Darwin Initiative Main and Post Project Annual Report

To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2020

Darwin Project Information

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Project reference	24-029
Project title	Enabling Baka attain food security, improved health and sustain biodiversity
Country/ies	Cameroon
Lead organisation	Manchester Metropolitan University
Partner institution(s)	Zerca y Lejos, CIFOR
Darwin grant value	£301,768.00
Start/end dates of project	2017-09-01 - 2020-08-31
Reporting period (e.g. Apr 2019 – Mar 2020) and number (e.g. Annual Report 1, 2, 3)	Apr 2019 – Apr 2020, Annual Report 3
Project Leader name	Prof. John E. Fa
Project website/blog/social media	
Report author(s) and date	John E. Fa, 26 June 2020

1.   Project summary

Wildlife in tropical rainforests of SE Cameroon is increasingly under pressure from overexploitation driven by a burgeoning human population, as well as by uncontrolled outside commercial interests. In this region, rural poor as well as indigenous peoples, Baka Pygmies, live precarious lives. The latter group are at an even greater social and political disadvantage since many have been displaced from the forest to settlements along the main roads. The health as well as livelihoods of these people is at risk.

The relationship between the use of forest products, subsistence agriculture and human health remains largely unstudied. Often, assessments of the links between biodiversity and wellbeing centre upon single issues e.g. how bushmeat hunting affects people's nutrition or income, without considering other intervening factors. A better understanding of the multiplicity of issues that affect people and wildlife will help generate interventions that result in long-term benefits for both.

In 10 Baka villages (Fig. 1), along the Djoum-Mintom road in SE Cameroon, in this project we gather data on the use of domestic crops and wild foods to determine their importance in satisfying the target populations' nutritional needs. In parallel, we assess the human health status of villagers to determine levels of malnutrition and disease and establish links with foods consumed. On the basis of the evidence collected, we propose solutions by encouraging families to produce local foods more efficiently, so that it can bridge nutrient gaps unmet by natural resources. By enabling better domestic food production and encouraging sustainable extraction

of wild resources (animals and plants) we aim to improve the general health of the study populations. We will achieve this by: 1) harmonising local production and consumption of domestic and wild foods across seasons, 2) generating domestic produce surpluses which can generate income to replace an over-reliance on wild meat trade, and this information will feed into 3) enabling hunting systems that encourage sustainable wildlife extraction as well as 4) understand the state of and pressures on threatened species. We aim to generate a system that can serve a model that can be rolled out to other Baka villages in the region to improve agri-food systems, and as a result reduce the impact on wildlife.
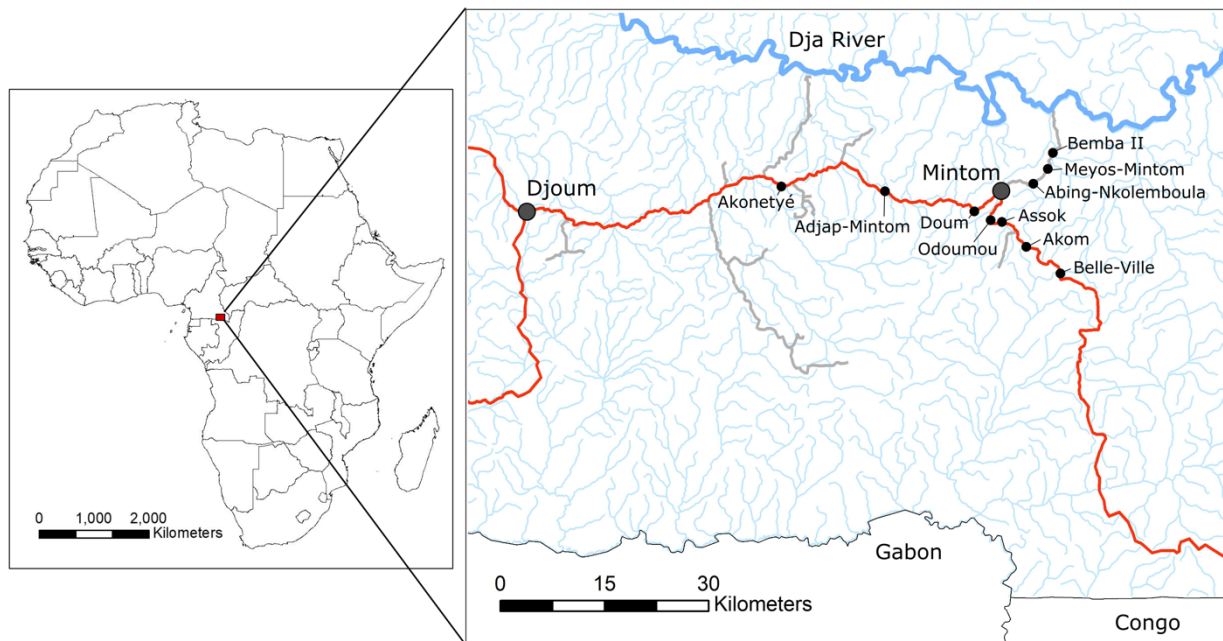
Fig. 1. Map of the 10 Baka villages involved in the present Darwin project.

Our ultimate interest in this project is to **alleviate poverty** and **improve general health** of the Baka in our study area. We will achieve this by helping our target communities attain sufficient nutritional and economic autonomy and attain food security. In so doing, these populations will become less dependent on commercial wild meat trade; hence reducing the impact of our Baka population on threatened wildlife. We will also encourage sustainable extraction of the more common hunting-resilient bushmeat species so as to enable a relative constant source of animal protein. Resulting also from this, we will generate scientific evidence that can support our understanding and encourage the resolution of the problems at hand, whilst also communicating and disseminating our findings as peer-reviewed journal articles and as informal communiqués with clearly identified stakeholders (Cameroon government officials, Baka community members).

2. Project partnerships

Our project is a collaboration between the international development NGO, Zerca y Lejos (ZyL), an international forestry research institution (CIFOR), the Cameroonian government body responsible for protection of forests and wildlife (MINFOF) and Manchester Metropolitan University (MMU). The partnership between MMU and CIFOR was in place by the time the project started and was formalized with the signing of a memorandum of understanding in Manchester in Feb. 2017. Under this MOU, the Darwin project was presented by CIFOR to MINFOF as part of their umbrella collaboration accord. Meetings between our in-country leadership and MINFOF headquarters in Yaoundé will be held at regular intervals throughout the duration of the Darwin project to update the national authorities of our progress.

The *ZyL*/MMU partnership has permitted the smooth functioning of the project on the ground without any serious obstacles. A main achievement has been the integration of a variety of activities such as the health and agricultural extension work, which are directed by *ZyL*, and the ecological and wildlife use studies carried out by our in-country team. This collaboration has advanced through a clear and regular interaction between our In-Country Project Coordinator

(ICPC) and the Project Leader (PL), with the support from *ZyL* headquarters in Madrid and various MMU departments (Head of School of Science and the Environment, Accounts) in Manchester.

Our project is based on the clear commitment to the rights of Indigenous Peoples to fully participate in decision making of matters that affect their rights. Thus, all our work incorporates the perspectives, opinions and ideas of most Baka villagers involved in our project, and therefore we facilitate direct involvement in all planned research and interventions. At the start of the project we organised a first meeting with village leaders, in the *ZyL*-Djoum headquarters (Mission Catholique de Djoum) to introduce the aims and aspirations of the Darwin project. This was followed by the formal launch of the project on 2 Dec. 2018, in which a total of 29 village representatives attended. This meeting was also held in Djoum.

We continue in regular contact with *Mr. Richard Eba'a Atyi*, Coordonnateur Regional, CIFOR Afrique Centrale, and with the following authorities: 1) Madame the Ministre de la Recherché Scientifique et de l'Innovation in Yaoundé; 2) Préfert du Departement du Dja et Lobo in Sangmelima; 3) Sous-Préfert de l'arrondissement de Djoum; 4) Sous-Préfert de l'arrondissement de Mintom; and 5) the department delegate MINFOF of Dja et Lobo, Sangemelima, conservator of the Dja Biosphere Reserve (DBR).

As part of our commitment to enabling a functioning Community of Practice around our project, we have had regular meetings with international organisations (Zoological Society of London, Forest Peoples Programme, Centre Pour l'Environnement et le Développent) operating around the Dja Landscape (DL), as well with our sister Darwin project (#24005) working on bushmeat with communities along the NW periphery of the DL. We have also initiated research collaborations with the Higher Teacher Training College of Bertoua in Cameroon.

3.   Project progress

The following narrative follows the agreed baseline timetable for the project. Here, we also report progress on outputs. We include information on activities undertaken during the reporting period.

a)   Overall

The overall purpose of this Darwin Project was to ensure hunting and agriculture are managed sustainably to improve food security and health of Baka Pygmy populations in an area in southern Cameroon. Working with the targeted communities, we have generated much needed baseline to understand the level of dependency of these communities on wildlife resources and on the cultivation of their own food sources. We have also generated crucial data on the health status and poverty levels of the Baka in the region. These new sources of information are unprecedented. Based on this evidence, gathered during the first two years of the project, in Y3 we have focussed on sharing this information with all the Darwin Project's communities, and worked with them on ways on furthering the communities' understanding on how best to manage their natural resources in the future.

As recommended by the Spanish embassy, our ex-pat field team (ICPC - Guillermo Ros and the HO - Eva Avila, both Spanish nationals) were unable to travel to Cameroon due to potential security risks during the elections period in February 2020. Furthermore, as a result of COVID-19, further travel restrictions were imposed after March 2020, and neither the ex-pat field team nor the Project Leader were able to join field operations in Cameroon. The Project Leader had planned to travel to Cameroon in May 2020. Closure of the project will be undertaken remotely since it is unlikely that any trips from Europe will occur before August 2020.

b)   Team composition and new initiatives

We continue with our full Darwin field team without any changes (Appendix 1).

c) Collaborations

i) *Traditional use of medicinal and food plants by Darwin Baka communities*

Under the formal links established with Prof. Jean Lagarde Betti from the Higher Teacher Training College of Bertoua and our Darwin project, the Cameroon team completed all the analyses of used plants gathered during 2019 (full details of the work undertaken is given in our Darwin Y2 annual report). A final report and databases were submitted to the Project Leader and a scientific paper has now been submitted (see list of scientific papers resulting from this Darwin project in Annex 2). Two other papers, one on use of fungi and another on the use of use of plants for medicinal purposes, are being prepared for publication.

ii) *Environmental and health risks to humans and wildlife from lead-based ammunition*

We collaborated with Dr. Pedro Mayor, from the Autonomous University of Barcelona, to support a Spanish government-funded project. This project is part of a worldwide initiative to understand the impact of ammunition lead on wildlife and humans. Our contribution to the project was to engage hunters in five of our Darwin villages to offer voluntarily liver samples (Appendix 2). This material was taken to our Village Reporters (VR) in each village and hunters were given a small incentive (500 FCFA/£O.68) for each sample they donated. All VRs were trained and supervised by RO (our FA) during one-day long sessions in December, January and February. During these meetings, the VRs were trained on how to safely store samples (these were kept in a formol solution in plastic vats) and on how to record the necessary information. All VRs had to follow clear health and security instructions when dealing with the samples.

We organised permits to collect biological samples through our link with CIFOR-Cameroon. A formal communication was sent by the CIFOR Cameroon office on October 21st, 2019 to the various authorities in our study area and to the Ministry of Scientific Research and Innovation in the capital, Yaoundé. Mr. Essiane from the CIFOR-Cameroon office also visited the local administrations in Sangmelimá, Djoum and Mintom during the month of December to explain the nature of this collaboration. Data collection started during the first week of June without any obstacles.

iii) *Analysis of Baka agricultural practices*

Using part of our consultancy budget, we engaged the Tropical Forest and Rural Development Association (TR-RD), a Cameroonian NGO dedicated to environmental and social issues in the region, to assist us in understanding the extent and efficacy of the agricultural practices undertaken in our Baka communities (Appendix 3). This information is vital to further understand ways of improving the production of food crops. The first phase of field work to assess current state of local agriculture in five villages (July 2019). A second field work phase was carried out in September 2019 to assess farmer perception through focus group discussions and meetings with local authorities about current policies to develop local agriculture. All data were compiled and analysed, and first report delivered in October 2019.

3.1   Progress in carrying out project activities

Output 1: Research outputs developed and shared with target audiences (local government, villagers and international development community)

All activities completed.

Output 2: Databases created and made available for use by nutrition practitioners and field managers.

All activities completed.

Output 3: Hunting use zones maintained with hunters across 10 communities.

All activities completed.

Output 4: *Independent [i.e. not linked to wild meat offtake] measures of population status of protected fauna available for management purposes.*

All activities completed.

Output 5. *Improvement of human health and livelihoods achieved through an increase in dietary intake, nutritional status, and medical interventions.*

Baseline survey of health status of Baka population

Information on health of the inhabitants of our study villages was not possible during Y3 during to disruptions caused by COVID-19 (see section 3.2.).

Food consumption and nutrition surveys

All data collection on food consumption and nutritional intake using 24-h recalls was completed in Y2. No further activities were undertaken in Y3, planned for March-May 2020, due to disruption from COVID-19; our Health Officer was not able to travel to the country.

Agricultural programme

Activities linked with agricultural training and support of Baka families within the five participating villages continued during Y3. A total of 97 training meetings were organised between 2018 and 2019 in which 118 persons participated; 56 men and 62 women. The average number of meetings (Table 1) attended per person in each village varied from 3 (out of 5 meetings held) in Nkolemboula to 8 (out of 16 meetings). Percentage attendance went up from 13% to 17% between 2018 and 2019. The average number of participants ranged from 9 to 16 in Doum; this reflected the size of the villages.

Further support to villagers in setting up cooperatives, financial support for improvement of fields and setting up of a seed bank. Details of progress towards each of these activities are given in 3.2.

Table 1. Participation of farmers in meetings organised as part of the *ZyL*/Darwin project's agricultural programme.

	Average number of meetings attended per person			Average number of participants per meeting	
2019	**Mean**	**SD**	**Total number of meetings**	**Mean**	**SD**
Akom	5.72	3.07	11	15.09	4.01
Assok	7.89	4.80	16	13.31	4.87
Bemba	5.16	3.77	14	11.79	3.31
Doum	6.88	2.52	11	15.64	6.73
Nkolemboula	5.79	3.39	13	8.46	3.15
2020	Mean	SD	N	Mean	SD
Akom	4.68	1.35	6	19.50	4.32
Assok	5.70	1.71	8	19.25	4.95

Bemba	4.57	1.67	6	21.33	4.27
Doum	4.83	1.40	7	15.86	6.18
Nkolemboula	3.00	1.65	5	9.00	3.00

3.2   Progress towards project Outputs

Output 1: *Research outputs developed and shared with target audiences (local government, villagers and international development community)*

All data gathered and analyses undertaken has been shared with the participating villages, as well as with in-country practitioners, including in a Community of Practice workshop in Y2 (see Y2 Annual Report).

Articles already published from our work have been forwarded to the relevant authorities, and other scientific papers (currently in press or under review) will be sent when published (see Annex 3 Table 2- publication list). A further meeting in May 2020 was planned during which all our findings would have been further discussed and shared, but this has not been possible due to COVID-19.

Presentation of the results of work was also possible in a workshop organized by the Georg-August Göttingen University and coordinated by Prof. Matthias Waltert at the Congo Basin Institute (CBI) facilities in Yaoundé on October 2019. The workshop aimed to discuss and agree ways for resolving conservation conflicts around West-Central African Protected Areas.

Output 2: *Databases created and made available for use by nutrition practitioners and field managers.*

Databases resulting from our work on 24h recalls and on the use of food plants will be distributed to national authorities involved in food security issues at the end of the project.

Output 3: *Hunting use zones maintained with hunters across 10 communities.*

All activities around this output has been already completed, data analysed, and two scientific papers submitted for publication (see Annex 3 Table 2). A summary of results is given below.

a.   Hunting territories

From the mapping of hunting territories, we determined whether wild meat extraction levels per village were related to the size of these, we also measured habitat use by hunters and finally defined the overlap between hunting territories and extractive industries in the region. Mapped village hunting areas averaged 20,523 ±10,870 ha (range 7,681 - 35,202 ha); all villages used a total of 205,235 ha. From 295 tracks of 51 hunters, we showed that hunters travelled an average of 16,528 ± 13,545 m (range 952 - 89,788m) from each village. Home ranges, derived from kernel utilization distributions, were correlated with village offtake levels, but hunter offtake and distance travelled were not significantly related, suggesting that enough prey was available even close to the villages. Hunters in all village areas exhibited a clear bias towards certain habitats. We also showed that all village hunting territories and hunter home ranges fall within mining and logging concessions.

Our results are important for local understanding of forest land uses and to reconcile these with the other land uses in the region to better inform decisions concerning land use policy and planning.

b.   Hunting offtake

With the collaboration of hunters in our 10 Baka villages we were able to describe the use of wild meat from data collected from 1,946 hunting trips by 121 hunters. We show that most trips are

of around 13 hours and a median of eight hours. A mean ± SD of 1.15 ± 1.11 animal carcasses were taken in a single trip; there was a positive correlation between duration of trips and carcasses.

A total of 2,245 carcasses of 49 species of 24 animal families were taken in the study; species diversity was similar in all villages except one. Most hunted animals were mammals, with ungulates contributing the highest proportion.

By species, just over half of the animal biomass extracted by all hunters in our study villages was provided by four mammal species. Most animals were trapped (65.77% ± 16.63), followed by shot with guns (22.56% ± 17.72), other methods (8.69% ± 6.96) and with dogs (2.96% ± 4.49). A mean of 7,569.7 ± 6,103.4 kg yr-1 (2,080.8 - 19,351.4) were extracted per village, giving 75,697 kg yr-1 in total, which is equivalent to 123 UK dairy cattle. In all villages, 48.07% ± 17.58 of animals hunted were consumed by the hunter and his family, around 32.73% ± 12.55, were sold, followed by a lower percentage of carcasses partially sold and consumed (19.21% ± 17.02).

Between 60% and 80% of carcasses belonged to the "least concern" category, followed by "near threatened", "vulnerable" and, rarely "endangered". The only endangered species hunted was the central chimpanzee (*Pan troglodytes*). Our results indicate that hunting is important primarily for the food security of these peoples and from the data available are probably not impacting the supply of wild meat in mid- to long-term if hunter densities do not increase.

Output 4: *Independent [i.e. not linked to wild meat offtake] measures of population status of protected fauna available for management purposes.*

All information on the status of fauna in the village hunting areas based on camera trapping in three grids has been collected and analysed. We are in the process of finalising a publication to be submitted to a journal in June 2020. Data includes more than 20,000 captured photos containing events, capture success, more than 4% for each grid. Using this information, we were able to generate information on richness, abundance, activity and community structure of larger-bodied mammals (on average 5kg); some data on large birds has also been possible. We compared our findings with data obtained for the protected area (DBR) just north of our study area. Our results show that although most species in the protected area were found in our study area, larger-bodied animals such as buffalo and elephant were not detected during our study. Overall, most species encountered in our study area were less abundant than in the DBR though some species, such as the mandrill (*Mandrillus sphinx*) and the agile mangabey (*Cercocebus agilis*), and water chevrotain (*Hyemoschus aquaticus*) and central chimpanzee (*Pan troglodytes*) were more abundant outside the reserve boundaries. Our conclusion is that our Baka villages' hunting territories are only moderately depleted, which links with our findings that offtake by hunters in these could be sustainable (see Output 3).

Output 5. *Improvement of human health and livelihoods achieved through an increase in dietary intake, nutritional status, and medical interventions.*

a.   Household income and wealth surveys

A total of 111 structured household interviews have been applied within our 10 study villages, close to 80% of all households. We recorded livelihoods engaged by each household as well as assets owned, house type and conditions, access to water, and use of lighting. We also asked for information on daily income and expenditure. These results have been sent for publication in the journal *Ecohealth* (see Annex 3 Table 2).

We found that all Baka owned their houses (89.2%), which consisted mainly of one-room mud walls, but the level of ownership of basic goods was rudimentary; no family owned electronic goods such as television sets or fridges since less than 1.00% possessed electricity generators. Although most households owned beds, only two thirds owned mattresses and mosquito nets. Not every household had access to bathrooms or built-in toilets, most used communal latrines. Access to water was communal, from rivers, springs, wells or from shared water pumps.

The only animals owned were dogs and chickens but no other livestock (sheep, goats or cattle). Ownership of material goods was very limited with 21% possessing cell phones. Gun ownership was less than 3% but many families owned traditional weapons, spears. The main source of income for most families was from the sale of wild meat; an estimated daily income of 473.21 ± 308.63 Central African CFA francs, XAF, equivalent to 0.79 ± 0.5 US$ (n = 84). For those households which were able to engage in some form of agriculture, proceeds recorded from the annual harvest of plantain, a main crop, was only 25,069 ± 30,453 XAF or 41.63 ± 50.57 US$ (n = 29) per annum. Most households depended on wild meat hunting (88.3%), fishing (58.6%), gathering of forest non-timber products (45.9%), agriculture (83.8%), small jobs (known locally as "petit jobs") with their non-Pygmy neighbours (74.8%) and only two households were engaged in formal employment (1.8%).

b.   Baseline survey of health status of Baka population

All data on anthropometrics, disease and morbitiy gathered during two campaigns in 2018 and 2019 have been stored to future reference and use. These databases have been passed onto the medical team in *ZyL*; these data will be invaluable to support any future clinical work undertaken by *ZyL*. The 2020 health campaign was not possible, although planned, because of COVID-19. Doctors and medical staff could not travel during March and April, for when the campaign was planned. Furthermore, all areas in which we work were locked down from 15 March until the end of May 2020.

During our campaigns we were able to collect anthropometric and health data for 1,092 of 2-to-12 year old Baka Pygmy children, and for 176 adults from our Darwin villages. These data are unique since very little is known of the health of Pygmy populations in the Congo Basin. From these data we determined stunting, wasting, and obesity frequencies for children based on the Body Mass Index (BMI), and also assess changes in BMI with age for adults. These results have already been published in two scientific papers in the journal *Human Ecology.* Details of these publications can be found in Annex 3 Table 2.

c.   Agricultural programme

Understanding farming practices

During Y3 we continued working with *ZyL* in supporting the improvement of cultivation of food crops. As in Y2, our activities in the field have been led by our agronomist, FF, working with all participating families.

In 2018, we interviewed farmers (n = 52) who participated in our agricultural support programme to understand their perception of the importance of agriculture and the use of crops especially since the implementation of our programme. Results showed that 79.55% of respondents answered that agriculture was important as "access to food", and 36.36% of respondents suggested that agriculture conferred them "autonomy". As many as 13.64% of the respondents stated that agriculture allowed them to sell produce and to use proceedings to improve their access to health and schooling for their children. Almost all respondents (93.18%) answered that before our programme was instated food crops were obtained by exchanging Non-Wood Forest Products (NWFP), hunted game or by doing "petit jobs" (offer of labour to Bantu farmers). Most respondents (70.45%) actually acquired agricultural products through "petit jobs" and only 6.82% grew their own crops. After the start of our programme, 79.55% of respondents confirmed they have regular access to agricultural products; bananas (59.09%), taro (59.09%), peanuts (50%) and especially cassava (72.73%).

Analyses of farming practices were undertaken by TR-RD, recommended by the International Institute for Tropical Agriculture (IITA) whom we had originally approached for this consultancy. A first phase of work of 15 days was undertaken in July 2019, and a second phase during September 2019. TR-RD worked with a total of 27 farmers in 52 fields (12 in Akom, 7 in Assok, 12 in Bemba, 8 in Nkolemboula and 12 in Doum); a total 36,393 ha (13,726 ha in Akom, 3,183 ha in Assok, 8,438 ha in Bemba, 2,897 ha in Nkolemboula, and 8,149 ha in Doum). Information gathered included: 1) Characterizing all fields owned by project participants describing all types

of crops cultivated in each; 2) Quantifying crop density within a sample of 50m^2 (10m x 5m) quadrats. In each quadrat, all crop plants were counted, measured and observed; 3) Describing the process carried out by farmers to establish a field, and 4) Characterizing the type of soil found in each field. We also investigated the main challenges faced by farmers in pursuing agriculture, and described the main channels used by participants to commercialize their products. A final report has been produced by TR-RD and we will be preparing a scientific paper for publication in a relevant journal.

Farm schools

Our project has focussed on increasing food security in the participating villages by improving the production of subsistence food crops. The latter has been undertaken through the implementation of farm schools led by *ZyL* and the Darwin project. The following agricultural workshops themes were delivered during Y3 in the farm schools (Appendix 4).

Dates	Workshop
January - 2019	Selection and conservation of seeds (cocoa)
10- January- 2019	Organization of agricultural work
20- February- 2019	Selection of agricultural land
10- March- 2019	Cleaning and preparation of fields
March 15- 2019	Sowing
May 15- 2019	Field maintenance
06- June- 2019	Protection of crops against pests
20- June to 20- July- 2019	Selection and conservation of seeds
20- November- 2019	Field maintenance, pests and diseases
05- December-2019	Determining land quality and site selection

At the end of the March and August agricultural campaigns, we evaluated the degree of knowledge acquired by participants by asking them questions around: a) Planting and transplanting of fruit trees, particularly crop alignment and plantation frames and b) Crop maintenance such as weeding, sanitary pruning and crop replacement. We found that knowledge retention of these practices was average to poor, but from our focus groups discussions the general response to participation in the agricultural programme was positive. Examples of the testimonials indicate this very clearly:

- It is a privilege for us today to have certain seeds at our disposal which was not the case other times. We can now be like the Bantus who produce what they want when they want. Also, we already have a small work material - it is already a step.
- We had seeds, but we could not save them due to lack of knowledge and techniques.
- The change is perceptible now, because we have the seeds which allow us to hope for a radiant harvest which galvanizes a lot to no longer go stealing in the fields of others; only, our fields cannot sufficiently meet our food needs per family yet.

Financial support to farmers to improve their fields

At the beginning of each agricultural campaign, the project supplies a grant to support farmers' individual projects. Given that farmers are already organised within cooperatives, the grant is managed by the bureau's group to be distributed according to individual and common needs.

The grant consists of a total of 762 euros to each of the groups of the 5 towns.

This activity consisted of 3 phases:

1- Subsidy distribution mechanisms - Communities make a demand specifying their needs to carry out an agricultural project. The contribution to be made by applicant group and by *ZyL/Darwin* will then be determined. This will then inform how the grant will be distributed amongst the applicant community.

2- Justification - After the project is implemented, recipients must then justify how they have spent the money.

3- Evaluation and monitoring – The outcome of each funded project will be evaluated by the *ZyL*/*Darwin* team to measure their success.

Encouraging farming cooperatives

Our agricultural programme has successfully encouraged participating farmers in the five villages to organise themselves into farming cooperatives (Appendix 5). Cooperatives encourage better exchange of ideas and teamwork between farmers as well as present a unified front when communicating with the local administrations and other organised groups (such as NGOs). Each cooperative is run by village representatives and is managed by agreements, internal statutes and rules, which participants have developed with the support of the agricultural programme.

Table 2. Farming cooperatives initiated in the five Baka villages participating in our agricultural programme.

Villages	Association Name	Type
Assok	ABATOMANIE	Association
Akom	TONI PWEKE	Association
Bemba	NGASSA MAO TE NAJE	Association
Doum	BOUMA BO PWODE	GIC (Group d'initiative Communautaire)
Nkolemboula	DJOKO	Association

Implementing community savings and the management of economic resources

Amongst the Baka the *tontine* is an association of people who hold meeting periodically to pool their savings to cope with particular or communal problems collectively. Participants regularly pay a fixed contribution to a pooled fund. In this case, four of our five communities have already organised themselves to pool their savings: a) to pay for health emergencies, b) for individual needs and c) for common needs. In addition, every two weeks an established amount is distributed to a member of the association. The following are details of the current status of community savings initiatives in the five study villages:

Villages	Status	Amounts (in FCFA)
Assok	Not operational presently	0
Akom	Started January 5 2020	15,000
Bemba	Started December 2019	38,600
Doum	Started February 1 2020	28,500
Nkolemboula	Started June 28 2020	1,400

FPIC

To better implement the FPIC procedures, a number of meetings were held to improve communication between communities and our project. During these meetings, decision-making systems within the group were also agreed. Additionally, a mobile phone was provided to a member chosen by the group to be in charge of staying in touch with the ICPC. The form of communication was especially important during the COVID-19 crisis, since groups could stay in touch members of the project team.

Although delayed by COVID-19 we will be putting up sign boards in each village to serve as a physical newsletter space where information on upcoming meetings, administration reports, agricultural innovations or other information that may concern the community will be displayed.

Seed bank

The seed bank provides a communal system of seed storage to serve as a security net during lean seasons, individual crop loss and/or low-yielding agricultural campaigns. It works as a bank

to which each member contributes a part of their harvest at the end of a campaign to be deposited in the communal store. It is the group itself who decides the amounts to share, who and how to manage the stock and how to loan seeds to a new member. The groups are agreeing on the set of rules to govern the functioning of each seed bank and provide the material for the construction of the store.

Seed banks have already been built in three villages - Bemba, Assok and Doum (see photos in Appendix 6). Through an agreement between the groups and *ZyL*/Darwin, the responsibilities of each of the parties have been specified The communities provided land, water, and accommodation and food for the technician who built the warehouse. Additionally, groups are responsible for building the bricks.

Food consumption and nutrition surveys

As described in our Y2 report, all dietary household surveys were completed by the end of Y2. Market surveys were conducted during September-October 2019 to estimate local food weights and average measurements, for use in our dietary analyses (Appendix 7).

During Y3, our team has been working on the nutritional analyses of foods consumed, to assess the nutritional intake and dietary profiles of our study population. We are employing the Nutritics software which allows a more nuanced analysis of macro and micronutrients per household and per Adult Male Equivalent (AME). Mrs. Fernanda Lacerda, dietitian in the Jersey General Hospital, with whom we held in-person meetings in Jersey in February 2020, has been assisting us with the dietary analyses through regular online meetings. Online communication has also been maintained with Dr. Amy Ickowitz (CIFOR) throughout Y3 to discuss data interpretation and comparison with data collected by her team also in Cameroon.

3.3   Progress towards the project Outcome

The outcome of our project is to improve food security and health in Baka settlements by ensuring that there is a sustainable use of wildlife resources, namely wild meat and forest plants, but also improve the agricultural systems currently used for the production of subsistence crops. In order to achieve, we have proceeded along two main fronts: 1) gathering of data on health, food access and consumption, extent of territories and overlap with other land uses and 2) actively supporting communities to organise themselves in cooperatives to enable better food production systems. In this report, we discuss the progress made towards the main indicators (indicator numbers are the same as in the logframe) initially established in the project's log frame.

Although in this report we will not detail the work done in Y3 with the communities to examine customary laws and governance issues (these will be included in the final report of the project), here we focus on progress around the main indicators linked to the project outcome.

0.1 By end of Y2, at least a 10% increase in food security, 15% increase in dietary diversity in monitored households.

We collected information on dietary diversity and nutrient intake for a sample of households within our study villages. During Y1 we attempted to determine baseline food insecurity among a representative sample of households, with USAID Household Food Insecurity Access Scale (HFIAS) survey tool. We found that the HFIAS questions related to perceptions of food insecurity (e.g. "In the past four weeks, did you worry that your household would not have enough food?") that were not understood by our participants. Given the impossibility to assess food insecurity through the HFIAS survey, we were able, from different sets of data – hunting offtake, forest plants study, 24h recalls - to show that although access to food is relatively steady and regular throughout the year, the type of food, especially for sources of animal protein, varies seasonally. Although we are still analysing this information, preliminary findings suggest that food intake is relatively low per person, as indicated by the BMI levels observed in our population (see our papers Funk *et al*. 2020a,b, Annex 3 Table 2). Having said this, we are not able to suggest that

we have fulfilled our expectation of increasing dietary diversity or food security by 10% or 15%, respectively, but inroads into this has been made, as shown in indicators 0.4 and 0.5. By focussing on promoting community mechanisms that establish strategies such as: a) training farmers to conserve seeds, b) diversify agricultural varieties, c) establishing seed banks where farmer can stock and loan seeds to other farmers and d) improving savings, we are effectively allowing these communities to become more resilient and in turn improve their food security. Additionally, it is important to highlight that *ZyL*'s education programme, through the work promoted by our livelihoods' intervention activities, is working with farmers so they can provide corn for nutritional porridge for children in nursery schools every morning.

0.2 By end of Y3 there is a 10% reduction of revenues from the hunting of resilient species in catchment areas and a 10% decrease in number of protected species hunted.

At the start of the project we had assumed that it was necessary to reduce hunting of wildlife in the territories used by our Baka villages. The information gathered during Y1 and Y2 on hunting offtake, territories and the sale and consumption of species hunted leads us now to suggest that animal biomass extracted by the 10 Baka villages is likely to be sustainable if it remains at the same level. We also show from our studies that a very small proportion of protected species are hunted (see our paper Avila Martin *et al*. submitted, and Fa *et al*., submitted Annex 3 Table 2). We are aware that we have only measured extraction in our villages (a large sample of hunters participating) and that other hunters, especially from outside the villages, are exercising pressure on the animal populations in the area. If outside hunters are prohibited from entering the Baka territories and the lands used by our villages (and other Baka villages in the region) are respected, we believe that the current hunting practices fall within acceptable levels. Further analyses of the data gathered, in line with information obtained in our study on customary laws, will allow us to recommend a way forward.

0.3 By end of Yr3, a 10% decrease in anaemia rates in pilot Baka communities from a current 60%, as a result of encouraging adequate nutrition.

We have been able to assess levels of malnutrition during two major clinical campaigns in 2018 and 2019. This was not possible for 2020 due to the COVID-19 crisis. Our findings, some of which have already been published, suggests that malnutrition is rife among the study villages. However, we have discovered that the malnutrition assessments (following WHO standards) that have been undertaken for Pygmy populations are compromised by not taking into account the genetic component of stature in Pygmies (see our papers, Funk *et al*. 2020a,b in Annex 3 Table 2).

Our intention at the start of the project was to measure the impact of our intervention around the improvement of food production on anaemia rates. Although are still analysing our data to determine e.g. whether families that grow their own crops are nutritionally better off than those with no access to their own food crops, linking lowering of anaemia rates as a result of our activities may be premature. We have advanced our understanding of the relationship between wild and domestic foods and health, but we are aware that we fall short of the intention of our indicator.

0.4 At least 50% of target communities involved in agricultural extension work are participating in project (against baseline of e.g. 13%).

As a result of our agricultural programme, the number of participants involved, particularly women has increased significantly (Table 3). We have been able to achieve nine times more persons involved in the agricultural extensions work during the lifetime of the project, as many as 77 participants (more than 50% of the village inhabitants). More specifically, from 11 women involved at the start of the project, by 2019 a total of 68 women were included in our agricultural training activities. The composition of participation was the following:

- Doum: 16 households, of which 9 households are composed by couples and 7 were women.
- Akom: 16 households, of which 11 households are composed by couples, 3 households composed by women and 2 composed by men.
- Bemba: 14 households composed by couples.
- Nkolemboula: 6 households, of which 3 are households are composed by couples, 1 by a man and 2 by women.
- Assok: 18 households, of which 15 households are composed by couples and 3 by women.

Table 3. Changes in number of persons participating in the *ZyL*/Darwin project agricultural programme.

2017				2019			Change in participation	
Village	Men	Women	TOTAL	Men	Women	TOTAL	Increase in number of persons involved	% change
Akom	10	5	15	13	14	27	12	80%
Assok	5	3	8	15	18	33	25	312%
Doum	9	3	12	9	17	26	14	116%
Bemba	7		7	14	14	28	21	271%
Nkolemboula	4		4	4	5	9	5	125%
TOTAL	35	11	46	55	68	123	77	904%

0.5 By end of Y3, there is a 10% increase in income from agriculture in 10 study villages.

From 111 household surveys undertaken, 30 farmers involved in our agricultural programme were able to sell agricultural products from their fields. The most common crop sold was plantain, followed by banana and cassava. The average income per farmer derived from the last agricultural campaign is 27,534 FCFA ± 34,144 FCFA.

In turn, from focus group discussions, some testimonies endorse this result when participants affirm that"- *We find a profit from agricultural products because we are already starting to sell our plantains, which allow us to get some foodstuffs, medical care, and pay somewhat the children's pension".*

0.6 Cameroonian practitioners and university students trained on how to generate evidence for better decision-making when dealing with conservation-development interphases at the end of Y3.

Four pre-doctoral Cameroonian students, working with Prof. Jean Lagarde Betti from the Higher Teacher Training College of Bertoua, participated in data collection and analyses of the use of forest plants.

3.4   Monitoring of assumptions

Assumption 1: System is in place to allow continuous data analyses to disseminate project learning before publications appear.

> Comments: No issues. Analyses of all datasets undertaken, and results communicated to the relevant partners.

Assumption 2: Written papers are used to disseminate results of project and used to further discussions with appropriate authorities.

> Comments: By the end of the project we will have produced a total of 10 peer-reviewed publications. All papers have been sent to our partners for review before publication, and will be deposited in MINFOF, CIFOR-C and universities in Yaoundé and Bertoua.

Assumption 3: Nutrient composition database supervised by the project's Food and Nutrition expert, Dr. L. O'Connor at MMU. Our nutritional work has been supported by Prof. Barrie Margetts (Univ. of Southampton).

> Comments: Dr. O'Connor is no longer involved in our project since she has relocated to Ireland. Nutritional support has been given by Prof. Margetts and Dr. Amy Ickowitz from CIFOR and more recently by Mrs. Fernanda Lacerda, a qualified dietitian.

Assumption 4: CIFOR-C intervention consultant supports the project to better understand outcomes and future prospects.

> Comments: There has been an excellent level of support from CIFOR-C, helping us obtain permits to work in the study area, and allowing us to use as a sounding board to discuss our methods and results.

Assumption 5: MINFOF is able to send ecoguards to attend the training workshops.

> Comments: We were in discussions with MINFOF to ensure the participation of ecoguards in a second COP meeting at the end of the project. This has not been possible because of COVID-19.

Assumption 6: Local research assistants employed to support data gathering.

> Comments: Assumption discarded. Participation of local hunters and villagers in our project has been more than expected.

Assumption 7: Hunters motivated to contribute to the project.

> Comments: As in Assumption 6, a large number of hunters have participated in our project.

Assumption 8: Conditionality of no hunting of protected species created in line with health and agricultural support provided via Output 5.

> Comments: Through our study of offtake and hunting territories we have established that hunting of protected species is not a major issue. We have revised the issue of conditionality – we are not withdrawing support if hunting of protected occurs – but our work in Y3 with hunters to review their customs will reinforce a way forward.

Assumption 9: Hunting information obtained can estimate level of protected species offtake. Use of indirect methods to determine veracity of reports. Use of targeted interview techniques can verify if hunters participating in the project are taking protected species.

> Comments: Our data shows that hunting of protected species is low. We consider that the data gathered by VR to quantify hunting levels was not flawed by hunters give us false information on animals hunted, this is because VR regularly checked the quarry brought to the village.

Assumption 10: Increase in populations of protected species can be linked to the project's activities.

> Comments: This assumption is still valid, though means of verifying this will take longer than the length of our project. Given that our camera trap data shows that numbers of large animals is still relatively high in the hunting territories, and that numbers of protected species hunted is low, we are confident that the situation of most species (particularly large primates, giant pangolins and large duikers) is reasonably good. However, this should be investigated over a longer time period.

Assumption 11: Food security measured as "physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

> Comments: This has been done and supported by the data obtained on nutritional intake and access to food sources.

Assumption 12: Baseline information on health available from *ZyL* medics. Ethical premises of use of persons' medical records are clear.

Comments: We now have health data on all Darwin villages for 2018 and 2019, and *ZyL* has allowed us to access data from health campaigns going back to 2007 when these started. The older data has not been analysed.

Assumption 13: Agricultural extension programmes and training of women farmers will continue to be operated by *ZyL.*

Comments: Our discussions with *ZyL* confirm that the NGO will continue these activities in the Darwin villages beyond the lifetime of our project.

Assumption 14: Information of food production by families gathered at the start of the project.

Comments: This has been done.

3.5   Impact: achievement of positive impact on biodiversity and poverty alleviation

Throughout the project we have focused on undertaking a detailed assessment of conditions on the ground, fully engage and support the communities and prepare the conditions to work on the establishment of a working model for sustainable wild meat extraction for subsistence. Equally we have advanced in improving domestic food production. Better nutrition of domestic and wild products will have a positive impact on human health. We will be able to measure the contribution our project has made towards this aim.

4.   Contribution to the Global Goals for Sustainable Development (SDGs)

Our project is working towards Goals 1 (No Poverty), Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), Goal 5 (Gender Equality) and Goal 15 (Life on Land).

5.   Project support to the Conventions, Treaties or Agreements

The project will, through the promotion of a working model for sustainable wild-caught meat trade, contribute to the implementation of Articles 8c, 8d, 8i, 8j, 10a, 10c, 17.1, 17.2 of the CBD.

6.   Project support to poverty alleviation

Our target communities are Baka groups in southeastern Cameroon that have been displaced from their traditional hunter-gatherer lifestyles to live in roadside villages. In socio-economic and political spheres, the Baka are underprivileged in comparison to the more prevalent Bantu peoples in the country. Thus, our project is directly aimed at improving the lives of these rural indigenous peoples by working towards mechanisms that ensure a sustainable supply of domestic and wild foods, and by so doing better their health. We also aspire to raise farm incomes as a main element of an antipoverty effort, providing safety nets and building opportunities for self-sufficiency.

7.   Consideration of gender equality issues

Our project encompasses a vehicle for women's empowerment given that many women in our target villages are involved in agricultural activities led by *ZyL*. On the other hand, as household and food managers, women work closely with our HO on nutritional issues providing essential information on food insecurity issues, foods consumed and their preparation. This results in their empowerment and encourages their active participation in our project. Moreover, the recruitment of a female Baka assistant to assist us with our work in the villages engenders further trust in our project. This also promotes active participation in community group discussions and makes sure that their points of view are considered.

8.   Monitoring and evaluation

The table below, as shown in our Y2 annual report, details methods used in the monitoring and evaluation of each component of our project.

Monitoring needed	Evidence/data available	Data sources	Regularity of monitoring	Person/s responsible	Resources
1. Socioeconomic status of households	Demographics, assets, income, wealth, livelihoods	Interviews	Weekly	ICPC, FA, PL	Covered by project
2. Use of wildlife	Number/type of animals hunted, hunting effort, number sold or kept for own consumption	Village Reporters	Weekly	ICPC, FA, HO, PL	Covered by project
	Geolocation of tracks used by hunters in forest	GPS records	Weekly	FA, HO, ICPC, PL	Covered by project
3. Village hunting zones	Participatory mapping process with hunters	Maps	Reviewed by team for accuracy of locations mentioned by villagers during the mapping process	FA, ICPC, PL	Covered by project
4. Faunal status in village hunting zones	Camera trapping	Photos	Procedures checked by MMU FANs	FA, HO, ICPC, PL	Covered by project
5. Household nutrition	Food consumption patterns	Food lists	Once at the end of information gathering period	HO, ICPC, PL	Covered by project
	Food insecurity measures	Modified HFIAS Questionnaires	Weekly	ICPC, HO, PL	Covered by project
6. Human health		Medical examination records	Once at the end of each medical campaign	ICPC, HO, PL	Covered by *ZyL* and volunteers

9.   Lessons learnt

We have aspired to develop and implement a project that was led by good science and practice at the same of working directly with our Baka communities to improve their livelihoods and health. We are proud of how our team has been able to be effective on the grounds on both fronts. We have been able to achieve practically all outputs, but we were unable to undertake further work in the case of camera trapping, since a second campaign was impossible due to funding constraints. Such operations on the ground were far more expensive than originally budgeted, given that we used MMU staff. We have engaged with Cameroonian professionals who can do this at a more cost-effective rate.

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

None applicable

11.   Other comments on progress not covered elsewhere
None

12.   Sustainability and legacy

In terms of sustainability and exit strategy, at this stage, the project has focused on carrying out feasibility, assessment and baseline activities. The data collected, and sustainability considerations, will shape the model implemented beyond the life of the project.

The establishment of a Community of Practice ensures that lessons learned from the project are able to inform the wider conservation community in Cameroon.

13.   Darwin identity

The project partners have referenced the Darwin Initiative at the project launch event and at project presentations to beneficiaries and key stakeholders and the Darwin logo has been displayed on all published material and project vehicles. Acknowledgement of the Darwin funding is included in all scientific papers published. The partners have explained the aims and objectives of the Darwin Initiative more fully to government stakeholders, the British High Commission in Yaoundé, as well as national and local conservation actors working in Cameroon.

14.   Safeguarding

All activities undertaken within our Baka communities continue to follow a very clear FPIC process. Any involvement of community members is accompanied by a written or oral declaration of consent. Despite the limitations placed on the project by the COVID-19 we have managed to maintain close communications with our field team, and via them with our community members, but directly with local authorities and other organisations involved in our project.

This project was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ministry of Territorial Administration and Decentralization (Arrete No. 00034) awarded to ZyL to perform health and development work within the Djoum-Mintom region. Verbal informed consent was obtained from all subjects. Verbal consent was witnessed and formally recorded. We followed the Guidelines for Applying Free, Prior and Informed Consent (Buppert T & McKeehan A (2013) Guidelines for Applying Free, Prior and Informed Consent: A Manual for Conservation International. Arlington, VA: Conservation International). To maintain confidentiality, all participant names were dissociated from all datasheets prior to data analysis.

The project has also followed the safeguarding policy of the lead organisation, Manchester Metropolitan University (https://www.mmu.ac.uk/media/mmuacuk/content/documents/policy/policy_ref_Safeguarding.pdf)

15.   Project expenditure

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2019 – 31 March 2020)

Project spend (indicative) since last annual report	2019/20 Grant (£)	2019/20 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Monitoring & Evaluation (M&E)				
Others (see below)				
TOTAL				

Note: Given that COVID-19 has disrupted the closure of our project in-country, during which time we were going to engage with all of our partners and communities, we wonder whether the underspend of close to £10,000 can be transferred to 2021 for the same purposes.

Annex 1:   Report of progress and achievements against Logical Framework for Financial Year 2019-2020

Project summary	Measurable Indicators	Progress and Achievements Apr 2019 – Mar 2020	Actions required/planned for next period
Impact: Hunting and agriculture are managed sustainably to improve food security and health of rural populations through the effective and sustainable management of domesticated and wild food resources.		This project can provide us with unprecedented insights in the linkages between food production, wildlife use and human health.	██████████
Outcome: Food security and health improved in 10 Baka settlements (~190 households) in southeastern Cameroon, through the sustainable use of wildlife resources, and implementation of environmentally-friendly agricultural systems. (Note that these 10 settlements are representative of the overall Baka population in the Djoum-Mintom area of 2,000 inhabitants).	0.1 By end of Y2, at least a 10% increase in food security, 15% increase in dietary diversity in monitored households. 0.2 By end of Y3 there is a 10% reduction of revenues from the hunting of resilient species in catchment areas and a 10% decrease in number of protected species hunted. 0.3 By end of Yr3, a 10% decrease in anaemia rates in pilot Baka communities from a current 60%1, as a result of encouraging adequate nutrition. 0.4 At least 50% of target communities involved in agricultural extension work are participating in project (against baseline of e.g. 13%). 0.5 By end of Y3, there is a 10% increase in income from agriculture in 10 study villages. 0.6 Cameroonian practitioners and university students trained on how to generate evidence for better decision-making when dealing with conservation-development interphases at the end of Y3.	Progress towards the attainment of these indicators is explained more in detail in section 3.3. above.	We need to complete some analyses and preparation of publications and a major final report to distribute to all our national partners, as well as international collaborators.

Output 1. 1. Research outputs developed and shared with target audiences (local government, villagers and international development community)	1.1 Hunting offtake data and faunal abundance shared with MINFOF and other local and international conservation partners to increase uptake of results. COP meetings organised to disseminate and discuss results of project. 1.2 Journal article of hunting pressures and hunting sustainability of bushmeat species submitted to open access journal by end of Y2. 1.3 Journal article on dietary intakes and food sources of key nutrients prepared by end of Y2. 1.4 Journal article on links between forest, domestic crops and general health, especially of vulnerable groups (children, aged <5) completed by end of Y3. 1.5 Journal article on differences in large mammal abundance in community hunting areas vs non-hunted areas submitted by Y3. 1.6 Report on land use and landscape analysis presented to project partners (Community of Practice, COP, collaborating universities, MINFOF) to understand conflict areas between extractive industries and livelihoods of study communities.	10 scientific papers written - five submitted for publication and two already published and another three in preparation (see Annex 3, Table 2). All planned scientific outputs will be shared with our collaborators before publication.

Activity		
Activity 1.1 Assembling project resources (in-country). 1.2 Project launch meeting (in-country) for partners and target communities. 1.3 Identification and establishment of agreed parameters. 1.4 Establishment of Community of Practice (COP). 1.5 Partnership agreements between project, communities, CIFOR-C, MINFOF representatives. 1.6 Ongoing monitoring of data collection by communities and local partner with monthly reports. 1.7 Monthly reports published on website and dissemination of project newsletter. 1.8. Six-monthly review (data collection) of biological indicators and socio-economic surveys. 1.9 Six-monthly analysis of data by MMU. 1.10 Annual meetings of COP. 1.11 Six monthly project review meetings with local communities, hunters and traders and local game guards to enable feedback from beneficiaries. 1.12 Development of publication drafts and circulation for internal peer-review. 1.13 Submission of final publications to peer-reviewed journals.		1.1 Achieved 1.2 Achieved 1.3 Achieved 1.4 Achieved 1.5 Achieved 1.6 Achieved 1.7 No specific website for the project developed since it was not considered high priority. Instead, popular articles prepared in its place. 1.8 Achieved 1.9 Regular review of data gathered by PL and MMU staff. 1.10 No regular meeting organised. Partners have met *ad hoc* but COP meeting organised with all partners on March 2019. Next COP meeting cancelled due to COVID-19. 1.11 Weekly meetings held with all project collaborators but stopped after March 2020 due to COVID-19.. 1.12 Publication drafts sent to collaborators before sent to journal. 1.13 7 out of 10 scientific papers either published or submitted to journals.
Output 2. Databases created and made available for use by nutrition practitioners and field managers.	2.1 Electronic nutrient composition database of consumed foods in study area made available from MMU server and disseminated widely to potential users by Y3.	2.1 Nutrient composition database from other sources to be completed by end of project and shared with relevant national authorities, no bromatological analyses of wild meat and plants possible due to cost of exporting biological samples;
	2.2 Spatial data on wildlife extraction patterns stored in GIS shapefiles by end of Y2.	2.2 All participatory hunting maps for Phase I and Phase II villages stored as GIS shapefiles available in the project's Google Drive; maps included in publication.
	2.3 Wildlife use and extraction data stored in electronic database for use by project partners from end of Y3,	2.3 Gathered hunting data (offtake and hunter follows) during Y1 and Y2 stored in Excel datasheets and deposited in the project's Google Drive; analyses included in publication.
	2.4 In Y3, final workshop organised to train practitioners (e.g. MINFOF, Forest Peoples, Centre for Environment and Development, others) and Cameroonian university students on how to gather relevant data to understand	2.4 Practitioners' workshops planned for Y3 not possible due to COVID-19.

		conservation/development issues using our project area as a model.	
	2.5	In Y1 and Y3, baseline and post-project review workshops respectively, organised with project partners and other stakeholders.	2.5 Final post-project workshop cancelled due to COVID-19.
	2.6	At least 4 Master's student projects, a minimum of 2 from Cameroon, resulting from research undertaken for Outputs 3-5 completed by end of Y3.	2.6 MSc students could not be recruited but four doctoral from Higher Teacher Training College of Bertoua trained and completed consultancy of use of forest plants for the Darwin project. Field work completed and publication submitted to journal.

Activity	
2.1 Development of an electronic nutrient composition database of wild and domestic foods consumed in study area.	2.1 In progress. To be completed by end of project.
2.2 Collection of samples for nutrient composition database of foods	2.2 Not possible due to high export costs.
2.3 Preparation of nutrient composition database of foods for use in planned diet studies.	2.3 In progress. To be completed by end of project.
2.4 Spatial data on wildlife extraction rates, and areas hunted stored in GIS shapefiles and analysed (cross ref. Activity 3.4)	2.4 Spatial data on hunting zones and hunter follows stored in GIS platforms. Data shared between field team and MMU. To be shared with MINFOF and other organisations such as Forests Peoples Programme.
2.5 Spatial analyses of hunting areas and hotspots undertaken by MMU.	2.5 Done.

Output 3. Hunting use zones maintained with hunters and meat traders across 10 communities respecting agreed quotas.	3.1	By Y2, 70% of households in study communities (approx. 190 total families) participate in monitoring of wild species offtake. [note due to FPIC procedure followed, full participation cannot be guaranteed]	3.1 Full participation of inhabitants of all villages achieved. We obtained data on 1,946 hunting trips by 133 hunters (130 men, 3 women). This met the target of 70% of all households involved in this part of the project.
	3.2	By mid-Y3, community-based management plan for hunting resilient, fast-breeding species established in conjunction with at least 80% of participating hunters	3.2 Discussions with hunters on setting hunting goals and manage hunting practices started in Y2 and completed during Y3. This information will set the basis for a way forward for all communities to manage their wildlife resources. Full report will be available by the end of the project.
	3.3.	By end Y3, all participating hunters commit to complying with the community-based management plan	3.3 Offtake data on hunting of protected species collected during Y1 and Y2 shows that protected species are not important for villagers' food security or livelihoods. Given this result, we do not consider it necessary to urge any compliance on this point. However, in the document to be produced in 3.2. we recognise the importance of villagers to

	developed between them and the Darwin project	respect the Cameroonian hunting laws that prohibit the hunting of protected species.
Activity 3.1 Focus group discussions with hunters to establish working practices 3.2 Hunter interviews to establish hunting volumes and intensity 3.3 Training of village reporters to document hunted prey volumes and frequency. 3.4 Monthly village reports of animals hunted and numbers. 3.5 Participatory mapping of hunting zones around target villages.		3.1 Achieved. 3.2 Achieved. 3.3 Achieved. 3.4 Achieved. 3.5. Achieved.
Output 4. Independent [i.e. not linked to wild meat offtake] measures of population status of protected fauna available for management purposes	4.1 Abundance and distribution of hunted and protected species determined through analysis and interpretation of camera trapping data throughout Y1 and Y3.	4.1 All camera trapping data for 3 grids in hunting zones analyses and prepared for publication.
	4.2 Status of fauna determined using traditional ecological knowledge (TEK) methods through hunter perception surveys undertaken during Y1 and Y2.	4.2 Questionnaires analysed and data prepared for publication.
Activity 4.1 Baseline survey of wildlife status from hunter interviews. 4.2 Capacity-building training for local members of monitoring networks. 4.3 Camera trapping grids operational in identified hunting zones in Activity 3.4. 4.4 Camera trapping data analysed by MMU to detect changes in presence and abundance large-bodied/protected analysed.		4.1 Hunter/fisher surveys not undertaken in Y2. Further interviews planned for early Y3. 4.2 To be undertaken in Y3. 4.3 No camera trapping undertaken during Y2. Y1 camera trap data analysed and prepared for publication. 4.4 Achieved. Two MMU MSc students involved in the data analyses.
Output 5. Improvement of human health and livelihoods achieved through an increase in dietary intake, nutritional status, and medical interventions.	5.1 By Y3, food security in households participating in agricultural scheme has improved from initial baseline estimates in Y1.	5.1 Baseline estimates of human health, food consumption and nutritional intake completed.
	5.2 By Y3, at least 30 women farmers trained in agricultural improvement and farming techniques.	5.2 From 11 women participating in our agricultural programme in 5 villages at the start of the programme in 2017, as many as 68 women were trained the programme in 2019. Women participation by 2019 was 55%.
	5.3 Number of households producing their own food and commercial crops	5.4 Baseline information of number of households producing their own crops obtained.

	will increase by 10% compared to baseline.	
Activity 5.1 Training of household and farming survey assistants. 5.2 Baseline survey of home-produced foods and trade in sample households, 5.3 Socioeconomic surveys of sample households. 5.4 Baseline survey of health status in sample households 5.5 Nutritional assessment of sample households based on dietary recalls. 5.6 Baseline survey of agricultural production and activity in sample households. 5.7 Training of women farmers		5.1 Achieved. 5.2 Achieved. 5.3 Achieved. 5.4 Achieved. 5.5 Achieved. 5.6 Achieved. 5.7 Achieved.

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Hunting and agriculture are managed sustainably to improve food security and health of rural populations through the effective and sustainable management of domesticated and wild food resources. (Max 30 words)			
Outcome: (Max 30 words) Food security and health improved in 10 Baka settlements (~190 households) in southeastern Cameroon, through the sustainable use of wildlife resources, and implementation of environmentally-friendly agricultural systems. (Note that these 10 settlements are representative of the overall Baka population in the Djoum-Mintom area of 2,000 inhabitants).	0.1 By end of Y2, at least a 10% increase in food security, 15% increase in dietary diversity in monitored households. 0.2 By end of Y3 there is a 10% reduction of revenues from the hunting of resilient species in catchment areas and a 10% decrease in number of protected species hunted. 0.3 By end of Yr3, a 10% decrease in anaemia rates in pilot Baka communities from a current 60%[2], as a result of encouraging adequate nutrition. 0.4 At least 50% of target communities involved in agricultural extension work are participating in project (against baseline of e.g. 13%). 0.5 By end of Y3, there is a 10% increase in income from agriculture in 10 study villages. 0.6 Cameroonian practitioners and university students trained on how to generate evidence for better decision-making when dealing with conservation-development interphases at the end of Y3.	0.1 Household surveys in 50% of the 190 households (around 700 persons) of the 10 study villages. Description of food consumed, analyses of food types and nutrient intake (using 24-hour recalls), and food-insecurity questionnaires, undertaken in around 25% of all households (total 50 households). 0.2 Hunting zones from hunter participatory mapping exercises, direct hunter offtake data and hunter territory maps. 0.3 Medical records from all *ZyL* clinics. Consumption rates of macro- and micronutrients from dietary records. Impact of parasite reduction and malaria suppression. 0.4 Surveys of fields dedicated to agriculture. Analysis of detailed records of agricultural production of all managed fields determined in Y1 as baseline, and production records kept during Y2 and Y3. Minutes of meetings. 0.5 Income change from different sources calculated from data obtained in baseline household survey in Y1 and from two subsequent follow up surveys, at the end of Y2 and Y3.	Relevant government authorities support project interventions. Government authorities have sufficient authority and presence in the area to control the exploitation of protected species but allows hunting of fast-breeding taxa. Improvement in anaemia rates result from both better nutrition from the project's intervention and lowering of disease. The latter currently being undertaken by *ZyL*. Supply chains are open and supported by local institutions. Local markets are open to surplus subsistence crops (e.g. cassava, peanuts) and cash crops (e.g. cacao) cultivated in study communities . Rates of protected species bycatch (due to indiscriminate snaring technique of hunting) are not significant. Published evidence[3] shows that among the poorest households, reliance on wild meat

[2]*ZyL* health data of Baka populations in the study region (see http://zercaylejos.org/proyectos/health-en/?lang=en) indicate that 78%, 79% and 60% of children (6 months – 12 years) suffer from high intestinal parasite loads, malaria and anaemia, respectively.
[3]Nielsen, M.R. et al. (2018). The importance of wild meat in the global south. Ecological Economics 146, 696–705.

		0.6	At least 10 MINFOF and university students trained on conservation/livelihoods methods.	income is inversely related to domestic animal income and revenue from agriculture. This is the basic tenet and assumption in our project.
Outputs: **1.** Research outputs developed and shared with target audiences (local government, villagers and international development community)	1.1 Hunting offtake data and faunal abundance shared with MINFOF and other local and international conservation partners to increase uptake of results. COP meetings organised to disseminate and discuss results of project. 1.2 Journal article of hunting pressures and hunting sustainability of bushmeat species submitted to open access journal by end of Y2. 1.3 Journal article on dietary intakes and food sources of key nutrients prepared by end of Y2. 1.4 Journal article on links between forest, domestic crops and general health, especially of vulnerable groups (children, aged <5) completed by end of Y3. 1.5 Journal article on differences in large mammal abundance in community hunting areas vs non-hunted areas submitted by Y3. **1.6** Report on land use and landscape analysis presented to project partners (Community of Practice, COP, collaborating universities, MINFOF) to understand conflict areas between extractive industries and livelihoods of study communities.	1.1 Reports presented to MINFOF and other stakeholders. Meeting minutes and participant lists attending COP meetings. 1.2 Data analyses and project records on hunting and faunal abundance made available to MINFOF before publication. 1.3 Draft versions of papers made available for national and international peer review before being sent to relevant journals. 1.4 Draft versions of paper, letters/emails showing stakeholders have been consulted, evidence of submission to journal. 1.5 Draft versions distributed to stakeholders and partners for comments and analysis of implications. 1.6 Draft versions distributed to stakeholders and partners for comments and analysis of implications. 3D Augmented Landscape analyses, undertaken in conjunction with Rohan Fisher from Charles Darwin University, Australia, to be made available to COP members.	System is in place to allow continuous data analyses to disseminate project learning before publications appear. Written papers are used to disseminate results of project and used to further discussions with appropriate authorities.

2. Databases created and made available for use by nutrition practitioners and field managers.	2.1 Electronic nutrient composition database of consumed foods in study area made available from MMU server and disseminated widely to potential users by Y3. [note creation of the database itself is activity 2.1]	2.1 Nutrient composition database, dissemination statistics..	Nutrient composition database supervised by the project's Food and Nutrition expert, Dr. L.O'Connor at MMU. [Note: this has not held true as LOC no longer involved in project. She was involved at the start] Our nutritional work has been supported by Prof. Barrie Margetts (Univ. of Southampton).
	2.2 Spatial data on wildlife extraction patterns stored in GIS shapefiles by end of Y2.	2.2 Copies of shapefiles stored by MMU and *ZyL and* made available to COP members. All non-sensitive spatial data will be shared via Google Drive.	
	2.3 Wildlife use and extraction data stored in electronic database for use by project partners [by when?].	2.3 Copies of databases open to use by all project partners and shared via Google Drive. All hunter data will be anonymised.	CIFOR-C intervention consultant supports the project to better understand outcomes and future prospects.
	2.4 In Y3, final workshop organised to train practitioners (e.g. MINFOF, Forest Peoples, Centre for Environment and Development, others) and Cameroonian university students on how to gather relevant data to understand conservation/development issues using our project area as a model.	2.4 Training manual produced on conservation/livelihoods data generation methods and analyses. Workshop proceedings and list of attendants. 2.5 Reports on baseline analysis in Y1, and future directions reports produced at the end of Y3.	MINFOF is able to send ecoguards to attend the training workshops.
	2.7 In Y1 and Y3, baseline and post-project review workshops respectively, organised with project partners and other stakeholders.	2.6 Research proposals, Master's theses.	
	2.8 At least 4 Master's student projects, a minimum of 2 from Cameroon, resulting from research undertaken for Outputs 3-5 completed by end of Y3.		
3 Hunting use zones maintained with hunters across 10 communities	3.1 By Y2, 70% of households in study communities (approx. 190 total families) participate in monitoring of wild species offtake. [note due to FPIC procedure followed, full participation cannot be guaranteed]	3.1 List of participating hunters in project. Datasheets. Database. Hunting zone maps. Data reports. 3.2 Community based management plans, reports/participation lists/photographs	Local research assistants employed to support data gathering. Hunters motivated to contribute to the project.

	3.2 By mid-Y3, community based management plan for hunting resilient, fast-breeding species established in conjunction with at least 80% of participating hunters 3.3. By end Y3, all participating hunters commit to complying with the community-based management plan developed between them and the Darwin project	[per village probably – note communities share hunting areas, between each other and also with Bantu] 3.3 TBD depending on the community based management plan (likely to include e.g. offtake data) Data reports, electronic databases. Graphical representation of trends. Hunting zone maps. Written accounts of hunter workshops. Signed declaration by hunters.	Conditionality of no hunting of protected species created in line with health and agricultural support provided via Output 5. [future reporting should explore how this will be carried out through the project – including when and how] Hunting information obtained can estimate level of protected species offtake. Use of indirect methods to determine veracity of reports. Use of targeted interview techniques can verify if hunters participating in the project are taking protected species [
4. Independent [i.e. not linked to wild meat offtake] measures of population status of protected fauna available for management purposes	4.1 Abundance and distribution of hunted and protected species determined through analysis and interpretation of camera trapping data throughout Y1 and Y3. 4.2 Status of fauna determined using traditional ecological knowledge (TEK) methods through hunter perception surveys undertaken during Y1 and Y2.	4.1 Faunal status survey reports which determine changes in fauna during project. 4.2 Reports of status of hunted and non-hunted prey species including analyses of depletion zones derived.	Increase in populations of protected species can be linked to the project's activities.
5. Improvement of human health and livelihoods achieved through an increase in dietary intake, nutritional status, and medical interventions.	5.1 By Y3, food security in households participating in agricultural scheme has improved from initial baseline estimates in Y1. 5.2 By Y3, at least 30 women farmers trained in agricultural improvement and farming techniques. 5.3 Number of households producing their own food and commercial crops will increase by 10% compared to baseline.	5.1 Reports of food types consumed and origin of foods. Nutritional intake data. Household surveys of income and expenditure to assess links between food security and wealth status. 5.2 Agricultural extension programme reports and manuals. Testimonials from people involved in the project (stories of change) to capture e.g. increased participation.	Food security measured as "physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Baseline information on health available from *ZyL* medics. Ethical premises of use of persons' medical records are clear. Agricultural extension programmes and training of women farmers will continue to be operated by *ZyL*.

		5.3 Crop production records for all farmers participating in agricultural expansion programme.	Information of food production by families gathered at the start of the project.

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

Output 1. Research outputs
1.1   Assembling project resources (in-country).
1.2   Project launch meeting (in-country) for partners and target communities.
1.3   Identification and establishment of agreed parameters.
1.4   Establishment of Community of Practice (COP).
1.1   Partnership agreements between project, communities, CIFOR-C, MINFOF representatives.
1.2   Ongoing monitoring of data collection by communities and local partner with monthly reports.
1.7   Monthly reports published on website and dissemination of project newsletter.
1.8.   Six-monthly review (data collection) of biological indicators and socio-economic surveys.
1.9   Six-monthly analysis of data by MMU.
1.10   Annual meetings of COP.
1.11   Six monthly project review meetings with local communities, hunters and traders and local game guards to enable feedback from beneficiaries.
1.12   Development of publication drafts and circulation for internal peer-review.
1.13   Submission of final publications to peer-reviewed journals.

Output 2. Database creation and sharing
2.1   Development of an electronic nutrient composition database of wild and domestic foods consumed in study area.
2.2   Collection of samples for nutrient composition database of foods
2.3   Preparation of nutrient composition database of foods for use in planned diet studies.
2.4   Spatial data on wildlife extraction rates, and areas hunted stored in GIS shapefiles and analysed (cross ref. Activity 3.4)
2.5   Results of all information gathered by the project presented to COP members and communities at end of Y1 and end of Y3.
2.6   Presentation of completed Masters' theses by the end of Y3.

Output 3. Hunting use zones
3.1   Focus group discussions with hunters to establish working practices (cross ref. Activities 1.4 and 1.8)
3.2   Hunter interviews to establish hunting volumes and intensity
3.3   Training of village reporters to document hunted prey volumes and frequency.
3.4   Monthly village reports of animals hunted and numbers.
3.4   Participatory mapping of hunting zones around target villages.

Output 4. Protected fauna

4.1   Baseline survey of wildlife status from hunter interviews.

4.2   Capacity-building training for local members of monitoring networks.

4.3   Camera trapping grids operational in identified hunting zones in Activity 3.4.

4.4   Camera trapping data analysed by MMU to detect changes in presence and abundance large-bodied/protected analysed.

Output 5. Human health and livelihoods

5.1   Training of household and farming survey assistants.

5.2   Baseline survey of home-produced foods and trade in sample households,

5.3   Socioeconomic surveys of sample households.

5.4   Baseline survey of health status in sample households

5.5   Nutritional assessment of sample households based on dietary recalls.

5.6   Baseline survey of agricultural production and activity in sample households.

5.7   Training of women farmers

5.8   Six monthly monitoring of agricultural production changes.

Annex 3: Standard Measures

Table 1   Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
2	Number of people involved in academic training.	4 F/2 M	Cameroonian/British		4	2 MMU MSc students		2
6A	Number of people to receive other forms of education/training	30	Cameroonian	50	50	123	223	50
11A	Number of papers to be published in peer reviewed journals					10	10	3
12A	Number of computer based databases to be **established** and handed over to the host country				3		3	3
14A	Number of conferences/seminars /workshops to be organised to present/disseminate findings				2		2	3

15A	Number of national press releases in host country(ies)						2	2
18A	Number of national TV programmes/features in host country(ies)						1	1
20	Estimated value (£'s) of physical assets to be handed over to host country(ies)							

Table 2   Publications

Title	Type	Detail	Gender of Lead Author	Nationality of Lead Author	Publishers	Available from
1. Diet and nutrition of sedentarised Baka Pygmies in southeastern Cameroon.	Journal	Ávila Martín, E., Ros Brull, G., Funk, S.M., Fa, J.E. (in preparation)	F	Spanish	*Food and Nutrition of Indigenous Peoples in CDN*	
2. Wild meat hunting and use by sedentarised Baka Pygmies in southeastern Cameroon.	Journal	Ávila Martin, E., Ros Brull, G., Funk, S.M., Luiselli, L., Okale, R., Fa, J.E. (under review)	F	Spanish	*PeerJ*	
3. Ethnobotanical survey of wild edible plants used by Baka Pygmies in southeastern Cameroon.	Journal	Billong Fils, P.E., Afiong Nana, N., Betti, J.L., Farick Njimbam1 O., Tientcheu Womeni, S., Ávila Martin, E., Ros, G., Okale, R., Fa, J.E., Funk, S.M. (under review)	M	Cameroonian	*Journal of Ethnobiology and Ethnomedicine*	
4. Status of hunted fauna in non-protected areas in southeastern Cameroon.	Journal	Rivers, R., Cain, B., de Kort, S., Jones, M., Ros Brull, G., Ávila Martin, E., Okale, R., Fa, J.E. (to be submitted).	F	British	*Oryx*	

5. Hunting territories and land use overlap in sedentarised Baka Pygmy communities in southeastern Cameroon.	Journal	Fa, J.E., Ros Brull, G., Ávila Martin, E., Okale, R., Fouda, F., Fárfan, M.A., Fisher, R., Funk, S.M. (under review)	M	British	*Applied Geography*	
6. Understanding growth and malnutrition in Baka Pygmy children. Human Ecology	Journal	Funk, S.M., Palomo Guerra, B., Bueno Zamora, A., Ickowitz, A., Afoumpam Poni, N., Aminou Abdou, M., Hadam Sibama, Y., Penda, R., Ros Brull, G., Abossolo, M., Ávila Martín, E., Okale, R., Ango Ze, B., Moreno Carrión, A., García Sebastián7 C., Ruiz de Loizaga García, C., López-Romero Salazar, F., Amazia, H., Álvarez Reyes, I., Sánchez Expósito, R., Fa, J.E. (2020)	M	German	*Human Ecology*	https://doi.org/10.1007/s10745-020-00161-5

7. Divergent trajectories of BMI over age for adult Baka Pygmy people and their sympatric non-Pygmy populations.	Journal	Funk, S.M., Palomo Guerra, B., de Mena Martínez, N., Ickowitz, A., Fa, J.E. (2020).	M	German	*Human Ecology*	https://doi.org/10.1007/s10745-020-00151-7
8. Governance issues.	Journal	Ros Brull, G., Ávila Martin, E., Funk, S.M., Fa, J.E. (to be submitted).	M	Spanish	*Journal to be confirmed*	
9. Poverty and health in Baka Pygmy populations.	Journal	Ros Brull, G., Funk, S.M., Ávila Martin, E., Okale, R., Fa, J.E. (submitted).	M.	Spanish	*EcoHealth*	
10. The COVID-19 pandemic endangers Africa´s indigenous Pygmy populations.	Journal	Fa, J.E., Nasi, R., Funk, S.M. (submitted).	M	British	*British Medical Journal*	

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	X
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, 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. However, we would expect that most material will now be electronic.	
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.	