these transects were carried out continuously during this year by the principal investigator of this component, and the closely attended training will hopefully ensure high quality data collection until the conclusion of the project.	
Activity 3.6. Conduct dung beetle surveys		Extensive sampling of dung beetle populations was conducted between July 2009 and February 2010 along 30 transects in both várzea and terra firme, as well as in communities. Surveys were repeated in both the wet and dry seasons. Additionally, the two terra firme 100 ha plots were surveyed monthly between October 2009 and February 2010. Fieldwork for this activity is now successfully completed and dung-beetle specimens are currently being identified prior to analysis.	
Activity 3.7. Conduct 0.1 ha tree plots		Vegetation surveys were conducted in 111 small plots (10m x 100m) which, in combination with surveys conducted in 2008, brings the current total to 170 (17.0 ha). This work will assess the density of trees, lianas and saplings in várzea and terra firme habitats, as well as derive estimates of above-ground biomass and carbon stocks across the reserves and will be continued during the next year. A total of 300 plots was planned but 200 may now be more realistic.	
NEW ACTIVITY 3.8. Conduct bone and leaf decomposition experiments		Six transects (three várzea; three terra firme) are being used to monitor decomposition of cattle femurs (July 2009 – July 2010) and leaf litter (September 2009 – September 2010).	
NEW ACTIVITY 3.9. Conduct surveys for scavenger fauna		Camera trapping was used during July-Aug 2009 to record scavenging activities at selected sites baited with cattle femurs in várzea and terra firme forest.	

Project summary	Measurable Indicators	Progress and Achievements April 2009- April 2010	Actions required/planned for next period
NEW ACTIVITY 3.10. Conduct avifauna surveys		Develop a comprehensive programme of understorey avifaunal surveys using mist-net samples across the two focal reserves.	
Output 4. Local communities in RDS Uacari and RESEX Medio-Jurua, and other reserves are able to effectively apply large-scale management recommendations.	*4a. A user-friendly, illustrated community-based wildlife management (CBWM) handbook that can be distributed to rural communities of lowland Amazonia.* *4b. Publications, presentations and SDS workshop, Manaus.*	Very good progress is being made on the collection of long-term data sets but analysis will still only be possible assuming the successful continuation of the survey methods established. Progress towards this output is therefore only just starting and will advance much further following assessment of various long-term components of the project. The indicators are still appropriate at this point.	
Activity 4.1. Analyse long-term data collected from all project components		Two full years of data collection has been completed. Data entry is ongoing and analysis is underway. This year will see continued data entry and further in-depth analyses.	
Activity 4.2. Conduct meetings with all local stakeholders		Significant meetings with local stakeholders have taken place during the past reporting year, notably the three-day workshop/field course at the Bauana Field Station with local monitors. Further direct contact will be maintained and strengthened during the next year until the end of the project.	
Activity 4.3. Write publications and presentations		Publications and presentations will begin to emerge as individual components of the project reach completion. Presentations are already being given and the first publications are being prepared.	
Activity 4.4. Interpret findings to develop recommendations		Interpretation of findings and subsequent recommendations will begin to emerge as individual components of the project reach completion. The first example is a guide to the *Copaifera* trees found in the reserves.	
Activity 4.5. Publish, print and distribute CBWM		The production of a community-based wildlife management handbook is not planned until further towards the end of the project.	
Activity 4.6. Organise workshop in Manaus to present findings and recommendations		The final technical workshop in collaboration with SDS in Manaus is not planned until further towards the end of the project.	

Annex 2 Project's full current logframe

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: To work with local partners in countries rich in biodiversity but poor in resources to achieve the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.			
Purpose To design appropriate guidelines to manage game vertebrates and other key NTFP resource populations in large multiple-use tropical forest reserve, helping the Brazilian federal and state governments in developing, stimulating and implementing effective community-based forest resource management programmes that are grounded in the socioeconomic reality of Amazonian Sustainable Development and Extractive Reserves, and Indigenous Territories.	*New and unique knowledge on the spatial structure of extractive activities in tropical forest reserves, and how these relate to natural mosaics of habitat productivity.* *Quantitative estimates of sustainable harvest quotas of target species, assuming both a closed and an open population scenario where depletion can be balanced by immigrants from source areas.* *An experimental study of the source-sink dynamics of game populations using multiple large no-take areas mapped with the assistance of and enforced with the help of local communities.* *Results that provide the State of Amazonas and the Brazilian federal government with practical management information helping them fulfill commitments to the Convention on Biological Diversity.*	*Field surveys and spatial modelling data.* *Successful implementation of a viable spatially-structured experimental harvest programme that can be co-managed by local communities.* *Publication and wide distribution of an illustrated user-friendly management handbook that can be understood by the semi-literate rural population of Amazonian extractive and sustainable development reserves.* *Publications in high-impact international scientific journals.* *Reports in Brazilian high-circulation popular science magazines (e.g. Ciência Hoje; Natureza & Sociedade).* *Reports to state-level and federal environmental agencies in Brazil including SDS-State of Amazonas, IBAMA, and Ministério do Meio Ambiente (MMA).*	*That focal communities will maintain their active participation in the project and uphold the experimental manipulation of hunting throughout the length of the project.* *That new knowledge will actually be used by state-level and federal government agencies to instigate, facilitate, design and implement community-based wildlife management (CBWM) programmes in a growing number of Amazonian multiple-use forest reserves.* *That any resulting policy changes will be implemented effectively via SDS-Amazonas, IPAAM, and IBAMA (state and federal branches).* *That IBAMA's National Centre of Sustainable Development of Traditional Populations (CNPT) can help promote participatory CBWM protocols in all Amazonian extractive reserves under its management jurisdiction.* *That several of the lessons and insights from this project will be generalised to other multiple-use Amazonian forest reserves, including Extractive Reserves, Sustainable Development Reserves, National Forests, and Indian Reserves.* *Project results can be fed through to the revision process of the now obsolete federal Faunal Protection legislation act of January 1967.*

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Outputs *1. Assessment of forest resources extracted, and levels of offtake.* *2. Quantitative assessment of the demographic sustainability of forest resource extraction.* *3. Local monitors, field technicians and students able to assess and monitor forest biodiversity using quantitative methods.* *4. Local communities in RDS Uacari and RESEX Medio-Jurua, and other reserves are able to effectively apply large-scale management recommendations.*	*1a. Daily records of the identity, weight, sex and reproductive condition of animals consumed, including game vertebrates and fish.* *1b. Spatially-explicit mapping of hunting trips and resources harvested.* *2a. Seasonally repeated census data from at least 100 line-transects of 5 km in length in both hunted and nonhunted várzea, paleo-várzea, and terra firme forests, on both banks of the Rio Juruá.* *2b. Mapping of the spatial distribution of key NTFP populations, including Copaifera and Carapa trees.* *2c. A study of the demographic impact of extractive practices on key NTFP resource populations.* *2d. Sustainable harvest models under different source-sink scenarios.* *3. Minimum of 49 local monitors and 10 Brazilian students trained in quantitative biodiversity surveys, and harvest assessments.* *4a. A user-friendly, illustrated community-based wildlife management (CBWM) handbook that can be distributed to rural*	*1. Survey reports, biodiversity and resource databases and correspondent files from collaborators.* *2a. Survey reports, data and correspondent files from internal collaborators.* *2b. Survey reports, data and correspondent files from internal collaborators.* *2c. Survey reports, data and correspondent files from internal collaborators.* *2d. Development of spatially-explicit sustainable harvest models.* *3. Field survey reports, correspondent files from collaborators detailing student involvement and skills gained. Skills certification schemes for those involved.* *4a. Wildlife management handbook successfully developed and widely disseminated.* *4b. Twelve papers in peer-reviewed scientific journals, and high-circulation Brazilian science magazines.* *4a & 4b. Copies of all publications, conference abstracts and workshop proceedings sent to DEFRA*	*1. Proposed methods will allow standardised quantification of offtakes and resource densities.* *1&2. Level of acceptability of simplified protocols is sufficiently high, and data acquisition can be sustained.* *1&2. Harvest zoning agreements can be established and maintained.* *2. A competent spatial modeller can be recruited to apply empirical results to a series of harvest mosaic scenarios based on spatio-temporal simulations.* *2&3. Adequate students can be attracted from within partner institutions.* *3. Assimilation by local community 'monitors' and MSc students of field course information is satisfactory.* *4. Impact of the SDS/INPA Technical Workshop and publications are sufficiently significant to influence wildlife management policy through IBAMA, IPAAM, and MMA (Ministry of Environment).* *4. Level of receptivity and uptake of resource management guidelines at RDS Uacari and RESEX Medio-Jurua are satisfactory.* *4. Results are adequate to provide novel publications with national and international impact.* *4. Level of receptivity and uptake of resource management guidelines are satisfactory in other State of Amazonas reserves where the project 'toolbox' approach is applied.*

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	communities of lowland Amazonia. *4b. Publications, presentations and SDS workshop, Manaus.*	*(Darwin Initiative).*	
Activities *GIS mapping of the reserves and forest types, establishment of harvest and population census protocols, experimental design and considerations of spatial scale;* *Training of local community monitors, Brazilian MSc students and reserve staff;* *Field research programme involving the delimitation and implementation of experimental no-take areas following wide consultation with at least 20 of the 49 local communities.* *Data analysis and spatial modelling;* *Dissemination of results;* *SDS/INPA Workshop.*	Activity Milestones *Yr1: Formal assessment of RDS Uacari and ResEx Médio Juruá, including spatial mapping of forest types, local communities, and stream subcatchment basins, and establishment of harvest protocols (4 months; Sept-Dec 2007).* *Yr1: Leaders of all 49 local communities attend the initial planning meetings and training sessions; Selection of Brazilian students from collaborating institutions; Initiation of short field courses and supervised training programme; Experimental no-take areas are delimited and begin operating (6 months; Sept – Feb 2007/08).* *Yr1 - Yr3: Sampling protocols agreed by July 2007. Household-level surveys targeting specific resource types and fieldwork begin, including 24 month quantification of seasonal changes and phenological patterns of resource populations and their food supply (Sept 2007 - Aug 2009).* *Yr 3: Ongoing analysis and spatial modelling conducted throughout the period of data collection will be enhanced and finalised within a 6 month period following termination of field data collection (Sept 2009 – Feb 2010).* *Yr 3 – Yr4: SDS/INPA Workshop; First high-impact publication and management handbook (March 2010) followed by others both in Portuguese and English. Information summarised and presented to the State of Amazonas and Brazilian Federal Government.*		Assumptions GIS mapping can be completed both at UEA and SDS on the basis of high-resolution satellite images and initial field surveys. INPA and SDS contacts are in place; Fieldwork logistics can be implemented at Carauari, Amazonas; boats and other equipment are purchased and field station is refurbished. Local communities become willing collaborators, as indicated by partner institutions. Deployment of experimental no-take areas can be agreed upon following mapping of catchment areas, as indicated by collaborating institutions. Theoretical and applied results are written-up. Illustrator completes hand-drawings. Workshop is well attended by IPAAM, SDS, IBAMA and INPA staff.

Annex 3 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

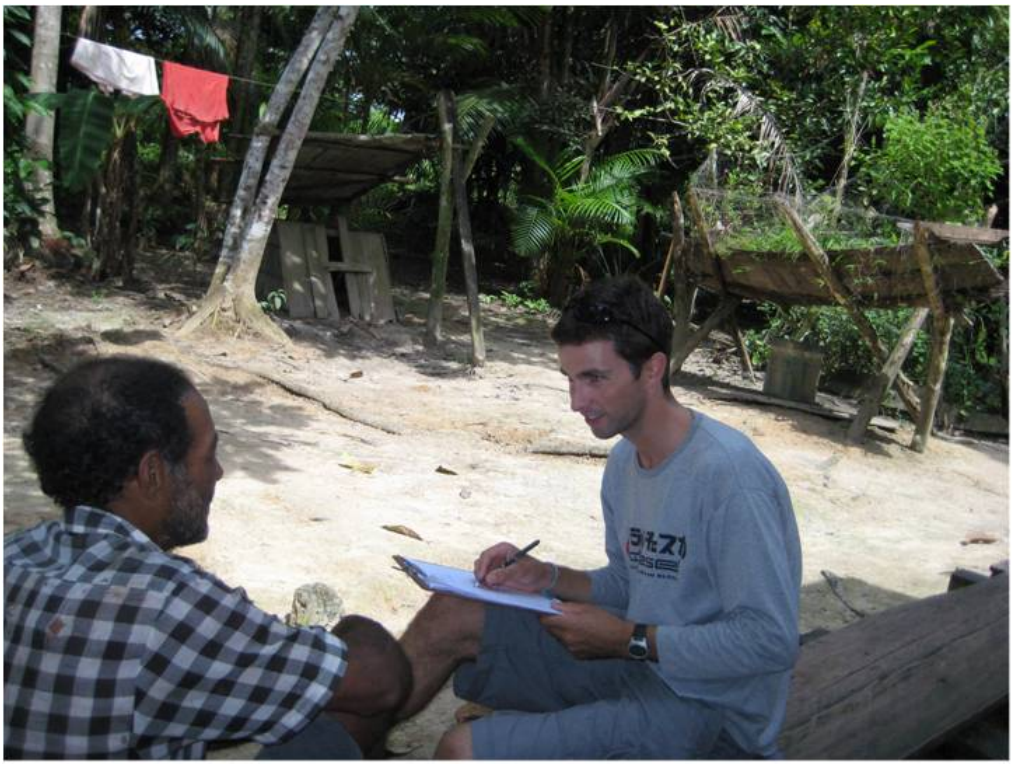

Figure 2. Household interview of head of household by a project member.

Figure 3. Focal-group interview with project member, showing local field assistants and community leaders.

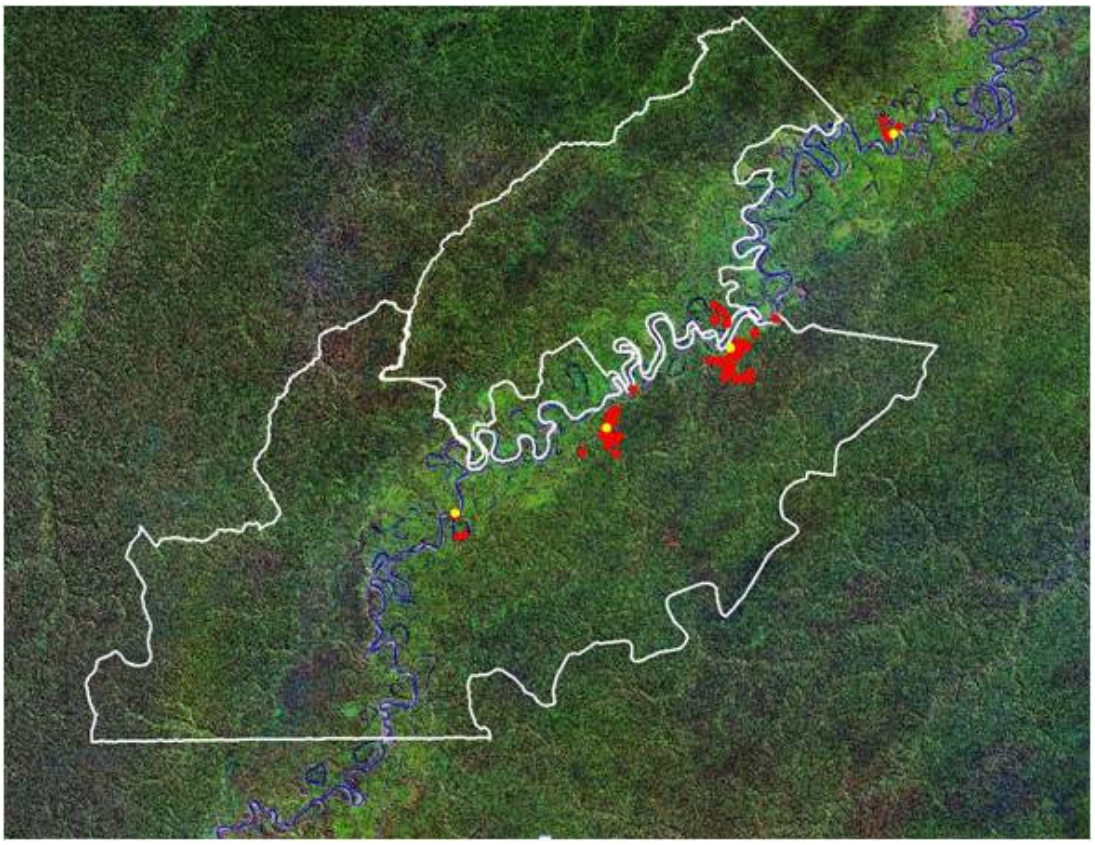

Figure 4. Initial mapping of hunting trips at four distinct villages in the Medio-Jurua region.

Figure 5. Project monitor measuring a red howler monkey (*Alouatta seniculus*) hunted by villagers.

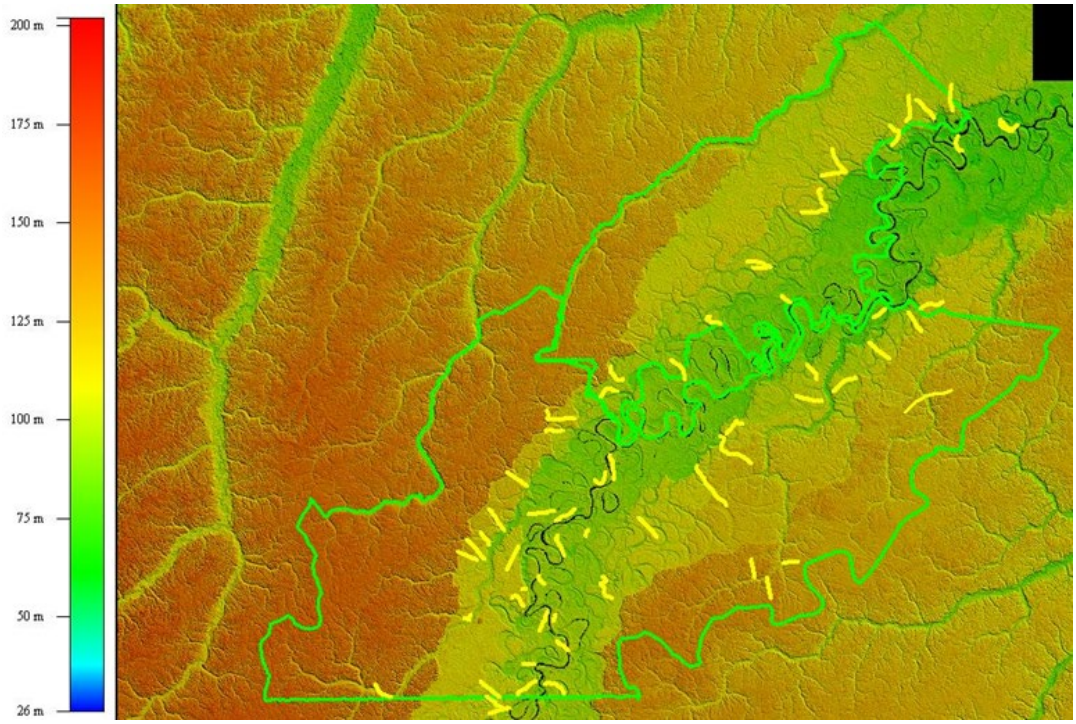

Figure 6. Map of established transects in floodplain (várzea) forest (green areas) and terra firme forest on higher ground (yellow and orange areas).


Figure 7. Motorized canoe trip up a perennial stream to reach one of the most remote areas to open new transects for faunal and fruit censuses.

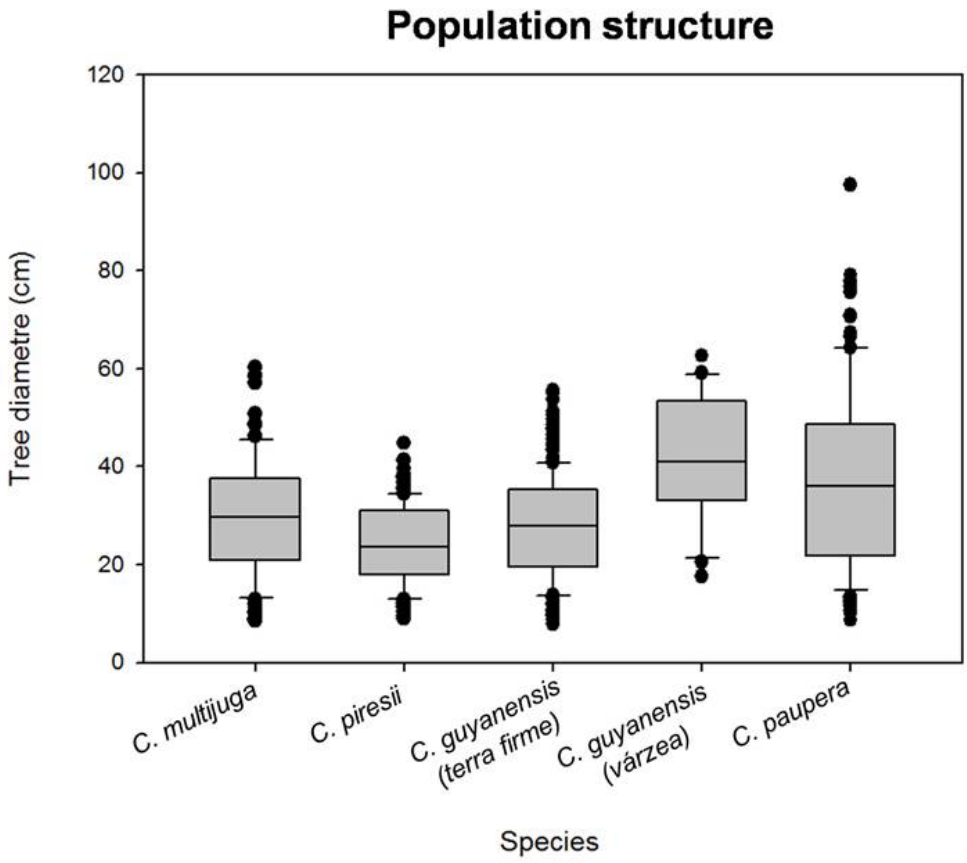

Figure 8. Population structure of *Copaifera* spp. from transects surveyed in terra firme and várzea forests.

Figure 9: Local monitor drilling a *Copaifera* tree to extract a medicinal oil.

Figure 10. Local field assistant visiting a drilled *Copaifera* tree to measure, identify and georeference it.

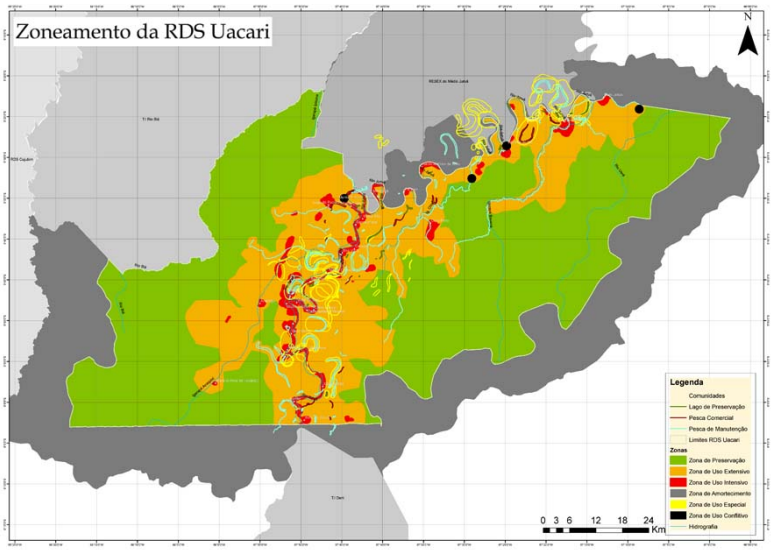

Figure 10a. Map of no-take areas set aside within the Uacari Sustainable Development Reserve under local agreements with the communities most directly affected by these wildlife refugia.

Means of verification for Activity 2.6 – Map, data and results are not yet available.

Figure 11. Attendees (monitors, collaborators & project members) at the 3rd Project Workshop at Bauana field station, held in September 2009.

Figure 12. The project coordinator with monitors at the 3rd Project Workshop.

Figure 13. Data entry assistant (Lucineide Viana) conducting data consolidation and data quality control with local interview monitor at the 3rd Project Workshop.

Figure 14. IBAMA employees at the 3rd Project Workshop lecturing on reserve management objectives.

Figure 15. SDS collaborator attending the 3rd Project Workshop.


Figure 16. Project member reinforcing methodological training of line transect surveys in the field.

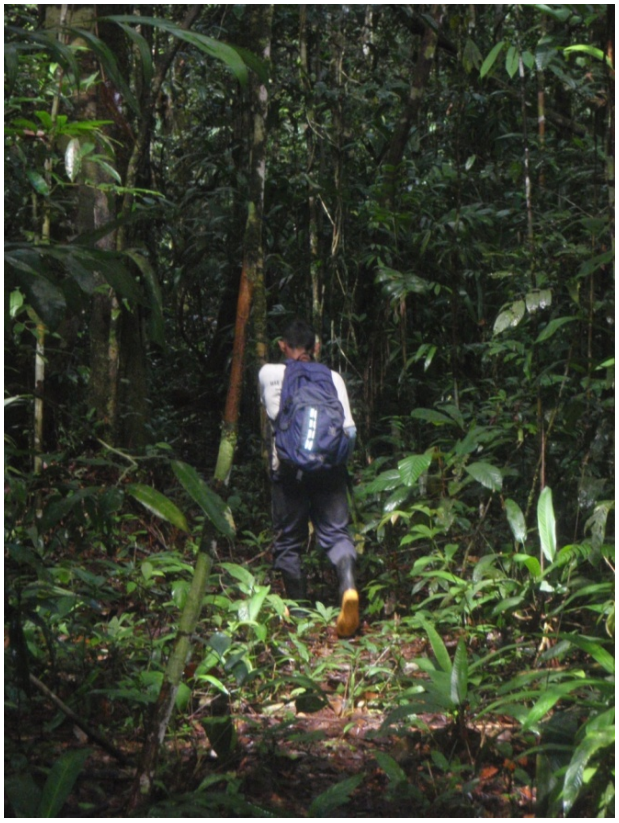

Figure 17. Monitor conducting a line transect survey for fauna and fruit.

Figure 18. Monitor collecting material from a suspended fruit/leaf-litter traps within a 100 ha forest plot.

Figure 19. INPA herbarium technician and local assistant identifying tagged trees monitored on a monthly basis during phenological surveys.

Figure 20. ‘Bola’, a local hunter, setting up a dung-beetle trap on one of the project transects.

Figure 21. Brazilian postgraduate student (R. Braga) and member of the dung-beetle team baiting a trap.

Figure 22. Monitor measuring tree DBH during survey of 0.1 ha plot.

Figure 23. Bone decomposition experiment being carried out by an undergraduate student.

Figure 24. Leaf-litter decomposition experiment in várzea forest prior to flooding.

Figure 25. Nine-banded armadillo (Dasypus novemcinctus) captured by a camera trap at a bone decomposition site.

Figure 26. Carlos Peres, the project coordinator, processing a bird extracted from a mist-net line.

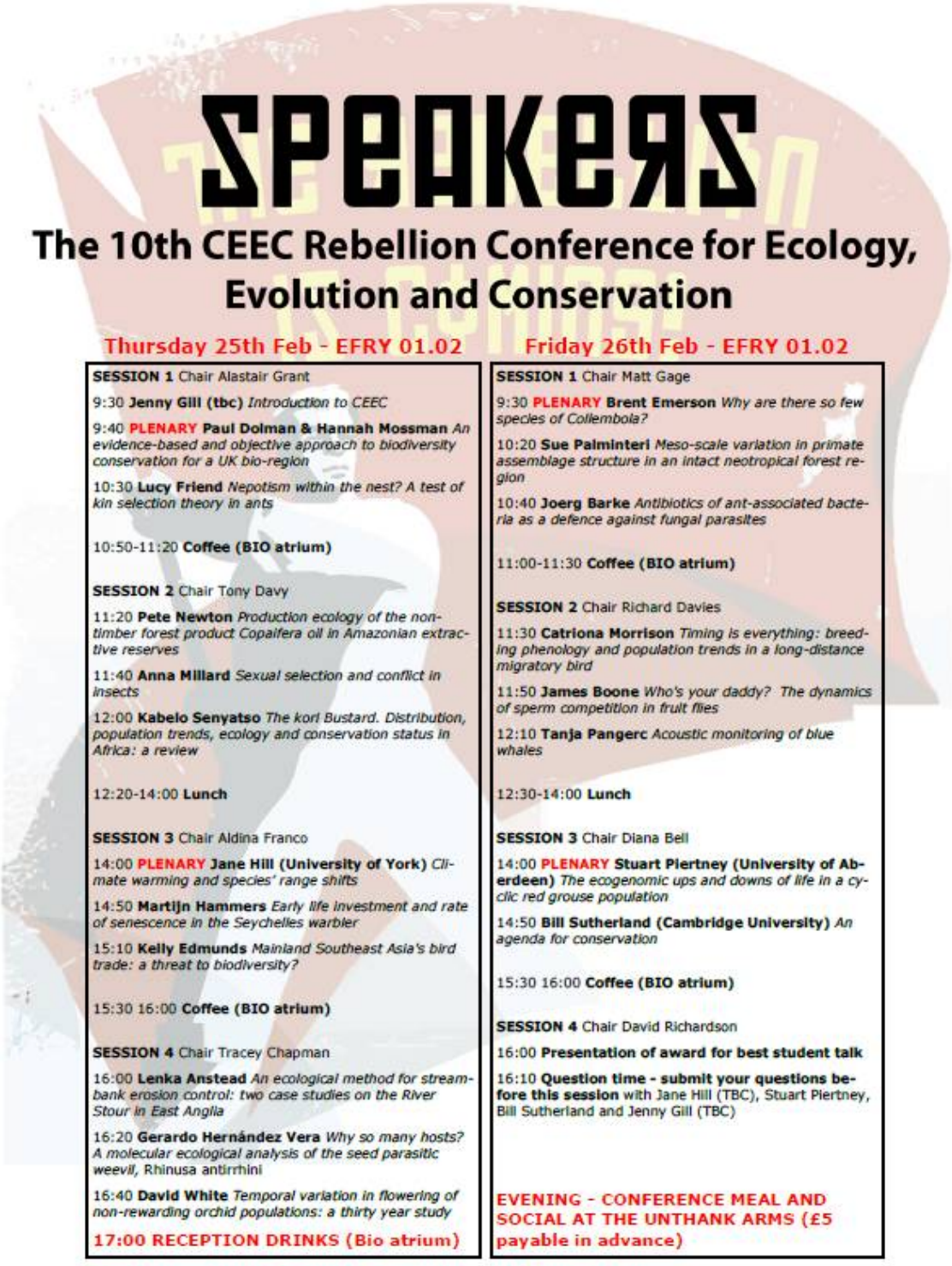

Figure 27. Presentation by P. Newton at CEEC, University of East Anglia, February 2010.

Student Conference on Conservation Science
23 -25 March 2010

PROGRAMME

Tuesday 23 March 2010

08.30 - 09.30	Registration in Zoology Department (Elementary Lab)	
09.30 - 09.45	**Welcome**	Professor Alison Richard (University of Cambridge)
09.45 - 10.00	**Introduction to the conference**	Rosie Trevelyan (Tropical Biology Association)
10.00 - 11.00	**Plenary: The Cinderella story of tropical forests and climate mitigation**	
	Professor Ruth DeFries (Columbia University, USA)	Chair: Jon Hutton (UNEP-WCMC)
11.00 - 11.30	Coffee (Elementary Lab)	
11.30 – 12.50	**Student talks: Session 1**	**Habitat fragmentation and conservation corridors**
Land-cover change, forest fragmentation and gorillas		Bienvenu Takem Mbi (Cameroon)
Habitat fragmentation, predation and bird behaviour		Renzo Vargas (Bolivia)
Conservation value of human-modified habitats in a Costa Rican corridor		Alvaro Redondo Brenes (Costa Rica)
The feasibility of conservation corridors in Peru		Daniela Lainez del Pozo (Peru)
12.50 - 14.00	Lunch (Elementary Lab)	
14.00 - 15.30	**Workshops: Session 1**	
15.30 - 16.00	Tea (Elementary Lab)	
16.00 – 17.40	**Student talks: Session 2**	**People and livelihoods**
What makes benefit-sharing work? A study among the San		Guilia Sajeva (Italy)
Modeling resource use in Maputaland		Bruno Nhancale (Mozambique)
Estimating the resource potential of Amazonian extractive reserves		Peter Newton (UK)
Market forces, resource management and biodiversity in Kichwa communities		Johan Oldekop (Germany)
Seaweed farming: can it reduce fishing pressure on coral reefs?		Nick Hill (UK)
18.00 – 19.00	**Who's who in conservation?** (with pizza, in Elementary Lab)	
19.00 – 20.45	**Wine reception, sponsored by *Science*** (in Zoology Museum)	
	Introduction to plenary (Babbage Lecture Theatre)	Sir Graham Wynne (RSPB)
	Plenary: Conservation - where have we come from, and where are we going?	
	Tony Juniper (Prince of Wales' Rainforest Project and the Green Party)	

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Figure 28. Presentation by P. Newton at SCCS, University of Cambridge, March 2010.

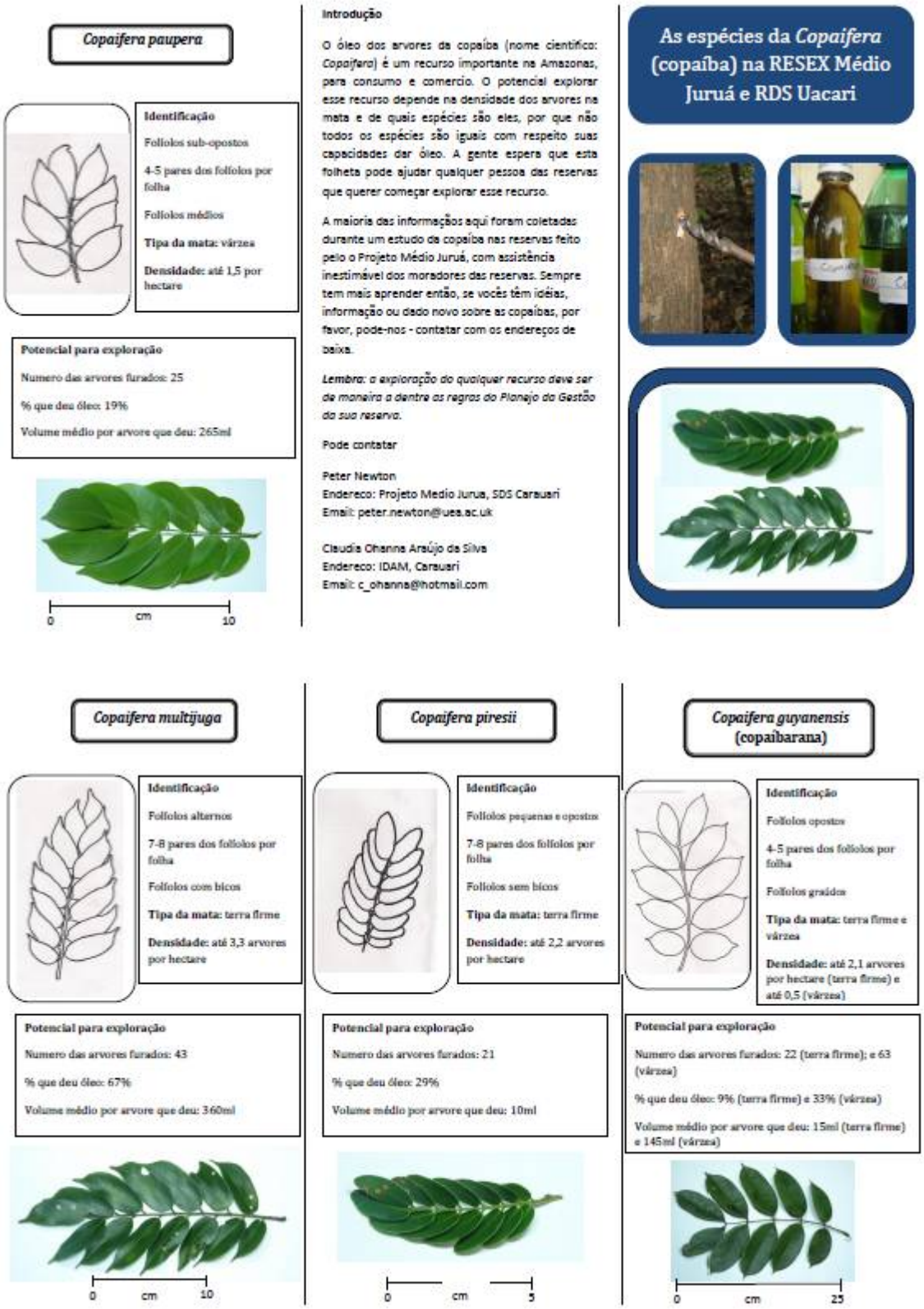

Figure 29. Field guide to *Copaifera* spp. trees produced in collaboration with IDAM.

Figure 30. Posters of birds, fish and reptiles produced for distribution in local primary schools in Carauari.

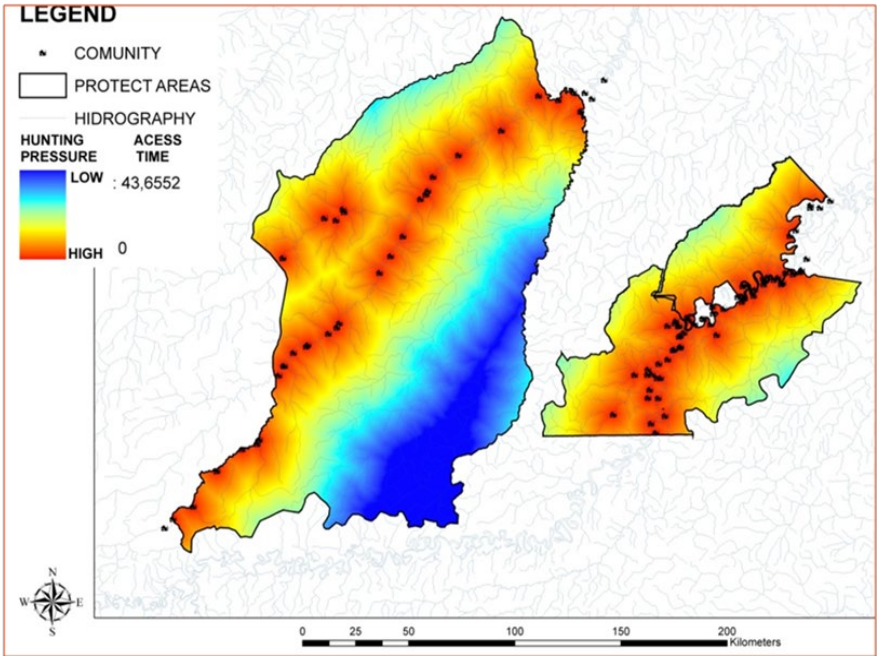

Figure 31. Radially-asymmetric time-limited hunter accessibility model (Peres et al. unpubl. data) across three reserves in the State of Amazonas including the two target reserves included in this project. Red (hotspots) and blue areas (coldspots) show zones of high and low probability of physical access, respectively, across a large landscape in which the biophysical properties of the terrain are known.

NEW ACTIVITIES 3.8 and 3.9

A study into the decomposition of cattle femurs in an Amazonian rainforest: a comparison of nutrient cycling between terra firme and várzea forests. **[An undergraduate dissertation (January 2010) at the University of East Anglia by Leejiah Dorward]**

Abstract:

Terra firme (unflooded) forests grow on some of the least fertile soils in the Amazon basin; in contrast várzea forests are annually flooded by white water river systems which deposit mineral rich Andean sediment leaving higher levels of plant important nutrients in várzea soils. Ecosystems that grow on poor soils often display tighter nutrient cycling than those growing on fertile soils. The rates of decomposition of cattle femurs in terra firme and várzea were compared to test if nutrient cycling in terra firme was tighter than in várzea. The impact of insect numbers, vertebrate activity, fungal activity and a number of environmental variables on decomposition were also compared. Decomposition of the femurs was shown to be phased, initially the decomposition of residual soft tissue dominated weight loss after which bone tissue decomposition dominated. Multiple regressions showed different variables affected weight loss during different decomposition phases. Insects and visible microbial activity had a greater impact on decomposition in the first phase ($P<0.001$, $R2=0.71$), while soil moisture and forest type dominated the later phase ($P<0.001$, $R2=0.34$). Vertebrate and maggot activity along with the time period that the medullary cavity had been exposed were significant factors throughout. Forest type was a significant variable in multiple regressions ($P<0.001$, $R2=0.64$) of the whole decomposition process ($P=0.003$) with terra firme femurs decaying faster. The formula $y = a + be^{-kt}$ was used to calculate decay constants (k values) for each femur, these differed between forest types ($P<0.001$) with k values in terra firme showing faster decomposition rates than those várzea. These results support the hypothesis that nutrient cycling in terra firme is more efficient than in várzea. The complex interactions of variables at different stages of the decomposition process show how complicated a process bone decomposition is and its value as an area research that deserves more attention.

Methodology - Bones:

186 cattle femurs were spread across six transects split evenly between terra firme and várzea. Exceptionally high river levels in 2009 forced a delay and staggering in deployment of femurs in várzea, deployment was in the week starting 8th July in terra firme and the week starting 27th July in várzea. Femurs were secured to small trees every 150m along the transects with wire. The femurs were visited on a weekly basis until the 11th September and terra firme femurs were visited again on the week starting 11 October. At each visitation femurs were weighed and data was also collected on the percentage arthropod cover by type (termites, ants, beetles, maggots and flies and bees) and the percentage of the femurs surface displaying discolouration or fungal growths (as a rough measure of the level of fungal and microbial activity). Whether the medullary cavity was externally accessible to invertebrates and vertebrates and any sign of vertebrate activity, such as tracks on the ground within 2m of the femur or marks of feeding since the last visit on the femurs, was also recorded. Femurs were categorized according to a 1-7 index of bone condition which was also recorded at every visit. At each site canopy photos were taken and later analysed with Gap Light Analyzer to assess canopy gap fraction and leaf litter volume was also measured. To estimate the rate of water loss from the femurs five fresh femurs were weighed, dried in an oven until there was no further weight loss and then reweighed. Every three weeks five femurs were randomly selected from each forest type and removed from the forest to be weighed, dried and reweighed to estimate the rate of water loss from the femurs that were in the field.

Methodology - Camera Traps:

Five digital Reconyx HP45 camera traps (Reconyx, LLP, 3600 Hwy 157, Suite 205, La Crosse, WI 54601) were used to monitor scavenging at femurs. Five femur sites were camera trapped in terra firme however due to initial software incompatibility issues with the camera traps this effort only continued for a week. These problems were resolved by the time the femurs were placed in várzea where five femurs were camera trapped for five weeks. Camera traps were placed 30cm off the ground on trees approximately four metres away from the femur being trapped. Camera traps were set up to take three photos at one second intervals for every motion detected. Femurs were selected for camera trapping by their proximity to animal trails or by their placement in habitat that was expected to achieve higher capture rates. However, it was made sure that cameras were at least 1km apart to ensure some degree of independence.

Checklist for submission

	Check
Is the report less than 5MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	x
Is your report more than 5MB? If so, please advise Darwin-Projects@ltsi.co.uk that the report will be send by post on CD, putting the project number in the Subject line.	
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	x
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	
Have you involved your partners in preparation of the report and named the main contributors	x
Have you completed the Project Expenditure table fully?	x
Do not include claim forms or other communications with this report.	No