

# Darwin Initiative: Half Year Report

(due 31 October 2012)

<b>Project Ref No</b>	18-010
<b>Project Title</b>	Tools for the sustainable harvest of Maya Nut (Mesoamerica)
<b>Country(ies)</b>	México, Guatemala, El Salvador, Honduras
<b>UK Organisation</b>	The Natural History Museum, London
<b>Collaborator(s)</b>	Maya Nut Institute
<b>Project Leader</b>	Alex Monro
<b>Report date</b>	31/10/2012
<b>Report No. (HYR 1/2/3/4)</b>	3
<b>Project website</b>	<a href="http://www.MayaNutInstitute.org">www.MayaNutInstitute.org</a>

## 1. Outline progress over the last 6 months (April – September) against the agreed baseline timetable for the project (if your project has started less than 6 months ago, please report on the period since start up).

### 1.1 Course content and structure planned in consultation with partners

Completed.

### 1.2 Course materials produced

Completed. A third draft of the course materials has been completed. We are seeking to improve the course content with the execution of each course. This enables feedback from participants and our own experiences to be incorporated.

### 1.3 Trial course implemented, materials & contents tested/ improved if necessary

We have implemented two trial courses, in El Guayabo Honduras (Río Platano Biosphere Reserve, and in Versailles, Nicaragua (San Cristóbal National Park). and have refined the methodology over several iterations. The manual will be printed in December 2012 and ready for use by producer groups in 2013.

We have made many changes to the original manual based on feedback from the producers and the project implementers. Some of the methodology was not appropriate for the type of forest the women are harvesting e.g. with respect to transect size. In addition we added a methodology to obtain information about the natural regeneration in natural forest so that we can monitor size class distribution dynamics over the long term.

### 1.4 120 Mesoamericans from 20 village forest committees trained in field data gathering for calculation of sustainable Mayanut seed harvest levels and the biodiversity associated with Mayanut forests

Ongoing. To date 56 women from six communities have been trained. New groups for future training have been identified, two in Nicaragua (Cosiguina National Park buffer zone and Chacocente National Park and buffer zone) and one in Guatemala (private forest near Mazatenango). Once the methodology is approved by the respective governments in each country, we expect to be able to work in more communities and forests. The government approval is likely to take at least 6-8 months in Nicaragua, three months in Honduras and in El Salvador we are not certain that the government will be interested in sustainable forest management for nontimber forest products. We still need to communicate the importance of Maya Nut for biodiversity and future food security to the Salvadoran government and this could take time.

### 1.5 30 Mesoamericans from 20 village forest committees trained in technical aspects of forest management: logical basis and basic interpretation of the gathered data as tools for sustainable Mayanut seed harvest levels

Training is Ongoing. To date 56 women from 6 communities have been trained. We have trained fewer communities because we have not yet firmly established our methodology and are therefore reluctant to disseminate it widely. We have trained more women than planned originally because there was more interest in the trainings than we were expecting to have.

### 1.6 30 Mesoamericans from 10 village forest committees trained in marketing and accounting

Completed. 30 women from 10 communities have been trained.

### 1.7 Basic forest inventories of major faunal groups associated to absence/presence of Mayanut trees undertaken.

We have collaborated with biologist from COHDEFOR Honduras (Honduran Forest Development Cooperation) data from camera traps from two Maya Nut forests, one in Guatemala and one in Honduras. We hope to be able to confirm that Maya Nut is a keystone species of critical importance for Mesoamerican carnivores. Basic forest inventories of wildlife consuming Maya Nut will be compiled in early 2013.

### 1.9 Field data compiled in each country and analyzed for calculation of sustainable Mayanut seed harvest levels by partners

To date five sites have been surveyed and we plan to include a further 3 sites over the coming 6-month period:

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

Draft position agreements for two forests, El Guayabo in the Río Platano Biosphere Reserve and Volcan San Cristobal, Nicaragua are in process and will be submitted to COHDEFOR (Honduras) and MARENA and MAGFOR (Nicaragua) in December, 2012. The remaining plans completion will be dependent on whether we can identify enough producer groups who are marketing Maya Nut from forests, as there are quite a few groups harvesting Maya Nut from private fields and isolated patches of trees where “forest management plans” have been difficult to conceptualize and therefore implement. When we

originally wrote this proposal for 20 forest areas, we had assumed that more producer groups harvesting from forests would begin marketing Maya Nut. This has not happened yet, due to the fact that there is still no viable market for Maya Nut products in El Salvador or Nicaragua. Honduras, on the other hand, is successfully creating a local/national market and we hope to identify new forests in Honduras and Nicaragua (Honduras is planning to buy Maya Nut from Nicaraguan producers in December 2012.)

### *2.2 Sustainable harvest levels of Mayanut seeds for 20 forest areas compiled and analyzed together with the faunal inventories to produce the guidance document on sustainable harvesting of Mayanut*

Field visits to forests where Maya Nut is harvested strongly suggest that establishment of Maya Nut trees is not seed-limited but rather the product of forest management practices, e.g. the use of the forest floor for grazing by cattle. The assumption behind the use of harvest restrictions to ensure that future generations of seed will become established has not been supported by field observation or current scientific understanding of tree establishment (For example, Terborgh et al. 2011 *Journal of Ecology* 99: 935). Because of this we are working on a sustainable management plan of Maya Nut which will focus on the density of >1m seedlings and saplings rather than seed. This will enable communities to decide how they manage their forests but provide them with a measure that is directly linked to the future establishment of trees.

### *3.2 Undertake molecular analysis of Mayanut genetic diversity.*

We have completed the compilation, extraction, amplification and sequencing of 291 samples from all of Maya Nut's range in Central America and most of its range in South America and the Antilles. These samples include population samples from 39 localities and single spot herbarium samples from an additional 72 localities. These are presented in the table below). We plan to expand this aspect of the study to include a molecular phylogeny of all 13 species in the Maya Nut genus (*Brosimum*). We feel that this is necessary in order for us to be able to confirm that what is being harvested in Mesoamerica is a monophyletic group, that is a group of individuals more closely related to each other than to other individuals within the genus. This would be an assumption of the population genetic methods that we plan to apply to the data. We plan to have all of the analyses completed by the end of March 2013 giving us time to use these to develop reforestation guidelines and disseminate the results.

For the population level analyses we have used the following chloroplast markers: rpS16-trnQ, ndhF-rpL32-R, rpL32-trnL and the nuclear ribosomal marker ITS. We will analyse the following parameters (software used in parentheses):

- Estimations of migration and gene flow (MIGRATE, GENETREE, MDIV)
- Inference about past demography (population size change) (ARLEQUIN)
- Phylogeographic analyses (TCS, GEODIS)

We are interested in whether there is genetic structure across the geographic range of Maya Nut (*Brosimum alicastrum*), whether that structure correlates with geographic features such as the Andes mountains in South America, the Central Cordillera in Central America, or the Isthmus of Panama; with altitudinal gradients; or alternatively with ecological features such as the wet and dry climates of the east and west coasts of Central America. Identifying this structure will help us identify zones of seed. The genetic structure identified will form the basis of the identification and referencing of land-races for output 3.3.

With respect to the testing of monophyly for our group we will sample the ITS, MatK and rbcL regions of the chloroplast and nuclear ribosomal genome of all of the known members of the genus and analyse the data using Maximum Parsimony and Maximum Likelihood (Bayesian) analyses. Because we will use the two plant DNA barcoding chloroplast regions to do this we will also generate data that can be used to establish diagnostic molecular identification tools for Maya Nut and its sister species. This could have applications for the monitoring of the species and its non-timber forest products in the future.

### *3.5 Seed storage protocol produced*

Like many tropical forest trees Maya Nut (*Brosimum alicastrum*) is considered to be a recalcitrant species. This means that the seed will not germinate past a certain time following dispersal and that there is no seed bank within the soil. It also means that you cannot store seed for any length of time (past two weeks) which limits its application in reforestation and restoration projects. The Seed Conservation Unit of the Millennium Seed Bank of the Royal Botanic Gardens, Kew (MSB) has been undertaking research into recalcitrant seed storage for over a decade and are a recognized centre of excellence for this field.

After two delays due to unforeseen circumstances Anaité López of the Universidad de San Carlos, Guatemala spent six weeks working with Tim Marks and Hugh Pritchard developing a seed storage protocol for *Brosimum alicastrum* at the MSB in September-October 2012. Ca 2000 seeds were sent by courier to MSB and this material formed the basis of the research at MSB. Tests were undertaken to identify optimal germination and growing temperatures and humidity, rates of desiccation at different humidity levels and the effect of these parameters on seed viability. From this information a storage protocol can be designed. All of the tests were completed and this information will now be used by Anaité López at the University of San Carlos in Guatemala to test and refine a protocol. Of note was the fact that seeds desiccate extremely slowly, amongst the slowest desiccating recalcitrant seeds encountered by the MSB. Cryogenic storage, a popular approach for recalcitrant seeds requires extensive desiccation of the seed to maintain seed viability. The extreme desiccation resistance of this seed will make it difficult to establish a cryogenic approach. It might however provide the basis for low temperature-humidity storage which would represent a much more practical approach.

### *4 Monitoring survey of harvest levels, income, biodiversity undertaken at project inception and end.*

Monitoring income of rural women Maya Nut harvesters has been ongoing. Our survey was difficult for some surveyers to understand, therefore we are missing some data from 2 producer groups. This will be completed by the next reporting period.

Monitoring production (kg of seed/tree/year) has proven extremely difficult. Existing methodologies will not work in our conditions. The participatory methodologies we developed were not practical for field application. To further complicate

collection of this data, we have determined that in El Guayabo, Honduras and Plan de Amayo, El Salvador, fruiting occurs biennially, with heavy crops and very light crops in alternating years. This discovery has major implications for Maya Nut forest management, particularly in light of research (camera traps at Maya Nut trees) confirming the importance of Maya Nut seed for terrestrial herbivores, and subsequently, large carnivores. We will discuss the implications and management strategy of this phenomenon in our next meeting with the Ministries of Forestry in each country.

**2. Give details of any notable problems or unexpected developments that the project has encountered over the last 6 months. Explain what impact these could have on the project and whether the changes will affect the budget and timetable of project activities.**

It has proven difficult to estimate production of kg/seed/tree/year. We are revising our methodology and establishing permanent plots in dense Maya Nut forests to estimate production/m<sup>2</sup>) in forests with >xx (TBD) adult female trees/ha in the hope that this methodology will prove more reliable for estimating seed production. Many forests which are harvested by groups have extremely high densities of adult trees with considerable crown overlap, making it difficult to determine production per tree.

Project Manager Anaíte Lopez has left the project to work at the Universidad de San Carlos in Guatemala

**Have any of these issues been discussed with LTS International and if so, have changes been made to the original agreement?**

Discussed with LTS:                    yes, in...October 2012 (month/yr)

Formal change request submitted yes, in... October 2012.(month/yr)

Received confirmation of change acceptance    yes in...October 2012 .....(month/yr)

**3. Do you expect to have any significant (eg more than £5,000) underspend in your budget for this year?**

Yes                No       

If yes, and you wish to request a carryforward of funds, this should be done as soon as possible. It would help Defra manage Darwin funds more efficiently if you could give an indication of how much you expect this request might be for.

Estimated carryforward request: £

**4. Are there any other issues you wish to raise relating to the project or to Darwin's management, monitoring, or financial procedures?**

Because of delays and inconsistencies with the development of the initial field methodology we do not have consistent information yet for all field sites. This however is in the process of being rectified and we have agreed to use a simplified methodology and to adapt the calculation of a number of parameters to meet local conditions.

Please send your **completed form by email** to Eilidh Young at [Darwin-Projects@ltsi.co.uk](mailto:Darwin-Projects@ltsi.co.uk) . The report should be between 1-2 pages maximum. **Please state your project reference number in the header of your email message**  
**eg Subject: 17-075 Darwin Half Year Report**