Darwin Initiative: Final 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)*

Darwin Project Information

Project reference	23-104 ref 3206
Project title	Improving livestock management for economic-environmental stability in Mesoamerica's Mosquitia
Country(ies)	Nicaragua, Honduras
Lead organisation	Wildlife Conservation Society
Partner institution(s)	The National University of Agriculture, Honduras during the initial project period.
Darwin grant value	£299,700
Start/end dates of project	1 April 2016 – 30 April 2021
Project leader's name	Fabricio Diaz Santos
Project website/blog/social media	
Report author(s) and date	Fabricio Diaz Santos and John Polisar, April 30, 2021

1 Project Summary

Spanning 22,568km² the bi-national "Heart of the Mesoamerican Biological Corridor" of Nicaragua and Honduras is the second largest wild area in Central America, harbouring intact forests, high biological diversity, and regionally at-risk wildlife including jaguar, harpy eagle, green and scarlet macaw, white-lipped peccary, and migratory birds. This remote area is occupied by Indigenous groups (Miskitu, Mayangna, Tawahka, and Pech) and ladino settlers whose subsistence lifestyle has been transitioning into the cash economy and increasingly involves domestic livestock. While much of the area's difficult mountainous terrain is still wild, this complex of protected areas and Indigenous territories has experienced increasingly rapid forest loss (the highest in Central America) and forest degradation due to unsustainable cattle ranching. Deforestation for low-productivity pastures is the region's primary threat to biological diversity. Poverty and malnutrition create incentives for raising cattle. However, malnourished and weak cattle do not optimally alleviate poverty and poor cattle management is a threat to the environment. Recognizing the desire and right of local people to raise beef and dairy cattle for local consumption and even sale in sections of protected areas where it's permitted, we aim to improve livestock management and production, including silvopastoral systems, improved pastures, and better animal health, directly linked to forest, wildlife, and biological diversity conservation through conservation agreements. We partner with territories that are sincerely interested in ecosystem conservation, providing technical expertise in environmentally responsible and productive livestock management techniques, and developing conservation agreements. This project intends to reduce deforestation in specific project areas, maintain existing wild forest blocks, and help communities elevate their standard of living while protecting biodiversity and conserving the ecosystems they inhabit.

The primary project areas are communities along main rivers of Nicaragua and Honduras. This includes 15 communities along the Coco, Bocay, Amak, and Lakus rivers in Nicaragua's Bosawas Biosphere Reserve, and 5 communities along the Rio Patuca in the Tawahka Asangni and Rio Platano Biosphere Reserves in Honduras, for a total of 20. These areas are centrally located in the map in Figure 1. This project concluded on January 30, 2021.

Figure 1. Map of project location.

2 Project Partnerships

The project area in Nicaragua lies in the Bosawas Biosphere Reserve, where we have been working closely with the Territorial Indigenous Government (GTI) of the Region of the Upper Rio Coco and Bocay (Region Especial de Alto Wangki Bocay), which is comprised of three separate Indigenous territories, Mayangna Sauni Bu (MSB), Kipla Sait Tasbaika (KST), and Miskitu Indian Tasbaika Kum (MITK). We originally planned to work through the Nicaraguan National University of Agriculture, but found it more efficient to work directly with the territories. Our activities and progress in Nicaragua have been planned and executed in collaboration with the three Indigenous territories, with the Presidents of the GTIs and the individual farmers, and this project includes Indigenous field coordinators and parabiologists, some of whom we have worked with for 14 years. The territories are intrinsically linked with project execution, and communication with them occurred nearly every month.

In Honduras, our formal partner was the National Agricultural University (UNAG) until mid-way through Year 4 (2020). Administrative delays within the university (some up to 6-8 months) meant that we had to switch to direct execution by our own rapidly strengthening institutional and administrative presence in Honduras. We alerted Darwin to this transition and the change request was approved. The Project Leader and the Wildlife Conservation Society (WCS) Nicaragua-Honduras team spent significant time in the capital city advancing administrative, financial, and political foundations, as well as in the project site, advancing partnerships, field

research, and other activities to ensure successful project execution. We are linked with the Federación Indigena Tawahka of Honduras (FITH) based in the community of Krausirpe in the Tawahka Asangni Biosphere Reserve, a ladino community in Nueva Esperanza, Miskitu farmers in Tukrun and Kurhpa, and a Miskitu cattlemen's association in Wampusirpe. The latter three areas are within the Miskitu territorial council Butuka Awayala MayaraIwi Idianka Asla Takanka (Organización de los Indigenas de Patuca Medio/Middle Patuca Indigenous Organization – BAKINASTA) and are in and near the Rio Plátano Biosphere Reserve**.**

During Year 4 we were in close coordination with Institute of Forest, Protected Area and Wildlife Conservation (ICF) staff that oversee the section of the Rio Plátano Biosphere Reserve in which the project is located. WCS staff conducted additional meetings with key actors, such as ICF field personnel, FITH leadership, and leaders of the regional Miskitu Indigenous organization Miskitu Asla Takanka (MASTA), which is the umbrella Miskitu political organization within which BAKINASTA falls – to discuss conservation issues in the project area. Project execution in Honduras began through UNAG-linked faculty, alumni technicians (some were Indigenous youth from the project area) and local community members; and then was led by the rapidly growing WCS Honduras program (that has worked with the same network and has also expanded integration with local and national institutions).

Our initial partner in Honduras, UNAG had~ 20 years of experience in the Honduran Mosquitia and provided satisfactory links with communities and field capacity for execution, but also had recurrent external and internal challenges. There were a series of delays in Honduras during the first three years, due to student strikes and national turbulence associated with a contested election, among other issues, which resulted in administrative and field delays. In Year 4, these delays continued without societal turbulence, and it became obvious we needed greater agility to execute on our own. WCS had incorporated personnel with their own deep levels of experience in the project area, which has facilitated the transition. We are grateful to Darwin for the approval of the transition and accompanying change requests due to aforementioned delays, followed by the COVID19 crisis, which froze travel in Honduras. In addition to the above institutions, personnel from the Pan American School of Agriculture Zamorano, the National Autonomous University of Honduras (UNAH), the Honduran Society of Ornithologists (ASHO), ICF, and the Direction of Biodiversity in the Secretary of Natural Resources and Environment (DIBIO/SERNA) participated in additional avian sampling in the project area in February 2020. Teams in both countries integrate deeply with local institutions for impacts in the field. After the end of this project, we will continue to grow the partnership and it will inform WCS´s strategy in La Mosquitia, including new agroforestry activities as well as support to the same beneficiaries. Momentum initiated during this project provided the platform for protected area patrols in Nicaragua, led to substantial engagement with the American Bird Conservancy in both countries, and directly impacted efforts in the Honduran project area to solidify cacao agroforestry as a conservation tool for wild mammals and birds, and a sustainable livelihood for local people.

3 Project Achievements

3.1 Outputs

All intended outputs were achieved. Below is a description of our advances towards project achievements, outputs, and activities.

Output 1. Improved livestock management and community conservation techniques adopted by at least 109 families in 20 communities (15 Nicaraguan and 5 Honduran communities) across four ethnic groups in four protected areas and two countries.

In Nicaragua, 145 families were trained in this project, during Years 2, 3 and 4, often with substantial representation of women in activities: 42% in years 2-3; 62% during year 3 and 49% in year 4. In Honduras, 184 families were trained during years 2-4, 33% of which were women. As part of this, a total of 109 Conservation Agreements (43 in Nicaragua and 66 in Honduras) were developed and signed with direct beneficiaries, as part of processes that included close technical assistance and surveillance. Due to external obstacles and months lost to the COVID 19 lockdown, the WCS team in Honduras needed an extension to complete technical assistance in the field and the final community meetings to assess project impacts during year

4 of the project. Despite these challenges, we were able to complete all tasks according to the agreed upon timeline, before January 30 of 2021.

Activity 1.1: We conducted ambitious participatory diagnoses of livestock management and forest conservation challenges in the communities, completing pre-project data analyses in Year 1 and 2, and post-project analyses in Year 3 and 4. We have summarized the diagnoses of livestock and farm management challenges experienced by beneficiaries in Honduras and Nicaragua in Annex 1.

Activity 1.2. In Nicaragua, we completed training in veterinary medicine and how to manage improved pastures and silvopastoral systems during Years 2-3, subsequently delivering training on how to reduce conflict between farmers and jaguars during Year 4. This involved a total of 145 community members, including 43 farmer beneficiaries whose participation continued (and strengthened) throughout the project. The latter training included detailed documentation of animal husbandry advances with GPS coordinates, mapped polygons of farms, and photographs of silvopastoral system progress in each individual farm. In Honduras, we delivered silvopastoral, agroforestry and animal health training to a total 170 farmers during Years 2-3, including 66 farmer beneficiaries with constant engagement. The final training for reducing conflicts between farmers and jaguars and pasture improvements took place during Year 4, including 75 farmers. During the four years of activities, we worked with local coordinators strengthening their leadership skills, thus building local capacity for sustained future work integrating conservation and livelihood improvement in this underserved region. In Nicaragua, we worked with three Indigenous coordinators, one from each of three Indigenous territories, and in Honduras we worked with a five-person committee in each of the five communities. Silvopastoral systems have progressed well with high success rates (see Annexes 2 and 3).

Activity 1.3: Three workshops to share experiences in the management of silvopastoral systems in Nicaragua were organized by the territory and conducted in February 2020. They involved a total of 79 people, 26 in Mayangna Sauni Bu (84% women and 16% men), 26 in Kipla Sait Tasbaika (27% women and 73% men), and 22 in Miskitu Indian Tasbaika Kum (40% women and 60% men), documented through photographs and signatures. In Honduras, activities included community meetings and exchange visits to participating farms, emphasizing visits to model farms developed by WCS, with two model farms in each of the five communities, for a total 10 model farms including 75 people (see Annex 2 and 3).

Output 2: Explicit agreements through which project beneficiaries commit to conservation outcomes adopted by at least 130 families in seven communities across four ethnic groups, four protected areas, and two countries.

Activity 2.1: In Year 1 in Nicaragua, prior to delivering training and materials, we developed conservation agreements at two levels; 1) territorial agreements signed by representatives of Indigenous Governments of 3 territories totalling approximately 2,800 km², and 2) agreements with individual project beneficiaries (47 total). The technical assistance in livestock production was conditioned upon commitments by communities to control deforestation and ensure the following rules are abided by: zoning (including agriculture, hunting, and conservation zones), no hunting of white-lipped peccaries and spider monkeys, reduced hunting of slow-reproducing specialist species (versus fast reproducing generalist species), restriction of tapir hunting for purposes of crop damage control only, and managing livestock to reduce human-jaguar conflicts. In Year 2 in Honduras, similar agreements were signed by participating farmers, albeit now that we have transitioned from UNAG to WCS and carefully reviewed the agreements, there are fewer families involved than initially estimated by the project partner: 18 in Wampusirpe, 10 in Kurhpa, 12 in Tukrun, 9 in Nueva Esperanza, and 11 in Krausirpe, plus another six in more remote tributaries, for 66 agreements involving 66 families in Honduras,

and 43 in Nicaragua, for a total of 109 in 20 communities between the two countries. Before signature of Conservation Agreements, WCS developed workshops in communities discussing the priorities and goals of conservation of forests and wildlife, in exchange for technical assistance.

Activity 2.2: In Year 1 in Nicaragua, obtaining the conservation agreements and planning the interventions entailed 12 meetings in the capital with Indigenous leaders, and was reinforced during 12 meetings in the territories, for a total of 24 meetings. The efficacy of those Conservation Agreements was reviewed during annual meetings held in six communities in Nicaragua in Year 2. In Year 3 and Year 4, efficacy was reviewed in 5 meetings each that indicated that silvopastoral systems were proceeding well and the participants were appreciative of the advancements made integrating agricultural improvements and conservation objectives (Annex 2 and 3). Defence of the Indigenous-designated “conservation zone” was one of the commitments in the territory level agreements we signed with leaders in Nicaragua during Year 1. During Years 3-4, collaborative SMART-based patrols enabled the recuperation of core habitat from more than 150 illegal invaders, seizure of weapons and equipment, including chainsaws and machetes, and protection of approximately 80,000 ha of titled Indigenous territories in a key refuge and source site for endangered species, an important step towards securing critical bi-national connectivity.

In Honduras, we obtained conservation agreements and planned conservation interventions over the course of 17 meetings held between Years 1 and 2. In Year 4, there were a total of 14 meetings in the project area. The meetings emphasized the following: the alignment of livestock management improvements with adherence to the conservation agreements; monitoring progress towards enhanced livestock management using silvopastoral systems, establishment of live-fences, and inclusion of forage trees in pastures as metrics of success; evaluating reduction in areas occupied by livestock; and discussing the impact that tighter management of livestock had on reductions in conflicts with jaguars. The meetings also emphasized better delivery of veterinary medicines, measures of increased livestock productivity, and assessments of reduction in hunting of white lipped-peccaries, tapir and spider monkeys. Sharing lessons learned and best practices, as well as challenges and obstacles encountered during the project, were part of the meetings and overall project processes.

Output 3. Learning and Outreach: Report on the impacts of improved livestock management practices, evaluating and comparing forest cover, biodiversity, and poverty reduction impacts across the spectrum of cultural contexts. Dissemination of methods and lessons learned to nearby communities, agricultural and protected area agencies, and across the entire NGO, Multilateral, and government community.

Activity 3.1: All socioeconomic and biological data collection in Honduras and Nicaragua, pre- and post- intervention, was conducted and completed according to standardized protocols, including: (1) format for collecting field socioeconomic data; (2) a specific data sheet for camera trapping field sampling and (3) specific sampling instructions for avian sampling. Data analysis of field surveys has been completed and summarized in technical reports (see Annexes 1, 4, 5). Those documents are focused on analysing changes in specific parameters, comparing pre- and post- intervention values. The socio-economic data is useful for distilling and showing changes in farmer behavior (knowledge, practices and attitudes). The biological data provides measures of changes on communities of birds and mammals at different geographic scales, examines the direct biological impacts of the silvopastoral systems, as well as in the surrounding areas at landscape scale, and the project’s implications for bird and mammal communities. These analyses have been critical for linking, documenting, and assessing the activities and impacts of the project.

We looked at land use changes using remote sensing and spatial GIS analysis comparing historical land use trends (2006-2016) vs Darwin project supported silvopastoral systems (2016-2020). This provided a robust assessment of project impacts on farming practices and forest cover trends (see Annex 6).

Activity 3.2: Working papers have been produced based on technical reports generated from the socioeconomic, birds and mammal field surveys. These working papers are focused on the impacts of enhanced livestock management, combined with conservation agreements, and strengthened livelihoods of local communities, and trends in bird and mammal communities. Submissions to international journals will take place beyond the project period.

Activity 3.3: The results of technical reports have been shared with local communities in Nicaragua and Honduras, during the final annual meetings to evaluate the project and share experiences, best practices, and lessons-learned. WCS shared results of technical reports in Nicaragua during joint Institutional public presentations with local Universities: Universidad de las Regiones Autónomas de la Costa Caribe de Nicaragua (URACCAN) in Siuna and UNA in Managua. In Honduras, the equivalent took place during joint activities with ICF. Due to the COVID-19 lockdown in Honduras, those presentations were conducted virtually (see Annexes 7 and 8).

3.2 Outcome

Outcome: Improved livestock management techniques are successfully implemented in ladino and Indigenous farms in the Mosquitia, leading to rigorously documented improved welfare of vulnerable communities, conservation of biological diversity, and forest cover.

This outcome can be described using **measurable indicators of Forest cover, Biodiversity and Human wildlife conflict.** We are pleased to report positive results on those indicators because the project interventions drove changes in the knowledge, practice and attitudes of farmers, not only in enhanced livestock management and productive systems, but also on management and conservation of natural forest and wildlife.

0.1 Forest cover: Rate of forest clearing in 40,000 hectares of target communities and household farms is reduced by 30% as compared to the 10-year historical average. At the binational scale, the rate of forest cover change from 2006-2016 was 667 ha/year of forest lost (0.61%/year) in the targeted 41,000 ha bi-national area. This rate reversed, recovering 1073 ha/year of natural forest (0.98%/year) from 2016 until 2020. This was a consequence of compliance of the Conservation Agreements made between farmers, Indigenous authorities, and WCS, that drove changes in knowledge, practice, and attitudes of farmers in their productive systems and awareness of conservation needs, increased through silvopastoral systems. This project and its advances were particularly impactful on the Nicaraguan side. There, the recorded deforestation rate from 2005 - 2016, was of 0.81%/year (730 hectares/year), losing 8037 hectares of natural broadleaf forest over 11 years. Capacity-building, exchanges of experiences, lessons-learned and interactions between farmers and project coordinators, impacted silvopastoral systems and changes in farmer productive system and conservation activities. The project reduced deforestation in Nicaragua, recovering 4057 hectares of forest from 2016 to 2020, or 1014 hectares/year (1.13%/year) through 2016-2020, Annex 6.

0.2 Biodiversity: After three years, avian alpha diversity/species richness in livestock systems and frequency of medium-sized and large mammals adjacent to livestock systems has increased, and species composition between specific livestock production systems and nearby intact forests have become significantly more similar according to the Sorenson quantitative /Bray-Curtis index.

The avian baseline was originally assessed during 2016-17, based on bird surveys conducted in three different kinds of vegetation in the two countries and remeasured during 2019-20 to measure project impacts on bird communities (richness and diversity of bird species). The data collected using standardized field methods (mist nets and point counts) were used in multivariate statistical analyses. A total of 223 bird species were recorded in the Nicaraguan side, and 137 species in Honduran areas, recording at least 29 species with high international conservation and research priority. Results show a clear trend of the conservation of alpha diversity in the areas of project influence. Values of 2.8 or higher in Shannon-Weiner Indices indicated that, overall, diversity was preserved despite the presence and existence of small-scale livestock management systems. In general, the richness of bird species also increased. In the area of project influence we recorded four additional species in areas of natural broadleaf forest, 24 species in secondary forest and six additional species in open areas. Natural regeneration and restoration of vegetation at the local and landscape scale around silvopastoral systems were key factors in these results. Contrasts in bird communities categorized by land use types softened due to the introduction of silvopastoral systems and forest recovery. The project's impacts led to increased species presence across land use types, resulting in richer bird communities in natural forests near silvopastoral systems, and overall, an increased presence of birds dependent on natural broadleaf forest. The improved ecological quality of areas near silvopastoral systems had positive impacts on the conservation of birds dependent on well-conserved forest. In addition, bird communities in areas of secondary forest surrounding silvopastoral systems became more similar to natural forest, with increasing Bray-Curtis values of similarity (Annex 4).

The mammal base-line was established during 2016-17 across human use areas, with camera trap lines radiating along gradients from interventions areas into natural forest in the two countries, sampling at three levels of human influence. These gradients were remeasured during 2019-20. Multivariate analysis of variance and correlation coefficients analysis of mammal species were based on frequency of capture data of all species. The camera traps obtained images of 18 species of mammals and two birds on both the Honduran and Nicaraguan sides. The main result of statistical analysis shows no change in abundance and composition of mammal species during the project period (2016-2020) and gradient of human influence, $p=0.47$. The value of mammal species similarity indices across the gradients ranged from 0 to 1 (totally different to complete similarity). In this case the similarity indices of the community of mammals increased from 0.73 to 0.79, when comparing mammal species across zones of medium and low levels of human influence between 2017 and 2019-20. This means that mammal communities in agriculture areas, with distance 2200 and 4200 m, became more similar to communities in deep forest, between 4200 and 6200 m of distance from Indigenous settlements, a metric of positive change due to project interventions (Annex 5).

Although these impacts in the mammal community were subtle, that also means there was no observed negative influence of silvopastoral systems on mammal communities at the landscape and large geographical scale. When the baseline documented jaguars and white-lipped peccaries were near villages, it was clear that substantially improving the status and distribution might be challenging. However, the results (mammal distributions in the project area), when combined with the documented containment of livestock and deforestation expansion provide clear evidence of a well conserved mammal community at the large geographical scale, and no decline of mammal populations. This was aligned with data/information from the socioeconomic surveys, confirming that areas near communities and agriculture contain a similar diversity and abundance of wildlife species as that found present far from human communities, deep in the natural forest. We didn´t detect greatly increased frequencies of mammals across related to time and space gradients due to two reasons: 1) because we initially found a good well-conserved community of mammals, including all species to be present in this region of Mesoamerica; 2) some of these mammals operate at large spatial scales with trends less visible when sampling at a relatively fine grain. It is however clear that there was no negative impact of the silvopastoral systems that we promoted, and mammal communities became more similar along the gradients contained in the area of project influence. We didn´t detect decreasing presence of mammal species. This is important

evidence that well managed small scale and contained livestock systems not necessarily clash with conservation goals. That is an important finding in a world desperate for conservation solutions, and in this area where many inhabitants living in poverty may be interested in livestock. These successes need to be qualified: 1) animal husbandry and pasture management must be sound and spatially limited to areas where permitted; and 2) conservation commitments are critical for this to be accomplished.

Although Indigenous communities obviously know about the importance of wildlife and forest in their livelihoods, after implementing silvopastoral systems they increased their knowledge and awareness of the importance of sustainable use and conservation of wildlife and forests. All (100%) of the beneficiaries confirmed the high importance of natural forest for satisfying their basic needs through wood, fruits, natural medicines, natural fibers, bushmeat, water, and honey. This project emphasized the importance of trees species of forest for increasing productivity and keeping healthy livestock, for example using trees of *Brosimum* sp (Ojoche) and *Erythrina* sp (Elequeme) as source of high quality of protein for increasing productivity of milk and cheese, and healthy cows, increasing the value of native trees and forest near silvopastoral systems. As a result of the project, the presence of *Brosimum alicastrum* trees increased in beneficiary livestock systems, from 51% to 74% of all the farms. This and other tree species can enhance livestock nutrition and production in, and surrounding, areas of management of cows. In general, the project changed livestock systems from expanding deforested pastures that were burned on an annual basis, to “fire-free” diversified systems that included native and useful trees for cows and wildlife (Annex 1).

0.3 Human-wildlife conflict: Retaliatory killing of carnivores, particularly jaguars, reduced by 50% across project farms, households and communities.

Socioeconomic surveys were developed in Honduras and Nicaragua, including the perspective of farmers on wildlife use, abundance/distribution, conflict between human and species, thereby building a robust baseline of the current socioeconomic situation, livelihood of beneficiaries, and conflict and use of wildlife and natural forest by beneficiaries. Wildlife data from surveys complemented data on wildlife capture frequency from the camera trap study. Socioeconomic data showed only 5.6% of farmers mentioned problems with jaguars and pumas killing domestic animals at the beginning of project (2017), and this decreased to 0% in 2019. During the same time there was a decrease in negative opinions of farmers about jaguars from 26% to 0%, and positive perspective of jaguars increasing from 61% to 90%. The percentage of farmers inclined to kill jaguars and pumas attacking domestic animals was kept under 40%, but they were inclined to kill only identified and confirmed specific jaguars that killed domestic animals, not innocent jaguars or pumas. In fact, it appears that zero large cats were killed in the area of project influence during the project. Project staff were local Indigenous representatives, with no need to hide the truth. There was no cultural chasm and project coordinators lived in the area, so that interpretation is reasonable. These positive changes were possible because constant and extensive interactions with farmers and explanations to farmer about necessary availability of natural prey, techniques for avoiding conflict with jaguars and pumas, emphasizing the responsibility of farmers for controlling their domestic animals, keeping them far from the forest and near their house, at the same time reducing hunting in forestry areas near farms (Annex 1). A key action of the Darwin project was to improve fencing options for farmers to control domestic animals and delivering technical assistance for increasing availability of nutritional and veterinary improvements for increased productivity of livestock. Through this work, the percentage of farmers keeping their livestock without control reduced from 28% to 8%, which was as a key factor for reducing incursions of cows into the forest, thus reducing the conflict between jaguars and farmers. Interestingly, statistical analysis showed the highest frequency of photo-captures of jaguars (*Panthera onca*) near communities, yet, as stated, losses of livestock to the cats was negligible to nil as a result of improved husbandry (Annex 1 and 5).

0.4 Local Livelihoods: At least 200 (originally, but updated to 130 via an approved Change Request Form) families will experience a 50% increase in livestock productivity due to integrated livestock management (including market value and availability for local consumption and subsistence.

This measurable indicator showed progress, especially in increased knowledge, practice and attitudes of farmers about their productive systems, emphasizing sustainable management of livestock, seeking and achieving a better balance between conservation of wildlife/forest and human development of communities. The main objective of socioeconomic surveys was to collect data to evaluate project impacts on local livelihoods and the standards of living to assess positive/negative impacts on sustainable productive systems.

In the deeply forested interior of la Mosquitia, livestock have not been a traditional activity of Indigenous communities. To the east, in the Caribbean pine savannah, the practice is somewhat more engrained, with cattle grazed amidst the sparsely spaced pines. At least in Honduras, in the broadleaf forest biome, where most of this project took place, livestock are a new land use. This explains why Indigenous people usually don´t have a clear productive objective for cows in their farms and communities, which was a motivation for this project – to improve management to increase productivity of their operations. Before the project, livestock systems usually showed low productive levels, and 97% of farmers were focused on self-consumption of milk and meat. Now silvopastoral systems are increasing capacity of milk and meat production at a small-scale. As a consequence, the proportion of beneficiaries selling meat in their communities increased from 23% of farmers in 2017 to 53% in 2019. This new meat source is an alternative to bushmeat and reduces hunting needs, and provides a small-scale additional income source. These results imply enhanced productivity and additional economic income in the local community, diversifying livelihood options for beneficiaries and their communities, while as shown above, stimulating zero associated environmental degradation, and instead accomplishing net gains (the goal as stated in the project's title). The increased productivity, nutrition, and economic gains at this level is enhancing Indigenous family livelihoods, increasing their quality of life, but not transforming Indigenous people into large scale land-intensive cattlemen, nor promoting livestock without control in Indigenous communities. The negative perception of local farmers about their economic situation diminished from 8% in 2017 to 3% in 2019, at the same time, intermediate perceptions of their economic situation increased from 92% to 97% of beneficiaries (Annex 1).

Indigenous livelihoods have historically been based on sustainable use of natural resources and subsistence agriculture (and tourism is thus far nil in the areas two days from the nearest road with no electricity), so they identify livestock production as the only potential external source of economic income for their families. This perception increased from 33% to 72% between 2017 and 2019. This project increased the availability and capacity of farmers to invest part of their profits in supporting silvopastoral systems for new local beneficiaries, from 74.4% to 94.9%, because of increased income from livestock activity, another subtle evidence of increasing incomes for small farmers. Although 100% of farmers invest their profits in food for families, increasing expenditures on clothing and recreation seemed to be new trends we encountered, and implies some "disposable income". Project activities and training were also focused on avoiding wasting money on incorrect and unnecessary veterinary medicines for cows and the other domestic animals used for self-consumption and low-level sales. The project emphasized enhanced nutrition from inexpensive native plants, increasing the value of forest and native trees for livestock production, including planting useful trees into pastures and productive systems. As a consequence, 10% of farmers reduced their agricultural supply expenses, slightly reducing their pastures, medicine and vitamins production expenses (Annex 1).

Silvopastoral systems helped farmers to solve multiple obstacles to productivity in their farms. The proportion of people mentioning problems of water quality was reduced from 18% to 2.6 %. The proportion of farmers with problems of insects and wildlife destroying their crops decreased from 38% to 5%. The perception of farmers being in a "*good cattle situation*" increased from

12% to 54%, reducing "*regular cattle situation*" from 83% to 46%. The proportion who viewed themselves as being in a "*bad cattle situation*" decreased from 5% to 0%. These changes can be explained by auto-investments in veterinary medicine, which increased from 51% to 95%, and the proportion investing in nutrition for cows increasing from 59% to 85%. The average of their self-investment in medicines was highly meaningful (p=<0.0001), increasing from C$ 799 to C$ 2425 (Annex 1).

Indigenous community livelihoods are mainly based on sustainable use of natural resources, therefore the quantity of pigs and/or chickens of each family represents a clear expression of healthy incomes, and a way for saving economic resources for future use. This increased as a consequence of the growing income provided by livestock production stimulated with silvopastoral systems of the Darwin project. The percentage of owners with less of 10 pigs decreased from 85% to 77%, but owners with 11-25 pigs increased from 8% to 20%. Similar trends were observed in the percentage of owners of chickens, increasing the number of owners with more than 11 chickens by 37%. One additional evidence of economic improvement is the slight trend of increasing percentage of farmers who were owners of cows, without sharing ownership with other people, from 92.3% to 94.9%, and farmers with shared ownership of cows descending from 7.7% to 5.1%. In addition, livestock (milk and meat), pig and chicken production imply alternative sources of animal protein for local human population, potentially reducing pressure of hunting (Annex 1).

3.3 Monitoring of assumptions

0.1 Forest cover: Cloud-free and current scenes of project areas are available for remote sensing analysis.

There were considerable issues with cloud cover in the 2006 scenes and it was necessary to pool 2005 and 2006 scenes, but that has been done and we established the baseline rates. By extending the project's end date, we were able to use clear scenes from the 2020 dry-season (fewer clouds).

0.2 Biodiversity: Relative frequency data reflect true population trends. Fluctuations due to weather, seasons, disease, and wildlife population dynamics remain within normal parameters, allowing detection of the effects of improved agriculture and reduced deforestation (To mitigate this risk we will standardize sampling and use robust experimental designs).

Baseline biological sampling started first in Nicaragua, setting the stage for protocols to use across both countries. In order to minimize sampling error, a standardized camera trapping design and data sheet was deployed for every station/camera. The avian sampling and data collection protocol used in Nicaragua was shared with the Honduran field teams. In Nicaragua, avian sampling was executed by an MS-level ornithologist with 20 years of experience who is also a MoSI coordinator. This was assisted by a university level biologist with abundant experience and local Indigenous crews with previous experience in avian inventories, linear foot transects, and MoSI migratory bird monitoring. The camera trapping was supervised by a Nicaraguan field coordinator with 12 years of experience and an Indigenous para-biologist who worked on the first jaguar camera trap survey in Nicaragua in 2006. The Project Leader ensured adherence to the camera trap sampling design in Honduras. During the first survey in 2017, a camera trapping specialist with 13 years' experience accompanied field crews and trained them. During the last avian survey in Honduras in Year 4, WCS organized a team composed of some of the country's top ornithologists. With rigorous robust sampling and strict quality control, we reduced variance due to observer and sampling error.

0.3 Human-wildlife conflict: Honest pre- and post- reporting by project participants.

In Nicaragua, local trusted coordinators distributed the questionnaires about human-wildlife conflict, which was likely to generate honest results. In Honduras, we also integrated with local institutions and families, our main technicians are Miskitu and Ladino local graduates from UNAG, and similar dynamics prevailed. During a series of additional interviews in Honduras conducted by an MS candidate, she noted differences in responses based upon who

accompanied her (conservation personnel or not) and the time allocated for the interview, which suggests that having interviews delivered by trusted local people who live in the area (which is what we have done) will obtain good results.

0.4. Local livelihoods: Changes due to improved livestock management are measurable and observable within the 3-year time period.

Changes were clearly measurables and robust evidence was distilled on technical reports. Several biological parameters showed highly meaningful differences, with clear changes on knowledge, practices and attitudes of indigenous farmers.

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

Impact: Environmentally sustainable livestock management practices are successfully adopted across the bi-national Heart of the Mesoamerican Biological Corridor, leading to biodiversity protection and improved welfare of vulnerable communities.

In Mosquitia, the depletion of forests and biodiversity and poverty of Indigenous communities is closely linked to unbalanced models of human and social development. In this region of Mesoamerica, unsustainable, extensive, illegal livestock is the main driver of deforestation and subsequent decline of wildlife and traditional livelihoods of Indigenous communities based on sustainable use of natural resources, and increasing poverty and hunger. Because livestock has not been a traditional activity of Indigenous communities, it has been difficult for them to adapt and incorporate livestock production into their livelihoods in an optimal way. This project provided potential solutions through silvopastoral systems, balancing livestock production and additional income selling production at a small, local scale to alleviate poverty, while also stimulating traditional use and conservation of forest and wildlife. The project increased understanding of enhanced livestock management adapted to Indigenous basic needs, increasing knowledge, practice, and attitudes of farmers about productive systems, management, and conservation of natural forest and wildlife. Indicators of **Forest cover**, **Biodiversity**, **Human-wildlife conflict** and **Local Livelihood** mentioned in **3.2 Outcome** show evidence of this project contributing to biodiversity conservation and human development/wellbeing (alleviating poverty) in Indigenous communities.

In both countries, the project's momentum enabled us to secure additional, complementary funding for critical on-the-ground needs, including patrols along territorial boundaries (through a Department of State (DoS) Central American Free Trade Agreement (CAFTA-DR) grant, a DoS International Narcotics and Legal Affairs (INL) grant, and funds through a U.S. Fish and Wildlife Service Cooperative Agreement. Darwin 23-014 also leveraged additional funds for camera trapping surveys from the Liz Claiborne and Art Ortenberg Foundation. We directly leveraged the work in Darwin 23-014 to expand our impact on migratory bird conservation, cacao agroforestry, cattle management, forest conservation and additional protected area law enforcement efforts through a joint project with American Bird Conservancy (ABC) using U.S. Fish and Wildlife Service Neotropical Migratory Bird Funds. Using the platform of Darwin 23-014, we developed a collaboration with the Yale Environmental Protection Clinic to collect data on forest trends, threats, opportunities, actors, and mechanisms to strengthen bi-national forest connectivity in the project area. The latter resulted in a joint White Paper that we publicized in news releases**.** During 23-014, the Project Leader joined Conservation International Coordinated Rapid Ecological Appraisal Program expedition into a high-profile archaeological site, alternatively known as the White City/Lost City of the Monkey God/Lost City of the Jaguar, which albeit remote, is also quite near our project area in Honduras (22 miles from Krausirpe) and in the same watershed. The results of the WCS Yale White Paper (which was enabled by Darwin 23-014) were combined with knowledge gained during the Lost City expedition for synthetic large-scale perspectives on conservation needs in the bi-national Mosquitia that were communicated to inform decision makers.

Darwin 23-014 also enabled us to identify additional opportunities to promote livelihoods that are compatible with conservation. In the project area in Honduras, farmers produce cacao

grown in complex agroforestry systems. In one section, cacao is purchased and processed by a business in Wampusirpe (Cacao Direct) and used by chocolate producers in Honduras, and the United States, with bean-to-bar products that win prestigious international awards. In another section, the Miskitu farmers have a cooperative that sells to Chocolate HALBA in Switzerland. Following the lead of one of the Yale students, WCS started exploring the potentials to better promote the Cacao Direct products from agroforestry cacao systems as an economic alternative to deforestation. We have forged an innovative partnership with Roatan Chocolate Factory, which sources its cacao from Cacao Direct. They are producing a conservation chocolate bar line that will help support an Indigenous ranger team in the BAKINASTA Miskitu Indigenous territory. We are also launching an innovative collaboration with the WCS Business Operations team to profile these chocolate bars and our conservation work in WCS zoo concessions and stores.

We remain committed to also establishing a broader more comprehensive farm-to-market strategy of jaguar friendly and bird friendly cacao in the project area, with the goals of 1) expanding markets through verified labelling as an incentive to expand impacts; 2) ensuring farm level practices that provide safe passage for jaguars and prey, optimizing migratory bird habitat. The cacao based sustainable livelihood work enabled by the Darwin 23-014 project has significant potential, working from the farm level up, for larger scale environmental and economic impacts. Darwin 23-014 also served as a springboard for several additional projects focused on Indigenous territorial protection both in the area and in adjacent territories in Honduras.

Darwin 23-014 expanded WCS´s local capacity to execute field projects, which enabled us to support Indigenous communities to protect their territories against illegal encroachers in Honduras and Nicaragua. The support was also the primary catalyst for a WCS-ABC institutional synergy that has now extended beyond 23-014 in time, facilitating additional funding for another detailed socioeconomic and livelihood assessment, related to cacao farms in Patuca River, Honduras. That project is currently underway, with WCS Honduras staff conducting questionnaires to explore how to best empower and transform cacao agroforestry into a more explicitly conservation oriented economic activity. ABC is also supporting an Olancho, Honduras based expert cacao consulting group to expand diversified complex cacao agroforestry systems in the same area, yet another indirect spin off from 23-014.

Beyond publicizing the project in range wide jaguar meetings, international congresses, with the Secretariat of UNDP, in press releases and blogs, we will be generating international refereed publications. In the works are the following: 1) manuscript examining mammal distribution and abundance across time and space; 2) manuscript presenting avian species that indicate forest status and recovery, and analyses of Darwin project 23-014 impacts; 3) a manuscript examining patterns of mammal distribution and abundance across both countries – core reserve zones through riverside community edges, three biosphere reserves, three river valleys, four ethnic groups, using 19,993 camera trap images for analyses from 2006 to 2019. We will review that analysis, of which Darwin provided the final and essential part, with data from near communities and associated with agricultural initiatives.

Over the past few years, WCS and our partners have made strong progress on positioning Mesoamerica’s Five Great Forests (of which the bi-national Mosquitia is one) in key international policy and funding discussions, as well as international media. At the UN Framework Convention on Climate Change Conference (UNFCCC COP25), WCS organized two events on behalf of the Five Forests initiative, and supported the eight countries of Central America in presenting their regional climate action plan, which commits to protecting Mesoamerica’s five great forests and achieving carbon neutrality in the agricultural and forest sector by 2040. We also expanded critical funding for the five forests through approval of two major grants, including aGreen Climate Fund (GCF) readiness project, setting the foundation to submit a full GCF grant proposal in the future; and a proposal from the European Union. The

EU project will enable us to advance our More Trees, Fewer Cows approach, working with a regional partnership comprised of governments, Indigenous communities, and civil society to transform agriculture and food systems, support Indigenous conservation solutions and forest-based income streams, protect intact ecosystems, and eliminate illegal cattle ranching in Mesoamerica's Five Forests. While higher-level publicity, political advances, and scientific impact may seem remote to local human well-being, the core of this project is an improved synthesis of how to achieve sustainable livelihoods and conservation in a socially sensitive local context.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to Global Goals for Sustainable Development (SDGs)

Goal 1, End poverty in all its forms everywhere;
Goal 2, End hunger, achieve food security and improved nutrition, and promote sustainable agriculture; and
Goal 3, Ensure healthy lives and promote well-being for all at all ages.
In La Mosquitia, the depletion of forests/biodiversity and poverty in Indigenous communities are closely linked to unbalanced models of human and social development. In this region, unsustainable extensive livestock is the main driver of deforestation and subsequent declining populations of wildlife, which has disrupted the traditional livelihoods of Indigenous communities based on sustainable use of natural resources, increasing poverty and hunger. Livestock is not been a traditional activity of Indigenous communities, therefore it's been difficult for them to incorporate livestock production in their livelihood in an optimal way. This project aimed to address these challenges through implementation of silvopastoral systems balancing livestock production providing additional nutrition and income by selling via local community markets to alleviate poverty and hunger. The aim was to ensure improve food security and nutrition and sustainable production of food, promoting well-being, while also stimulating traditional use and conservation of forest and wildlife. Those objectives were met. The project supported enhanced livestock management, adapted to Indigenous basic needs. The project led to positive changes in farmer' knowledge, practice, and attitude of productive systems and management and conservation of natural forest and wildlife. The Indicator of **Local Livelihood** mentioned in **3.2 Outcome** shows evidence of this project contributing to human development/wellbeing (alleviating poverty) in Indigenous communities.

On a larger scale, our program in La Mosquitia seeks to sustain natural ecosystems and goods and services that provide the basic necessities for people's lives. The project is working to ensure that poor and vulnerable forest-dwelling and riverine Indigenous populations have formal access to and management authority over the land, waters, and natural resources on which they depend, including those that provide food, shelter, and medicine. Conserving natural systems and the ecosystem services they generate is necessary to protect the livelihood security and resilience to environmental shocks of these isolated, politically marginalized populations.

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Silvopastoral systems of this project were implemented in areas of historically poorly planned and unsustainable livestock production in Indigenous communities, promoting better management and resulting in a more sustainable economic alternative income for local families, with increased sale of milk and meat in local communities. Although livestock work in Indigenous communities is usually led by men, this project's training and technical assistance had a strong focus on women, with more than 40% participation in Nicaragua and 33% in Honduras. The **Local Livelihood indicator mentioned in Outcome 3.2** demonstrates this project's contribution to improved human development/wellbeing (alleviating poverty) in communities, resulting in less chaotic and more sustainable livestock production and community livelihoods. This way, the project expanded opportunities for "decent work and economic growth" of Indigenous people through improved management of silvopastoral systems and, as a consequence of increased income, increased production of pigs and

chickens by beneficiary families. The latter also led to new opportunities for work and income for the women and young people that usually are in charge of that work. Unsustainable use of natural resources undercuts the long-term potential for livelihoods and job security. This project promoted sustainability and legitimate use of natural resources, seeking to create and shift economic activities into decent work that conserves nature over the long-term. The metrics demonstrate solid advances on all those goals.

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
In the Mosquitia Forest, illegal, unsustainable extensive livestock is the main source of deforestation, and because of the soils also it is driving serious environmental degradation. Indicators of **Forest cover**, **Biodiversity** and **Human-wildlife conflict** mentioned in **3.2 Outcome** demonstrate how this project promoted and enhanced sustainable livestock management in production areas, promoting natural regeneration and restoration of vegetation, and stimulating connectivity of forest at a landscape scale. This process of reversing land degradation and biodiversity loss leads to positive changes in the knowledge, practice, and attitude of farmers of productive systems and better management and conservation of natural forest and wildlife. This project worked diligently and collaboratively to reduce deforestation and hunting, conserve wildlife, wild places, and biodiversity and ecosystem services in deep collaboration with Indigenous peoples, communities and governments. Our core focus was to conserve the full complement of native wildlife and the vital ecological roles they play in maintaining healthy, productive, and resilient ecosystems. According to the metrics employed, substantial advances were made towards meeting those goals.

4.2 Project support to the Conventions or Treaties (e.g. CBD, Nagoya Protocol, ITPGRFA, CITES, Ramsar, CMS, UNFCCC)

This project addressed Aichi targets 1,2,3,4,5,7,12,14,15, and 19 and all five goals of the CBD. In particular, we reduced direct pressures on biodiversity and promoted sustainable resource use, strengthening local capacity for territorial planning and management, and enhancing the benefits of water provision services for vulnerable rural livelihoods. Through conservation agreements, we provided technical assistance that reduced pressures on biodiversity and promote sustainable use. The project has had a positive impact on territorial management. The goals of forest conservation and improved livestock management helped to preserve clean and consistent water for communities. This project has made advances at the local level, and also informed higher level initiatives. The Mosquitia and the Five Forests of Mesoamerica are now included within the region's formal climate strategy (before UNFCCC) with an aim towards decarbonization of the region's agricultural and forestry sectors by 2040. https://news.mongabay.com/2019/12/central-american-countries-pledge-to-protect-mesoamericas-5-great-forests/; https://dujour.com/culture/global-wildlife-conservation-5-great-forests-of-mesoamerica-initiative/. In addition, John Polisar, former project leader, and the International Policy Team in WCS played a significant role in having the jaguar listed in Appendix 1 and 2 of the Convention on Migratory Species (CMS) in February 2020 (during Year 4) (https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/13835/Jaguars-Receive-Further-Protection-Under-Convention-of-Migratory-Species.aspx, https://www.unenvironment.org/news-and-stories/story/maximum-protection-across-borders-emblematic-jaguar. Honduras is a signatory to the CMS and likely the inclusion of this wide-ranging species in Appendix 1 of CMS will help transboundary conservation in the bi-national Mosquitia.

4.3 Project support to poverty alleviation

In La Moskitia, the depletion of forest/biodiversity and poverty of Indigenous communities are closely linked to unbalanced models of human and social development. Unsustainable extensive livestock is the main driver of deforestation and consequent declining populations of wildlife, disrupting traditional lifestyles of Indigenous communities based on sustainable use of natural resources, increasing poverty and hunger. Because livestock has not been a traditional

activity of Indigenous communities, it has been difficult for them to adapt livestock production into their livelihood in an optimal manner. This project contributed to solutions by inserting silvopastoral systems as production enhancing tool, supporting 109 families from 20 communities in two countries with improved livestock management. By balancing livestock production and additional economic income selling production at small scale local community markets the project was effective for alleviating poverty, hunger, and ensuring food-security-improved nutrition and promoting sustainable productivity of food and promoting well-being, paradoxically, also stimulating the traditional use and conservation of forests and wildlife. The project resulted in enhanced livestock management adapted to Indigenous basic needs. The Indicator of **Local Livelihood** mentioned in **3.2 Outcome** shows evidence of this project contributing on human development/wellbeing (alleviating poverty) on Indigenous communities.

4.4 Gender equality

Although livestock in Indigenous communities are usually managed by men, this project promoted and opened opportunities to listen to the voices of women and invited them to decision making table, emphasizing participation of women in all activities. Following their involvement and input, we responded to their request to participate in transforming livestock management in Indigenous communities and increasing their role in productive systems. Participation of women exceeded 40% in Nicaragua and reached 33% in Honduras (see Annexes 2 and 3), increasing involvement of women in livestock management. The **Local Livelihood** indicator shows this project influenced the management of production of pigs and chickens by beneficiary families, as part of strengthening livestock management, opening new opportunities for work and income for women and young people.

4.5 Programme indicators

- **Did the project lead to greater representation of local poor people in management structures of biodiversity?**

Yes. Livestock is the main driver of deforestation in the Mosquitia, usually developed by large cattlemen with high economic capacity, buying and selling livestock and often illegally buying and selling national and Indigenous lands, promoting widespread environmental degradation, deforestation, and defaunation, as well as elevating conflict with jaguars and other wildlife. These entropic forces are frequently in conflict with Indigenous communities over land and resources, taking advantage of weak economic capacity, unsatisfied basic needs and poorly organized members of Indigenous communities. This project was the reverse of that. Although livestock were again the theme, this project emphasized local control and conservation commitments, i.e. balance for a sustainable future. The project focused on bringing, via silvopastoral systems, new knowledge and capacity into Indigenous communities, improving practices in their productive areas, increasing incomes and keeping their traditional use of natural resources (forest and wildlife) to satisfy their basic needs. Through holistic efforts, this project increased representation of local people facing poverty in management of their own social structures for a better management and conservation of biodiversity. This project supported Indigenous communities, mainly small farmers and women, to increase their management and control of livestock production, food security, increase economic income, and prioritize meeting their basic needs.

- **Were any management plans for biodiversity developed and were these formally accepted?**

Yes, “Conservation Agreements” were accepted and signed by (1) Indigenous beneficiaries, (2) Indigenous governments and (3) WCS. These documents established the terms and responsibilities of participants.

- **Were they participatory in nature or were they ‘top-down’? How well represented are the local poor including women, in any proposed management structures?**

Our work in this region has been and continues to be, highly participatory. The final text of the conservation agreements was the result of at least two rounds of conversations between

members of communities, Indigenous governments, and WCS. Women of Indigenous communities participated and provided their feedback about processes and practices. Responding to community priorities and ways to work with them were the main focus (due to the highly participatory style of collaborations), but conservation goals and objectives (for forest and wildlife) were as much a part of that as economic benefits.

- **How did the project positively influence household (HH) income and how many HHs saw an increase?**

The project directly increased the livestock productivity of farmers, milk and beef, as external sources of economic income, at the same time emphasizing their Indigenous identity and traditional livelihoods, based on sustainable use of natural resources from forests, rivers and subsistence crops, and wildlife through sustainable hunting. For example, the percentage of farmers receiving income from livestock production was 33% in 2017, but after implementing silvopastoral systems, it increased to 72% in 2019. Meat production was sold in their neighbourhood by 23% of farmers in 2017 and increased to 51% during 2019. Through these ways the project increased economic income. Other **Local Livelihood** indicators show evidence of increasing income of farmers. In addition, because the forest was recovering around silvopastoral systems and connectivity at landscape scale increased, sustainable hunting and other natural resources continued to available. In this way, 100% of farmers and other members of communities benefited from the project.

- **How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?**

Pre- and Post- socioeconomic surveys included (%) percentage of farmers to measure the situation of farmers and trends in changes of knowledge, practice and attitudes of farmers, but also livestock activity. Using these measures, the percentage of farmers receiving incomes from livestock production increased 39% from 2017 to 2019, meat production sold by project beneficiaries in their neighbourhood increased 28% from 2017 to 2019. Other **Local Livelihood** indicators show evidence of increasing incomes of farmers. In addition, recovering forest around silvopastoral systems and connectivity at landscape scale meant that hunting and other natural resources continue to be available for farmers and communities, indicating 100% of farmers and other community members benefited from the project.

4.6 Transfer of knowledge

This project continuously focused on transferring knowledge, practice and attitudes to enhance local farmer livestock production, based on silvopastoral systems: learning by doing, field schools, training delivered in their farms and on model farms, emphasizing importance of Indigenous traditions based on sustainable use of natural resources. The workshops in which the project was assessed and the lessons learned shared were an embodiment of shared processes and communal discussions, whereby all participants are exposed to project advancements and learn together.

This project was focused on transferring knowledge for adapting silvopastoral systems into their traditional livelihoods, keeping the role forest and wildlife as central for solving the basic needs of the communities. This project was not focused on promoting any formal qualification for members of communities.

4.7 Capacity building

Capacity building took place in multiple thematic areas: veterinary medicine, pasture management, use of native trees important for livestock production, live fences, and herd management were the main themes for enhancing local farmers' livestock production. This project used different ways to build capacity of farmers: learning by doing, field schools, trainings in their farms, and model farms, always emphasizing importance of Indigenous

traditions based on use of natural resources. The capacity building was focused at the local community level, usually with more than 40% of women involvement in activities.

5 Sustainability and Legacy

When referring strictly to the specific project activities, considerable advances were made that will likely resonate into the future. The changes to enhance livestock management, using silvopastoral systems, new knowledge, practices, and attitudes of farmers on productive systems, all linked to increasing economic benefits for farmers and families, are achievements likely to endure.

However, it is difficult, almost impossible to over emphasize the catalytic role that Darwin 23-014 played in the staffing up and empowerment of WCS programs. In turn, because of a collaborative approach with national and local institutions – a related strengthening of the defence of protected areas and Indigenous territories, related cacao livelihoods projects, strengthened Indigenous institutions and more, including expanded public relations and near global impact. Portions of this project were communicated in magazine articles, newsletters, online blogs, and articles, and professional presentations at the local, university, government, and regional (Latin American) levels. Further, the scientifically strong technical reports, beyond having training value, will be transformed into peer reviewed publications.

Current work threads in both countries include sustainable livelihoods, patrols to protect Indigenous territories, combatting illegal wildlife trade, strengthening management capacity of Indigenous communities and biodiversity and forest conservation. Almost all these threads found some percentage of genesis in the enabling environment created by Darwin 23-014.

6 Lessons learned

Honduras and Nicaragua are two of the most challenging countries to conserve biodiversity, protected areas and Indigenous rights in Latin America. Those complications were exacerbated by the global COVID pandemic during Year 4 (2020). Considering the complex overlapping challenges a most important lesson learned was that careful selection of institutional and local partners for actions on the ground is a key factor for optimal performance of field activities and deep positive impacts of conservation messages in these remote Indigenous communities. Projects and actions need to first build and assure robust, well-trained, reliable and engaged institutional partners on the ground.

Nicaraguan and Honduran universities were initially identified as institutional partners for implementing this project in Moskitia: (1) Universidad Nacional Agraria (UNA) based in Managua/Nicaragua and (2) Universidad Nacional de Agricultura (UNAG) based in Catacamas/Honduras. At the beginning of project in Nicaragua, WCS identified potential bureaucratic and operative complications for future joint activities on the ground. This way, WCS kept all operative actions under control of its team, spending Year 1 and 2 strengthening the capacities of local community leadership and Indigenous coordinators of WCS. Field activities were completed on time and under control of reliable Indigenous teams based in Indigenous territories, keeping political and institutional turbulences with low influence on activities of this project. In Honduras, there was several distinct episodes of intense external socio-political turbulence, but also internal bureaucratic and administrative challenges in the original partner, UNAG, that recurrently inhibited and delayed field work. During Year 4, WCS took control of pending activities not implemented by UNAG, identifying local Indigenous coordinators based in Indigenous territories under WCS´s coordination, thus completing pending tasks before the final deadline of January 30, 2021. The lesson is that Institutional partners with complicated administrative structures may imply potential additional challenges. Working with this kind of institutional partner must be previously assessed, based on experience and real commitments on initiatives of conservation and management of natural

resources, protected areas and Indigenous territories in Mosquitia, and flexibility for working in these remote areas.

6.1 Monitoring and evaluation

We didn´t change the original design described in the logframe. This project included two main sources of M&E of achievements and outputs/outcomes developed at the beginning (2016-17) and end of the project (2019-20): (1) Socioeconomic and livelihood surveys and (2) biological (bird and mammal) surveys. The M&E system was highly useful, particularly for sharing with Indigenous partners, because it showed the current socioeconomic situation of beneficiaries and communities, and with wildlife and forest around their communities and farms, with emphasis on hunted species. The results of M&E that WCS developed were shared with communities during annual meetings and the final assessment of the project. The most important findings were the following:

1. This project improved livestock management and community conservation techniques in 20 communities in the binational Moskitia (Honduras-Nicaragua) working directly with 109 families, but impacting hundreds and thousands of members of Indigenous territories because of the broader implications of improved forest and wildlife conservation and addressing the basic needs of all members of the Indigenous territories.
2. A balanced model of improved human well-being and effective conservation of forest and wildlife is feasible in Indigenous territories of Mosquitia, but it is important to include and emphasize Indigenous identity and pride as part of the process. The rate of deforestation was reversed from one of loss to a net recovery of natural forest because of increased knowledge of the key role of well-preserved natural resources for solving basic needs. By continuing traditional land use practices of small-scale shifting cultivation, combined with the judicious use of small scale silvopastoral systems the latter clearly functioned as a tool for achieving a balanced model within Indigenous communities of Mosquitia,
3. The Conservation Agreements were an important ingredient in the success. They clarified the conservation goals, defined the desired outcomes, and are potentially a model of social contract of governance.
4. This project increased productivity and economic income of Indigenous farmers diversifying livelihood of families, empowering women and young people in the productive process of food in Indigenous communities with new active roles.
5. The emphasis on enhanced livestock and silvopastoral systems at small scale didn´t stimulate deforestation, instead it promoted natural and facilitated regeneration of vegetation, the connectivity of forest at local and landscape scales, restoring bird communities in deforested areas, and stability in mammal communities – which did not exhibit changes despite insertion of silvopastoral systems.
6. This project reduced conflicts between wildlife and farmers, increasing the level of control exerted in managing domestic animals, keeping them near houses and far from the forest, emphasizing the responsibility of farmers for conserving prey species for jaguars, and reducing hunting of wildlife.
7. The emphasis on enhanced livestock management changed the trend of several socioeconomic and livelihood parameters in a positive way, based on changes of knowledge, practice, and attitudes of Indigenous communities about: goals of their productive systems, negative impact of: extensive livestock, overhunting and depletion of wildlife species, uncontrolled use of fire in production systems.

6.2 Actions taken in response to annual report reviews

Comments from reviewers were focused on clarifying accomplishment of silvopastoral systems in Honduras, and clearly quantify progress towards the outcome, showing adequately livestock management improvements. We are confident this final report includes satisfactory evidence demonstrating the successful positive impact. Please see Section 3.1. Output 1: Activities 1.1, 1.2, 1:3; Output 2: Activity 2.1, 2; Output 3: Activity 3.1. Annexes: 1 and 2.

7 Darwin identity

In Year 3, The project Leader until Year 4 (John Polisar) gave an interview for an article in the American Bird Conservancy's magazine, and drafted an article for the Darwin Newsletter. The support from Darwin was also acknowledged in a widely circulated WCS news release that announced the availability of the WCS Yale White paper and synthesized deep work with the Indigenous territories with the encroaching threats and the tools needed to confront them: https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/11349/Joint-Study-by-WCS-Yale-Identifies-Challenges-and-Opportunities-to-Safeguard-One-of-Mesoamericas-Last-Forest-Blocks.aspx

Also in Year 3, findings and material from this project with credit given to Darwin was given in the following venues: 1) A range wide multi-institutional strategic planning workshop jaguar conservation, Bogota, Colombia; 2) the final presentation in a symposium of transboundary carnivore research and conservation in the Society for Conservation Biology's North American Congress, Toronto; 3) a presentation to lead staff of United Nations Development Program Secretariat, New York; 4) presentations to several courses at the National University of Agriculture, Catacamas; and 5) staff and technicians ICF in Honduras and Secretariat Natural Resources and Environment (MiAmbiente) Tegucigalpa. In addition, our partners from the National University of Agriculture presented at the Honduran Monitoring Round Table, Tegucigalpa, and a student involved in camera trapping and bird sampling presented at a National Biodiversity Day event in Tegucigalpa, and a University hosted half day event with the Center for Tropical Agricultural Research and Training (CATIE).

During Year 4, John Polisar included portions of the Darwin-supported work (images and conservation tools) in jaguar conservation-focused presentations delivered at the IUCN Latin America and Caribbean Protected Area Congress in Lima, Peru in October. These include the following: 1) a 30-minute presentation on jaguar conservation tools during an expert panel composed of UNDP, Panthera, WCS, WWF, and two government representatives (Mexico and Costa Rica); 2) a 30-minute keynote speech; 3) a 15-minute presentation that was part of a symposium on Biological Connectivity. Conservation personnel from a dozen countries participated in these three events. Also in Year 4, publications about harpy eagles and Swainson's warbler in the project area were published in international refereed journals, acknowledging support from Darwin.

Final results of this project were presented during two public presentations in Nicaragua: in (1) Universidad de las Regiones Autónomas de la Costa Caribe de Nicaragua (URACCAN) in the Caribbean Region of Nicaragua and November, October 25, 2020, and (2) Universidad Nacional de Agricultura (UNA) in Managua, November 17, 2020, with participation of university students and teaching staff. John Polisar also included results from Darwin 23-014 in an invited presentation to the Nicaraguan Ministry of Environment and Natural Resources on October 30, 2020. In Honduras, WCS has developed less formal public presentation during online meeting with ICF´s officials, emphasizing the support of the Darwin Initiative, including its logo in Power Point slides, Annex 8.

8 Finance and administration

8.1 Project expenditure

Project spend (indicative) since last annual report	2020/21 Grant Budget (£)	2020/21 Total actual Darwin Expenses (£)	Variance %	Comments (please explain significant variance)
Staff costs				
Consultancy Costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Monitoring and Evaluation				
Others				
TOTAL				

Staff employed (Name and position)	Cost (£)
John Polisar, Project Leader	
Jeremy Radachowsky, Director, Mesoamerica and Western Caribbean	
Carlos Fajardo, Financial Management, Latin America and Caribbean Program	
TOTAL	

Capital items – description	Capital items – cost (£)
TOTAL	

Other items – description	Other items – cost (£)
Equipment and Supplies	
Consumables	
TOTAL	

8.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
TOTAL	

8.3 Value for Money

Purchases in Honduras were done following financial procedures and norms implemented by the recently created WCS program in the country which assumed direct execution of the project during its last year and accelerated execution of delayed activities. During that time, WCS Honduras carried out workshops, communal meetings and acquisition of materials for supporting sylvopastoral systems along the Patuca River, obtaining the best prices available per item, according to local market. In Nicaragua also, WCS well established team executed expenses following WCS purchase norms and procedures, trying to maximize expenditures and reach the highest number of beneficiaries as stated in the logical framework.

When WCS finished the relationship with local partner UNAG in Honduras, followed a protocol to adjust pending expenditures and recover materials or capital items purchased by the partner, such as outboard motor (15hp). Which was received in good order and is currently being used by WCS field team for execution of activities under this project, thus maximizing the use of this item.

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

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

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Environmentally sustainable livestock management practices are successfully adopted across the bi-national Heart of the Mesoamerican Biological Corridor, leading to biodiversity protection and improved welfare of vulnerable communities.			
Outcome: Improved livestock management techniques are successfully implemented in ladino and Indigenous farms in Mosquitia, leading to rigorously documented improved welfare of vulnerable communities, conservation of biological diversity, and forest cover.	**0.1 Forest cover:** Rate of forest clearing in 40,000 hectares of target communities and household farms is reduced by 30% as compared to the 10-year historical average. **0.2 Biodiversity:** After three years, avian alpha diversity/ species richness in livestock systems and frequency of medium-sized and large mammals adjacent to livestock systems has increased, and species composition between specific livestock production systems and nearby intact forests have become significantly more similar according to the Sorenson quantitative /Bray-Curtis index. **0.3 Human-wildlife conflict:** Retaliatory killing of carnivores, particularly jaguars, reduced by 50% across project farms, households and communities. 0.4 **Local Livelihoods:** At least 130 families will experience a 50% increase in livestock productivity due to integrated livestock management (including market value and availability for local consumption and subsistence).	**0.1 Forest cover:** Comparisons between long-term trends and project impacts using remote sensing, validated by on the ground reconnaissance and interviews. 0.2 **Biodiversity:** Results of pre- and post- intensive avian sampling in and adjacent to implemented systems and in nearby forest. Results of medium and large mammal sampling adjacent to pilot projects and in nearby forests, using block design 0.3 **Human wildlife conflict:** Baseline information on attacks from questionnaires compared to frequencies during the project. 0.4 **Local livelihoods:** Project participant surveys; livestock mortality; calving rate; time to market; records of livestock sales from rancher logs (improvements will be disaggregated by gender)	**0.1 Forest cover:** Cloud-free and current scenes of project areas are available for remote sensing analysis. (This is one of the reasons we will also employ on-ground verification). 0.2 **Biodiversity:** Relative frequency data reflect true population trends. Fluctuations due to weather, seasons, disease, and wildlife population dynamics remain within normal parameters, allowing detection of the effects of improved agriculture and reduced deforestation. (To mitigate this risk, we will standardize sampling and use robust experimental design.) 0.3 **Human-wildlife conflict:** Honest pre- and post- reporting by project participants. 0.4 **Local Livelihoods**: Changes due to improved livestock management are measurable and observable within the 3-year project lifetime.
Outputs: **Output 1**. Improved livestock management and community conservation techniques adopted by at	**1.1** At least 130 Miskitu, Mayangna, Sumo, and campesino families identified and trained in management	Number of households/ farms implementing integrated systems; number of people trained in ranch management plans and methods; notes of meetings with ranchers; field visit	Ranchers and vulnerable communities will be interested and incentivized to participate in project activities.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
least 130 families in seven communities across four ethnic groups in four protected areas and two countries.	techniques (with >40% of participants' women) by year 1. **1.2** Improved management techniques adopted and established in seven target communities by year 3. **1.3** At least 50 farmers from nearby communities are invited to tour farms with improved techniques, exposing them to the concepts and practices in a participatory fashion with challenges and successes openly discussed by year 3.	reports and photos; rancher logs documenting use of improved practices. Participant lists of inter-community exchanges, tours, and presentations; Changes in knowledge, attitudes, and practices, ascertained through pre- and-post questionnaires	
Output 2. Explicit agreements through which project beneficiaries commit to conservation outcomes adopted by at least 130 families in seven communities across four ethnic groups, four protected areas, and two countries	**2.1** Explicit agreements with 130 families with clear commitments to conservation outcomes in exchange for support with livestock management developed, signed, and implemented by year 2. **2.2** A total of 21 meetings (one in each of seven communities annually for 3 years) held to present and discuss results achieved, and challenges of conservation agreements by 2019.	Signed conservation agreements, photos, annual reports, final external report, meeting minutes. Meeting minutes, photos, annual reports. Informational materials produced, list of institutions	Institutional support and legal framework remain favourable to the implementation of community conservation agreements. Communities are able to reach consensus and maintain an adequate amount of cohesion regarding their participation in community agreements.
Output 3. Report on the impacts of improved livestock management practices, evaluating and comparing forest cover, biodiversity, and poverty reduction impacts across the spectrum of cultural contexts. Dissemination of methods and lessons learned to nearby communities, agricultural and protected area agencies, and across the entire NGO, Multilateral, and government community.	**3.1** Pre- and post- intervention measurements of livestock management knowledge, attitudes, and practices, productivity, forest cover, biodiversity, wildlife conflict, and livelihoods at the household and community level by years 1 and 3, respectively. **3.2** Working paper rigorously evaluating the effectiveness of sustainable ranching interventions on conservation and development impacts drafted, presented to participating communities for feedback, and article submitted for	Monitoring databases; working paper draft; minutes of meetings with communities and other stakeholders; submission or acceptance letter of peer-review article, 1,000 copies of report printed and delivered and copy of four separate presentations, one local and one national, for each of the two countries	External factors do not significantly change the socioeconomic or ecological context in a manner that confounds the attribution of impacts of livestock management implementation or conservation agreements (e.g. El Niño impacts on forest fires).

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	publication in a peer-reviewed scientific journal by year 3. **3.3** Written reports delivered to relevant actors and four presentations are given to local and national leaders by year 3		

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: Improved Livestock Management

1.1 *Conduct participatory diagnostics of livestock management and forest conservation challenges* in each community and determine interventions tailored to each target community/household, ensuring at least 40% participants women. Participatory diagnostic of livestock and farm management challenges, will include questionnaires and meetings to assess knowledge, attitudes and practices regarding livestock condition, livestock management, forest clearing, human-jaguar conflicts, sources of livestock losses, nutritional status in households, hunting practices and locations.

1.2 *Deliver capacity-building training in participatory livestock management improvements*. Initiate expert delivery of hands-on participation training in field schools, generating a cohort of future leaders in each target community, working in site specific increasing productivity in target farms, diversification of food sources for livestock sites, elevating nutritional status, effecting protection of water sources, and training in diagnosis of diseases and basic veterinary medicine, as well as education on methods to reduce human-carnivore conflicts.

1.3 *Conduct exchange visits to participating farms*, inviting and supporting at least 50 farmers from nearby communities to tour farms with improved techniques, exposing them to the concepts and practices in a participatory fashion, and openly discussing challenges and successes.

Output 2: Community Conservation Agreements

2.1 *Generate conservation agreements with target communities* through a participatory process, linking technical assistance in livestock management to explicit community commitments to forest and biodiversity conservation outputs that are congruent with protected area conservation objectives.

2.2 *Hold annual assembly meetings* in each community implementing a conservation agreement to present and discuss results achieved, challenges, and lessons learned (a total of 21 meetings, or one in each of seven communities annually for 3 years).

Output 3: Learning and Outreach

3.1 *Pre / post monitoring of livestock management practices and livelihoods indicators and biodiversity and forest conservation indicators* including knowledge, attitudes, practices, and productivity of livestock management, forest cover, avian diversity and abundance, medium and large sized mammals, and human-jaguar conflicts.

3.2. *Working paper* rigorously evaluating the effectiveness of sustainable ranching interventions on conservation and development impacts drafted, shared with all participating communities for feedback, and *one article completed and submitted for publication* in a peer-reviewed scientific journal by year 3.

3.3 *Disseminate informational material* highlighting results and lessons learned to share with institutions working in and impacting the Mosquitia. Share information about conservation agreements more widely in electronic form on social networks, websites, and through partner institution networks and deliver written reports to relevant actors, including four separate presentations delivered to relevant local and national leaders.

Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
Impact: *Environmentally sustainable livestock management practices are successfully adopted across the bi-national Heart of the Mesoamerican Biological Corridor, leading to biodiversity protection and improved welfare of vulnerable communities.*		Installed silvopastoral systems in farms of 109 families spanning 21 communities, four ethnic groups, three reserves, two countries, including training and livestock improvements for beneficiaries: live fences, improved pastures were assessed and documented in farms of Honduran and Nicaraguan communities, with evidence of improvements. All trainings were completed, about veterinary and natural medicines for livestock, improved pastures, fodder and nutritional banks, native trees on pastures and live fences, with close joint surveillance by local Indigenous authorities and WCS. This way, achieving changes on knowledge, practices and attitudes of local farmer about livestock management, and agricultural practices, reducing use of fire and size of areas for livestock management from tens of hectares to small plots of 1-3 hectares. Final communal meeting and individual visits of farms and assessment of best practice and lesson learned completed in Honduras and Nicaragua. These activities under this Darwin project have stimulated changes on knowledge, practices, and attitudes of local farmers about livestock management promoted natural restoration and regeneration of vegetation and forests around silvopastoral systems, this way stimulating connectivity at landscape scale, and reversing trend of rate of deforestation in area of La Moskitia. This way promoting conservation of forests, particularly relevant for conservation of biodiversity. Spatial analysis of land use developed by WCS showed this project had direct influence over 136062 hectares of Indigenous communities in Honduras-Nicaragua Moskitia, in 2006 these areas showed 108466 hectares of natural broadleaf forest, decreasing to 101546 hectares until 2016, before starting silvopastoral systems, caused by 629 hectares of deforestation/year (0.57%/year) as rate of deforestation in these communities. This rate reversed, implementing silvopastoral systems, to recovering 1073 hectares of natural forest/year from 2016 until 2020, because changes on knowledge, practice and attitudes of farmers in their productive systems and awareness of conservation needs, stimulated with incidence of silvopastoral systems of Darwin project.
Outcome Improved livestock management techniques are successfully implemented in ladino and Indigenous farms in Mosquitia, leading to rigorously documented improved welfare of vulnerable communities, conservation of biological diversity, and forest cover.	**0.1 Forest cover:** Rate of forest clearing in 40,000 hectares of target communities and household farms is reduced by 30% as compared to the 10-year historical average.	0.1 At binational scale, the rate of forest cover change 2006-2016 was 667 ha/year of forest lost (0.61%/year) in the targeted 41,000 ha bi-national area. This rate reversed, recovering 1073 ha/year of natural forest (0.98%/year) from 2016 until 2020. This project and its advances were particularly impactful on the Nicaraguan side. There, the recorded deforestation rate throughout 2005 and 2016, was of 0.81%/year (730 hectares/year), losing 8037 hectares of natural broadleaf forest over 11 years. The project reduced deforestation in the Nicaraguan side, recovering 4057 hectares of forest from 2016 to 2020, 1014

Project summary	Measurable Indicators	Progress and Achievements
	0.2 Biodiversity: After three years, avian alpha diversity/species richness in livestock systems and frequency of medium-sized and large mammals adjacent to livestock systems has increased, and species composition between specific livestock production systems and nearby intact forests have become significantly more similar according to the Sorenson quantitative /Bray-Curtis index. **0.3 Human-wildlife conflict:** Retaliatory killing of carnivores, particularly jaguars, reduced by 50% across project farms, households and communities. **0.4 Local Livelihoods:** At least 200 (originally, but updated to 130 via an approved Change Request Form) families will experience a 50% increase in livestock productivity due to integrated livestock management (including market value and availability for local consumption and subsistence.	hectares/year (1.13%/year) throughout the 2016-2020 interval. In Honduras, though the territories committed to conserving approximately 20,000 hectares of natural forests no significant changes happened in forest near communities in Patuca River, Annex 6. 0.2 . Avian baseline was originally assessed during 2016-17, based on bird surveys conducted in three different kinds of vegetation in the two countries and remeasured during 2019-20 to measure project impacts on bird communities (richness and diversity of bird species). The data collected using standardized field methods (mist nets and point counts) were used in multivariate statistical analyses. A total of 223 bird species were recorded in the Nicaraguan side, and 137 species in Honduran areas, recording at least 29 species with high priority of international conservation and research. Results show a clear trend of the conservation of alpha diversity in the areas of project influence. Values of 2.8 or higher in Shannon-Weiner Indices indicated that, overall, diversity was preserved despite the presence and existence of small-scale livestock management systems. In general, the richness of bird species also increased. In the area of project influence we recorded four additional species in areas of natural broadleaf forest, 24 species in secondary forest and six additional species in open areas. Natural regeneration and restoration of vegetation at the local and landscape scale around silvopastoral systems were key factors in these results. Contrasts in bird communities categorized by land use types softened due to the introduction of silvopastoral systems and forest recovery. The project's impacts led to increased species presence across land use types, resulting in richer bird communities in natural forests near silvopastoral systems, and overall, an increased presence of birds dependent of natural broadleaf forest. The improved ecological quality of areas near silvopastoral systems had positive impacts on the conservation of birds dependant on well-conserved forest. In addition, bird communities in areas of secondary forest surrounding silvopastoral systems became more similar to natural forest, with increasing Bray-Curtis values of similarity, Annex 4. The mammal base-line was established during 2016-17 across human use areas, with camera trap lines radiating along gradients from interventions areas into natural forest in the two countries, identifying three levels of human influence. These gradients were remeasured during 2019-20. Multivariate analysis of variance and correlation coefficients analysis of mammal species were based on frequency of capture data of all species. The camera traps obtained images of 18 species of mammals and two birds on both the Honduran and Nicaraguan sides. The main result of statistical analysis shows no change on abundance and composition of mammal species along time

Project summary	Measurable Indicators	Progress and Achievements
		(2016-2020) and gradient of human influence, p=0.47. The value of mammal species similarity indices across the gradients ranged from 0 to 1 (totally different to total equality). In this case the similarity indices of the community of mammals increased from 0.73 to 0.79, when comparing mammal species across zones of medium and low levels of human influence between 2017 and 2019-20. This means that mammal communities in agriculture areas, with distance 2200 and 4200 m, became more similar to communities in deep forest, between 4200 and 6200 mts of distance from Indigenous settlements, a metric of positive change due to project interventions, Annex 5. . 0.3 Socioeconomic surveys were developed in Honduras and Nicaragua, including the perspective of farmers on wildlife use, abundance/distribution, conflict between human and species, thereby building a robust baseline of the current socioeconomic situation, livelihood of beneficiaries, and conflict and use of wildlife and natural forest by beneficiaries. Wildlife data of surveys were complementary with frequency of capture from camera trap study. Socioeconomic data showed only 5.6% of farmers mentioned problems with jaguars and pumas killing domestic animals at the beginning of project (2017), which became 0% during 2019. During the same time there was a decrease in negative opinions of farmers about jaguars from 26% to 0%, and positive perspective of jaguars increasing from 61% to 90%. The percentage of farmers inclined to kill jaguars and pumas attacking domestic animals was kept under 40%, but that group was composed of individuals inclined to kill only identified and confirmed specific individual jaguars killing domestic animal, without killing of innocent jaguars or pumas. In fact, it appears that zero large cats were killed in the area of project influence during the project. Project staff, especially in Nicaragua, were local Indigenous representatives, with no need to hide the truth. There was no cultural chasm and project coordinators lived in the area, so that interpretation is reasonable. These positive changes were possible because constant and extensive interactions with farmers and explanations to farmer about necessary availability of natural prey, techniques for avoiding conflict with jaguars and pumas, emphasizing the responsibility of farmers for controlling their domestic animals, keeping them far from the forest and near their house, at the same time reducing hunting in forestry areas near farms, Annex 1. A key action of Darwin project was to improve fencing options for farmers to control domestic animals and also delivering technical assistance for increasing availability of nutritional and veterinary improvements for increased productivity of livestock. This way, the percentage of farmer keeping their livestock without control reduced from 28% to 8%, which was as a key factor for reducing incursions of cow into the forest, thus reducing the conflict between jaguars and farmers. Interestingly, statistical analysis showed the highest

Project summary	Measurable Indicators	Progress and Achievements
		frequency of photo-captures of jaguars (Panthera onca) near communities, yet – as stated losses of livestock to the cats was negligible to nil as a result of improved husbandry, Annexes 1 and 5 0.4 In the deeply forested interior of la Moskitia, livestock have not been a traditional activity of Indigenous communities. Entering the project, livestock systems usually showed low productive levels, 97% of farmers were focused on self-consumption of milk and meat. Now silvopastoral systems are increasing capacity of milk and meat production for small-scale, as consequence the proportion of beneficiaries selling meat in their communities increased from 23% of farmers in 2017 to 53% in 2019. This new meat source is alternative to bushmeat for reducing hunting needs, and small-scale additional income source. These results imply enhanced productivity and additional economic income in the local community, diversifying the livelihood of beneficiaries and their communities, while as shown above, stimulating zero associated environmental degradation, and instead accomplishing net gains (the goal as stated in the project's title). The increased productivity, nutrition, and economic gains at this level is enhancing livelihood of Indigenous families, increasing quality of their life, but not transforming Indigenous people into large scale land-intensive cattlemen, nor promoting livestock without control in Indigenous communities. The negative perception of local farmers about their economic situation diminished from 8% in 2017 to 3% in 2019, at the same time, intermediate perceptions of their economic situation increased from 92% to 97% of beneficiaries, annex 1. Because Indigenous livelihoods have historically been based on the use of natural resources and subsistence agriculture (and tourism is thus far nil in the areas two days from the nearest road with no electricity), they identify livestock production as the only potential external source of economic income for their families. This perception increased from 33% to 72% between 2017 and 2019 as far as farmer's perspectives on this importance of livestock. This project increased the availability and capacity of farmers to invest part of their profits in supporting silvopastoral systems for new local beneficiaries, from 74.4% to 94.9%, explained because increasing economic income from livestock activity, another subtle evidence of increasing economic incomes for small farmers. Although 100% of farmers invest their profits in food for families, increasing expenditures on clothing and recreation seemed new trends we encountered, and implies some "disposable income". Project activities and training were also focused on avoiding wasting money on incorrect and unnecessary veterinary medicines for cows and the other domestic animals used for self-consumption and low level sales. The project, emphasized enhanced nutrition from inexpensive native plants, increasing the value of forest and native trees for livestock production, including inserting useful trees into

Project summary	Measurable Indicators	Progress and Achievements
		pastures and productive systems. As consequence, 10% of farmers reduced their expenses on agricultural supplies, explaining slight reductions of expenses on cost production on pastures, medicine and vitamins, annex 1. The perception of farmers about being in a “good cattle situation” increased from 12% to 54%, reducing “regular cattle situation” from 83% to 46%. The proportion who viewed themselves as being in a “bad cattle situation” decreased from 5% to 0%. These changes can be explained by auto-investments in veterinary medicine, which increased from 51% to 95% of farmers, and the proportion investing in nutrition for cows increasing from 59% to 85%. The average of their self-investment in medicines was highly meaningful (p=<0.0001), increasing from C$ 799 to C$ 2425, annex 1. Because livelihood of Indigenous communities is mainly based on useful of natural resources of forest and wildlife, the quantity of pigs and/or chickens of each family represents a clear expression of healthy incomes, and a way for saving economic resources for future use. This increased as consequence of the growing income provided by livestock production stimulated with silvopastoral systems of Darwin project. The percentage of owners with less of 10 pigs reduced from 85% to 77%, but increased from 8% to 20% owners with 11-25 pigs. Similar trends were observed in the percentage of owners of chickens, increasing 37% owners with more than 11 chickens. One additional evidence of economic improvement is the slight trend of increasing percentage of farmers who were owners of cows, without sharing ownership with other people, from 92.3% to 94.9%, and farmers with shared ownership of cows descending from 7.7% to 5.1%. In addition, livestock (milk and meat), pig and chicken production imply alternative sources of animal protein for local human population, potentially reducing pressure of hunting, Annex 1.
Output 1. Improved livestock management and community conservation techniques adopted by at least 200 families in seven communities across four ethnic groups in four protected areas and two countries.	**1.1** At least 130 Miskitu Mayangna, /Sumo and campesino families identified and trained in management techniques (with > 40% of participants women) by year 1. **1.2** Improved management techniques adopted and established in seven target communities by year 3.	1.1 In Nicaragua 145 families were trained along this project, during years 2, 3 and 4, usually with good representation of women in activities: 42% in years 2-3; 62% during year 3 and 49% in year 4. in Honduras 184 families were trained during year 2-4, with participation of 33% of women. Because external obstacles and pandemic of COVID, WCS Honduras needed extensions of time for completing pending technical assistance and final meetings of assessment of project during the year 4 of the project. Nevertheless, all tasks were completed under the timelime of Darwin project, before January 30 of 2021.

Project summary	Measurable Indicators	Progress and Achievements
Please note, we submitted an approved change request form to reduce the number of families to 130. At the end we worked with 15 communities in Nicaragua, 5 in Honduras, for a total of 20 communities, of four ethnic groups, in three protected areas, and two countries.	**1.3** At least 50 families from nearby communities are invited to tour farms with improved techniques, exposing them to the concepts and practices in a participatory fashion with challenges and successes openly discussed by year 3.	1.2 Working directly with 20 target communities in Honduras and Nicaragua, representing 3x expansion over initial indicator, beneficiaries and other member of communities inserted live fences, enhanced pastures and useful trees for livestock production, but mainly changing knowledge, practice and attitudes of members of communities about livestock and productive systems, reducing areas for livestock, reducing use of fire in agricultural activities, restoring and regenerating natural vegetation around silvopastoral systems and abandoned areas used for livestock, reducing conflict between jaguars and farmers, increasing aware about importance of forest and wildlife for solving their Basic Necessities. increasing productivity and economic incomes of beneficiaries from livestock production selling in local into communities, enhancing livelihood of Indigenous communities and economic sustainability of productive systems. As consequence of these changes we reverted 667 ha of forest lost (0.61%) each year during 2006 to 2016 on recovering 1073 hectares (0.98%) of natural forest/year from 2016 until 2020. 1.3 During Year 4, in Nicaragua, 79 farmer toured farms with improved techniques. In Honduras, this task was completed with 75 families touring in different model farms of communities.
Activity 1.1 *Conduct participatory diagnostics of livestock management and forest conservation challenges* in each community and determine interventions tailored to each target community/household, ensuring at least 40% participants women. Participatory diagnostic of livestock and farm management challenges, will include questionnaires and meetings to assess knowledge, attitudes and practices regarding livestock condition, livestock management, forest clearing, human-jaguar conflicts, sources of livestock losses, nutritional status in households, hunting practices and locations.		Completed and finished socioeconomic and livelihood data analysis, post project, summarizing diagnostics of livestock and farm management challenges of beneficiaries in Honduras and Nicaragua. Resuming data of questionnaires and meetings to assess knowledge, attitudes and practices regarding livestock condition, livestock management, forest clearing, human-jaguar conflicts, sources of livestock losses, nutritional status in households, hunting practices and locations.
Activity 1.2. Deliver *capacity-building training in participatory livestock management improvements.* Initiate expert delivery of hands-on participation training in field schools, generating a cohort of future leaders in each target community, working in site specific increasing productivity in target farms, diversification of food sources for livestock sites, elevating nutritional status, effecting protection of water sources, and training in diagnosis of diseases and basic veterinary medicine, as well as education on methods to reduce human-carnivore conflicts.		In Nicaragua we completed veterinarian and improved pasture and silvopastoral systems management training during Years 2-3 and reducing conflict between farmer and jaguar during Year 4, total 147 members of communities, including 47 final farmers beneficiaries. In Honduras we delivered silvopastoral and agroforestry and animal health training, total 170 farmers during Year 2-3. Final training for reducing conflicts between farmers and jaguars and renew of pastures took place during Year 4, including 75 farmers. Along four years of activities we worked with local coordinators strengthening their leadership capacities, building local capacities for future work with communities In Honduras there was a five-person committee in each of the five communities. In Nicaragua, we worked with three Indigenous coordinators, each of three Indigenous

Project summary	Measurable Indicators	Progress and Achievements
		territories. In Honduras, locally-based alumni of the UNAG were field coordinators, now WCS Honduras has contracted an expert in sustainable livestock management from Olancho and several in-territory techs in Gracias a Dios (project areas). Abundant technical training has been delivered in both countries, completing all capacity-building training in participatory livestock management improvements
Activity 1.3 *Conduct exchange visits to participating farms,* inviting and supporting at least 50 farmers from nearby communities to tour farms with improved techniques, exposing them to the concepts and practices in a participatory fashion, and openly discussing challenges and successes.		In Nicaragua, three exchanges of experiences in the management of silvopastoral systems were organized by territory and conducted in February 2020. They involved a total of 79 people, 26 in Mayangna Sauni Bu (84% women and 16% men), 26 in Kipla Sait Tasbaika (27% women and 73% men), and 22 in Miskitu Indian Tasbaika Kum (40% women and 60% men). In Honduras, several activities where developed, including annual meeting and exchange visits to participating farms, emphasizing visits on model farms developed by WCS, two model farms in five communities, total 10 model farms including 75 people, Annex 2 and 3.
Output 2. Explicit agreements through which project beneficiaries commit to conservation outcomes adopted by at least 200 families in seven communities across four ethnic groups, four protected areas, and two countries.	**2.1** Explicit agreements with 130 families with clear commitments to conservation outcomes in exchange for support with livestock management developed, signed, and implemented by year 2. **2.2** A total of 21 meetings (one in each of seven communities annually for 3 years) held to present and discuss results achieved, and challenges of conservation agreements by 2019.	2.1 After switching from UNAG to WCS, at the end of Year 2, the total of conservation agreements confirmed in Honduras was 66 families, and 43 in Nicaragua, 109 families in total. It is still 21 communities, four ethnic groups, three protected areas, three watersheds and two countries. All conservation agreements were signed in Years 1 and 2 and at this stage, we assessed positive and clear compliance. 2.2 During Year 1 we conducted a total of 15 meetings between the two countries. During Year 2 we conducted 14 meetings in Nicaragua and 9 in Honduras, for a total of 23**.** During Year 3 we conducted 3 meetings in Nicaragua and 2 in Honduras for a total of 5. Thus, we entered Year 4 with a total of 43 meetings. Including the 5 final meetings in Nicaragua and 12 in Honduras translates to a total of 60 meetings, thus far.
Activity 2.1. *Generate conservation agreements with target communities* through a participatory process, linking technical assistance in livestock management to explicit community commitments to forest and biodiversity conservation outputs that are congruent with protected area conservation objectives.		Conservation agreements were signed prior to delivery of materials in Honduras and Nicaragua, technically and successfully implemented by WCS, and clear engagement and compliance by beneficiaries. The fulfilment of commitments by beneficiaries was satisfactory, supported on results of socioeconomic data, showing evidence of positive changes of knowledge, practices and attitudes about sustainable livestock management, with emphasis on forest and biodiversity conservation. Successful reduction of extensive livestock areas to small semi-intensive management areas with enhanced control of cows and domestic animals reducing conflict between human and jaguars, at the same time reducing use of fire on agriculture and livestock activities, promoting restoration and natural regeneration of vegetation around silvopastoral systems and abandoned areas no more used for containing cows. This way increasing forest connectivity at local and landscape

Project summary	Measurable Indicators	Progress and Achievements
		scale, restoring bird communities of natural forest in degraded areas, keeping mammal communities along all gradient of human influence, near and far from communities, including presence of jaguars, and increasing productive of pigs and chickens as alternatives for feeding families and alternative source of animal protein for reducing dependence of hunting of wildlife
Activity 2.2. *Hold annual assembly meetings* in each community implementing a conservation agreement to present and discuss results achieved, challenges, and lessons learned (a total of 21 meetings, or one in each of seven communities annually for 3 years).		We completed all three annual reviews in Nicaragua pooling communities for sharing results, lesson learned and experiences of activities between beneficiaries, representatives of Indigenous governments, members of communities and coordinators of project in Nicaragua. This way, the first annual review included six meetings, with representatives from 16 communities, the second annual reviews were developed grouping people in three meeting. The third annual review and final in Nicaragua was conducted in five communities, for a total of 14 annual meetings. In total, this project has developed 60 meetings. One final annual assembly took place in the Honduran side at the year 4, taking severe measures for preventing contagious of COVID. Delays in Honduras were constant along Years 1-2-3.
Output 3. Learning and Outreach: Report on the impacts of improved livestock management practices, evaluating and comparing forest cover, biodiversity, and poverty reduction impacts across the spectrum of cultural contexts. Dissemination of methods and lessons learned to nearby communities, agricultural and protected area agencies, and across the entire NGO, Multilateral, and government community.	**3.1** Pre- and post- intervention measurements of livestock management knowledge, attitudes, and practices, productivity, forest cover, biodiversity, wildlife conflict, and livelihoods at the household and community level by years 1 and 3, respectively. **3.2** Working paper rigorously evaluating the effectiveness of sustainable ranching interventions on conservation and development impacts drafted, presented to participating communities for feedback, and article submitted for publication in a peer-reviewed scientific journal by year 3. **3.3** Written reports delivered to relevant actors and four presentations are given to local and national leaders by year 3	3.1 Pre and post intervention measurements are done in Honduras and Nicaragua, detailed analyses and report completed, a substantial metrics and conclusions can be reviewed in Section 3.1, Output 1, Activities 1.1 and 1.2; Output 2, Activity 2.2, Output 3, Activity 3.1, Section 3.2, Section 3.3, 0.2, 0.3, and Annexes 1, 2, 3, 4, 5. 3.2 Working papers are based on technical reports of socioeconomic, birds and mammal field surveys, focused on impacts of enhanced livestock management and implications for strengthened livelihood of local communities, and changing trends of bird and mammal communities. Submissions to international journals will take place beyond the project period. 3.3 Results of technical reports have been shared with local communities in Nicaragua and Honduras, during final annual meetings of assessment of project, sharing experience, good practices and lesson learned with local communities. WCS shared results of technical reports in Nicaragua during joint Institutional public presentations with local Universities: URACCAN in Siuna and UNA in Managua, in the Honduran this happened during activities with ICF, because COVID pandemic those presentations were under virtual mode, Annexes 7 and 8
Activity 3.1. *Pre / post monitoring of livestock management practices and livelihoods indicators and biodiversity and forest conservation indicators including knowledge, attitudes,*		The pre and post -intervention diagnostics for both countries were completed, analysed and summarized. These are quite comprehensive and serve as a solid baseline, for measuring and tracking future trends and success of projects and activities balancing human development and conservation of wildlife and forest in Moskitia of Honduras and Nicaragua.

Project summary	Measurable Indicators	Progress and Achievements
practices, and productivity of livestock management, forest cover, avian diversity and abundance, medium and large sized mammals, and human-jaguar conflicts		
Activity 3.2. *Working paper* rigorously evaluating the effectiveness of sustainable ranching interventions on conservation and development impacts drafted, shared with all participating communities for feedback, and *one article completed and submitted for publication* in a peer-reviewed scientific journal by year 3.		First draft with different emphasis (birds, mammals and livelihoods and sustainable development) are done, pending review by several members of WCS´s team, and will be submitted to peer review journal, including *Oryx* journal.
3.3 Disseminate informational material highlighting results and lessons learned to share with institutions working in and impacting the Mosquitia. Share information about conservation agreements more widely in electronic form on social networks, websites, and through partner institution networks and deliver written reports to relevant actors, including four separate presentations delivered to relevant local and national leaders.		In Nicaragua, presentations were completed in two public joint activities with Nicaraguan Universities: (1) ***Jornada de Semana Científica 2020, October 27 2020, in Siuna,*** with Universidad de las Regiones Autónomas de la Costa Caribe nicaragüense/Siuna, and (2) ***Experiencias de estrategias de conservación y restauración de ecosistemas, November 17 2020, in Managua*** with Universidad Nacional Agraria (UNA). In Honduras, presentations were completed in public activities with ICF, annexes 7 and 8.

Annex 3 Standard Measures

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis						
1b	Number of PhD qualifications obtained						
2	Number of Masters qualifications obtained						
3	Number of other qualifications obtained						
4a	Number of undergraduate students receiving training						
4b	Number of training weeks provided to undergraduate students						
4c	Number of postgraduate students receiving training (not 1-3 above)						
4d	Number of training weeks for postgraduate students						
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)						
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)						
6b	Number of training weeks not leading to formal qualification						
7	Number of types of training materials produced for use by host country(s) (describe training materials)						

Research Measures	**Total**	**Nationality**	**Gender**	**Title**	**Language**	**Comments/ Weblink if available**

9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)						Participatory process?
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						
11b	Number of papers published or accepted for publication elsewhere						Location?
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country						
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country						
13a	Number of species reference collections established and handed over to host country(s)						
13b	Number of species reference collections enhanced and handed over to host country(s)						

Dissemination Measures		**Total**	**Nationality**	**Gender**	**Theme**	**Language**	**Comments**
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work						
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	4	Nicaragua	Male	Socioeconomic impact of silvopastoral in	Spanish	Organized by local Universities and Nicaraguan

Dissemination Measures		Total	Nationality	Gender	Theme	Language	Comments
					indigenous communities		and Honduras institutions

Physical Measures		Total	Comments
20	Estimated value (£s) of physical assets handed over to host country(s)		
21	Number of permanent educational, training, research facilities or organisation established		
22	Number of permanent field plots established		Please describe

Financial Measures		Total	Nationality	Gender	Theme	Language	Comments
23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work						

Annex 4 Aichi Targets

	Aichi Target	Tick if applicable to your project
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	X
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	X
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	X
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	X
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	X
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	X

14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, Indigenous and local communities, and the poor and vulnerable.	X
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	X
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	
18	The traditional knowledge, innovations and practices of Indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of Indigenous and local communities, at all relevant levels.	X
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	X
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
Technical document	Stopping the Tide: A Strategy for Maintaining Forest Connectivity within the Mesoamerican Biological Corridor. Brian Lee et al 2018	USA	USA	Male	Yale University	https://c532f75abb9c1c021b8c-e46e473f8aadb72cf2a8ea564b4e6a76.ssl.cf5.rackcdn.com/2018/06/11/too7yirh0_WCS_Yale_Stopping_the_Tide_in_the_Moskitia.pdf
Technical document	Improving livestock management for economic-environmental stability in the Mesoamerica's Moskitia. John Polisar. 2018	USA	USA	Male	Darwin Initiative Newsletter: 27-28	https://www.darwininitiative.org.uk/assets/uploads/2018/05/Darwin-Newsletter-May-2018-IDB-FINAL.pdf

	Harpy Eagle (Harpia harpyja) and Crested Eagle (MorphnuS guianensis) in Indigenous territories of the Nicaraguan Mosquitia, one of the five great forests of Mesoamerica Heydi Herrera-Rosales. 2019	Nicaragua	Nicaragua	Female	Neotropical raptors fund	https://assets.peregrinefund.org/docs/newsletters/final-spizaetus-28-spanish-2019-12-24_155707.pdf

Annex 6 Darwin Contacts

Ref No	23-104 ref 3206
Project Title	Improving livestock management for economic-environmental stability in Mesoamerica's Mosquitia
Project Leader Details	
Name	Fabricio Diaz Santos
Role within Darwin Project	Coordinator in Nicaragua
Address	
Phone	
Fax/Skype	
Email	
Partner 1	
Name	
Organisation	
Role within Darwin Project	
Address	
Fax/Skype	
Email	
Partner 2 etc.	
Name	
Organisation	
Role within Darwin Project	
Address	
Fax/Skype	
Email	

Annex 7 Supplementary material (optional but encouraged as evidence of project achievement)

This may include outputs of the project, but need not necessarily include all project documentation. For example, the abstract of a conference would be adequate, as would be a summary of a thesis rather than the full document. If we feel that reviewing the full document would be useful, we will contact you again to ask for it to be submitted.

It is important, however, that you include enough evidence of project achievement to allow reassurance that the project is continuing to work towards its objectives. Evidence can be provided in many formats (photos, copies of presentations/press releases/press cuttings, publications, minutes of meetings, questionnaires, reports etc.) and you should ensure you include some of these materials to support the annual report text.

If you are attaching separate documents, please list them here with an Annex reference number so that we can clearly identify the correct documents.

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.	
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.	X
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	
Have you completed the Project Expenditure table fully?	X
Do not include claim forms or other communications with this report.	