CBI CONGO BASIN INSTITUTE

THE EBONY PROJECT

Developing an Integrative Program for Restoration, Use and Community-based Livelihoods

Progress Report
October 2020

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DEVELOPING AN INTEGRATIVE PROGRAM FOR RESTORATION, USE AND COMMUNITY-BASED LIVELIHOODS

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Cover picture: An ebony tree planted in Somalomo by project participants. Photo by Vincent Deblauwe.

Congo Basin Institute, Yaoundé, October 2020

PROJECT PARTNERS

The Ebony Project is coordinated by the Congo Basin Institute (CBI) in Yaoundé, Cameroon, and the work is implemented by CBI and the following project partners:

CBI CONGO BASIN INSTITUTE
PARTNERSHIPS FOR SCIENCE, EDUCATION AND THE ENVIRONMENT

IITA
Transforming African Agriculture

International Institute of Tropical Agriculture
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Crelicam
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The Ebony Project is developing activities in collaboration with institutions in Cameroon including:

Université de Yaoundé I, Yaoundé, Prof. N. Niemenak

ENEF CAMEROON

Ministry of Environment, Nature Protection and Sustainable Development (MINEPDED), Ministry of Forests and Wildlife (MINFOF), Cameroon, Conservation of the Dja Faunal Reserve
National Forestry School Mbalmayo, N. Kingsly

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From The Ebony Project Team

The Ebony Project is a partnership where business, communities, and researchers work together to protect a valuable timber species, reforest degraded land, address local food security issues, and improve rural livelihoods. It began in 2016 and is funded by Bob Taylor of Taylor Guitars. Annual Progress Reports are designed to be a time capsule documenting the successes and challenges since the publication of the previous year's report, reviewing previous assumptions and forecasting new ones. Please see previous annual reports for a more comprehensive overview of the project at www.crelicam.com/resources.

This year, The Ebony Project, and indeed the world, was irrevocably shaped by the COVID-19 pandemic. The pandemic limited the ability of our field teams to visit participating communities, slowed training, stymied research efforts, and threatened the annual spring planting scheduled to begin in April 2020, when movement restrictions were at their height. *And yet*, thanks to the perseverance and hard work of the team, an overall decentralized project approach, and the nature of the multi-year project cycle at the village level, the Project persevered and planted 6,646 ebony trees and 1,345 fruit trees this year, surpassing our original 2016 goal of planting 15,000 ebony trees. This report discusses that success and others, our challenges, and what we learned about our project by having to implement it in the middle of a pandemic.

Learning from our past is going to be increasingly important as we look towards the future and The Ebony Project's potential role in global restoration, tree planting, and conservation efforts.

Members of The Ebony Project Team and other collaborators at CBI's Bouamir Field Station. Photo credit: Vincent Deblauwe.

COMMUNITIES

Growth and Geography

The Ebony Project is now active in six communities: Ekombité, Somalomo, Bifolone, Kompia, Adjan, and Zoebéfame I (Figure 1), up from four in 2019. The project planned to expand to an additional two villages in 2020, but the COVID-19 pandemic limited our ability to travel to new field sites. The project plans to add these two villages in 2021.

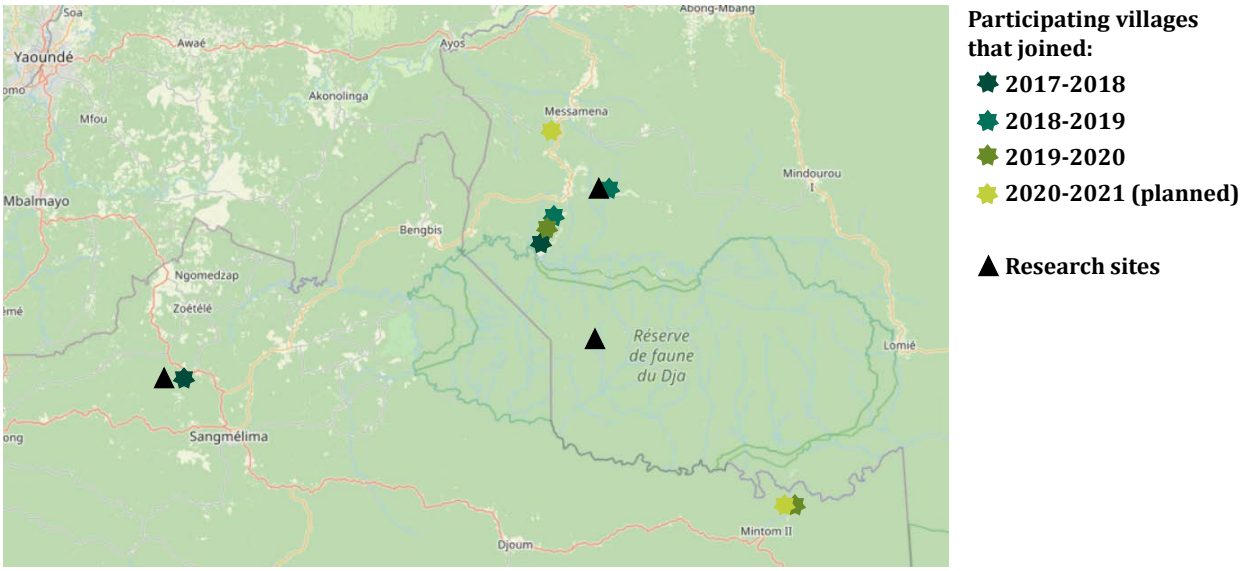

Figure 1: Map of project locations

The two new villages added in 2020 illustrate two potential expansion strategies moving forward. Adjan is located near communities that already participate in the project. Community members in Adjan sought to join the project after witnessing neighboring communities' participation. This "organic growth" approach offers important benefits:

- *Operational simplicity*: recruiting a community to participate is easier when there is existing familiarity and interest. Further, proximity simplifies logistics for site visits (e.g., community meetings, trainings, technical assistance, and planting).
- *Impact*: Forest restoration is a key goal of the Ebony Project, and having project sites clustered increases the overall conservation impact in the region. Further, when fruit trees mature, opportunities to create local and regional markets are enhanced.
- *Validates the project model*: Interest from neighboring communities suggests the project's approach is valuable to communities that already participate.

The second expansion community in 2020 is Zoebéfame I, located south of Dja Faunal Reserve, and represents the current most isolated and logistically challenging project site. This community

was selected because it is located in an area of particularly high conservation value and represents a foothold in the buffer zone on the opposite side of the Dja providing a more holistic conservation impact on the World Heritage Site. Further, the project staff have longstanding prior ties to the community.

In the future, project expansion south of the Dja may also prove synergistic with other ongoing international restoration efforts, including transboundary efforts in Gabon, Republic of Congo, and the Central African Republic. Any such future expansion could use a combined approach where we introduce the project to a village in a high-priority geographic area and then expand by word of mouth.

Tracking Community Progress within the Project Cycle

Participating communities have continued to advance through the project cycle, as first discussed in the 2019 Progress Report (Figure 2).

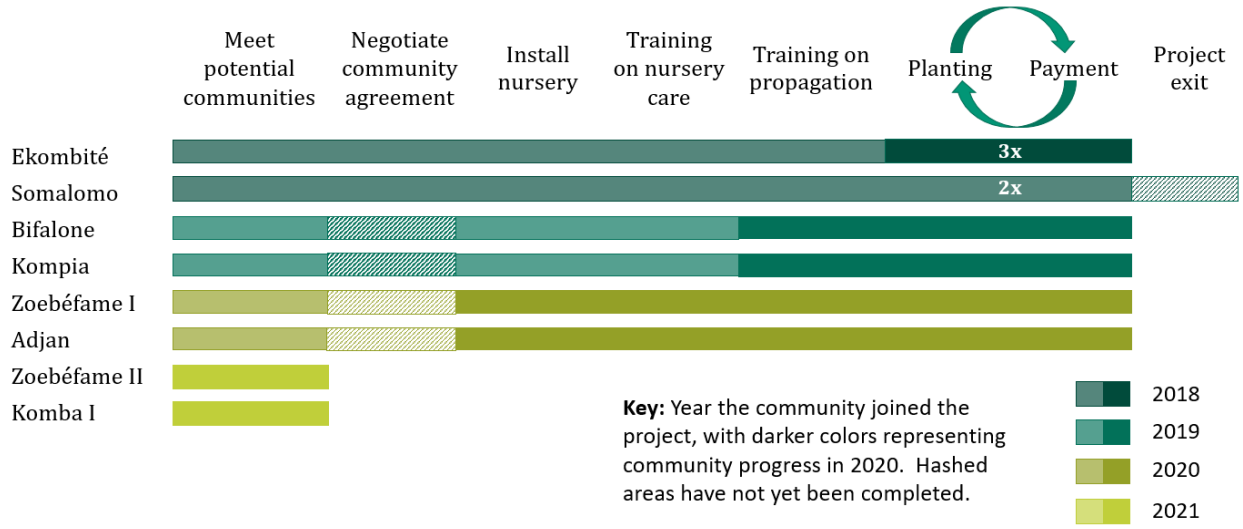

Figure 2: Trajectory of participating communities, organized by year

Community Agreements — Formal written Community Agreements with participating individuals and villages are a foundational document for the Ebony Project. These documents memorialize what the project will provide and what the individual/community's obligations are in return. Unfortunately, the execution of such agreements continues to lag behind other preliminary project activities in the newer villages (i.e. Bifalone, Kompia, Zoebéfame I, and Adjan). There are several reasons for this, including non-COVID-19 related medical issues in 2019 concerning senior project staff responsible for agreement negotiation and signature, and the COVID-19 pandemic in spring 2020. Community Agreements are usually signed at large, quasi-formal gatherings in the community designed to increase awareness and encourage community buy-in. Such gatherings have been impossible since mid-March because of the pandemic. In July 2020 the Project Team resolved to move forward with signing the agreements in very small groups with community leaders and delaying the larger community events for a later date.

These agreements will also play an important role as communities start to graduate from the project. Somalomo is anticipated to be the first community to successfully rotate out of the program. As per the 2019 report, there has been a decline in ebony planting in both Somalomo and Ekombité, the original two project sites. In short, project participants in Somalomo will soon reach capacity in available land to plant out. In 2019 and 2020 there was only minimal planting in Somalomo, although the main participant has expressed interest in continuing to plant ebony in 2021. The project will monitor the activity in Somalomo during the ebony fruiting and seed production season in September 2020 and work with the community members to decide the best way forward based on their contributions and enthusiasm. Even if Somalomo ceases to germinate and plant ebony, the project will continue to engage with the community to provide technical support for the ebony trees that the community previously planted, monitor ebony growth, and make the regular support payments for plant maintenance under the MoU.

According to a recent project survey, farmers in all of the participating communities plan to plant ebony in 2021 in larger numbers than in 2020, demonstrating community willingness to continue and even accelerate ebony planting.

Community Compensation

As enshrined in signed Community Agreements, the Ebony Project provides modest financial compensation to participating individuals and/or communities for their work to establish and maintain a nursery, to grow saplings, and to plant ebony and fruit trees when mature in various landscapes. Last year, the Project Team worked to better clarify this compensation arrangement in order to remove any ambiguity, as these agreements had evolved somewhat organically during the first few years of the project. Efforts to more formalize compensation have gone well, and in the coming year the Ebony Project will focus on clear and consistent messaging to participating communities to eliminate any ambiguity surrounding compensation. Improvements include:

- Making compensation language clearer in the Community Agreement, and reviewing this language in detail at the time of signing
- Reviewing the compensation structure with field staff so they are consistent and accurate in their informal communications with communities
- Paying the compensation at consistent intervals and based on clear parameters

Land Use Planning and Documentation

While land ownership in Cameroon is complex, there may be grounds for farmers to claim individual ownership of trees they plant on their customary lands. Proving ownership of a single tree or multiple trees across a landscape decades later, however, will be a challenge. Since the project's inception, it has been our intent to document tree plantings via a "Sylvicultural Booklet" that would record species and locations. In 2020, the Ebony Project began to implement a draft Sylvicultural Booklet, printing out pages that are filled out by hand by project staff working with participants to record their individual identification information, the locations of their plots via GPS coordinates, and the tree species planted. The project leaves one copy with the farmer and takes

the other copy to enter the data into the project database. While the Sylvicultural Booklets are not a legal document, we hope this information can strengthen any subsequent ownership claims in the future.

A farmer who participates in The Ebony Project plants a tree.

Photo credit: Vincent Deblauwe

Coordination with Stakeholders

Collaboration between The Ebony Project and the Government of Cameroon dates back to November 2017, when Taylor Guitars and Cameroon's Ministry of Environment, Nature Protection, and Sustainable Development (MINEPDED) signed a public-private partnership (PPP) to support the advancement of The Ebony Project.

The coordination continued this year with the following visits and exchanges with officials from Cameroon and the U.S.:

- The Assistant Secretary of State of the United States, Tibor Nagy, accompanied by the U.S. Ambassadors to Cameroon (Peter Barlerin), the Central African Republic (Lucy Tamlyn) and the Democratic Republic of Congo (Mike Hammer) visited Crelicam in March 2019
- MINFOF Regional Delegates of East Region, Gerorges Amougou Ondoua, and Centre Region Mr. Mbele, visited Crelicam in May and June 2019
- A U.S. Congressional delegation that included Karen Bass, Barbara Lee, Ron Kind, and Hank Johnson visited Crelicam in June 2019
- The Secretary General of the Ministry of Forestry and Fauna (MINFOF), Joseph Nyongwen, visited Crelicam in November 2019
- MINFOF Regional Delegate the East Region, Gerorges Amougou Ondoua, and Divisional Delegate of Haut Nyong Division, Mr. Kebu, the Conservator of the Dja Faunal Reserve visited Bifalone in December 2019
- The U.S. Ambassador to Cameroon, Peter Barlerin, visited participating communities Somalomo and Bifalone in December 2019

U.S. Ambassador and U.S. Representatives Karen Bass, Barbara Lee, Sharon Jackson Lee, Ron Kind, and Ron Wright visit Crelicam.

June 2019

Photo credit: Matthew LeBreton

GROWING AND PLANTING TREES

Ebony Production

To date, **the project has transplanted over 15,000 ebony saplings**. There are two stages to planting:

1) **Producing the saplings:** The project produces ebony plants by sowing seeds or via asexual generation (i.e., cuttings). Efforts to reproduce ebony via tissue culture have been suspended pending the identification of resources and expertise to address technological roadblocks. Plantlets are kept in community-built and managed local nurseries. Figure 3 shows ebony production by year. Seed counts are not yet available for 2020 but we anticipate production to match or exceed the 2018 production based on phenology data.

Community nurseries. Communities are at the core of plant production. Installing a nursery and training on nursery care are key aspects of community participation (Figure 2). The Project Team works with the communities to construct nurseries by providing the design, technical assistance, and any materials that cannot be gathered or procured locally by community members. The Project Team then provides training on how to germinate and grow ebony and locally valuable fruit trees in the nursery.

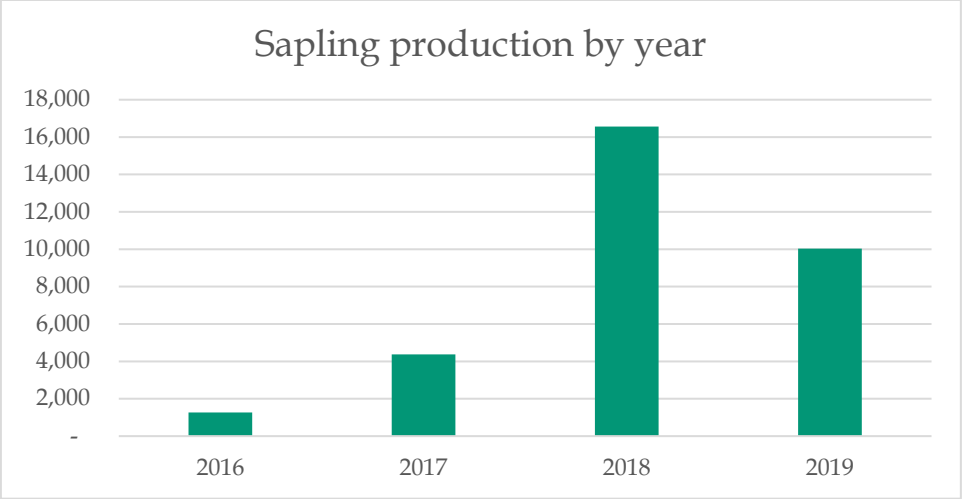

Figure 3: Ebony plant production by year

2) **Transplantation:** After the plants have grown in the nursery, they are transplanted in various settings ranging from open field, mixed agroforestry with moderate canopy cover, and mature secondary forest with closed canopy. Survival rates beyond the first year after transplanting range from 80 to 100% with higher mortality associated with less shade cover. See *The Ecology of Ebony* section below for additional information. Farmers will need to continue to tend trees once a year until they are well-established three to five years after transplantation.

   Figure 4 summarizes the transplantation of all species by year and by community.

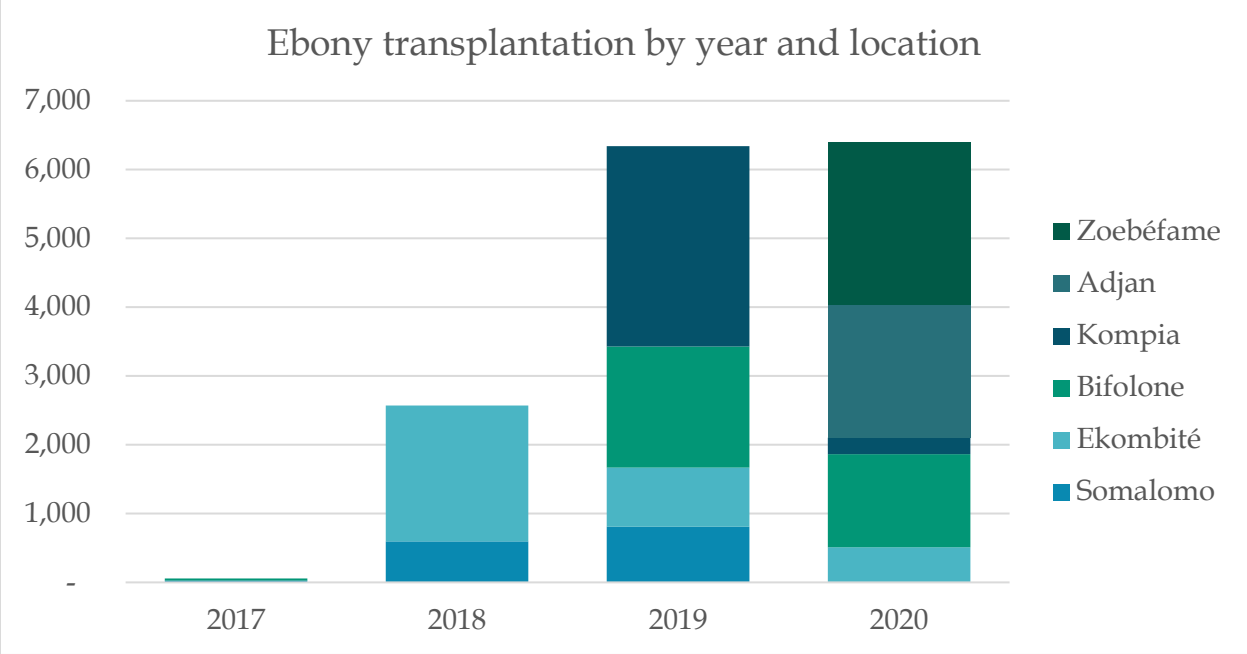

Figure 4: Ebony transplantation by year and location

The project had a successful spring planting season, despite restrictions on field activities this year related to COVID-19. By modifying the work plan to minimize interaction between project staff and participating communities, the project was able to plant 6,646 ebony trees and 1,345 fruit trees. See the *Operations Under COVID-19* section below for additional details about community-based planting during the global pandemic.

Caring for plantlets in community-built and managed local nurseries.

Photo credit: Chris Sorenson

Fruit Tree Production

From project inception, the planting of fruit trees has been considered a critical part of the Ebony Project model providing participants with long-term value that will last long after financial compensation agreements have been satisfied. Upon successfully rotating out of the project cycle, participating villages will have planted out portions of their land in both a high-value hardwood and in a variety of locally valuable fruit trees. In a region where rural families sometimes face food insecurity, planting a variety and abundance of fruit trees will provide both sustenance and economic opportunities.

As reported in the 2019 Progress Report, for various reasons the Ebony Project underperformed with the planting of fruit trees and has made a commitment to significantly increase fruit tree production and transplantation in 2020. Accordingly, we are pleased to report that in 2020 the project planted 1,345 fruit trees—more than twice as many as we planted in the previous three years combined. However, the project still fell short of its goal of 5,000 fruit trees. The shortfall was largely due to:

- Lower than expected germination rates for some fruit species

- Community members taking fruit trees from nurseries and planting them outside of Ebony Project plots[1]
- Mismanagement of collected seeds

Moving forward, the Project Team is confident that past issues can be easily addressed and has redoubled its commitment for 2021.

The fruit trees germinated in the different project nurseries at the time of writing are summarized in Table 1. These plants will be transplanted in 2021.

	Avocado	Bush Mango	Moabi	Djansang	Safou	Mango	Soursop	Cherry	Citrus spp.	Padauk	Bubinga
Zoebéfame I	34	0	0	0	0	471	36	0	75	0	0
Adjan	205	0	150	0	482	0	0	0	2	0	0
Ekombité	0	1	0	0	0	0	0	0	0	0	0
Kompia	137	0	0	163	500	345	95	0	49	0	0
Bifolone	106	22	0	0	318	0	0	1	0	0	0
IBAY	1727	969	6	597	112	288	0	0	0	0	0
IITA	0	0	0	0	0	0	0	0	25	0	0
CRELICAM	0	0	0	0	0	0	0	0	0	45	16
TOTAL	2209	992	156	760	1412	1104	131	1	151	45	16

Table 1: Fruit trees germinated this year in each nursery

Avocado (Persea americana Mill.), mango (Mangifera indica), bush mango (Irvingia gabonesis), moabi (Baillonella toxisperma Pierre), cola (Cola acuminata (P. Beauv.) Schott & Endl.), African nutmeg (Monodora myristica (Gaertn.) Dunal), djansang (Ricinodendron heudelotii (Baill.) Pierre ex Heckel), safou (Dacryodes edulis H.J. Lam), ayous (Triplochiton scleroxylon K.Schum.), soursop (Annona muricata L.), cherry (Dacryodes macrophylla (Oliv.) Lam.).

In 2021, the project will continue to emphasize fruit tree production building off of what was successful in 2020. Specific tactics include:

- Share responsibility for fruit tree production more widely across the Project Team. Specifically, the CBI team based at IITA will become more involved in fruit plant propagation activities, including through the hiring of a mid-level project manager who will take responsibility for increased fruit tree production.
- Produce a greater diversity of fruit trees species. To date, the project has focused largely on a few high-demand species (e.g., bush mango and djansang). However, diversifying the species cultivated will decrease risk, provide a larger pool of source materials (seeds and

[1] We are still investigating this phenomenon and anticipate continuing to discover information and testing strategies to address this issue over the course of the next year.

trees for marcotting), and improve the biodiversity value of the resulting agroforestry stands.

- Move toward greater decentralization of fruit to production. To date most production has occurred in Yaoundé with seedlings transported to participating villages. In 2020, the project significantly increased the training of community members on reproduction, including training over 60 people in marcotting. This will lay the foundation for local fruit tree production and needs to be continued in 2021 with additional training and on demand technical assistance.
- Explore alternative methods of production. The vast majority of fruit tree production in the project to date has come from seeds, and this will continue to be an important source of saplings. However, in 2020 the project began making steps to diversify the forms of production, including setting some marcots. The project will continue to explore how these alternative methods of production could be increased.
- Seek specialized support for fruit propagation. This includes possible foundation support to "surge" fruit tree production, and grant application to explore new technology-based approaches to generating locally valuable fruit trees.

Tracking Plant Production and Transplantation

As the project has grown, so have the amount and types of data the Project Team needs to track. In 2020, we began laying the groundwork for two potential changes that will improve the way we collect and communicate data:

1) Currently, our field teams collect data on nursery inventories, transplanting, and planting locations on paper, and manually enter the data into a spreadsheet upon their return to Yaoundé. This approach is time-consuming, and offers many opportunities for human error. Based on months of analysis, the project-supported UCLA Practicum Team has recommended that The Ebony Project adopt Open Data Kit (ODK), an open source software for collecting, managing, and using data in resource-constrained environments. The Practicum Team provided guidance and tutorials on how to configure ODK to support The Ebony Project's field teams. In 2021, we plan to move forward with implementing the recommendations, which will require investment in personnel time and mobile devices.

2) Taylor Guitars is providing additional in-kind support to build an Ebony Project interactive data visualization dashboard. Taylor's Business Intelligence Manager is working directly with Dr. Vincent Deblauwe to develop a process whereby data already being collected monthly will automatically be fed into a dashboard. The initial dashboard will be an internal tool, although the team will be able to take snapshots to share with external stakeholders. See Annex II.

ECOLOGICAL WORK ON EBONY

Since its inception, the Ebony Project has been designed as a pilot project for larger-scale rainforest restoration efforts for the Congo Basin. Accordingly, in addition to planting ebony and fruit trees, the project conducts research to better understand the basic ecology of African ebony and identify conservation measures that can improve ebony regeneration in the forest.

Despite centuries of exploitation, very little information is available on the natural history of African ebony. There is an urgent need to understand the conditions for adequate regeneration of the species both in natural and plantation settings. Since 2017, Ebony Project scientists have studied the pollination and dispersal of ebony seeds by large mammalian fauna in the Dja Faunal Reserve of Cameroon. To achieve this, ebony trees and saplings were exhaustively inventoried in three 400ha forest plots. In addition to these plots, the 15 and 30 year old ebony plantations at ENEF, Mbalmayo and Ekombité, respectively, are inventoried annually. Time has made this annual data collecting increasingly powerful, and in 2020, it supported the following findings:

1) Diameter growth. The diameter of 900 ebony trees are measured annually. The average annual diameter increment in the forest is lower than 5 mm, which makes ebony one of the slowest growing species of the Congo Basin. The growth is considerably faster in plantation settings where competition for sunlight is reduced compared to mature forest.

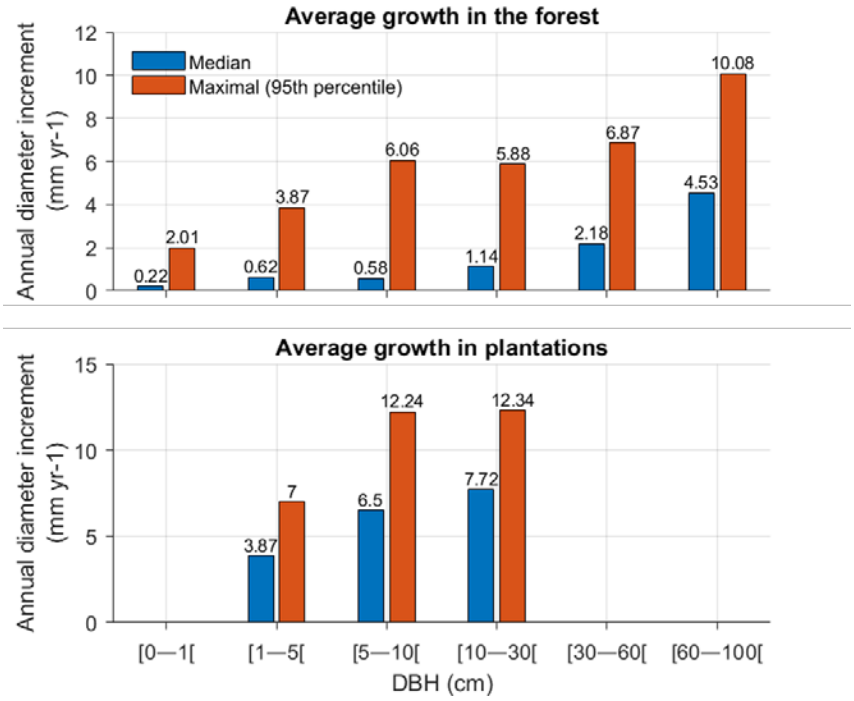

Figure 5: Average and maximal annual diameter increment in plantations and in the forest by diameter class

2) Growth and survival of saplings one year after plantation. We investigated the growth and survival of trees planted in various settings by project participants by following 20 ebony trees in the field of each participant. One-year survival rates of saplings transplanted in 2019 ranged from 98% in secondary forest to 82% in cocoa farms. We found that growth is proportional to canopy

opening. It was calculated that, when canopy opening increases from 20 to 50%, diameter increment increases from 0.5 to 2.5 mm yr^{-1} (linear regression, r^2=0.31), and survival decreases from 95% to 88%. We will continue to monitor these trees and newly planted ones to investigate the long-term survival of the trees planted during the project.

3) Pollination. Pollinators were observed using a camera that we designed specifically for this purpose. We discovered that the majority of the visits were done by meliponine bees (*Plebeina armata* and *Meliponula ferruginea*). However, the less frequent halictid bee might have an important role in pollination as they visit flowers before the meliponine start to be active at dawn.

When flowers pollinated by an animal do not receive rewards, pollination is said to occur by deceit. This is a common feature in dioecious species, like the African ebony. In order to analyze the floral reward production in ebony, we monitored nectar quantity, nectar concentration and pollen production in both male and female ebony flowers in the Mbalmayo and Ekombité plantations. We discovered that female flowers produce up to 30 times more nectar than male flowers. The concentration of the nectar is only slightly higher in male flowers. The male flowers offer pollen as an additional reward to the pollinators. Figure 7 shows that nectar production in male flower during the afternoon ensures the constant presence of a reward to insects when pollen is no longer available.

Peer-reviewed publications in 2020*

Deblauwe, V. 2020. Life history, uses, trade and management of *Diospyros crassiflora* Hiern, the ebony tree of the Central African forests: a state of knowledge, accepted in *Forest Ecology and Management*.

Tchouga, A.O., Deblauwe, V., Djabou, S.A.M., Forgione, G., Hanna, R., Niemenack, N. 2020. Micropropagation and Effect of Phloroglucinol on Rooting of *Diospyros crassiflora* Hiern. Hort. Sci. 55(4): 424-428.

* The Ebony Project's funder played no role in study design, in the analysis and interpretation of data, in the writing of the report, and in the decision to submit the paper for publication.

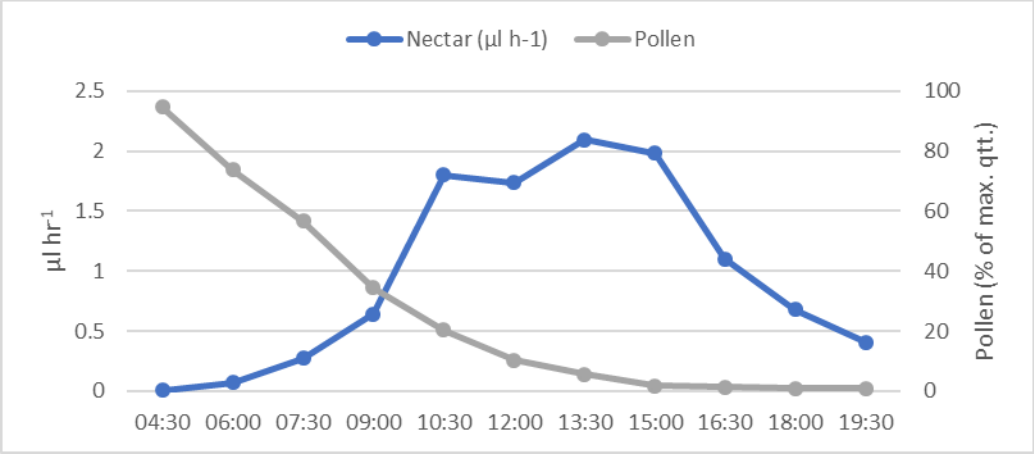

Figure 6: Average nectar production per flower and average pollen availability in male ebony throughout the day. Samples were collected in 30-year-old ebony trees in Ekombité, with exclusion nests enclosing the flowers.

The female and male organs are produced by distinct ebony trees, a characteristic known as dioecy. The separation of sexes makes ebony pollination susceptible to population decline in case of logging or other intervention. In other *Diospyros* species, however, individuals sometimes produce bisexual flowers or separate flowers of both sexes. This year we investigated the possible presence of hermaphrodite trees in ebony the populations. We found that that 13% (n=53) and 17% (n=6) of fruit producing trees in mature forest and plantation, respectively, produce mostly male flowers.

4) Fructification. Logging the largest ebony trees of the forest can potentially limit the regeneration success by increasing the distance between trees and decreasing the success of pollen dispersal. To identify whether there is pollen dispersal limitation, we tested the association between the fruit and seed set of female trees and the distance to the nearest male tree. We found that total fruit and seed production is strongly reduced in female trees that are further than 250m away from the nearest flowering male. This suggests that pollen dispersal limitation can occur when ebony abundance is low.

5) 2021 research next steps. We previously observed with camera traps in the Dja Biosphere Reserve that bushmeat hunting pressure reduces the probability that a seed will be transported away from the mother tree by a mammal disperser, which in turn leads to most seeds germinating right below the mother tree where the fruit first land on the ground. Our preliminary parentage analysis with DNA markers have shown that in hunted sites, the majority of seedlings are growing less than 100m away from their mother tree (short distance dispersal), while all seedlings found in a non-hunted site were brought by animals from mother trees located kilometers away. We also observed that compared to the number of mature trees, the number of seedlings were strongly reduced in hunted sites. This suggest that mortality of seedlings increases with hunting pressure.

However, the net effect of bushmeat hunting on recruitment success is difficult to predict as the removal of large mammals can both increase recruitment by removing natural enemies, like rodents and large mammals, and decrease recruitment because most seeds will not be dispersed and will germinate at the proximity of the mother tree, where mortality is the highest due to the proximity of the adult and associated insect herbivores and pathogen fungi.

Anthropogenic impacts on ebony reproduction. Our research has uncovered at least two ways that humans make it harder for ebony to reproduce:

1) *Hunting*. By hunting the species that disperse ebony seeds, humans cause ebony seedlings to cluster near each other and near the mother tree, potentially increasing competition, predation and disease.
2) *Logging*. If male and female trees are too far apart, ebony is much less likely to produce fruit. Logging the only mature male tree in the vicinity of one or more female trees could decrease or eliminate the ability of those females to reproduce.

To understand the reason for the lack of regeneration observed in the hunted sites, we will test the existence, amplitude and nature of negative distance- and density-dependent effect on seeds and seedlings survival. This will be achieved by manipulating seed density and distance to adults in the permanent ebony plot in Kompia.

Germinating ebony seeds to produce saplings like these has proven to the be the most reliable and efficient way to grow ebony trees for transplantation.

Photo credit: Vincent Deblauwe

Operations Under COVID-19

Obviously, the global COVID-19 pandemic presented multiple unforeseen challenges to previously planned activities. For example, restrictions on movements went into effect in March just as the field team would have typically been gearing up for the annual planting. However, a few factors enabled the project to move forward with planting and reach our 15,000 tree goal:

- Strong relationships with the communities where we work, most of whom are several years into a multi-year project cycle and already familiar with required annual activities
- Support provided by the project to the communities to prevent transmission
- Good communications within the Project Team, and between the Project Team and the communities
- Quick adjustments to the work plan for spring planting
- Decentralization of project activities through capacity-building in communities, community-based nurseries, and prepositioning of supplies

It is critical to take space in this report to thank our field team, our in-country management, and our participating communities for their perseverance and hard work. Thanks to their efforts, the project planted 7,830 trees as the world was reeling from a global pandemic.

There are aspects of our 2020 plans and programming that simply could not be accomplished as envisioned because of the pandemic, specifically:

- Delayed signing of community agreements
- Decreased amount of technical assistance provided for spring planting
- Delayed elephant research
- Delayed hiring of mid-level manager

Where possible, we are moving forward now with alternatives, or planning to renew stalled efforts once COVID-19 is no longer impacting operations.

FUTURE OPPORTUNITIES

The Ebony Project has now been operational for four years. During that time we have planted over 15,000 ebony trees, developed programming in six communities, and published candid accounts of our successes and challenges in annual reports each year.

The project started with an overt focus on planting West African ebony (*Diospyros crassiflora* Hiern), conducting basic ecological research on the species, and the planting of fruit trees. Guided by its business-centric origins, the project has remained disciplined concentrating on these core deliverables. However, in the coming years, and in consideration of possible new funders allowing for project expansion even beyond Cameroon, the project remains open to the inclusion of other hardwood species to be studied and planted. Below, we detail some of the directions that growth could take.

Growth in the Number of Communities: In 2020, the project expanded to two new communities, with plans to expand to an additional two communities next year. This expansion has been aided by adjacent communities expressing interest in participating after seeing our work in neighboring villages. Through this process we are learning how to expand carefully and strategically. The project is increasingly attracting the attention of the media, new donors, and potential new partners, some of whom are stepping forward to finance additional expansion. Paced expansion—fast enough to scale our impact and achieve efficiencies, but slow enough to avoid over-extension—continues to be a goal for the project.

Carbon Offsets: The technical potential for The Ebony Project to sequester carbon remains strong given the focus on enriching existing plantations and secondary forests and the fact that ebony is a dense wood that stores significant amounts of carbon over its century-long growth. However, the potential for establishing marketable carbon credits in Cameroon is less clear. The team is working on a methodology to measure carbon sequestration that would be scientifically sound and comply with national policy. Once the methodology is finalized, the team could seek third-party verification for the approach, work with the Government of Cameroon to integrate the effort into national approaches, and begin measuring the carbon sequestered by trees planted by the project.

However, the Government of Cameroon would need to approve any such credits before they could be offered for sale, and there is not currently a clear process to achieve that approval for credits generated at scale. The potential remains for the achievements of the project to be capitalized by the Government of Cameroon or communities as part of national or jurisdictional REDD+ projects, national C monitoring programs or national reforestation goals.

Connecting to Broader Forest Protection and Restoration Goals: The Ebony Project seeks to improve rural livelihoods, save an iconic species, and partially restore degraded forest. The team is keenly aware of the project's potential contributions to broader rainforest protection and restoration goals. While The Ebony Project itself is currently not a large scale rainforest restoration project, we believe the knowledge gained from the project offers important lessons that can be leveraged to help design and implement future integrative larger scale restoration efforts.

ANNEX I: STATUS UPDATES ON PRIOR REPORT TOPICS

- **Sylvicultural booklet**: This year we started printing and completing hard copies of the sylvicultural booklet during the planting season—a first for the project. We hope the booklets will improve farmers' potential to claim tenure for the trees they plant as part of the project. In the coming year, we hope to add a mobile app to improve data collection and accessibility, but will continue to provide farmers with hard copy booklets to support land tenure claims.
- **Tissue culture**: Last year, after years of scientific progress, the team reached a technological hurdle related to tissue culture that we lacked the expertise to overcome. The tissue culture work to date has been well-documented both in a peer-review publication and in the PhD thesis of a Cameroonian doctoral candidate. The team continues to search for the appropriate technical expertise to address the current hurdle, and in the meantime the tissue culture work has been put on hold.
- **Managing the team**: Last year's annual report detailed our decision to centralize more of the activities and management of the project within CBI. This has worked well so far and will be continued in the coming year.

ANNEX II: THE EBONY PROJECT DASHBOARD

The Ebony Project Dashboard in Tableau is a work in progress that will enhance monitoring and evaluation and project management. A screenshot of the beta version of the dashboard below illustrates its potential for interactive data management and visualization.