

Darwin Initiative – Final Report

To be completed with reference to the Reporting Guidance Notes for Project Leaders (<http://darwin.defra.gov.uk/resources/>) it is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Project Reference	18-010
Project Title	Tools for the sustainable harvesting of Maya Nut (Mesoamerica)
Host country(ies)	México, Guatemala, El Salvador, Nicaragua, Honduras, Panama & Costa Rica
Contract Holder Institution	Natural History Museum
Partner Institution(s)	Maya Nut Institute (Formerly The Equilibrium Fund)
Darwin Grant Value	£202,374.00
Start/End dates of Project	Start: Sept. 1, 2010. End: March 31, 2014
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Project Website	
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1 Project Rationale

The rationale behind this project was to provide the training and science to ensure that Mayanut forests in Central America are sustainably managed for food production, income, ecosystem services and biodiversity conservation by rural communities with minimal dependence on external assistance and aid. The project aimed to do so by focusing our capacity building on the women in rural communities and women-lead cooperatives and focussing science outputs on the use of Maya Nut for restoration / plantation. This focus fits within the context of the Maya Nut Institute (MNI)'s model of market driven conservation through women the aim of which is to ensure that economic benefits remain within a community and support children.

Maya Nut (*Brosimum alicastrum*) is a mid to late-successional, canopy-emergent tree in the fig family that is common and locally dominant in tropical forests from Mexico to northern Brazil and Ecuador. It occurs over a wide altitudinal range (20 to 1200 m) and in diverse ecological zones making it one of the most widespread and common species in evergreen and semi-evergreen tropical forests in Mexico and northern Central America. It is recognized as a famine food, traditional vegetable, fodder crop, timber and fuelwood and increasingly as a key species for reforestation in Central America. Maya Nut trees produce 30-210 kg dry weight of edible seed per ha per year with individual trees yielding up to 147 kg. The seeds have similar nutritional values to maize and wheat but also contain relatively high concentrations of calcium and the amino acids tryptophan and lysine which are limited in the Central American diet. Maybe as a consequence of its associations with indigenous culture and food insecurity Maya Nut is an underutilized non-timber forest product which prior to the work of the Maya Nut Institute in 2001 had been almost abandoned by rural communities outside of times of famine.

Maya Nut is also a significant component of the diet of the Central American medium-sized fauna including red-listed lilac-crowned parrot (*Amazona finschi*), mantled howler monkey (*Alouatta palliata*), spider monkey (*Ateles paniscus*), howler monkey (*Alouatta seniculus*), several species of bat, tapir (*Tapirus bairdii*), deer (*Odocoileus virginianus*) and agouti (*Dasyprocta* spp) that in turn form an important part of the diet of charismatic carnivores such as Jaguar, Margay, Ocelot.

Maya Nut's broad range and tolerance of edaphic and hydrological conditions means that its distribution closely matches lowland forest cover in Central America, a Biodiversity Hotspot with less than 50% of its original forest cover and an annual deforestation rate of 1.3%

The rationale of this project therefore was to exploit the synergies between the livelihoods and conservation value of Maya Nut forest in Central America, and the nutritional and livelihoods value of this non timber forest product through the production of tools and capacity for the sustainable use of the species. The problems the project sought to address were identified by MNI based on its experience of working with and discussions with harvesting communities in Central America and Mexico and of exporting and distributing Maya Nut products in the USA and Latin America. Specifically the project sought to increase the capacity of communities to establish and monitor sustainable harvest levels of Maya Nut and to generate the science to underpin the genetically sustainable reforestation of Maya Nut and to facilitate the long-term storage of viable seed. The MNI took responsibility for capacity building, the Natural History Museum (NHM) took responsibility for generating the scientific outputs and both organizations worked together on the production of the sustainable harvest guidelines and dissemination of the results.



Map of project area with communities (red dots), reforestation activities (green trees) and processing infrastructure for Maya Nut (yellow house).

2 Project Achievements

2.1 Purpose/Outcome

We broadly met our project purpose on development of sustainable harvest & management guidelines, capacity building and the scientific tools to support reforestation and seed storage. We characterised genetic diversity within the species with respect to geography and climate and we developed a storage protocol that supports the storage of seed for up to one year. We were unable, however, to get full recognition of those plans by two of the participant countries (Mexico, Guatemala). Our main focus was to develop plans for implementation by the harvesting community, our principle stakeholders, and that they ensured sustainability. This did not always concord with national government priorities or the processes of their agencies and together with bureaucratic efficiency this probably reflects our inability to get full recognition.

1a. Sustainable guidelines for Maya Nut seed harvesting and plantations are designed and implemented by stakeholders

(Measureable indicators: 1a. Sustainable guidelines filed with MNI and relevant in-country natural resources and protected areas ministries (Consejo Nacional de Areas Protegida (CONAP) in Guatemala, MARN in El Salvador, CONANP in Mexico)

Guidelines have been filed with the authorities in Nicaragua, Honduras and El Salvador (see Annex 7.1, 7.2 & 7.3). Guidelines were not submitted to CONAP, the relevant Guatemalan authority as they had produced their own management plans for Maya Nut. CONAP guidelines were not developed using a participatory methodology but did include additional NTFPs such as Xate Palm, Chicle and Allspice and so they decided to stick with their methodology. It was felt by MNI that these plans will be very difficult to apply as they rely on skilled and expensive professionals and not on harvester communities. Since their development in 2014 they are still awaiting approval from the Ministerio de Ambiente y Recursos Naturales (MARN). Guidelines submitted to MARN of El Salvador are under review / discussion. Our assumption with respect to this in the logframe was that Ministries would prioritise the adoption of site-specific management plans. Whilst this assumption is probably correct we were naive in respect to the time that it would take for them to do so, especially given that Ministry personnel change with each subsequent administration.

We identified harvesting communities as the main users of our sustainable harvest guidelines and designed the inventory methodology accordingly (see Annex 7). For this reason we took great care to produce guidelines that harvesting communities could monitor and evaluate themselves. Following several iterations of the methodology we consulted Chuck Peters at the New York Botanical Garden (bit.ly/1i8jetl) on the inventory strategy used to generate the data to underpin these guidelines at each community. This created some delay as we tested different sample based methodologies with communities which transpired not to meet the needs of the communities. It also created some tension with the forest technicians that we worked with to develop this project and with some of the Government authorities who preferred a plot/transect based approach with which they were more familiar.

The guidelines that we together with our collaborating communities have produced contain two elements. One is a quota of fresh seed per tree per harvest, and the second a minimum pool of regeneration. This approach was achieved through consensus: MNI and harvesting communities supported the use of a quota, while the NHM team felt that focussing on regeneration was more meaningful. The main limitations of a quota based system is that there is not enough data to come up with demonstrably sustainable numbers. The application of the guidelines should result in the generation of a modest dataset over the next few years. Currently, however, there exists relatively little quantitative data for the amount of seed produced by Maya Nut trees on an annual basis during the course of their lifetime and seed establishment and survival rather than seed availability is likely to be the limiting factor in natural regeneration of May Nut. By including this latter element in the harvest guidelines unsustainable harvesting should become rapidly apparent. The risk of including arbitrary quotas in this instance is probably not that economic sustainability rather than regeneration is compromised.

1b. 60% of participating communities report increases in benefits from Maya Nut forests including food, income, and ecosystem services from Maya Nut trees.

Maya Nut producer socioeconomic surveys conducted by MNI in-country staff in 2011 and 2013 include assessments of well-being and livelihood. They recorded a 14% and 22% increase in income from Maya Nut. Unfortunately MNI was unable to provide or compare the data to the 2011 baseline so it was not clear how this figure was calculated. They did, however, provide a summary of the 2013 producer survey and a case-study undertaken by a GIZ (german international cooperation) project in Honduras on the socioeconomic impact of Maya Nut harvesting in the community of El Guayabo. *Evidence E16, Annex 9 (MNI Annual Report), Annex 7.5 (2013 Socioeconomic survey), Annex 7.6 (2012 GIZ El Guayabo case study)*

2.2 Goal/ Impact: achievement of positive impact on biodiversity and poverty alleviation

Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), as articulated by the CBD Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets

Target 1 - By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably

Our project has sought to deliver tools and knowledge to ensure the sustainable harvesting of Maya Nut (*Brosimum alicastrum*) and so of the forests where it occurs. Our focus has been on non-governmental organizations and civil society groups in their role as producers. Furthermore through our partner MNI this sustainable non-timber forest product is linked to a developing market for ethically traded and environmentally sustainable health foods within the US thereby adding value to the product and so to the source trees and forest. *Evidence E1, E15, Annex 10.*

Target 4 - By 2020, at the latest, 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

Our project has worked with rural communities / small businesses to develop five and deliver three management plans for the sustainable harvesting of the non-timber forest product, Maya Nut. The aim of which is to ensure that the use of this species is within safe ecological limits. *Indicators, M6, M8. Evidence, E11, E13, Annex 7.1, 7.2 & 7.3.*

Target 7 - By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

The above sustainable harvest / forest management plans developed with and for local communities and NGOs to support sustainable forestry practices. Much of Maya Nut's benefit to wildlife occurs on the tree, bats, birds and arboreal mammals consuming the fleshy outer covering of the seed leaving the seed to fall to the ground where it can be harvested. In addition the management plans produced are designed to ensure that all of the seed which falls to the ground is not consumed thereby leaving seed for terrestrial mammals. Furthermore through our partner MNI this sustainable non-timber forest product is linked to a developing market for ethically traded and environmentally sustainable health foods within the US. Currently Maya Nut remains under-harvested, in that there are many localities where it could be harvested but is not. By facilitating the growth of an export market we hope to stimulate the harvesting of Maya Nut and the value it gives to the forests where it grows. *Indicators, M5, M6, M8. Evidence, E11, E13, E10.*

Target 13 - By 2020, 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

We have produced a map of genetic diversity for Maya Nut across its range with added detail for the region where it is harvested. This represents the baseline information against which the conservation of genetic diversity can be monitored. In addition we are publishing guidelines on

the transfer of Maya Nut germplasm across the region. Spanish summaries of which can be found on the MNI website and Tropical Botany blog (<http://wp.me/p44CjQ-ta>, <http://wp.me/p44CjQ-sM>). *Indicators, M12. Evidence, E16, E17.*

Target 14 - By 2020, 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.

We have produced tools to safeguard Maya Nut rich forests in a participative manner working with poor rural communities and targeting women.[Indicators for this target include the health and livelihoods provided by Maya Nut Harvest of communities who depend directly on local ecosystem goods and services and biodiversity for food and medicine.] *Evidence, E1 (Annex 7.5 & 7.6).*

Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), as articulated by the Global Strategy for Plant Conservation 2011-2020 Targets

Target 3: Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared

Our project has developed information on the spatial distribution of genetic diversity in Maya Nut, seed storage protocols and developed criteria to measure the sustainable harvesting of Maya Nut. These have been shared with our partner communities and the wider harvester community through the MNI YouTube page (<https://www.youtube.com/user/mayanutinstitute>) and the scientific literature. *Indicators, M6, M12. Evidence, E8, E9, E11, E15, E16, E18, <http://wp.me/p44CjQ-ta>, <http://wp.me/p44CjQ-sM>, Annex 8.1 & 8.2).*

Target 6: At least 75 per cent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity.

Our project has provided some of the agreements and tools to support the sustainable management of targeted forests in Guatemala, El Salvador and Nicaragua. *Indicator, M5. M10. Evidence, E10, E15, Annex 7.1, 7.2 & 7.3.*

Target 9: 70 per cent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge.

We have produced the baseline information that should underpin the conservation of genetic diversity in the non-timber forest product Maya Nut. *Indicator, M12, evidence E16, Annex 8.1).*

Target 12: All wild harvested plant-based products sourced sustainably

We have produced sustainable harvest guidelines, and working with MNI supported the certification of sustainable Maya Nut harvesters in Central America. *Indicator, M6, M10, M11. Evidence, E11, E15, Annex 7.1, 7.2 & 7.3.*

Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.

We have trained 183 women from rural communities in the concept of sustainable harvesting as well as in the skills necessary to process Maya Nut for sale nationally and for export. We have also trained Guatemalan scientist Anaite Lopez in how to establish optimal storage conditions for Maya Nut through an internship at the Millennium Seed Bank in the UK. *Indicator, M8. Evidence E18, Annex 11.1 & 11.2.*

Target 3. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015.

Our project focusses on providing poor rural women with the capacity to harvest, process and sell Maya Nut. This, we believe, increases their economic and social standing within their communities but also increases their control of family incomes. *Indicator, M8. Evidence, E13, Annex 11.1.*

Target 7 Ensure Environmental Sustainability

7a Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.

Our project outputs include sustainable harvest and forest management plans that have been submitted to national forestry or forest-planning agencies and so should contribute towards the development of country policies and programmes. In we have produced information on seed transfer zones and seed storage protocols that support the use of Maya Nut in afforestation programmes in Central America and during the course of our project the use of Brosimum in afforestation has increased significantly. *Indicator, M12. Evidence, E1, E16, E18. Annex 7.1, 7.2 & 7.3.*

7b: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss

Maya Nut distribution and genetic diversity within Central America matches low- to mid-elevation forest cover and species richness. Conserving forests rich in Maya Nut by creating an economic justification for doing so also protects the species associated with these forests. In particular Red List and vulnerable species which feed on the fruit of Maya Nut. This is the focus of one of our scientific publications. *Evidence, E9, E16. Annex 8.1.*

2.3 Outputs

Did the project achieve its outputs as laid out in the logical framework? Outputs set out in application

1. Communities obtain capacity to sustainably manage Maya Nut forests with minimal external assistance and/or supervision

1a. 120 Mesoamericans from 20 village forest committees trained in technical aspects of forest management: calculation of sustainable Maya Nut seed harvest levels, the biodiversity associated with Maya Nut forests, marketing, and accounting by year 3. **109 trained in sustainable harvesting; 183 trained in quality control for marketing (see Annex 11.1 & 11.2)**

1b. Basic forest inventories of major faunal groups associated to absence/presence of Maya Nut trees and in relation to some measure of forest conservation status i.e. Biodiversity value of Maya Nut **MNI created a survey and focus group of hunters that was going to generate this data. The hunters turned out not to want to be interviewed or talk about it because hunting is illegal. if we had had more time and funds we would have framed it this differently.**

2. Stewardship agreements at provincial and village levels in place and functioning

2 a. Draft position agreements for 20 local forest areas by year 2, revised by year 3 **Ongoing, not signed yet, because MNI unhappy with the data and the way that it is collected. MNI, however, has developed its own certification programme which includes sustainable management and harvesting as key criteria (Annex 10).**

2 b. Guidance document on sustainable harvesting of Maya Nut seeds for 20 forest areas produced and disseminated by year 3 **Produced for 3 forest areas (see Annex 7.1, 7.2 & 7.3)**

3. Knowledge of inter and intrapopulation variability for Maya Nut in Mesoamerica. Protocol for the long-term storage of Maya Nut seed developed. Promising seed transfer zones for Maya Nut landraces are delineated and genetic diversity (germplasm) conserved both in and ex situ as sources of seed for reforestation throughout its former range.

3a. Produce and disseminate at least one scientific document (journal paper, thesis) on Maya Nut genetic diversity and agronomic species improvement potential based on phenotype. (see Annex 8.1). **We did not evaluate promising phenotypes or agronomic species improvement potential. This was not a realistic objective for our project given the type of genetic markers that we used and the resources available to us. We had two offers of collaboration from Ken Oyama (Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Michoacán) and the Lancetilla Botanic Gardens in Honduras, but neither resulted in any meaningful collaboration. We did however map the genetic diversity of Maya Nut across its range and identify seed-transfer zones for the sustainable transfer of germplasm to support restoration and plantation.**

3b. Produce and disseminate a document naming and recommending Maya Nut landraces for restoration and reforestation (see above)

3c. Ex-situ genetic conservation plots established in La Ceiba, Honduras, and Yucatan, Mexico. **Lack of buy-in from the partners, lack of budget to pay for establishment of the plots**

3d. Seed storage protocol published . **In collaboration with the Millennium Seed Bank we successfully developed a 12 month storage protocol. This represents a significant technical achievement given that the seeds are recalcitrant and exhibit no dormancy and that they are prone to fungal infections at low temperatures. During the course of developing this protocol we discovered that Maya Nut exhibits a rarely documented physiology which may explain its ecological plasticity and dominance in lower elevation forests (see Annex 8.2).**

Did the project encounter problems, either anticipated or unexpected, in achieving the outputs, and how were they resolved?

The project encountered several problems during its course. Some of these were unexpected: the poor quality of the budget prepared by the initial partner at MNI and their subsequent poor financial management, the failure of potential partners, such as the Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Michoacán to collaborate with the development of genetic markers as initially agreed. Other problems, such as the challenge of developing a storage protocol for a recalcitrant seed were anticipated and planned for. Overcoming these challenges was difficult and required significant support from partners such as the Millennium Seed Bank, our PostDoc technician, Tonya Lander and MNI Director Erika Vohman.

The original budget for the project was inadequate with respect to the overseas component of the project (training, data collection). We had assumed that our main partner and project coordinator, Cecilia Sanchez at MNI Mexico was experienced in budgeting given her role in MNI. Unfortunately this was not the case and her financial management of the first six months of the project was inadequate. As a result, after six months of the project running and in consultation with the Darwin Initiative Cecilia Sanchez was replaced by Guatemalan Associate of MNI, Anaíte López. Unfortunately Anaíte was not dynamic enough to coordinate and execute the training budgets and was also replaced, this time with MNI Director Erika Vohman who forewent the programme coordinator salary and used these funds to support training activities. This arrangement continued until the end of the project. With hindsight I think that it was a mistake to have the project's main partner employed by the project as coordinator and with respect to the budget it would have been sensible to have somebody based in Mexico review it. In addition, although I knew our project partner relatively well before the project began I had never worked on a project with her before. With hindsight it would make sense for DI to ask for evidence of previous successful collaboration at the proposal stage. Given the budget constraints we prioritised training / capacity building over the collection of biodiversity data as we felt that this was more likely to meet the project objective of supporting the sustainable use of Maya Nut.

With respect to developing genetic markers we were planning, with their agreement, and had budgeted to use markers being developed by Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México to study the population of Maya Nut in Mexico. Unfortunately we were never able to get the markers and so had to develop our own markers from scratch. Fortunately I had budgeted for this eventuality but it meant that we had to use universal markers which carried the risk that they would not have the right resolution. Fortunately, and thanks largely to Tonya Lander we were able to select markers which functioned well and were economical to generate.

Project Partnerships

This project arose as a result of an approach from Maya Nut Institute Mexico (at that time known as Equilibrium Institute). The representative of the Maya Nut Institute Mexico had done her PhD at the NHM on the reproductive biology of Maya Nut and so there was a pre-existing connection. Demand for the work therefore arose from MNI but based on a local office and therefore not directly from the rural communities themselves. The project sought to combine science and capacity building to provide the foundation of a sustainable Maya Nut trade. Within the proposal capacity-building, field surveys and community engagement were the responsibility of MNI whilst the molecular and seed storage scientific outputs and project financial management and reporting were the responsibility of the NHM. Below this bilateral partnership there were partnerships between MNI and rural communities, government agencies responsible for protected areas / forest management and other NGOs concerned with the protection of Maya Nut forests and their fauna. And from the NHM side there were partnerships with the RBG Kew Millennium Seed Bank.

The relationship between MNI and NHM during the course of the project went through several phases. Initially the project was run by MNI Mexico and our project coordinator, Cecilia Sanchez. Unfortunately Cecilia was unable to manage project finances in a way that was acceptable to the NHM or MNI and was replaced by Anaite Lopez from MNI Guatemala. Anaite remained in post for just under a year at which time MNI decided that her performance was not acceptable and that MNI CEO Erika Vohman would coordinate MNI project activities. In summary therefore, the first year of the project saw a shift in the partnership away from the Central American branches of MNI to the main US headquarters, driven by a need to secure project delivery and reporting. During the project the partnership there was good communication with frequent discussions, annual visits and a mutual sharing of contacts. MNI regularly contacts NHM partner with scientific queries and NHM regularly contacts MNI with questions about the use of Maya Nut in the field. There were, however, difficulties at the time of writing this report of getting input from MNI and of obtaining the evidence to support project activities under their control. I have spent a lot of time over the past year getting the content for Annex 7, including spending time with Erika producing a first draft in April 2014.

The Darwin Initiative funded project has been instrumental in fortifying the relationship between Maya Nut Institute and the producer communities. This is because the DI funding for Sustainable Harvesting motivated us to create and implement our Maya Nut Certification Program. Sustainable Harvesting comprises one of 7 certification criteria for this program. To date two producer groups are working toward this certification, which is an assurance to the buyers that our product is sustainable, produced by women, fair trade, free of chemicals, molds and bacteria, and includes a guarantee of community reforestation and local consumption of Maya Nut via our Healthy Kids, Healthy Forests program financed by sales of certified Maya Nut.

The certification criteria and the sustainable harvest guidelines were developed by the producers themselves with assistance from Maya Nut Institute, GIZ, Fundacion AGAPE and other partners. The process required community participation and input, and has achieved a fairly high level of buy-in from some of the producer groups.

Challenges with the partnerships were primarily from the lack of government participation in El Salvador and Nicaragua, causing a lot of frustration for the teams in those countries. It was very difficult to arrange meetings in those countries to present our arguments to the new government officials who replaced the ones who had originally signed MOU's with Maya Nut Institute to implement the program. In Honduras the government remains committed to the project.

1. El Guayabo, Honduras

The partnership with this community was strong before the project started because the local partner, GIZ was very active and had invested a great deal of time and money in creating alternatives to logging for this community. The Honduran government was also invested in this community and contributed staff time and resources to developing and writing the management plan for Maya Nut in El Guayabo.

2. Plan de Amayo, El Salvador. The partnership with this community and with the local NGO Fundacion Agape has been and remains strong. The trainings and the development of the Management Plan did not change the partnership in any way, which is surprising and disconcerting. The producers enjoyed learning to conduct forest inventories and analyze the data and in the end were completely capable of conducting forest inventories and data analysis independently. Unfortunately, due to lack of interest and follow-through from the Ministry of Natural Resources, there were no incentives to continue with the work and the Salvadoran team never even finished writing the management plan because the Ministry of Natural Resources said they were not interested in it. We have all the data ready and analyzed and prepared to create a Harvest Plan but until the government requests it and offers technical assistance, they probably won't write the management plan.

3. Versailles, Nicaragua: This community was able to collect the data for their management plan but due to extreme illiteracy were not able to analyze the data. We hired a forester to help them, and the management plan is written and has been submitted to the Nicaraguan Ministry of Forests. The community is implementing the management plan to the extent that they can. This is one of our most important producer groups and they use the information from their Management plan to plan their harvests and to implement the traceability program which is required to sell internationally. The Darwin Initiative project has been extremely beneficial to this community and has served to greatly strengthen the partnership between the community, Maya Nut Institute and local NGO partners.

4. Alimentos Nutri-Naturales, Guatemala

This community (producer group) has a harvest plan that was conducted by professional foresters and submitted to the Ministry of Forests for them and later approved. The community/producer group does not reference their harvest plan unless it is to ensure they are implementing proper traceability in order to sell product to Maya Nut Institute. This is an excellent example of how the market can demand certain sustainability guidelines from producers and communities where they would not apply them on their own.

The relationship between the project and the Millennium Seed Bank (MSB) was a very productive one and we were able to train Guatemalan scientist (and ex project coordinator) Anaite Lopez in the techniques necessary to develop seed storage protocol. The MSB also provided subsidised accommodation for Anaite. The collaboration was also very productive for the MSB and we discovered several novel traits in Maya Nut seed which made it of great interests to scientists there. MNI gave a seminar to the MSB on their work in May 2014.

Challenges with the partnership have stemmed from the fact that the project budget prepared by MNI Mexico was inadequate to deliver the outputs under their remit within the project. This forced us to prioritise funding towards the main end-users of this project: rural women at the expense of negotiating with Government Departments and undertaking the biodiversity surveys. Inevitably this will have had some impact on the project. It also played some part in the decision to replace the salaried position of project coordinator with a non-salaried position. Also MNI were not experienced in the level and detail of reporting for DI projects something for which I as Project Leader take responsibility.

Partnerships have and are likely to continue post-project. Certainly MNI is continuing to work with communities to facilitate the export of Maya Nut to the US. MNI and the NHM are in regular contact with ideas to further support the sustainable harvest of this non timber forest product and NHM and the MSB are in regular contact and discussing several ideas for collaborative research.

With respect to lessons learnt, MNI US would like to have reviewed the budget in more detail. From the NHM perspective I think that although we knew the staff of MNI Mexico well we had not had an established working relationship and contact with MNI US which was very limited prior to the DI award. I think that with hindsight the review process for all DI projects could include more emphasis on assessing the strength and extent (duration) of the relationship between project partners. Additional challenges that we faced were related to the fact that halfway into the project neither leading partner was based in the region which made communication with the communities and interested parties challenging.

3 Contribution to Darwin Initiative Programme Outputs

3.1 Project support to the Conventions (CBD, CMS and/or CITES)

CBD Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets & Global Strategy for Plant Conservation (GSPC) 2011-2020 Targets

Our project has focussed on capacity building and the generation of scientific data and tools to support the use of Maya Nut as a non timber forest product adding value to the forest in which it grows and associated biodiversity, and to support its use in reforestation programmes in a manner that is economically, genetically and environmentally sustainable. The geographical focus for the project is within important areas for plant diversity for each ecological region but also falls within a Global Biodiversity Hotspot. This supports Targets 1, 4, 7, 13 & 14 of the CBD Strategic Plan and Targets 3, 5, 6 & 12 of the GSPC.

Training rural communities in the extraction, preparation and processing of a non timber forest product enables them to increase the income that they get from these forests and so raises the contribution that these forests make to their livelihoods but also their perceived value (Target 1). Producing criteria and management plans ensures that they do so in a sustainable manner (Target 4, 7; GSPC Target 6, 12). Because Maya Nut is largely an uncultivated tree and has a very wide distribution with respect to elevation and rainfall there is extensive overlap between the species distribution and natural forest at an elevation range (<1000 m) where forests are most vulnerable in Central America. Increasing the value of this species to rural communities should therefore support the safeguarding of the whole ecosystems in which they are found (Target 14, GSPC Target 5). Findings from our work also suggest that there is a correlation between the genetic diversity of Maya Nut and the species diversity of the forest that they are found in and that were this factor combined with investment risk data it would provide a tool to guide investment in conservation actions (Target 19, GSPC Target 4, 3).

Our work on Maya Nut genetic diversity supports the delimitation of seed / germplasm transfer zones which if respected will maintain the genetic diversity of the species (Target 7, GSPC Target 6, 9). Because these zones are relatively broad this will not be an onerous task and should not impact greatly on current use of seed (Target 13, GSPC Target 9). Our work developing a storage protocol represents a practical way to store seed for up to 12 months, a significant improvement on current storage times of ca 1 month. The impact of this is to facilitate the use of seed in reforestation / restoration (Target 14, 19, GSPC Target 4). Sites can now be planted at times best suited for restoration and at any time during the year. The storage of viable seeds also enables the seed from heavy fruiting years to be used in the subsequent year when fruiting levels are likely to be much lower.

3.2 Project support to poverty alleviation

- *Did the project contribute to improved human development and welfare?*

The project contributed education and training for some of the most marginalized women and youth in Central America with participants acquiring the skills and knowledge to harvest Maya Nut in a sustainable manner and as importantly learning how to process Maya Nut to international standards of hygiene and quality that permits access to markets in the US. MNI undertook livelihood and wellbeing surveys in 2011 and 2013 (Annex 7.5 for 2013 data)

- *Positive gains in HH income*

In 2013 we had 16 producers in Nicaragua who doubled their annual income from Maya nut sales and others who tripled it (Pers. Comm. Erika Vohman, 2015). In Guatemala harvesters increased their income by an average of 28% in 2013 (Pers. Comm. Erika Vohman, 2015). Unfortunately it was not possible to get a copy of the supporting evidence for these communications. Maya Nut producer surveys conducted by MNI in-country staff in 2011 and 2013 included assessments of well-being and livelihood and recorded a 14% and 22% increase in income from Maya Nut. *Annex 9*

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

MNI undertook baseline surveys in 2011 and again in 2013. Whilst they have not been able to provide us with the data and so I have not been able to verify this Erika Vohman has said that a 14% to 22% increase in income from Maya Nut was recorded during this period (see Annex 9, MNI Annual Report) with current income ranging from \$446 to \$2254 (see Annex 7.5 for a summary of the 2013 survey, Annex 7.6 got a 2012 case study in Honduras). It was very frustrating not being able to get the data to support the above figures and it is not clear why MNI were unable to provide them.

3.3 Transfer of knowledge

The project did not seek to deliver formal qualifications as this would be of little benefit outside of the academic / commercial environment. The project did, however, seek to deliver formal training in an informal setting within communities that was certificated by MNI. Mainly women and young adults were trained in one of two training course ranging in duration from 5 to 15 days which focussed on 1) sustainable Maya Nut forest management and harvest techniques, and 2) Maya Nut processing and quality control. In total 183 people received a total of 2,866 training days (see Annex 11.1). All of the trainees were from rural communities that were amongst the poorest populations of Lower Middle Income countries. Over 80% of the trainees were women.

Through the production of management plans the project sought to transfer knowledge on the sustainable use of Maya Nut forests by the rural communities who are *de facto* their stewards. Management plans were developed in partnership with the communities with input from the scientific partners in the project and the scientific outputs generated by the project. As these outputs are in the process of being published the transfer of the scientific outputs has also taken the form of online posts. Once the outputs are published we will seek to produce a simple pdf leaflet that presents our findings in a more visual format and which MNI can distribute to it's partner communities.

3.4 Capacity building

Anaíte López (female) was trained at the Millennium Seed Bank for one month in techniques to calculate optimal seed storage protocols. As a result she obtained a post at the Instituto Nacional de Bosques in Guatemala as a researcher. Erika Vohman reports that our community trainees, the vast majority of whom were women, enjoy increased status within their communities as well as increased autonomy.

The project did not seek to target national or regional decision makers but instead the rural communities on the ground who are the effective stewards of these forests. The project increased their capacity to manage these forests sustainably and the scientific outputs to support the planting of Maya Nut for restoration or plantation without causing genetic erosion of the species. Specifically training provided communities with the skills and knowledge to monitor their own resources directly, a 'safe' harvest level as well as the skills to generate added value for Maya Nut through ensuring that they produced a crop of export quality. The main way that the capacity of the host country has been supported has been through training and the generation of scientific data.

Through MNI's certification scheme and growth of a market for Maya Nut within the US as well as supporting local markets (see MNI Annual Report, Appendix 9) this has provided a mechanism and environmental incentives for the sustainable use of Maya Nut forests. Given that Maya Nut is a dominant species in many of the lowland forests of northern Central America this provides some support for the implementation of the CBD and Global Strategy for Plant Conservation as listed in Section 4.

3.5 Sustainability and Legacy

Achievements that are most likely to endure are the seed transfer zones, seed storage protocol and the training given to communities to monitor their forests and produce an export quality product. The genetic variation used to delimit seed transfer zones are a reflection of historical and biogeographical phenomenon (climate, pollination, dispersal etc) going back thousands, if not 100s of thousands of years. Whilst human impacts are likely to alter the resolution and degree of structure of this variation it is unlikely to generate a distinct regional pattern. We therefore believe that these transfer zones should protect existing genetic structure for the foreseeable future, especially given that they should not impact greatly on the main areas of Maya Nut commercialisation.

The seed storage protocol will enable the storage of viable Maya Nut seed for at least 12 months with minimal loss (<20%). This will be of benefit to organisation / communities using Maya Nut for reforestation and plantations within Central America but also outside of its natural range. For example, MNI in its reforestation work in Haiti suffered ca 80% loss of seed over a month long period. Had seed been stored at 15°C then loss would have been minimal. The protocol may need some adaptation to regional populations but this is unlikely as the protocol developed falls well within the physiological tolerances of the seed.

The impact of the training should endure as long as there is a market for Maya Nut, especially the training on quality control. The length of time the impact of training in sustainable harvesting will endure is harder to estimate and will be a product of the quality and appropriateness of the training together with a number of unpredictable socioeconomic variables which impact land use and whether rural communities are in an economic position to take a long-term view in planning their lives. Of the countries where Maya Nut is most actively harvested it would be hard to predict the future for policy with respect to wealth equality, rural poverty or land-use.

The project was transboundary and regional. Whilst we did maintain contact with the national agencies responsible for land-use planning where Maya Nut grows there was not significant interest. In part a consequence of the reasons discussed above, e.g. are focus on monitoring / managing through rural communities rather than GO or NGO professionals, but also because we had very few resources to invest in this aspect of the project.

We did not employ any project staff by the end of the project. Erika Vohman who took on the role of Project Coordinator did not draw a salary from the project enabling the funds to be spent on the training.

4 Lessons learned

The project management structure

The management structure was likely appropriate for this style of project, science outputs were handled through the NHM, training and outreach through MNI. One mistake was to have the project coordinator as main partner on the project as this makes it difficult to resolve issues of governance.

Did you have the right sort of expertise employed on the project?

We had the appropriate scientific expertise employed for the genetic structure and a very successful collaboration in place to develop the seed storage protocol. Whilst expertise could have been obtained to undertake effective biodiversity surveys and outreach we had no budget to take advantage of this. With respect to the training and outreach component I think that whilst there is expertise in training, we clearly lacked expertise in monitoring and evaluation, and outreach (additional to training) is not a strength for MNI. MNI also lacked the capacity for adequate reporting.

Was the project well planned i.e. was it based on a good understanding of the underlying issues? Had you correctly identified the problems in the application form?

The project identified the correct issues / problems at the application stage. The project was not well-planned with respect to budget or staffing and many offers of collaboration at the planning stage were not forthcoming once the project started. MNI was not able to report on training and socioeconomic impacts adequately.

Did you allocate sufficient resources to the problem outlined?

To the science outputs yes, to the training / biodiversity component / outreach no. We could also have usefully budgeted for external monitoring & evaluation. This had a profound impact on the project as we were unable to undertake the biodiversity surveys as planned, nor did we deliver an effective outreach programme.

Any other lessons you could draw out from this project that could be useful?

The main lessons I learnt and that I would like to suggest to DI are:

- Include a section on the Stg2 application form or in the letters of support that provides evidence of prior effective collaboration between the main parties. In our case although I knew the main partner well I had never delivered any outputs with her, neither did I know the Director of MNI.
- Review the project budgets against planned work. With hindsight it is clear to me that the budget for training, biodiversity surveys and outreach was inadequate, it may also have been to somebody else experienced with working in Latin America?
- Require a budget for Monitoring & Evaluation in all DI projects. There are consultants who specialise in this where it does not fall within the remit of the partners. We had no budget or plan for M&E. In addition we received only one project review and this was close to the end of the field activities.

4.1 Monitoring and evaluation

Summary of approved changes

- In May 2011 we replaced the main project partner, Cecilia Sánchez Director of the Mexico Programme of the Mayanut Institute with Erika Vohman, Executive Director of the Mayanut Institute and replaced the Project Coordinator (Cecilia Sánchez) with Anaíte López, Coordinator of the Guatemala Program of the Mayanut Institute. This was in response to the original Project Coordinator failing to comply with financial reporting requirements.
- In July 2011 we extended the project end-date to October 31 2013 so as to accommodate the delayed appointment of the post of NHM DNA Technician. This enabled us to appoint the preferred candidate, Tonya Lander who was not free to start until January 2012.
- In October 2012 we decided to dispense with role of project coordinator and direct the savings into increasing the amount spent on conferences, workshops and seminars. This was in response to a perceived need to strengthen the capacity building element of the project.
- In May 2013 and in respect of maternity the NHM DNA technician post ended on June 17 2013, as opposed to October 31 2013 as planned. After maternity pay we used the balance of the budget for the UK salary budget to employ her on a daily rate once her statutory maternity pay has finished. This amounted to an additional 39 days work starting January 2014 and finishing before March 30 2014.

Looking back over the life of the project, was the M&E system practical and helpful to provide useful feedback to partners and stakeholders?

We did not propose a monitoring & evaluation methodology in our proposal. We did, however, monitor the effectiveness of the sampling methodologies developed in the field with our partner communities and this resulted in substantial changes (see 2.1, 1a above). Given our budget and the issues encountered in the project we would have benefited from a M&E plan. It was

also unfortunate that we did not benefit from external reviews until close to the end of our field programme.

4.2 Actions taken in response to annual report reviews

We did not receive any reviews until Year 3.

5 Darwin identity

What effort has the project made to publicise the Darwin Initiative, e.g. where did the project use the Darwin Initiative logo and promote Darwin funding opportunities or projects?

The project was promoted as a Darwin Initiative project through a series of seminars at the Natural History Museum and RBG Kew, blogposts on the NHM NaturePlus platform and my own Wordpress blog (tropicalbotany.wordpress.com). The logo was used in presentations and two of the three management plans produced. The Darwin Initiative was acknowledged and mentioned in the two scientific publications produced.

Was the Darwin Initiative support recognised as a distinct project with a clear identity or did it form part of a larger programme?

The Darwin Initiative was recognised as a distinct project within the NHM & RBG Kew. Within MNI aspects of the project fell into a broader programme of capacity building but the sustainable harvesting and management plans were recognised as distinct.

6 Finance and administration

Detail to follow

6.1 Project expenditure

Project spend since last annual report	2012/13 Grant (£)	2012/13 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Others (see below)				
TOTAL				

Staff employed (Name and position)	Cost (£)
TOTAL	

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

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

6.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
MNI will provide 25% time-salary, office overheads	7,500*
MAGA will provide office space, 10% time salary, staff support	Not delivered
DGTA, AMEXTRA, CONANP & CUCSUR will provide office space, 10% time salary, staff support	Not delivered
AGAPE will provide 25%, office space, 10% time salary, staff support	3000*
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
Millennium Seed Bank staff time, laboratory use & overheads (4 people @ 2.5% for one year) based on Kew Research Office Rates	7000
TOTAL	

* These figures are estimates as MNI was unable to provide figures for this section.

6.3 Value for Money

I believe that this project represented good value for money but I do not believe that we have been able to demonstrate this in this report. The scientific outputs (3a & 3d) were delivered within budget and represent tools that can be applied to Maya Nut harvest in Central America. I believe that the capacity building also had a significant impact in the communities where we work but I do not feel that we have been able to demonstrate this.

Annex 1 Project's full 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
<p>Goal: Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.</p>			
<p>Sub-Goal: Mayanut forests in Mesoamerica are restored and sustainably managed for food production, income, ecosystem services and biodiversity conservation by rural communities with minimal dependence on external assistance and aid.</p>	<p>Measurable changes in farmers, community leaders and community members' attitudes toward Mayanut forests Promising Mayanut genotypes identified, conserved and made available for rainforest restoration, reforestation in new areas, and to Neotropical agronomic research institutions in participating countries. <u>Capacity for Ex-situ conservation of Mayanut by long-term storage of Mayanut germplasm (seed) exists.</u> Ground surveys show recovery in size class and increased forest cover in target biological corridors within 5 years of end of project. 60% of Mayanut producing communities are harvesting Mayanut using sustainable <u>guidelines plans</u> three years after project ends</p>	<p>Interviews and/or focus groups conducted and made available in TEF reports. At least 3 distinct Mayanut genotypes are identified, named, and planted at Lancetilla Botanic Garden in Honduras, <u>Yucatan (DGTA) in Mexico</u> and other sites if necessary. <u>Germplasm storage protocol published.</u> Participatory vegetation assessments using permanent transects in target areas available in TEF project reports Sustainable management plans for Mayanut forests are submitted, evaluated and, if approved, filed with TEF and local relevant ministries.</p>	
<p>Purpose 1a. Sustainable guidelines for Mayanut seed harvesting and plantations are designed and implemented by stakeholders 1b. 60% of participating communities report increases in benefits from Mayanut forests including food, income, and ecosystem services from Mayanut trees.</p>	<p>1a. Sustainable guidelines filed with TEF and relevant in-country natural resources and protected areas ministries (CONAP in Guatemala, MARN in El Salvador, CONANP in Mexico. 1b. Mayanut producer surveys conducted by TEF in-country staff in <u>2013 and 2014</u></p>	<p>1a. Sustainable guidelines for specific sites available online at TEF website 1b. TEF project reports</p>	<p>Ministries in every country prioritise adoption of guidelines for site -specific management plans and establish policies for current and future producer groups and mechanisms for enforcement. 1b. Mayanut producer groups remain cohesive and organised</p>

<p>Outputs (add or delete rows as necessary)</p> <p>1. Communities obtain capacity to sustainably manage Mayanut forests with minimal external assistance and/or supervision</p>	<p>1a. 120 Mesoamericans from 20 village forest committees trained in technical aspects of forest management: calculation of sustainable Mayanut seed harvest levels, the biodiversity associated with Mayanut forests, marketing, and accounting by year 3.</p> <p>1b. Basic forest inventories of major faunal groups associated to absence/presence of Mayanut trees and in relation to some measure of forest conservation status i.e. Biodiversity value of Mayanut</p>	<p>1a. Workshop reports</p> <p>1b Report and evaluation summary by community Training Co-ordinator</p>	<p>Trainees remain active in the project and village committees</p> <p>Forest neighbours maintain the goodwill required for local co-operation and with project leaders.</p> <p>Poorest and indigenous communities are well-represented</p>
<p>2. Stewardship agreements at provincial and village levels in place and functioning</p>	<p>2 a. Draft position agreements for 20 local forest areas by year 2, revised by year 3</p> <p>2 b. Guidance document on sustainable harvesting of Mayanut seeds for 20 forest areas produced and disseminated by year 3</p>	<p>2a and b. Agreements and guidelines document on sustainable harvest checked, approved, and analysed by project collaborators and village authorities.</p>	<p>Land tenure policies remain stable.</p> <p>Provincial and village authorities are supportive to producer groups</p> <p>Local and national governments remain stable</p>
<p>3. Knowledge of inter and intrapopulation variability for Mayanut in Mesoamerica. <u>Protocol for the long-term storage of Mayanut seed developed.</u> Promising seed transfer zones for Mayanut landraces are delineated and genetic diversity (germplasm) conserved both in and ex situ as sources of seed for reforestation throughout its former range.</p>	<p>3a. Produce and disseminate at least one scientific document (journal paper, thesis) on Mayanut genetic diversity and agronomic species improvement potential <u>based on phenotype.</u></p> <p>3b. Produce and disseminate a document naming and recommending Mayanut landraces for restoration and reforestation</p> <p>3c. Ex-situ genetic conservation plots established in La Ceiba, Honduras, and Yucatan, Mexico.</p>	<p>3 a and b. Annual reports, plus occasional academic and public media articles and presentations</p> <p>3c. Acknowledged by partner institutions.</p> <p><u>3d. Seed storage protocol published.</u></p>	<p>3a. Inter and intrapopulation genetic variability of Mayanut can be identified with molecular markers</p> <p>3b. Genetic variability found and current tools for restoration genetics will define the scope for advice of useful seed transfer zones</p> <p>3c. Collaborators discuss and agree on suitable genotypes to conserve</p> <p>3d. <u>The Seed Conservation Department of the Millennium Seed Bank remain World leaders in the storage of recalcitrant seed.</u></p>

Activities (details in workplan)

1.1-1.6 Course planned in consultation with partners. Trial course implemented. 120 Mesoamericans in 3 countries trained in field data gathering for calculation of sustainable Mayanut seed harvest levels and the biodiversity associated with Mayanut forests; 30 Mesoamericans trained in technical aspects of forest management including basis and interpretation of gathered data as tools for sustainable Mayanut seed harvest levels; 30 Mesoamericans trained in marketing and accounting.

1.7-1.9 Basic forest inventories of major faunal groups associated with Mayanut undertaken. Inventory data related to forest conservation status, data fed into the guidance document on sustainable harvesting of Mayanut. Field data compiled in each country and analysed for calculation of sustainable Mayanut seed harvest levels by partners.

2.1 Draft position agreements for 20 local forest areas by year 2, revised by year 3.

2.2-2.3 Sustainable harvest levels of Mayanut seeds for 20 forest areas compiled and analysed together with the faunal inventories to produce the guidance document on sustainable harvesting of Mayanut. Guidance document on sustainable harvesting of Mayanut seeds for 20 forest areas disseminated.

3.1-3.5 Select sample sites with partners and sample Mayanut populations across 7 countries throughout Mesoamerica. Undertake molecular analysis of Mayanut samples. Interpret the molecular data, produce an overview of how diversity within the species is partitioned across Mesoamerica, identify and name the principle land-races. Recommend land-races of agronomic potential based on phenotype. Produce and disseminate a document naming and recommending Mayanut landraces for restoration and reforestation. Protocol for the long-term storage of Mayanut developed by project staff at the Millennium Seed Bank.

Monitoring activities:

1a TEF GOs responsible for Natural Protected Areas will acknowledge that they have examined and approved the key project outputs (training, sustainable harvest yields, associated biodiversity) and express an undertaking to support the application of the sustainable harvest guidelines.

1b Harvest, biodiversity and income benefits to the partner communities and their members measured through two surveys. Survey results compared.

1a Workshop participants skills assessed post-course and compared to a bench-mark. Courses in different countries and years will be compared to an apriori agreed accepted minimum standard.

1b. Progress made towards specific objectives will be monitored by the project team at quarterly intervals. This will be a two-way process, community and GO partner feedback being solicited on how they see project progress in terms of their needs for the project.

2a TEF and partner communities will sign MOU style agreements at the beginning of the project committing to participation and objectives. At the end of the project partner communities will be asked to confirm that they will adopt the proposed sustainable harvest guidelines.

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

Note: For projects that commenced after 2012 the terminology used for the logframe was changed to reflect DFID's terminology.

LOGICAL FRAMEWORK

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Goal:</p> <p>Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.</p>			
<p>Sub-Goal:</p> <p>Maya Nut forests in Mesoamerica are restored and sustainably managed for food production, income, ecosystem services and biodiversity conservation by rural communities with minimal dependence on external assistance and aid.</p>	<p>M1 Measurable changes in farmers, community leaders and community members' attitudes toward Maya Nut forests <input checked="" type="checkbox"/></p> <p>M2 Maya Nut genotypes identified, conserved and made available for rainforest restoration, reforestation in new areas, and to Neotropical agronomic research institutions in participating countries. <input checked="" type="checkbox"/> Annex 8.1</p> <p>M3 Capacity for Ex-situ conservation of Maya Nut by long-term storage of Maya Nut germplasm (seed) exists. <input checked="" type="checkbox"/> (see Annex 8.2)</p> <p>M4 Ground surveys show recovery in size class and increased forest cover in target biological corridors within 5 years of end of project. <input checked="" type="checkbox"/> Methodology developed too late to monitor change.</p> <p>M5 60% of Maya Nut producing communities are harvesting Maya Nut using sustainable guidelines three years after project ends <input checked="" type="checkbox"/> Five out of seven communities (71%) (see Annex 7.1, 7.2, 7.3)</p>	<p>Interviews and/or focus groups conducted and made available in MNI reports. <input checked="" type="checkbox"/> Annex 9</p> <ul style="list-style-type: none"> • E1 Guatemala: demand for Maya Nut trees for reforestation increased 200% since 2011 (Ministry of Agriculture and Ranching, Vice Minister Celio Cuellar, Pers. Comm.). • E2 Nicaragua: community leaders (Miguel Cruz y Ariel Osorto from the communities of Versailles and Las Nubes repeatedly report incursions to the Ministry of Forestry in 2010, 2011 and 2013 because they are concerned about Maya Nut forest health and regeneration. • E3 Nicaragua: Maya Nut is registered for the first time as an export crop. • E4 Nicaragua and Guatemala export tax levied on Maya Nut exported from Nicaragua and Guatemala for the first time in 2013 and 2014. • E5 Nicaragua 2013 to 2014: 	

Project summary	Measurable Indicators	Means of verification	Important Assumptions
		<p>Maya Nut export sales increase from 800lb to 3,000lb.</p> <ul style="list-style-type: none"> • E6 Guatemala 2013 to 2014: Maya Nut export sales increase from 16,000lb to 25,000lb. The only communities commercializing Maya Nut in Guatemala and Nicaragua are the ones they have been working with on the DI grant. Maya Nut Institute has this information because we are the entity commercializing Nicaraguan and Guatemalan Maya Nut internationally. • E15 MNI Maya Nut certification programme (Annex 10) • E16 MNI 2013 Annual Report (Annex 9) <p>E7 At least 3 distinct Maya Nut genotypes are identified, named, and planted at Lancetilla Botanic Garden in Honduras, Yucatan (DGTA) in Mexico and other sites if necessary. <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Genotypes identified, not planted at Lancetilla Botanic Garden. Research published (see Annex 8.1)</p> <p>E8 Germplasm storage protocol published. <input checked="" type="checkbox"/> submitted (see Annex 8.2, http://wp.me/p44CjQ-sy)</p>	

Project summary	Measurable Indicators	Means of verification	Important Assumptions
		<p>E9 Participatory vegetation assessments using permanent transects in target areas available in MNI project reports <input checked="" type="checkbox"/> (see available on MNI library)</p> <p>E10 Sustainable management plans for Maya Nut forests are submitted, evaluated and, if approved, filed with MNI and local relevant ministries. <input checked="" type="checkbox"/> Submitted: Honduras, Nicaragua, El Salvador <input checked="" type="checkbox"/> Not submitted: Guatemala. <input checked="" type="checkbox"/> Approved: Honduras, Nicaragua. <input checked="" type="checkbox"/> Not approved: El Salvador. (see Annex 7.1, 7.2, 7.3)</p>	
<p>Purpose</p> <p>1a. Sustainable guidelines for Maya Nut seed harvesting and plantations are designed and implemented by stakeholders. <input checked="" type="checkbox"/> (see Annex 7)</p> <p>1b. 60% of participating communities report increases in benefits from Maya Nut forests including food, income, and ecosystem services from Maya Nut trees. <input checked="" type="checkbox"/> The results are summarized in MNI annual report. MNI was unable to provide any further information.</p>	<p>M6 1a. Sustainable guidelines filed with MNI and relevant in-country natural resources and protected areas ministries (CONAP in Guatemala, MARN in El Salvador, CONANP in Mexico. <input checked="" type="checkbox"/> see above (see Annex 7)</p> <p>M7 1b. Maya Nut producer surveys conducted by MNI in-country staff in 2013 and 2014 <input checked="" type="checkbox"/>?</p>	<p>E11 1a. Sustainable guidelines for specific sites available online at MNI website <input checked="" type="checkbox"/></p> <p>E12 1b. MNI project reports <input checked="" type="checkbox"/> See MNI Annual Report (Annex 9)</p>	<p>Ministries in every country prioritise adoption of guidelines for site -specific management plans and establish policies for current and future producer groups and mechanisms for enforcement. <input checked="" type="checkbox"/> Guatemala, Honduras. <input checked="" type="checkbox"/> EL Salvador, Nicaragua</p> <p>1b. Maya Nut producer groups remain cohesive and organised <input checked="" type="checkbox"/></p>
<p>Outputs (add or delete rows as necessary)</p> <p>1. Communities obtain capacity to sustainably manage Maya Nut forests with minimal external assistance and/or supervision</p>	<p>M8 1a. 120 Mesoamericans from 20 village forest committees trained in technical aspects of forest management: calculation of sustainable Maya Nut seed harvest levels, the biodiversity associated with Maya Nut forests, marketing,</p>	<p>E13 1a. Workshop reports <input checked="" type="checkbox"/>. (See Annex 10.2 & 11.1)</p> <p>E14 1b Report and evaluation summary by community Training Co-ordinator <input checked="" type="checkbox"/> MNI unable to provide reports as agreed.</p>	<p>Trainees remain active in the project and village committees <input checked="" type="checkbox"/></p> <p>Forest neighbours maintain the goodwill required for local co-operation and with project leaders. <input checked="" type="checkbox"/></p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	<p>and accounting by year 3. <input checked="" type="checkbox"/> 109 trained in sustainable harvesting; 183 trained in quality control for marketing (see Annex 9)</p> <p>M9 1b. Basic forest inventories of major faunal groups associated to absence/presence of Maya Nut trees and in relation to some measure of forest conservation status i.e. Biodiversity value of Maya Nut <input checked="" type="checkbox"/> MNI created a survey and focus group of hunters that was going to generate this data. The hunters turned out not to want to be interviewed or talk about it because hunting is illegal. if we had had more time and funds we would have framed it this differently.</p>		<p>Poorest and indigenous communities are well-represented <input checked="" type="checkbox"/></p>
<p>2. Stewardship agreements at provincial and village levels in place and functioning</p>	<p>M10 2 a. Draft position agreements for 20 local forest areas by year 2, revised by year 3 <input checked="" type="checkbox"/> Ongoing, not signed yet, because MNI unhappy with the data and the way that it is collected.</p> <p>M12 2 b. Guidance document on sustainable harvesting of Maya Nut seeds for 20 forest areas produced and disseminated by year 3 <input checked="" type="checkbox"/> Produced for 5 forest areas (see Annex 7)</p>	<p>E15 2a and b. Agreements and guidelines document on sustainable harvest checked, approved, and analysed by project collaborators and village authorities. <input checked="" type="checkbox"/> MNI certification and criteria (see Annex 11)</p>	<p>Land tenure policies remain stable. Provincial and village authorities are supportive to producer groups Local and national governments remain stable</p>
<p>3. Knowledge of inter and intrapopulation variability for Maya Nut in Mesoamerica. Protocol for the long-term storage of Maya Nut seed developed. Promising seed transfer zones for Maya Nut landraces are delineated and genetic diversity (germplasm) conserved both in and ex situ as sources of seed for reforestation throughout its former</p>	<p>M13 3a. Produce and disseminate at least one scientific document (journal paper, thesis) on Maya Nut genetic diversity and agronomic species improvement potential based on phenotype. <input checked="" type="checkbox"/> (see Annex 8.1) but not species improvement</p> <p>M14 3b. Produce and disseminate a document naming and</p>	<p>E16 3 a and b. Annual reports, plus occasional academic and public media articles and presentations <input checked="" type="checkbox"/> (see Annex 8.1 & 11, http://wp.me/p44CjQ-sv)</p> <p>3c. Acknowledged by partner institutions.</p> <p>3d. Seed storage protocol published. <input checked="" type="checkbox"/> (see Annex 8.2)</p>	<p>3a. Inter and intrapopulation genetic variability of Maya Nut can be identified with molecular markers <input checked="" type="checkbox"/></p> <p>3b. Genetic variability found and current tools for restoration genetics will define the scope for advice of useful seed transfer zones <input checked="" type="checkbox"/></p> <p>3c. Collaborators discuss and agree on suitable genotypes to conserve <input checked="" type="checkbox"/></p> <p>3d. The Seed Conservation Department of the Millennium Seed Bank remain World leaders</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
range.	recommending Maya Nut landraces for restoration and reforestation <input checked="" type="checkbox"/> (see Annex 8) 3c.Ex-situ genetic conservation plots established in La Ceiba, Honduras, and Yucatan, Mexico. <input checked="" type="checkbox"/> Lack of buy-in from the partners, lack of budget to pay for establishment of the plots 3d. Seed storage protocol produced to support longer term seed storage. <input checked="" type="checkbox"/> (see Annex 8.2, http://wp.me/p44CjQ-sy)		in the storage of recalcitrant seed. <input checked="" type="checkbox"/>

Annex 3 Standard Measures

Code	Description	Total	# of people receiving training/qualifications	
			# of people from developing countries	# male/female
Training Measures				
1a	Number of people to submit PhD thesis	0		
1b	Number of PhD qualifications obtained	0		
2	Number of Masters qualifications obtained	0		
3	Number of other qualifications obtained	0		
4a	Number of undergraduate students receiving training	0		
4b	Number of training weeks provided to undergraduate students	0		
4c	Number of postgraduate students receiving training (not 1-3 above)	0		
4d	Number of training weeks for postgraduate students	0		
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(i.e. not categories 1-4 above)	0		
6a	Number of people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	183	183	28/156
6b	Number of training weeks not leading to formal qualification	573	183	28/156
7	Number of types of training materials produced for use by host country(s)	2		

Research Measures		Total #	Comments where necessary
8	Number of weeks spent by UK project staff on project work in host country(s)	6	
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	3	Was it participatory? Yes
10	Number of formal documents produced to assist work related to species identification, classification and recording.	1	
11a	Number of papers published or accepted for publication in peer reviewed journals	1 published, 1 accepted for publication, 1 submitted	See Annex 8
11b	Number of papers published or accepted for publication elsewhere	0	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	0	
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	0	
13a	Number of species reference collections established and handed over to host country(s)	0	
13b	Number of species reference collections enhanced and handed over to host country(s)	1	

Dissemination Measures		Total #	Comments where necessary
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	4	Two seminars at NHM, 1 seminar at RBG Kew, 1 seminar at Millennium Seed Bank
14b	Number of conferences/seminars/workshops attended at which findings from Darwin project work will be presented/ disseminated.	1	UNESCO Botany in the 21 st Century Conference

Physical Measures		Total #	Comments where necessary
20	Estimated value (£s) of physical assets handed over to host country(s)	0	
21	Number of permanent educational, training, research facilities or organisation established	0	
22	Number of permanent field plots established	0	
23	Value of additional resources raised for project (<i>See Section 8.2 above</i>)	0	

Annex 4 Aichi Targets

Please note which of the Aichi targets your project has contributed to.

Please record only the **main targets** to which your project has contributed. It is recognised that most Darwin projects make a smaller contribution to many other targets in their work. You will not be evaluated more favourably if you tick multiple boxes.

	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.	✓
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.	
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.	✓
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.	
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.	✓
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.	
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.	✓
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.	
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.	
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.	✓
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. contact address, website)
Manuals	MANUAL TECNICO PARA EL OJOCHÉ, E. Vohman, 201	US	US	Female	Maya Nut Institute, Crested Bute	MNI Library: http://mayanutinstitute.org/
Journal	Microwave drying of plant material for herbarium specimens and genetic analysis, T. Lander	US	UK	Female	International Bureau for Plant Taxonomy and Nomenclature, Bratislava	http://bit.ly/1GnYBKr
Blog post	Collecting Maya Nut (<i>Brosimum alicastrum</i>): Crocodiles & driving, A.Monro, 2012	UK	UK	Male	Natural History Museum, London	http://bit.ly/1EjhYn4
Blog post	Storing <i>Brosimum alicastrum</i> (Maya Nut) seed, a very surprising result! A.Monro, 2012	UK	UK	Male	Natural History Museum, London	http://bit.ly/1wJHUWJ
Blog post	Maya Nut: developing a storage protocol for a Central American famine food, A.Monro, 2014	UK	UK	Male	WordPress	http://wp.me/p44CjQ-5T
Blog post	Maya Nut: not just an ordinary fruit (or nut), A.Monro	UK	UK	Male	WordPress	http://wp.me/p44CjQ-6i

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. contact address, website)
Blog post	Seminar Announcement: Livelihood and conservation value of Maya Nut in Central America, A.Monro, 2014	UK	UK	Male	WordPress	http://wp.me/p44CjQ-eh
Blog post	Seminar at Kew by Mike Rowley: tropical tree converts atmospheric CO2 into mineralized carbonat, A.Monro, 2014	UK	UK	Male	WordPress	http://wp.me/p44CjQ-ff
Blog post	'Win-win-wins in conservation: presentation at UNESCO 'Botanists of the 21st C' Conference, A.Monro, 2014	UK	UK	Male	WordPress	http://wp.me/p44CjQ-nr
Blog post	Seed transfer zones for Brosimum alicastrum in Central America, A.Monro, 2015	UK	UK	Male	WordPress	http://wp.me/p44CjQ-sv
Blog post	Zonas de transferencia para Brosimum alicastrum en América Central, A.Monro, 2015	UK	UK	Male	WordPress	http://wp.me/p44CjQ-sM

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. contact address, website)
Blog post	Seed storage protocol for Brosimum alicastrum (Ojushte, Rámon, Breadnut, Maya Nut), A.Monro, 2015	UK	UK	Male	WordPress	http://wp.me/p44CjQ-sy
Blog post	Almacenamiento de semillas de Brosimum alicastrum (Ojushte, Rámon, Capomo), A.Monro, 2015	UK	UK	Male	WordPress	http://wp.me/p44CjQ-ta

Also see Annex 8

Annex 6 Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide details for the main project contacts below. Please add new sections to the table if you are able to provide contact information for more people than there are sections below.

Ref No	18-010
Project Title	Tools for the sustainable harvesting of Maya Nut (Mesoamerica)
Project Leader Details	
Name	Alex Monro
Role within Darwin Project	PI
Address	Dept. Life Sciences, Natural History Museum
Phone	
Fax/Skype	
Email	
Partner 1	
Name	Erika Vohman
Organisation	Maya Nut Institute
Role within Darwin Project	PI & Project Coordinator
Address	
Fax/Skype	
Email	
Partner 2 etc.	
Name	Anaíte López
Organisation	
Role within Darwin Project	Ex Project Coordinator, Seed storage intern
Address	
Fax/Skype	
Email	
Partner 2 etc.	
Name	Hugh Pritchard
Organisation	Millennium Seed Bank
Role within Darwin Project	Supervised seed storage protocol research
Address	
Fax/Skype	

Partner 2 etc.	
Name	Nidia Solano
Organisation	Maya Nut cooperative leader in El Salvador
Role within Darwin Project	Representative of partner community
Address	
Fax/Skype	
Email	