



DEVISING SOLUTIONS TO BUSHMEAT EXPLOITATION IN THE CROSS-SANAGA REGION, W. AFRICA

PROJECT REFERENCE NUMBER: 162/10/004



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Darwin Initiative for the Survival of Species

Final Report

1. Darwin Project Information

<i>Project Title</i>	Devising solutions to bushmeat exploitation in the Sanaga-Cross region, W. Africa.
<i>Country(ies)</i>	Nigeria, Cameroon, Equatorial Guinea.
<i>Contractor</i>	Durrell Wildlife Conservation Trust/WildCRU University of Oxford
<i>Project Reference No.</i>	162/10/004
<i>Grant Value</i>	£216,018
<i>Start/Finishing dates</i>	Oct 2001 – April 2004

2. Project Background/Rationale

- ***Describe the location and circumstances of the project***

It is now widely acknowledged that commercial trading in the meat of wild animals is on the increase. Continuous exploitation of bushmeat is possible only if hunting-induced mortality does not exceed production. Various studies in West and Central Africa have clearly pointed to an ever-increasing demand for this meat, because it is either the only protein source for the low-income sectors of the human population or because it is a sought-out commodity by the more affluent. The bushmeat crisis is thus a multi-layered problem with, until now, unstudied linkages between the socio-economics of the human consumers and the biology of the prey species.

With this in mind, we chose a crucially significant biodiversity "hot spot" in tropical Africa: the Cross-Sanaga Rivers region (Cameroon and Nigeria), and including Bioko Island (Equatorial Guinea). Our study was directly applicable to this region but also tested region-wide methodology that can be applied elsewhere in West and Central Africa. The Cross-Sanaga River region (an area of approximately 40,000 km²) has fauna of major international conservation importance, currently threatened by the bushmeat trade. In addition to time spent in Africa, project staff spent time (approximately 6 months of the total project period) at the Durrell Wildlife Conservation Trust, Jersey, United Kingdom. WildCRU provided administrative and institutional support for the project, as well as expertise in desk-top publishing, statistical and professional support for the work undertaken. Regional workshops were held at Yaoundé and Calabar. Facilities in Calabar and Cameroon were made available by CERCOPAN and Limbe Botanical Gardens respectively.

- ***What was the problem that the project aimed to address?***

Vertebrate defaunation of the world's remaining tropical forests through overhunting is considered a major cause of biodiversity loss, in some cases more important than deforestation. Several studies have indicated that exploitation of bushmeat by tropical forest dwellers has increased in recent years. This is due to growing human populations, greater access to undisturbed forests, changes in hunting technology, scarcity of alternative protein sources, and the fact that bushmeat is often a preferred food. Mammals hunted for subsistence or commercial purposes are particularly affected.

Bushmeat hunting is the single most geographically widespread form of resource extraction in tropical forests and can affect the core of even the largest and least accessible nature reserves. Game harvests in South America and Africa usually exceed production, even in the case of traditional aboriginal societies still using rudimentary hunting technology. Such uncontrolled exploitation will bring about marked population declines, and eventually the extinction of a number of game species. Coupled with threats from habitat loss, even from historical deforestation, global extinctions of the most sensitive species such as primates are likely to occur as an accumulation of local disappearances. This may result in long-term changes in tropical forest dynamics through the loss of seed dispersers, large granivores, frugivores, and "habitat landscapers" such as large forest mammals.

Numerous international conservation organizations believe that tropical forest faunas are seriously endangered from current extraction levels of subsistence and commercial hunting. However, few studies have quantified this at a regional scale. Such a broader picture would help conservationists understand the extent of the problem and serve to highlight differences and similarities among geographical areas.

The problem is multi-disciplinary, since there are linkages between the socio-economics of consumers and hunters, and the ecology of the hunted species. Bushmeat is utilised by a wide range of rural and urban communities throughout Africa. Peoples of a wide range of socio-economic backgrounds and levels of access to wildlife are involved. Although the extent of use differs according to communities and countries, a clear trend exists in that demand is high and increasing. Bushmeat is crucial as a source of cheap protein for malnourished people throughout the continent. Inadequate diets and lack of purchasing power has resulted in malnourished peoples that are relying further on what naturally occurs to supplement their agricultural or livestock livelihoods. Human populations are increasing and standards of living are generally falling, thus pushing the demand for bushmeat upwards. Depletion of wildlife valued as a source of meat will have a negative impact not only on many species, but also importantly on food security. As such, this currently represents the most serious challenge in conservation in Africa. As this resource declines not only are a larger and more diverse range of species being targeted, but commercial trade is now an important supply mechanism that is gradually replacing subsistence hunting.

- ***Who identified the need for this project and what evidence is there for a demand for this work and a commitment from the local partner?***

The need for this project was identified by the project leaders. In particular, John Fa's research on bushmeat in the Congo Basin had indicated there was an urgent need to gather adequate data on the use of wildlife in a representative region, and this work fitted as an ideal collaboration with the expertise and work of the WildCRU. It was also crucial to investigate ways of integrating protection of wildlife and provision of protein to people in Africa. This is so because the bushmeat crisis epitomises the need to balance protection against such factors as poverty, health, and food security. Before starting the project, we communicated extensively with our local partners in Nigeria and Cameroon. They agreed that there was a need for our proposed study, and a commitment was made through Memorandums of Understanding with partners in the range countries.

3. Project Summary

- ***What were the purpose and objectives (or purpose and outputs) of the project? Please include the Logical Framework for this project (as an appendix) if this formed part of the original proposal or has been developed since, and report against this.***

This project differs from previous initiatives, not just in its wide regional focus, but in its innovative "high-intensity short time-period" approach to data collection. In order to achieve this, the project required the placement of field workers in strategic parts of the region to collect information on: a) bushmeat carcass numbers and species appearing in markets; b) human demographic data; c) socio-economic information (including wealth distribution and health) and d) population densities of the different prey species (primarily ungulates and primates) within the different forest types. These data were used within Geographic Information Systems (GIS) and used to prioritise areas of importance for conservation planning.

Our project also investigated ways of employing biometric data to generate practical guidelines for sustainable hunting and for monitoring impact. Some progress has been made on the use of sustainable hunting theory and on the use of bushmeat markets as indicators of prey population health. Although data analyses and production of scientific publications are still in progress, we envisage potential outcomes of the project to include better Protected Area Management with value placed on Non-Timber Forest Products. Underpinning this should be capacity building within the various government ministries associated with the environment. Additionally, the complete and continuing work on the amazingly important Darwin data set will provide directions for the development of realistic conservation strategies for extractive use of animals.

We trained 14 research assistants, and deployed another 80 local assistants. They were trained by the project to different levels, and operated over a large number of sites where data were collected. Locally, workshops were run to train project staff and disseminate information about the project. Planning meetings were held between the project directors and in-country co-ordinators

before the start of data collection to steer work on the ground. The project also aimed to stimulate awareness of conservation issues amongst local stakeholders and develop a working relationship and rapport with the conservation community, including enhancement of their ability to use information collected by the project.

A major regional workshop is being planned in Cameroon in 2006-2007 to report on the results of the project and encourage contact and links between workers in bushmeat within the region. This meeting will be a further step in consolidating the legacy of the project. Outputs of the regional workshop will include published proceedings. Efforts have been made pre- and post field work, to contact as many as possible of the regional scientists (working on sustainable use) and conservation managers in order to create a network of projects and links that would have a long term legacy.

- ***Were the original objectives or operational plan modified during the project period? If significant changes were made, when was approval given by the Darwin Secretariat?***

The main objectives of the operational plan of the project were fulfilled. No significant changes were made in the methodology applied. The only restriction to the work was the cost of deploying large numbers of field assistants within the considerable size of the project area. This meant that data collection had to be limited to five months. Despite this, the quality and volume of the data gathered exceeded any previous study of this type. Actually, there has been no previous study using quite such a large-scale approach based on recruiting local parabiologists. Thus, in absolute terms the data set is immense, and itself ensures that there will continue to be momentum from this project long after the official end-date.

- ***Which of the Articles under the Convention on Biological Diversity (CBD) best describes the project? Summaries of the most relevant Articles to Darwin Projects are presented in Appendix I.***

The main aim of the study was to provide a model of the bushmeat problem in general, and develop an integrated solution to the over-exploitation of wildlife in lowland forest areas in Africa. Thus, the project largely focused in investigating levels of extraction of bushmeat within an important biodiversity area in Africa (article 12). These data have been, and continue to be, used to assess the impact of use of wild species involved in the trade and recommend actions for their conservation or sustainable use (article 7). In particular, the project has investigated the impact of wildlife trade on a large number of species in areas surrounding and within national parks (article 8). In addition the project has fostered international ties and co-operation between scientists undertaking similar work (article 18) and has provided training for 14 young Africans and engaged 80 local assistants in wildlife activities during the course of the project (article 12). Two day-long public awareness and education sessions were also undertaken during the project in the habitat countries (article 13).

- ***Briefly discuss how successful the project was in terms of meeting objectives. What objectives were not achieved, or only partly achieved, and have there been significant additional accomplishments?***

The work within the various aspects of the project (landscape ecology, understanding supply and demand issues, seeking alternatives, and consensus building) was carried out as planned (detail given below). Reports, including published scientific papers were submitted to the collaborating organisations in Nigeria, Cameroon, and Equatorial Guinea. Results of this work were disseminated widely, through 10 local workshops and through interaction with stakeholders in the area during the project period.

At an international level, the importance of this project is the magnitude of the work undertaken on the ground. Its great success has been the implementation of a network of data gathering points within a large geographical area. Furthermore, despite the clear logistic challenges faced by the team in mobilising very large numbers of participants in difficult tropical terrain, the project has gathered invaluable data for use in understanding the bushmeat problem, and ultimately to assist in its resolution. Through the resolve of all of its executants, this project should serve as a model for others. In fact, adoption of our methodology has been proposed in the Democratic Republic of Congo to assess the impact of bushmeat hunting on endangered species there.

At a regional level, this project has achieved significantly in bringing together scientists and conservationists working on bushmeat issues. Two annual, regional workshops have been held, facilitated by this project and attended by field assistants, conservationists and scientists working in the region (details of participants given in Table 1). Initial workshops in Nigeria, Cameroon and Equatorial Guinea addressed standardisation of fieldwork techniques. The resulting techniques were used, in fact tried and tested during the duration of the project and can be used as a blueprint for other bushmeat work undertaken by our trained personnel. Regular workshops revisited some aspects of technique used and in addition, the analyses of the data were taught to the 14 research assistants employed by the project.

Data analyses and write-up for publication has been central to the project, but has taken longer than expected. This is largely because the enormity of the data set exceeded our expectations and the preparatory work preparing the data base for analysis was far more time-consuming than we had expected. Furthermore, the analytical challenges were more statistically complex, and hence we had to recruit additional time from statisticians – this was provided at no additional cost by WildCRU personnel, but took additional time. The strength of the data set means that we will also now continue to work on it for even longer than originally expected, as it still has much potential, and we will continue this after the formal completion of the project.

Project Team

Table 1: List of team members and collaborators in the Cross-Sanaga project.

Participant	Country	Project Role or Association
Team Members		
Dr. J. E. Fa	U.K.	Project Leader, Durrell Wildlife Conservation Trust, Jersey
Prof. D. W. Macdonald	U.K.	Project Leader, WildCRU, University of Oxford
Ms. S. Seymour	Nigeria	In-country co-ordinator
Mr J. Dupain	Cameroon	In-country co-ordinator
Dr. P.J. Johnson	U.K.	Statistician, WildCRU, University of Oxford
Ms. L. Albrechtsen	U.K./Equatorial Guinea	PhD student, WildCRU, University of Oxford
Collaborators		
Mr. A. Dutton	U.K.	WildCRU, University of Oxford.
Mr. Colo Agbor	Nigeria	Forestry Commission, Calabar
Mr. C. Agbor	Nigeria	Forestry Commission, Calabar
Dr. R. Amin	U.K.	Institute of Zoology, Zoological Society of London
Dr. M. Rowcliffe	U.K.	Institute of Zoology, Zoological Society of London
Dr. G. Cowlishaw	U.K.	Institute of Zoology, Zoological Society of London
Mr. K. Thomas	U.K.	Institute of Zoology, Zoological Society of London
Prof. J. Oates	U.S.A.	Hunter College, University of New York
Mr. R. Bergl	U.S.A.	Hunter College, University of New York
Dr. J. Cade	U.K.	Nuffield Institute of Human Nutrition, University of Leeds
Dr. D. Greenwood	U.K.	Nuffield Institute of Human Nutrition, University of Leeds, Leeds
Dr. D. J. Bell	U.K.	Centre for Ecology, Evolution and Conservation, School of Environmental Sciences, University of East Anglia, Norwich
Ms. S. Ryan	U.K.	Centre for Ecology, Evolution and Conservation, School of Environmental Sciences, University of East Anglia, Norwich
Dr. J. Meeuwig	Canada	Department of Biology, University of Montreal, Montreal.
Mr. D. Currie	U.K.	Durrell Wildlife Conservation Trust, Jersey

4. Scientific, Training, and Technical Assessment

- ***Please provide a full account of the project's research, training, and/or technical work.***
- ***Research - this should include details of staff, methodology, findings and the extent to which research findings have been subject to peer review.***

a) Estimates of bushmeat volume extracted

Reconnaissance trips were undertaken during December 2001-January 2002 to identify major bushmeat markets and source villages throughout the study area. To standardize sample collection, we undertook a pilot data collection period in Cameroon during February 2002. Based on these results, maximum coverage was considered only possible within a minimum of 90 localities over five months, in order to optimise the costs of deploying field personnel. The timing of sampling was important because of the need to cover wet and dry

seasons. Thus, sample months stretched between August and December 2002. This time period was also considered statistically adequate based on Fa *et al.*'s (2004) assessment of the efficiency of a number of methods for measuring volume of bushmeat extracted as well as the proportion of total species traded. Random sampling of sites was not an option. Instead, we grouped sampling activities around five main areas in Nigeria and another five in Cameroon. None of the sampled sites was within protected areas, although some villages are still found within Korup National Park.

Data were collected from rural and urban markets in 89 settlements (42 in Nigeria and 47 in Cameroon). Days during which bushmeat was recorded varied from 152.2 ± 1.40 days (range 100 -167 days) in Cameroon, to 142.3 ± 5.0 days (range 29-148) in Nigeria; number of sample days differing because not all localities had daily markets. Because of the large number of localities to be sampled, two in-country coordinators (SS, JD) recruited Nigerian and Cameroonian field assistants (a total of 10 in both countries) for the data collection phase of the project. All field assistants were trained in species identification, data entry and basic analysis. Regular workshops were organised to track progress. Field assistants would: 1) introduce project aims and objectives to Chiefs, council and/or community; 2) negotiate and discuss hiring of local collaborators; 3) supervise local collaborators, including regular overseeing and fine-tuning of data collection; and 4) assemble data sheets, and pay local collaborators. A total of five field assistants in Cameroon and another seven in Nigeria were employed by the project. Each assistant was responsible for monitoring from 4 to 9 sites. At each site, local collaborators (who lived in the village or town) were involved in daily data collection. The research assistants, who also worked the same time period and were based in the field, would visit local collaborators regularly to gather completed datasheets. Meetings between the research assistant and the in-country coordinators would take place every two weeks; a total of over 20 during the intensive 5-month data-collection period.

For each locality, the following information on the carcasses deposited at each site were recorded: the identity of the taxon, age and sex of the animal, the condition of the meat (smoked, fresh or alive), the identity of the seller, the sales price (in Nigerian Nairas or Cameroonian Cefa francs), the capture location of the meat, and its final destination. A total of 100,561 transactions were recorded in all localities. Species identification was sometimes difficult if the carcass had been smoked. In these cases, the carcass was identified to genus. This was an issue with some monkeys, carnivores and pangolins, but in only 2% of all transactions. All species were recognised using local names. In the Nigerian localities, around 11 dialects/languages were recorded (including English and pidgin), and another 16 were typical in Cameroon. Identity sheets for primates, duikers and other large mammals were used to help with this process.

Data accuracy was considered high since carcass numbers were counted directly by the trained field assistants, and all entries into a site monitored. The latter was verified during preliminary stays and discussions with villagers (or market stall owners in the case of large towns) before data collection started. Most of the recorded trade was legal, but some species (e.g. drill, chimpanzee, gorilla) are protected and, nominally at least, illegal.

Nonetheless, trade in protected species usually takes place openly. In some instances, only field assistants (who were local) were allowed to enter villages that may engage in illegal hunting e.g. those surrounding the National Parks. This is because although most bushmeat sellers were willing to allow field assistants to count carcasses on sale, others were extremely wary and data collection could have been seriously jeopardised if more than one observer was seen to be involved.

Extraction levels by species and taxonomic groups were calculated for all sites. From data collected during sample days (a total of 7,594 site days; 4,936 site days in Nigeria and another 2,658 site days in Cameroon) we normalized the data and computed numbers of carcasses extracted per annum. This was achieved by first calculating the average number of carcasses per species appearing in a site per day from the total number of days sampled during the study period ($n = 153$). Biomass extracted was then estimated by multiplying carcass numbers by the published species weights for mammals, reptiles and birds.

b) Development of sampling techniques using bushmeat markets

We used six relatively long-term datasets collected from bushmeat markets to explore how different sampling strategies perform in terms of representing known attributes of the entire sample. These markets are in parts of West Africa known to be internationally important for a variety of mammal species. We assessed the efficiency of each method in measuring the volume of bushmeat extracted (mean carcasses per day), their economic impact (the mean value of bushmeat offered per day), and the proportion of total species traded in the full series that are recorded by the strategy in question. We varied both the number of days sampled, and their temporal distribution with respect to each other, and how they are allocated with respect to the 'wet' and 'dry' seasons. We used a variant of Monte Carlo methodology to achieve this aim and we also compared how this empirical approach compared with estimates of required sample sizes derived from standard sampling theory.

While there is no guarantee that observations on a small number of markets can be extrapolated to other sites, these observations may provide some guidance for sample planning where no other data are available.

c) Household nutrition surveys

Household food consumption surveys provide a powerful yet economical tool for obtaining information about food consumption characteristics of a wide-cross section of the population. The nutrition assessment was field-tested as part of a more comprehensive baseline survey. The survey team (1 dedicated nutrition assistant in Nigeria and 2 in Cameroon- project staff) completed a sample of 850 household surveys after a period of intensive training and fieldwork. The surveys were field-tested in 2 villages of different ethnic origin, in Nigeria. The questionnaire was adapted and retested several times in order to increase the information derived from the interview, and to make the questions as understandable as possible.

Road conditions greatly complicated the fieldwork, although well-planned logistical support mitigated some of these difficulties. Research assistants travelled to each of their data collection sites in order to check on progress, and the limitations of public transport on bad roads in the rainy season made straightforward travelling impossible. Some sites were impassable by vehicle during the rainy season, and in these cases walking was the only option.

Results of the household surveys in conjunction with anthropometric measurements taken of school children in villages will confirm whether chronic malnutrition is a serious concern in the project area. Our data will allow us to examine the spectrum of foods consumed by people in the area, their nutritional intake and the importance of wild meat to their diets. Noteworthy features of the work in Nigeria and Cameroon were the excellent level of cooperation between villagers and the project. The initial introduction by the research assistants to the Village Chiefs and Councils ensured that the community was aware of the aims and objectives of the project and to give permission for the study to proceed.

There are three indicators of nutrition status based on anthropometry (physical measurements) which will be used in the analyses of our data:

- Chronic malnutrition (also called “stunting”) is a measure of height relative to age. It is perhaps the most relevant indicator for IFAD-assisted projects and for the overall well-being of a community. High levels of chronic malnutrition reflect deprivation over a period of months or years. Children who are chronically malnourished may suffer irreversible disability in mental and physical development, causing poor performance in school and reduced physical productivity for the rest of their lives.
- Acute malnutrition (or “wasting”) is a measure of weight relative to height. It is associated with temporary shocks, such as famine or episodes of illness.
- Underweight is a measure of weight relative to age. It is most often used to monitor the nutrition status of individual children.

d) *Distribution and abundance of main hunted species*

One of the major purposes of the project was to investigate the level of extraction of wild animals within a relatively large area of tropical moist forests. In so doing, we would generate a more accurate assessment of hunting intensity and perform analyses, with these data, assess sustainability of the main species involved.

From the village and household nutrition surveys, as well as from market survey data collected it was possible to obtain species presence/absence information for a selected number of key species (common species such as blue duiker, brush-tailed porcupine and pouched rat, as well as endangered species such as gorilla, chimpanzee, forest elephant, drill, red colobus and Preuss’s guenon monkey). These data will subsequently be used for the spatial modelling of species viability. Each data point is clearly geo-referenced and linked to cells within a GIS. Using a variety of techniques

(including logistic regression, non-linear classification and/or decision trees) we will be able to predict presence-absence of the key species from variables describing conditions in the recorded distribution points and/or those surrounding it (drawn from the GIS databases). These variables are shown in Table 2. Note that the phrase “in locality” refers to the area around the recorded cell, usually a village not just the village cell itself (since it is likely to be the former, rather than the latter, where the species was actually extracted from). This area is likely to be best defined as within a 10km radius of the village, since this is the typical penetration distance from access points.

Table 2. Variables and importance in analyses.

Variable	index of.....
Surrounding vegetation type in locality	carrying capacity
Number of competitor species present	carrying capacity
Average mass of other species in locality	relative profitability
Distance to nearest large forest block	sources/sinks
Human population density in locality	local demand
Human population density within 100km of cell	regional demand
Average household consumption in village	current offtake
Average price in village	demand
% of locality accessible from roads	accessibility
% of locality accessible from rail track	accessibility
% of locality accessible from river	accessibility
Other variables of conservation interest might include:	
Distance to nearest national park	
Distance to nearest active logging concession	

Ideally, all variables will be used in the analysis in two ways: as the current conditions, and as the prevalent conditions over a preceding specified time period (e.g. 10 years, depending on the availability of the data). This is because human demand over the last decade may be more important than current demand, at least for the larger species, which may be mostly absent now.

The reliability of the predictive models obtained was tested using a sub-sampling cross-validation method. With this method, the logistic regression analyses are based on only a sub-sample of the full dataset, e.g. 75% of all data. The predictions are then matched to the remaining 25% of the data. If the match is good, we can be confident that our regression equations are reasonably reliable. There will be an iterative element to this, such that we repeat this exercise using different combinations of subsets. Possible problems for consideration include (1) identifying the natural distribution limits of particular species, and (2) the non-independence of spatial data.

e) *Extent and condition of forest areas*

Key maps were collected for vegetation type, human population density, access (specifically roads/rivers/railways), land use type (location of National Parks, Reserves etc), and including logging concessions. All of these maps will allow our analyses to be conducted at the 1km grid-cell scale, and all are roughly coincident in date, ranging from 1997-2001.

The study area was stratified according to vegetation type, and human population density. These two variables capture most of the variation in bushmeat harvest and will facilitate more detailed analyses with additional variables subsequently.

Habitat type was defined for each 1km cell (each study village location). Since we were interested in habitat type with respect to local hunting and bushmeat supply, and this can occur within 10km of a village, we defined the habitat type for each cell (village) according to the overall habitat type within a 10km radius of that cell.

Initially, four basic habitat types were recognised within any given individual cell of the existing vegetation map (source: TREES Project, Joint Research Centre of the European Commission, 2000). According to the original map classification, these were lowland forest, secondary forest and forest-savanna mosaic (all of which we considered forest habitat), plus non-forest (including mangroves). Since we are only interested in the forest zone, we excluded those cells that were surrounded by predominantly non-forest areas (i.e. >75% nonforest cells). We then classified the forest cells (villages) into four new habitat categories, described in Table 3.

An existing map provides figures for human population density (to the nearest individual) at a 1km grid-cell scale for this region (source: Africa GIS Database, United States Geological Survey, 2000). We simplified this map so that population density was described according to three different categories: low density (≤ 15 people per km^2), medium density (≤ 100 people per km^2) and high density (> 100 people per km^2) populations. The latter category includes dense urban areas.

We then overlaid the vegetation map with the population density map, to identify the final stratification according to habitat and population density. A colour map has been produced showing this scheme (Fig. 1).

Further analysis of the level of deforestation of the forest areas is currently being undertaken. Satellite images have been obtained and examined to estimate the rates of forest loss in the study area. Ultimately, these data will be linked to exploitation patterns derived in this study.

f) *Risk assessment of high-priority prey species*

From the preceding analysis, we will be able to predict the current distribution patterns of each species for which we have presence-absence data on a cell-by-cell basis. This should be possible for all cells, since vegetation and socioeconomic GIS data are available countrywide. First, we established how the key predictor variables are likely to change over the next 10-20 years, on the basis of existing models of socio-economic development. For example, where are new roads planned, and how will human populations change?

Table 3. Stratification of the study area by habitat type.

Habitat type around cell (village)	% of forest area	Pattern of habitat in cells in surrounding 10km radius	
Primary forest	40	>75%	lowland forest (CLASS 1)
Secondary forest	15	>75%	secondary forest alone or in combination with lowland forest (CLASS 2, 5)
Forest-savanna mosaic	19	>75%	forest-savanna mosaic alone, or in combination with lowland forest, secondary forest, or both (CLASS 3, 6, 8, 11)
Forest-nonforest matrix	26	>75%	non-forest in combination with other forest types (note: >75% non-forest alone is excluded) (CLASS 7, 9, 10, 12, 13, 14)

Then, we projected how prey species distributions are likely to change as a result of these socioeconomic changes, using the regression equations that relate these two factors. This will result in maps identifying where bushmeat overexploitation problems are most likely to occur over this future time period, and also identify the likely reasons for this problem. This will then facilitate guidance and recommendations to the relevant local and national authorities.

g) Hunter surveys

A total of 151 hunters in Nigeria, identified as operating within 38 surveyed villages in the study region, were interviewed to determine presence/absence of prey species, and to establish hunter attitudes and information regarding background to animals in this region.

A short protocol for the collection of presence/absence data during interviews was developed from already published information, and all research assistants trained in its application. Each respondent interviewed was asked to identify the source of all bushmeat hunted during the survey period, methods used, frequency of hunts, animals that were scarce now but abundant before etc. Presence-absence data on species reported in interviews will be used to map distribution ranges of main bushmeat species using GIS.

- ***Training and capacity building activities – this should include information on selection criteria, content, assessment and accreditation.***

Table 4 details the list of personnel who received training from the project. We trained project personnel in two distinct areas: 1) field recording of bushmeat extraction and 2) household data recording, including nutritional surveys. Initial training sessions were formal and held in classroom settings. Project personnel were selected through interview. In-country coordinators visited the University of Calabar in the case of Nigeria and the Universities of Douala and Yaoundé in Cameroon to recruit possible research assistants. Undergraduate and sometimes postgraduate students undertaking relevant university courses were given an introduction to wildlife use and sustainability, general aspects of data collection and computerised data entry, sampling and use of the data collected for the project. Additionally, training was given in record keeping on

data sheets. Most training occurred while in the field, but some ad hoc training sessions were also undertaken at various times of the year. In addition to field staff training, project staff (S. Seymour) attended a 2-week training course in nutritional analyses and methodologies within the “*Nutritional Epidemiology*” module of the MSc in Public Health Nutrition at University of Southampton. This is done prior to start of field operations.

At another level the project has provided basic training in data recording to a total of 80 local assistants linked to each of the research assistants. The number of local assistants working with the named research assistants is given in Table 4. Local assistants would gather data on a daily basis for the project. The research assistants would train local assistants to enter information onto datasheets. Basic instruction on the use of these data was given to the local assistants.

5. Project Impacts

- ***What evidence is there that project achievements has led to the accomplishment of the project purpose? Has achievement of objectives/outputs resulted in other, unexpected impacts?***

The purpose of this project was to gather the necessary information on bushmeat trade in a representative area in Sub-Saharan Africa to assess accurately the extent of the problem and its linkages with livelihoods. This has been most effectively achieved. The results of the field work are being published in high-impact scientific journals. Evidence of the impact of the dissemination of these results is evidenced by the interest taken by other organisations in the information generated. Data from the Cross-Sanaga Darwin project is currently being used to inform HMG within another DEFRA project on the bushmeat trade (report due in June 2006). A recent development is that the methodology developed in our project is now been implemented in framework of CARPE/USAID program for CBFP, to contribute to Intermediate Result 1, Indicator 3: Landscape wide Monitoring of use of bushmeat.

Table 4: Cross-Sanaga project staff who received training.

Name	Position in Cross-Sanaga Project	Number of local assistants involved
Nigeria		
1. Peter Bette	<i>Research assistant-Aningaje axis</i>	4
2. Joseph Ugbe	<i>Research assistant- Uganga axis</i>	7
3. Emmanuel Akpushi	<i>Research assistant-Calabar municipality</i>	6
4. Sunday Francis	<i>Research assistant-Okunkang axis</i>	5
5. Imong Inaoyom	<i>Research assistant-Odukpani axis</i>	7
6. Joseph Ntui	<i>Research assistant-Ikom axis</i>	7
7. Eugene Bassey	<i>Research assistant- Ochon axis</i>	6
8. Gilbert Asunquo	<i>Research assistant-nutrition surveys</i>	
Cameroon		
1. Herbert Gatien Ekodeck	<i>Research assistant-Bangem axis</i>	7
2. Hudson Ebotmanchang	<i>Research assistant-Douala axis</i>	5
3. Lawrence Baya	<i>Research assistant-Kumba axis/nutrition surveys</i>	7
4. Priscilla Epolle	<i>Research assistant-Mount Cameroon axis</i>	9
5. Suzanne Nathalie	<i>Research assistant-Mamfe axis</i>	10
6. Manfred Epanada	<i>Research assistant-nutrition surveys</i>	
TOTALS	14 research assistants	80 local assistants

This project has stimulated the continuation of bushmeat related projects in Nigeria and Cameroon. For example, our main partner organisation in Nigeria (CERCOPAN) have continued gathering bushmeat hunting information from a local village and collaborate with the village to institute sustainable hunting within the surrounding forests. In Cameroon, protocols started by the Darwin project are being used in the area around the Dja Reserve, and Jef Dupain (our Cameroon in-country coordinator) is leading a bushmeat project in the Democratic Republic of Congo which follows the same methodology. We feel that these new initiatives will lead to enhancement of regional management of this particular wildlife resource. Similarly, the project has stimulated interest in other region; for example, it has led to WildCRU undertaking surveys of wildlife trade in Asia, and our WildCRU/Jersey team is exploring further collaborations on work growing out of the Darwin project, including possible work on the link with emergent diseases.

- ***To what extent has the project achieved its goal, i.e. how has it helped the host country to meet its obligations under the Biodiversity Convention (CBD), or what indication is there that it is likely to do so in the future? Information should be provided on plans, actions or policies by the host institution and government resulting directly from the project that building on new skills and research findings.***

This has happened indirectly through the involvement of national organisations and personnel in our project. However, there are plans to hold a final workshop in-country, in conjunction with all the relevant authorities. Information gathered by the project is sent to the host countries, but these data will be instructive rather than directive to the various government departments involved with bushmeat issues.

In both study countries, the results of our extraction data illustrates conclusively that most bushmeat is taken from inside the main protected areas; Korup in Cameroon and Cross River in Nigeria, and therefore a direct threat to region's biodiversity. But, our project has gathered parallel information on the role of bushmeat in the livelihoods of people in the region, which will allow us to determine which population sectors are most dependent on wildlife, and whether alternative solutions can be sought. Understanding the bushmeat issue from both conservation and development perspectives is fundamental. This is so because there have been divergent opinions among developed country conservation and development agencies on the best practices and policies to address this crisis in the bushmeat range states. Our project provides fundamental baseline data that can be used to close the gap between international development and conservation agencies to adopt a more consistent and supportive approach to bushmeat policy development. Such an approach should seek to secure important global biodiversity values while also recognizing the livelihood dimensions of the trade and the practicalities of policy change. With these goals in mind, we offer the results of our study as our contribution to this debate. Recognizing that this is only a first step, we believe that any further discussions must involve an array of stakeholders in the range states. The ensuing actions and policy will be part of the legacy of our project.

- ***Please complete the table in Appendix I to show the contribution made by different components of the project to the measures for biodiversity conservation defined in the CBD Articles.***
- ***If there were training or capacity building elements to the project, to what extent has this improved local capacity to further biodiversity work in the host country and what is the evidence for this? Where possible, please provide information on what each student / trainee is now doing (or what they expect to be doing in the longer term).***

Training has been a crucial element in this project. Young Cameroonian and Nigerian students (n = 14), who were part of the project, have been given the opportunity to acquire a set of practical and theoretical professional skills. The project has enabled young Africans to develop tools to understand more objectively complex environmental problems, like the bushmeat crisis. An important outcome of the project and its training has been to illustrate to young African professionals that science can be used most effectively to solve issues that impinge upon people as well as wildlife. Some of the nationals employed by the project have continued working in wildlife related fields, and two are currently employed by the Project Grande Singes in the Dja region in Cameroon. From de-briefing sessions undertaken by the project's in-country co-ordinators, we are confident that field staff benefited enormously from their participation in our project. Because all field staff had to produce a written project report (available for consultation) resulting from data collected by themselves, we were able to more formally assess the impact of the training.

In 2006, The Whitley-Laing Foundation has nominated one of our Cameroonian researchers, Mr. Manfred Epandaa, for an award related to work on sustainable bushmeat use and creation of alternatives.

Some of the nationals employed by the project have continued working in wildlife related fields. In Cameroon, two research assistants (Hudson Ebotmanchang and Manfred Epandaa) are currently employed by the Project Grande Singes. Herbert Gatien Ekodeck is currently with "Nature +, University Gembloux" working on issues of Community Forestry and Lawrence Baya is completing doing a PhD in Switzerland (after finishing studies at university in the UK). In Nigeria, Imong Inaoyom, was employed by CERCOPAN and later by WCS in Calabar.

- ***Discuss the impact of the project in terms of collaboration to date between UK and local partner. What impact has the project made on local collaboration such as improved links between Governmental and civil society groups?***

Durrell Wildlife and WildCRU have strong links with CERCOPAN and Project Grande Singes and continue to work with them. Thus Durrell Wildlife and WildCRU will continue the hitherto fruitful partnership and collaboration with these local institutions and facilitate communication between them, government and other stakeholders in the area. Although the formal end date of the project is upon us, the success of the project, and the richness of the data base, and the momentum achieved all mean that future projects will continue to be developed, and the outputs will continue to proliferate during at

least the next couple of years.

- ***In terms of social impact, who has benefited from the project? Has the project had (or is likely to result in) an unexpected positive or negative impact on individuals or local communities? What are the indicators for this and how were they measured?***

Social impact of this project has largely been through the training of large numbers of nationals. Eventually, the results of the project will have an important impact in the strategic planning of use of wildlife in the region. It also provides a template for tackling related issues in other regions.

Project Outputs

- ***Quantify all project outputs in the table in Appendix II using the coding and format of the Darwin Initiative Standard Output Measures.***
- ***Explain differences in actual outputs against those in the agreed schedule, i.e. what outputs were not achieved or only partly achieved? Were additional outputs achieved? Give details in the table in Appendix II.***
- ***Provide full details in Appendix III of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications database which is currently being compiled.***
- ***How has information relating to project outputs and outcomes been disseminated? Will this continue or develop after project completion and, if so, who will be responsible and bear the cost of further information dissemination?***

We disseminated information about the project and its outputs through talks and seminars (Fa: 3 presentations to conferences in UK and Germany); presentations at workshops; through radio and television (Radio interviews: Fa: 2 in UK); through magazine articles and book chapters (Fa: 2). We have already produced nine significant publications resulting from the work undertaken by the project. Currently, there are three scientific papers submitted, and four others in preparation. We also intend to publish an overview account of the whole project by Fa and Macdonald after the workshop, in a similar style to other WildCRU Darwin reports.

6. Project Expenditure

- ***Tabulate grant expenditure using the categories in the original application***

Table 5: Summary of Cross-Sanaga project expenditure (provided by Department of Zoology, University of Oxford on 06/04/06).

- ***Highlight agreed changes to the budget***

In early 2002 it became apparent that the project would benefit greatly from deploying considerably more local labour than was planned at the outset. This would enable a wide geographic coverage of markets within a short space of time, and would also require less time in-country for the coordinators.

DWM wrote to the DI (Sylvia Smith, EPINT, DEFRA) on 26/04/02 to request that we be allowed to wire funds accordingly and also requested a supplementary grant for the following financial year. SS replied on 14/06/02 to the effect that, while it was not possible to increase grants other than by a pre-set amount to offset inflation, transferring funds from the country coordinator's salary heading to local salaries was not problematical.

- ***Explain any variation in expenditure where this is +/- 10% of the budget***

See above

7. Project Operation and Partnerships:

- ***How many local partners worked on project activities and now does this differ to initial plans for partnerships? Who were the main partners and the most active partners, and what is their role in biodiversity issues? How were partners involved in project planning and implementation? Were plans modified significantly in response to local consultation?***

In Nigeria, our main partner was the NGO, CERCOPAN. CERCOPAN was founded in 1995. Originally a sanctuary for confiscated primates, which addressed a real need as the newly promulgated National Park carried out confiscations, CERCOPAN today is very much more than a sanctuary. In 2004 CERCOPAN was renamed as the **C**entre for **E**ducation, **R**esearch and **C**onservation **O**f **P**rimates **A**nd **N**ature, chosen to more accurately reflect the organisation's work, a staff of over 30 (including 4 international volunteers and 28 Nigerian staff) and an annual budget over \$100,000US. Over 100 primates

have been rescued through donations or confiscations by officials and are in varying stages of rehabilitation, have had successful breeding in several groups, and a thriving environmental education programme in 4 local government areas and 34 schools in Cross River State. CERCOPAN have also prioritized working with communities towards forest protection, land management and protection of endangered species, as well as research.

Consultation over project activities took place between the project and CERCOPAN. Senior staff consulted at CERCOPAN included Dr Zena Tooze, (Director). The project also worked closely with the Nigerian Forestry Department. An initial presentation on the scope of the project was given in Calabar to the relevant authorities, during which project activities were discussed. No major changes to the project were made.

In Cameroon, our main partners were WWF-Cameroon and Ministry of Agriculture (MINEF). However, during the initial stages of setting up of our project, many discussions were held with the Mount Cameroon Project (DFID) (at that time with Dr. Kristin Olsen). Former staff from the Mount Cameroon Project (Epolle and Priscilla), trained and involved in setting up hunters associations, were employed by the Darwin project. There was much consultation with the Wildlife Conservation Society (WCS), who are active in the Banyang Mbo reserve, within our study area. Future collaboration for mitigation of hunting pressures in various Cross-Sanaga sites was discussed. Issues to do with the Korup National Park were discussed with WWF-CARPO. We visited offices in Mundemba, and also in Nkongsamba. No specific collaboration was signed, but there was much informal information sharing. The project also collaborated with Dr. Jacqui Groves (WCS), who at the time was working on gorillas in the Takamanda forest, north of Mamfe. Our project was followed by and discussed with the EU-Cellule Environnement in Cameroon.

- ***During the project lifetime, what collaboration existed with similar projects elsewhere in the host country? Was there consultation with the host country Biodiversity Strategy (BS) Office?***

We have not had consultations with the BS office in any of the two countries involved. However, the project has always sought collaborations with institutions and individuals working on wildlife or livelihood issues. In Nigeria, the project developed strong links with the Nigerian Conservation Foundation. In Cameroon, we established strong links with WWF-Cameroon, WCS-Cameroon. Durrell Wildlife continues to collaborate on a formal level with the Project Grande Singes in the Dja Reserve, currently run by field staff employed by our project.

- ***How many international partners participated in project activities? Provide names of main international partners.***

The project has generated wide collaboration with a five international institutions. In particular, we work closely with the Institute of Zoology (Zoological Society of London), especially with Dr. Raj Amin, Dr. Guy Cowlshaw and Dr. Marcus Rowcliffe, in the application of modelling to data collected by our project. In Nigeria, we have collaborated extensively with Prof. John Oates (Hunter College, New York) and his team, who are working

for the Wildlife Conservation Society in the Cross River National Park, and are currently working on a publication that will integrate our project's results on bushmeat extraction, with their information on the status of wildlife populations in the area. We anticipate continued liaison and collaboration with these international institutions.

- ***To your knowledge, have the local partnerships been active after the end of the Darwin Project and what is the level of their participation with the local biodiversity strategy process and other local Government activities? Is more community participation needed and is there a role for the private sector?***

Our main local partners, CERCOPAN in Nigeria and Project Grande Singes in Cameroon, continue their activities in relation to bushmeat and sustainable hunting. Information generated by our project is fed to these to guide new thinking.

8. Monitoring and Evaluation, Lesson learning

- ***Please explain your strategy for monitoring and evaluation (M&E) and give an outline of results. How does this demonstrate the value of the project? e.g. what baseline information was collected (e.g. scientific, social, economic), milestones in the project design, and indicators to identify your achievements (at purpose and goal level).***

Data generated by our project represent the first of their kind. Baseline information collected is indicated in the sections above. Monitoring and evaluation was undertaken during the life of project in-country. For example, data quality was continuously assessed by the in-country coordinators, data entry supervised and information gathered adequately for the analyses phase of the project. We held 3 monthly meetings between project directors to evaluate progress, including a total of 6 visits by John Fa to Oxford to discuss progress during the project period. Dr. Paul Johnson, statistician involved with the project, checked data quality before and during data collection, including visiting Jersey for a three-day meeting with in-country project co-ordinators at the start of the project.

- ***During the project period, has there been an internal or external evaluation of the work or are there any plans for this?***

External evaluation of scientific findings will take the form of peer review of scientific papers, already published, or currently in preparation for international journals. The main co-ordinators of the project met at major strategic intervals during the project to evaluate and plan. A total of five other institutions from the UK and the USA (see Table 1) have been involved in different phases of the project and have provided external scrutiny. Thesis Panel meetings for Lise Albrechtsen have also enabled other professionals to be involved in the delivery of information resulting from the project (e.g. the late Prof. David Pearce).

- ***What are the key lessons to be drawn from the experience of this project? We would welcome your comments on any broader lessons for Darwin Initiative as a programme or practical lessons that could be valuable to other projects, as we would like to present this information on a website page.***

The main key lesson drawn from our experience of this project is to emphasise inter-disciplinarity, and the blending of biodiversity with local livelihoods and development. Of equal importance, the level of collaboration that has resulted between our respective institutions, and others involved in biodiversity conservation has been of great value. Our focus on education and training as part of the legacy of the project can not be underestimated.

This project has demonstrated the need and feasibility of working at a broader geographical scale. This is important because even though conservation actions at a local scale are able to achieve more direct results from which examples can be drawn, major conservation impacts in a country or region can only occur if we are able to generate information from multiple sites at once. Our project shows quite clearly that such projects (at least for data collection) are possible. However, these types of projects require much logistic planning and funding to achieve all its aims. We would recommend adoption of a similar approach in areas where this kind of conservation initiative is relevant, and the synthesis document planned by us, will be used to advise as wide a group of stakeholders as possible. The project has been able to refine whole new methodologies, including sampling strategies, which are being adopted by other organisations (see above).

9. Darwin Identity:

- ***What effort has the project made to publicise the Darwin Initiative, e.g. where did the project use the 'Darwin Initiative' logo, promote Darwin funding opportunities or projects? Was there evidence that Darwin Fellows or Darwin Scholars/Students used these titles?***

The Darwin logo has been used on our outputs (e.g. on the covers of the workshop publications) and in communications with partners and in all public presentations. The Darwin initiative has been acknowledged at seminars, on reports and scientific publications. In all contexts the project is known as, and referred to as, the Darwin Initiative Bushmeat Project.

- ***What is the understanding of Darwin Identity in the host country? Who, within the host country, is likely to be familiar with the Darwin Initiative and what evidence is there to show that people are aware of this project and the aims of the Darwin Initiative?***

The Darwin identity and logo was well recognised in the regional arena and in the conservation community in Nigeria and Cameroon. Staff working the project made every effort to ensure that partners and stakeholders were aware of the aims and objectives of the Darwin initiative and its role in facilitating the conservation of biodiversity in countries rich in natural resources, but economically poor.

- ***Considering the project in the context of biodiversity conservation in the host country, did it form part of a larger programme that dwarfed Darwin funding or was it recognised as a distinct project with a clear identity?***

No. Our project was the major initiative dealing with bushmeat issues in Nigeria and Cameroon.

10. Leverage

- ***During the lifetime of the project, what additional funds were attracted to biodiversity work associated with the project, including additional investment by partners?***

Using leverage of the Darwin Initiative grant, WildCRU was able to lever c. £45,000 from the University of Oxford to support Lise Albrechtsen studentship within the project. Subsequently, on the strength of our findings DWM visited the Disney Wildlife Conservation Fund in Florida and told them about the project – they then invited an application from WildCRU and made a donation of £9,500. In order to develop economic models of bushmeat harvest Lise Albrechtsen approached the Norwegian Research Council's Biological Diversity programme to contribute towards her doctorate and training at the WildCRU and to develop modelling techniques with the University of Bergen and this was led to support of her work in Equatorial Guinea to a value of £42,000.

The work from Equatorial Guinea is an associated component to the Cross-Sanaga project as a part of the country (Bioko Island) is located within this regional delta. In Equatorial Guinea, the research followed more or less the same set-up as in Cross-Sanaga– as such there was the possibility to use the data from Bioko Island within also this project.

Assessment of the availability and consumption of animal protein within the city of Malabo (c. 60 000 inhabitants), Bioko Island, included estimation of the annual animal protein supply to the city from daily counts of small livestock meats (goat, pork, lamb, duck, chicken), beef, fish and bushmeat (December 2003–March 2004) in the city's central market and other selling points, and the animal protein consumption per adult male equivalent (AME) was derived from a sample of around 200 households to explore influence of household income on consumption of different protein sources.

Consumption patterns indicated that larger-sized households purchased more meat, but protein intake per AME fell significantly with household size. Income was positively correlated with volume of small livestock meats consumed per household, but negatively related with bushmeat eaten. Income did not influence beef or fish consumption per household. Although the island is capable of producing more alternative meats, it cannot sustain itself on local production and will therefore continue to be dependent on importing a large proportion of meat (and protein). There is no dependency on bushmeat species in Bioko, but current offtake rates of wild species can still have a dramatic impact on wildlife populations if left unabated. Alternative ways of

ensuring sufficient protein supply for the Malabo population are crucial for wildlife conservation.

- ***What efforts were made by UK project staff to strengthen the capacity of partners to secure further funds for similar work in the host country and were attempts made to capture funds from international donors?***

We have assisted CERCOPAN to pursue other sources of funding for other projects in the Cross River region. Durrell Wildlife has instigated a memorandum of understanding with Project Grande Singes to support activities related to gorilla conservation and bushmeat in Cameroon.

11. Sustainability and Legacy

- ***What project achievements are most likely to endure? What will happen to project staff and resources after the project ends? Are partners likely to keep in touch?***

The volume of information generated by this project is unprecedented. The main achievement of this project is the fact that we have been able to gather much needed data on bushmeat trade in a significantly large area (40,000 km²) in Sub-Saharan Africa. The impact of the resulting papers and information will be of great significance.

- ***Have the project's conclusions and outputs been widely applied? How could legacy have been improved?***

This project's outputs will be of much value to adequately understanding the bushmeat problem. Our findings suggest new ways, and certainly clearer ways, of achieving sustainability of wildlife and people's livelihoods. Our impact as a project will be improved by continuing with the publication and dissemination of the results of the project. It is fundamental that we undertake a country workshop in which all the results of our study can be presented to all relevant authorities. We are confident that results of this study can be applied to similar situations where wildlife is potentially overexploited.

- ***Are additional funds being sought to continue aspects of the project (funds from where and for which aspects)?***

We have sought funding to continue studies of the use of bushmeat and food security in urban centres in the Cross-Sanaga region. A Darwin Initiative proposal was submitted but was not successful.

12. Value for Money

- ***Considering the costs and benefits of the project, how do you rate the project in terms of value for money and what evidence do you have to support these conclusions?***

Our project, a multi-site study involving large numbers of people and coverage of a large geographical area, is seemingly expensive. However, we argue that

the value for money of this project is very high – about £2,000 per data collection site. Although we are aware that more resources would have enabled us to undertake more sites for longer, we are confident that with the available resources from Darwin we were able to achieve maximum effort. Alongside data gathering, we made a tremendous effort to train and involve local counterparts; 94 nationals in total. These are demonstrable and valuable outcomes of the project.

Author(s) / Date

Dr J. E. Fa
Prof. D. W. Macdonald

28/04/06

	Verifiable indicators of Success:	Means of verification:	Assumptions:
Goals <i>To assist countries rich in biodiversity but poor in resources with the conservation of biological diversity and implementation of the biodiversity convention</i>			
Purpose For the study to provide a model of the bushmeat problem in general. To develop an integrated solution to the over-exploitation of wildlife in lowland forest areas in Africa			
Outputs			
1) Landscape Ecology			
a. Inventories of extent and condition of forest areas in the Sanaga-Cross region. (12A)	Multi-layered databases assembled that describe succinctly the current situation of habitats and hunted species in a region, the level of over-exploitation and assesses the critical socio-economic role that bushmeat plays in Africa.	Publications in the form of immediately available working documents for decision-makers and papers in peer-reviewed journals.	The provision of written materials and electronic databases is pivotal to understanding the dynamics and parameters of the bushmeat crisis, and will be crucial to the resolution of the problem.
b. Distribution and abundance of main hunted species within region. (12A)	Habitat classification system established. Protected areas, forestry concessions, industrial areas, extent of urbanisation mapped. Deforestation extent and trends determined.	Vegetation maps and other cartographic data (e.g. loss of forests) will be produced. Forest loss to be determined from historical remote sensing imagery.	Political support for the use of currently available cartography. Support from relevant institutions in Cameroon, Nigeria and Bioko Island. Full GIS support implemented.
c. Assessment of actual and potential human impact on habitats. (12A)	Knowledge of condition of prey populations throughout the study region. Possibility of identifying source or sink areas of bushmeat species. Information available on human population densities and socio-economic conditions in the study region. Models developed to predict likely demand of meat. Spatial predictions of hunting impact on prey populations.	Deforestation information to be used in conjunction with hunting data below. Published habitat suitability and abundance maps for prey species. Publication of sustainability maps. Determination of cost-effective, scientifically sound survey design to determine current population status of species in all habitat types within the region.	Availability of sufficient and realistic baseline information to predict distribution, abundance and hunting sustainability of prey species. Access to topographic, road and fluvial maps for the region, and population census data. Development of realistic model assumptions on decline in prey densities relative to distance from hunter aggregations.
d. Risk assessment of high-priority prey species. (11A)	Predictions of the risk of extinction of chimpanzee, gorilla, drill, Preuss's guenon, russet-eared guenon, Ogilby's duiker, buffalo and elephant within the study region.	Database of human population status and extent of impact on environment in the region. Spatial extrapolation maps of potential demand for bushmeat based on accessibility to areas, and human population densities. Published information on linkages between landscape data and population viability analyses of the target species. Sensitivity analyses using VORTEX or RAMAS/GIS models. Detection of lacunae in data necessary for current and future predictions of species viability.	Availability of extraction rates for target species or understanding of realistic hunting scenarios to incorporate in a metapopulation modelling approach to assess risk.
2.) Understanding Supply and Demand Issues			
a. Assessment of value and limitations of using bushmeat markets as hunting barometers. (11A)	Ethnological and socio-economic understanding of function and workings of markets in west Africa, particularly in the study region. Statistical analyses of bushmeat market dynamics.	Published information on how markets perform by using empirical data collected in Bioko Island and Rio Muni in 1996-1997 (NB: although Rio Muni is not within the study region, it will serve as an example of a continental market site).	Data for Bioko Island and Rio Muni is representative of other market sites in the study area.
b. Understanding stakeholders in the bushmeat trade in the study region. (11A,12A)	Gross definitions of stakeholders in the bushmeat issue for the region: community stakeholders, external stakeholders, institutions etc.	Published review of stakeholders in the bushmeat trade within the study area.	There is enough information on stakeholder groups and their activities for the region.
3.) Seeking Alternatives			
a. Assessment of the protein deficiency issue in the region. (11A, 12A)	Advancement of understanding whether bushmeat is largely motivated by protein needs of low-income sectors of the population or whether it is a commodity product for high-income ones. Study of health and nutritional status of human population in the study region. Analyses of supply and demand of food and commodity products for the human population in the region.	Published review of household consumption patterns, dependency on bushmeat as a source of protein.	Public health studies carried out by non-biologists may be available for analyses.
b. Food production alternatives	Understanding of current agricultural production within the region.	Published analyses of agricultural production and potential for the study area.	Existing statistics of current agricultural practices and production are available and accessible.
4.) Consensus Building			
a. Identification of technological inputs and know-how required to better contribute to biodiversity planning in successive phases of the project.	Desk study and debriefing discussions with project team members and relevant organisations.	Final reports on inventory data, socio-economic conditions in the region circulated to relevant authorities for discussion.	Links with Cameroonians, Nigerian and Equato-Guinean authorities established.

13. Appendix I: Project Contribution to Articles under the Convention on Biological Diversity (CBD)

Please complete the table below to show the extent of project contribution to the different measures for biodiversity conservation defined in the CBD Articles. This will enable us to tie Darwin projects more directly into CBD areas and to see if the underlying objective of the Darwin Initiative has been met. We have focused on CBD Articles that are most relevant to biodiversity conservation initiatives by small projects in developing countries. However, certain Articles have been omitted where they apply across the board. Where there is overlap between measures described by two different Articles, allocate the % to the most appropriate one.

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	Project %	Article Description
7. Identification and Monitoring	65	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities which have adverse effects; maintain and organise relevant data.
8. In-situ Conservation		Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
10. Sustainable Use of Components of Biological Diversity	10	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
12. Research and Training	10	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge

14. Appendix II: Outputs

Please quantify and briefly describe all project outputs using the coding and format of the Darwin Initiative Standard Output Measures.

Code	Total to date (reduce box)	Detail (←expand box)
Training Outputs		
1a	Number of people to submit PhD thesis	1
4a	Number of undergraduate students receiving training	14
4b	Number of training weeks provided to undergraduate students	104
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(i.e. not categories 1-4 above)	80
6a	Number of people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	14
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	4 J.Fa and D. Macdonald at study site in Cameroon 2 J.Fa at study site in Nigeria 20 L. Albrechtsen in Equatorial Guinea
10	Number of formal documents produced to assist work related to species identification, classification and recording.	
11a	Number of papers published or accepted for publication in peer reviewed journals	7
11b	Number of papers published or accepted for publication elsewhere	2
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	4
Dissemination Outputs		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	4 regional workshops organised.
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	2 (ZSL/ODI-Bushmeat and Livelihoods Conference).
15a	Number of national press releases or publicity articles in host country(s)	1 Independent by Fred Pearce
15c	Number of national press releases or publicity articles in UK	2 (article in <i>On the Edge</i> , article in BBC website)
15d	Number of local press releases or publicity articles in UK	2
19a	Number of national radio interviews/features in host country(s)	2 (two interviews by Jef Dupain for radio show in Cameroon)
19b	Number of national radio interviews/features in the UK	J.Fa in <i>Radio 4 Today</i> programme; BBC Scotland
19d	Number of local radio interviews/features in the UK	1 (Jersey)
Physical Outputs		
20	Estimated value (£s) of physical assets handed over to host country(s)	£28,000

15. Appendix III: Publications

Provide full details of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications Database that is currently being compiled.

Mark (*) all publications and other material that you have included with this report

Type *	Detail (e.g. journals, manual, CDs)	Publishers (name, city)	Available from (e.g. contact address, website)	Cost £
Published or in press				
Journal*	<i>Bushmeat And Food Security in the Congo Basin: Linkages Between Wildlife and People's Future</i> Fa, J.E., Currie, D. & Meeuwig, J. (2004)	<i>Environmental Conservation</i>	John Fa	-
Journal *	<i>Hunting Vulnerability, Ecological Characteristics And Harvest Rates of Bushmeat Species In Afrotropical Forests</i> Fa, J.E., Ryan, S. & Bell, D.J. (2004)	<i>Biological Conservation</i>	John Fa	-
Journal*	<i>Contrast In Availability And Consumption of Animal Protein In Bioko Island, West Africa: The Role of Bushmeat</i> Albrechtsen, L., Fa, J.E., Barry, B. & Macdonald, D.W. (2006)	<i>Environmental Conservation</i>	John Fa	-
Journal*	<i>Sampling Effort and the Dynamics of Bushmeat Markets.</i> Fa, J.E., Johnson, P.J., Dupain, J., Lapuente, J., Koster, P. & Macdonald, D.W. (2004)	<i>Animal Conservation</i>	John Fa	-
Journal*	S. Ling, N. Kumpel & L. Albrechtsen (2002)	<i>Oryx</i>	Lise Albrechtsen	-
Journal*	<i>Getting To Grips With The Magnitude of Exploitation: Bushmeat In The Cross-Sanaga Rivers Region, Nigeria And Cameroon</i> Fa, J.E., Seymour, S., Dupain J., Amin R., Albrechtsen L. & Macdonald, D.W. (2006)	<i>Biological Conservation</i>	John Fa	-
Journal*	<i>The Protein Gap</i> Fred Pearce (2005)	<i>Conservation in Practice</i>	John Fa	-
Book chapter	<i>Meat from the bush</i>	<i>Deep Jungle Pages 201-210</i>	John Fa	-

Submitted

Journal	Rapid faunal loss in Bioko Island Albrechtsen, L., Fa, J.E., Johnson, P.J., Castelo, R. & Macdonald, DW. (submitted)	<i>Conservation Biology</i>	John Fa	-
Journal	<i>Sustainability of Bushmeat Hunting in Cross-Sanaga Region</i> Fa, J.E., Amin, R., Rowcliffe, M., Cowlshaw, G., Seymour, S., Dupain, J. & Macdonald, D.W. (submitted)	<i>Conservation Biology</i>	John Fa	-
Journal	<i>Regional bushmeat price analyses: economic variations Cross-Sanaga Region</i> Albrechtsen, L., Fa, J.E., Seymour, S., Dupain, J., Macdonald, DW. (submitted)	<i>Animal Conservation</i>	John Fa	
In preparation				
Journal	<i>Detecting Depletion Profiles from Bushmeat Market Data</i> Fa, J.E., Johnson, P.J., Seymour, S., Dupain, J. & Macdonald, D.W. (in preparation)	<i>Animal Conservation</i>	John Fa	
Journal	<i>Nutrition study of people in the Cross-Sanaga</i> Fa, J.E., Seymour, S., Dupain, J., Johnson, P.J., & Macdonald, D.W. (in preparation)	<i>Human Ecology</i>	John Fa	
Journal	<i>Importance of dog meat as another source of bushmeat in the Cross River State, Nigeria</i> Fa, J.E., Seymour, S., Dupain, J., & Macdonald, D.W. (in preparation)	<i>Oryx</i>	John Fa	
Journal	<i>Perceptions and reality of bushmeat hunters in Nigeria</i> Fa, J.E. & Seymour, S. (in preparation)	<i>Human Ecology</i>	John Fa	

16. Appendix IV: Darwin Contacts

To assist us with future evaluation work and feedback on your report , please provide contact details below.

Project Title	DEVISING SOLUTIONS TO BUSHMEAT EXPLOITATION IN THE CROSS-SANAGA REGION, W. AFRICA
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