Partnerships for Forests

Improving species biodiversity:

A case study into the Xingu Seeds Network

Photo: Andrea Carlini

Forest restoration plays a key role in the fight against climate change and provides an opportunity to improve local livelihoods. Partnerships for Forests (P4F) is supporting regenerative business models in areas with high-biodiversity value across the tropics. In this case study, we illustrate how P4F's support in Latin America has promoted biodiversity through the Xingu Seeds Network and The Seed Paths Initiative projects.

On the supply side, the Xingu Seeds Network (ARSX) is an association that sells native trees seeds from over 250 different species collected in the transition area between the Brazilian Cerrado and Amazon. ARSX's operational model relies on geographically dispersed seed collectors that are able to collect a mixture of seeds from regions with different ecological characteristics and with high genetic diversity. On the demand side, The Seed Paths Initiative works to remove barriers for the adoption of the direct seeding technique, a restoration approach which is cheaper and often more effective than traditional seedling planting. Together these projects provide a high quality supply of native tree seeds and support a technique that can scale-up forest restoration, while generating direct benefits for marginalised populations.

The case study also draws on research conducted by the University of the State of Mato Grosso (UNEMAT) that analysed the intraspecific genetic diversity of two species commercialised by the Xingu Seeds Network. It presents preliminary findings that will be published in an academic paper. For both species, the genetic variability in the seeded population is not significantly different to the natural forest areas that was sampled. A high genetic diversity was found in all the studied populations and the average inbreeding coefficient was low for all populations.

Introduction:
Why Biodiversity Matters

Biodiversity can be measured in the variation of species, genetic diversity, and ecosystems that make-up the biosphere. The expected biodiversity of an ecosystem can be used as a metric to assess its health and can be used to gauge how well an area is naturally able to cope with, respond to, and bounce back from future shocks and stresses. Avoiding biodiversity loss is important to protect ecosystem services. The World Economic Forum estimates that more than half of the world's Gross Domestic Product (GDP) relies on nature and ecosystem services and 1.5 billion people around the world rely on forests for their livelihoods[1].

Even though tropical forests cover less than 10% of the planet's land surface, they support at least two-thirds of terrestrial biodiversity and are therefore crucial to protect. Sadly, commodity agriculture and unsustainable land use practices have accelerated the rate of deforestation and forest degradation, and have had negative impacts on biodiversity levels. These trends need to be reversed and restoration efforts need to more critically consider how they will mitigate against climate change, improve biodiversity, and protect local livelihoods.

> **"When it comes to the business of forest growth, it is crucial to focus on models that work with the communities living in and around the area being restored, ensuring they directly benefit from the process."**
>
> **Making Biodiversity Work for All** - Partnerships for Forests, 2020

Box 1. Looking at biodiversity across genetic-, species-, and ecosystem-levels

Type of biodiverity	Description
Genetic 	The breadth of genetic characteristics observed in a species. Genetic diversity is the variability in species that allows certain members of the species to adapt and evolve to suit a changing environment.
Species 	The breadth of different species found in any given environment. As each species plays a unique role in an ecosystem, any impact on a particular species is also felt by the ecosystem in whicht that species interact.
Ecosystem 	The breadth of ecosystems such as deserts, forests, grasslands, wetlands, and oceans found in any given region.

This case study focuses on **genetic diversity**, which is defined as "the variety of genetic characteristics within a species."[3] Also referred to as *infraspecific biodiversity*, this information is important for researchers when measuring species' adaptive potential in the face of environmental adversities. The quantification of this variability within populations of a certain species is key to evaluating how it deals with the environment, reproduction rates, and how prone it is to extinction.

[1] The Global Value of Nature, Nature4Climate.

[2] Making Forests and Biodiversity Work for All, Partnerships for Forests, 2020, p. 9.

[3] Making Forests and Biodiversity Work for All, p. 6.

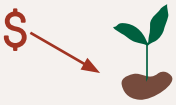
Context:
The Challenges for Restoration in Brazil

The Brazilian Forest Code legally defines how natural resources are to be managed, including forested areas within private properties. It requires Brazilian landowners to either preserve or restore a percentage of vegetation within their properties according to geographical and economical aspects. State level regulations of the Forest Code often require a minimum number of species in order to consider an area restored, according to the different biomes. This legal framework applies to all rural properties in the country.

Research suggests Brazil needs to restore around 19 million hectares in order to be compliant with the Forest Code. In addition, Brazil has made a commitment to restore 12 million hectares of forests by 2030 as part of its Nationally Determined Commitment.

Despite the legal obligation, compliance to the Forest Code has been poorly enforced. Several lobby groups in discussion with the Brazilian Federal Government over interpretations of the Forest Code have generated a sense of impunity around non-observance of the legislation. The lack of enforcement coupled with high deforestation rates, the expansion of agricultural lands, and reduced oversight are the main issues that continue driving deforestation rates in Brazil.

Box 2. Practical barriers for effective restoration

	HIGH COSTS AND LOW RETURNS	Traditional restoration methods using seedlings are expensive and resource intensive;
	LACK OF KNOWLEDGE	Rural producers that need to carry out restoration projects have limited training and access to technical assistance;
	UNSTRUCTURED SUPPLY CHAIN TO MEET RESTORATION NEEDS	Obstacles to restoration in the supply chain include a lack of appropriate regulations, access to credit, and the absence of a strong marketplace necessary to maintain the supply of seeds.
	LACK OF FINANCIAL INCENTIVES	There is a lack of existing scalable economic models to accelerate restoration in deforested areas.

Improving the Demand and Supply of Native Seeds

P4F has supported two projects that improve restoration activities in Brazil and work on both the supply and demand of using direct seeding methods. The first project, **the Seed Paths Initiative**, promotes restoration efforts using direct seeding methods and is working to increase the **demand** for using native seeds. The second project, **the Xingu Seeds Network,** strengthens the **supply** capacity of native seeds, through the collection and commercialisation of the sale of seeds. Combined, these two initiatives have been shifting the restoration approach across multiple sectors in the country.

The Seed Paths Initiative, is a multi-stakeholder group of experts working to scale-up restoration across Brazil using the muvuca technique. The technique combines a mixture of seeds for natural forest regeneration that is both cheaper and more efficient than traditional seedling techniques. Whereas traditional methods rely on planting young trees (seedlings) for forest restoration, the direct seeding technique directly sows native tree seeds into the soil. This approach mimics the natural forest regeneration process.

Additionally, this technique uses local farmers' existing knowledge of seed planting for which they can use their own machinery. This means that more locals can be involved in restoration and costs are kept low.

Actually, the cost of restoring using the muvuca technique is around three times lower than traditional seedling planting. As of September 2021, the technique has been used successfully in the Amazon, the Cerrado, Caatinga, and the Atlantic Forest.

The muvuca technique is also core to the work of the second project: the Xingu Seeds Network. The Network represents an emblematic group of native seeds collectors and is a flagship model for the business of collecting and commercialising seeds in Brazil.

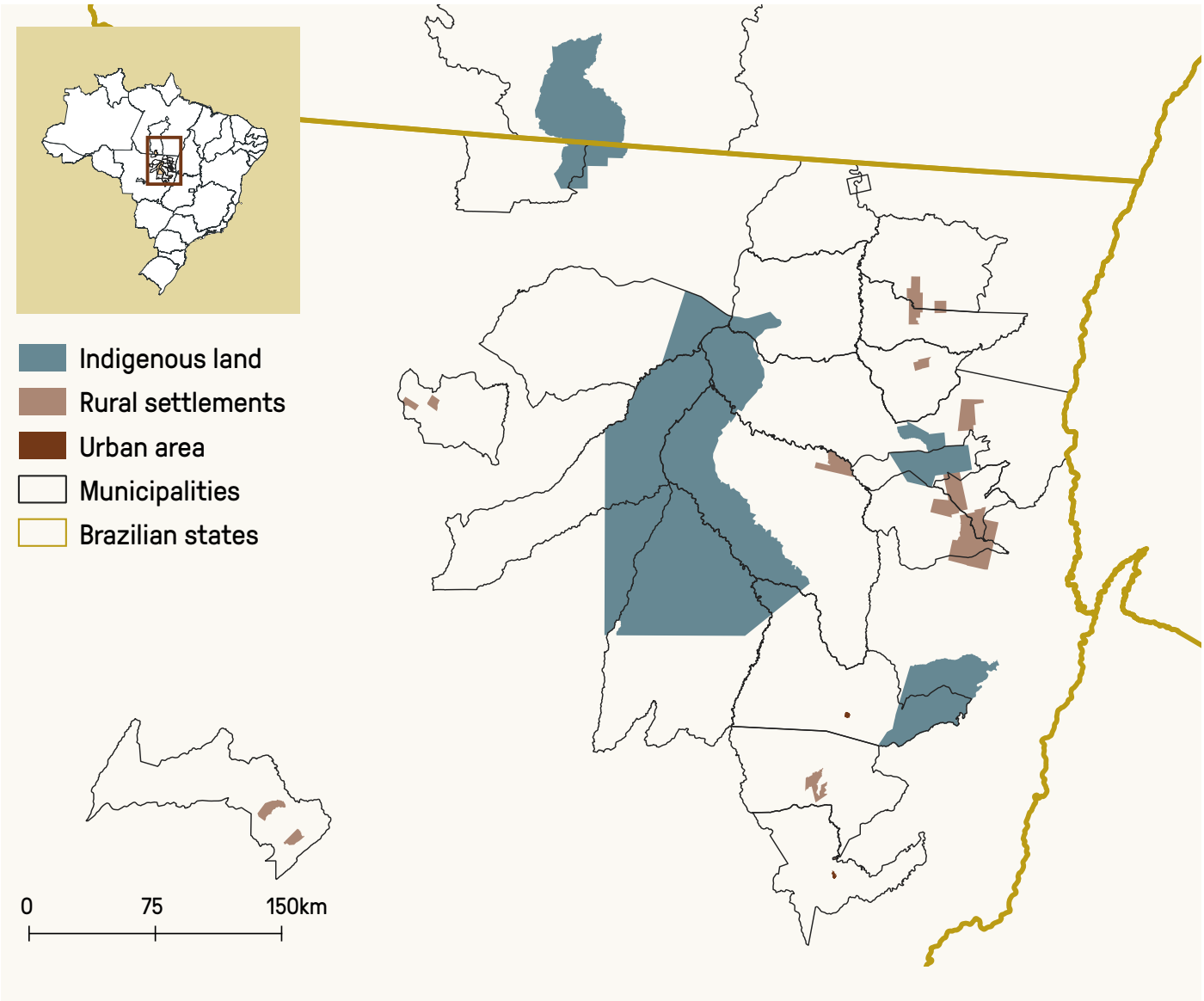
The Xingu Seeds Network was established in 2004 by the Instituto Socioambiental, a local non-profit organisation, together with other organisations and in partnership with Xingu Park indigenous leaders. It initially started as a campaign to stop deforestation and revitalise and protect river springs. Home to 16 different indigenous peoples, Xingu Park is Brazil's oldest officially recognised indigenous land, covering around 2.6 million hectares.

The Network is responsible for managing the collection, logistics, storage, and sales of native seeds. It is composed of more than 570 seed collectors, distributed across 27 nuclei (including urban areas, rural settlements, and indigenous villages). To date, the Xingu Seeds Network has amassed 221 tonnes of seeds from 220 native species leading to the restoration of 6,600 hectares of degraded land within the Xingu basin.

The community-based model helps integrate diverse groups and associations in seed collection networks, making use of traditional knowledge and promoting forest conservation through the commercialisation of non-timber forest products. These businesses create jobs and generate income for socially vulnerable and marginalised communities (including indigenous peoples, traditional populations, smallholders and rural settlers) mainly through the collection and sale of seeds. Within indigenous communities, fruit and seed collection is traditionally done by women and therefore they have directly benefited from the project by receiving higher incomes and becoming more empowered within the community.

P4F's strategy to grow the demand for restoration activities (The Seeds Path Initiative) while also strengthening supply capacity (the Xingu Seeds Network) has proven to be effective. The knowledge sharing and communication efforts of the Seed Paths Initiative has led to increased awareness of the benefits using the direct seeding methods. At the same time, the Xingu Seeds Network has seen an increase in demand from 2019 to 2021, despite challenges posed by COVID-19.

Box 3. A closer look at the governance arrangements in the Xingu Seeds Network



Box 3. A closer look at the governance arrangements in the Xingu Seeds Network

The Xingu Seeds Network organises seed collectors in a decentralised-nuclei model covering indigenous lands, rural settlements, and urban populations. Each nucleus is governed according to its existing governance model within the community they belong to. The seed collectors, who make up the nucleus, elect representatives to act as nuclei links. These are people who are responsible for organising seed requests, weighing processed seeds, and sharing the profits among the collectors.

Because the Xingu Seeds Network works with multiple groups of collectors from various regions, the seeds originate from different matrices and are mixed by species in different batches. Having representation from several regions strengthens intraspecific biodiversity since the seeds are collected from various matrices which aids the direct seeding technique.

P4F has supported the Xingu Seeds Network on developing and strengthening its business model, sales and marketing capacity, and governance arrangements. Since its establishment, the network planned for 5% of all sales to be returned directly to nuclei links but in practice this amount was not incorporated into the final price. Instead, the Network discounted it from the total amount sold to collectors, which was problematic to helping the Network survive. P4F supported this change and will allow more collectors to get involved in the association.

"The participation of the collectors in the decision-making process has always taken place. What changed, though, is the legitimacy given to these spaces, by the Steering Committee together with representatives from the indigenous, urban and family agriculture collectors alongside the Executive Board and Board of Trustees."

Bruna Ferreira - Director at the Xingu Seeds Network.

About the Study

To assess the intraspecific diversity promoted through the Xingu Seeds Association, researchers from UNEMAT compared the genetic diversity of two species collected in areas restored using seeds from the Xingu Seeds Network, both through direct seeding and seedling techniques, against natural areas.

The selected species were Baru *(Dipteryx alata)* and Jatobá-da-Mata *(Hymenaea courbaril L.)* – both among the most commonly used species for restoration. They are native to the Cerrado Biome, present high survival rates and are recognised for the large volume of fruit they produce which are consumed by native fauna.

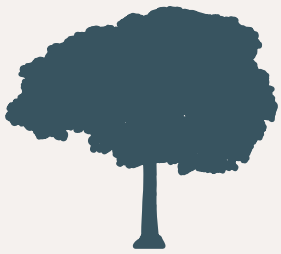
Baru has an 80% high survival rate[4] and is one of the few fruits available in the Cerrado during the dry season.[5] The fruits are important to fauna and also helps with the regeneration of the species. *Jatobá-da-mata* also has a high survival rate (94%) and is known for its fast growth. The tree provides shadow for the lasting species from the subsequent stages of the ecological succession, as well as being attractive to fauna due to its fruits.

Baru
Dipteryx alata

Jatobá da mata
Hymenaea courbaril L.

Steps of the Analysis

SAMPLE COLLECTION



Sample sites are chosen and collection of samples is started

GENOTYPING

Samples have their DNA extracted in laboratory

ANALYSIS

DNA extracted is analysed and results are registered

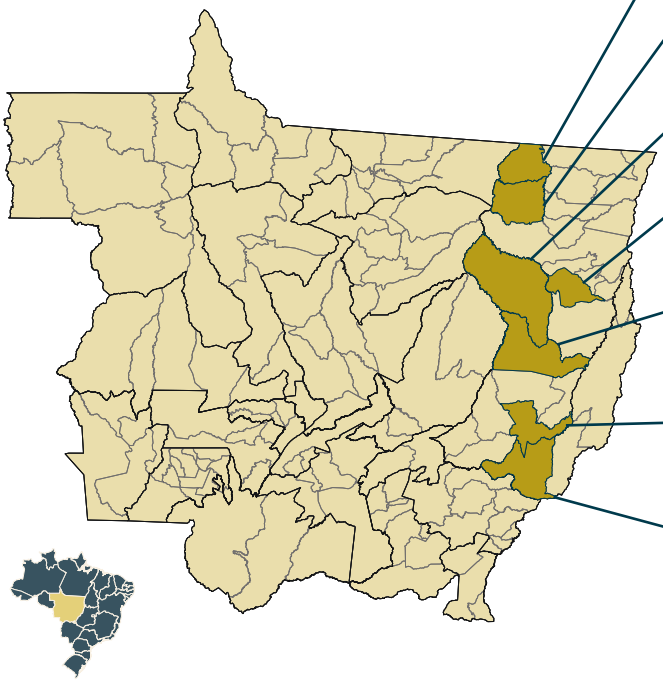
COMPARISON

The DNA is compared between the different collection sites

[4] J. C. Sampaio and J. R. R. Pinto. *Critérios para Avaliação do Desempenho de Espécies Nativas Lenhosas em Plantios de Restauração no Cerrado.*

[5] G. M. Valadão. *Aspectos econômicos do extrativismo do baru no Vale do Urucuia.*

All the municipalities used in the sampling have a similar profile due to the main activities in the region including agribusiness, and specifically grain production, cattle, and timber extraction. These areas also include indigenous territories that are under pressure from the expansion of the agricultural frontier.



Municipality	Type of planting *
Santa Cruz do Xingu - MT	▪ Direct seeding
São José do Xingu - MT	▪ Direct seeding ▪ Seedlings
Querência - MT	▪ Direct seeding
Bom Jesus do Araguaia - MT	▪ Seedlings
Canarana - MT	▪ Direct seeding ▪ Seedlings
Nova Xavantina - MT	▪ Natural
Barra do Garças-MT	▪ Direct seeding ▪ Seedlings

* All seeds used in direct seeds and seedlings techniques came from ARSX.

Early Results

The main finding of the study is that the intraspecific genetic diversity of the samples with the Xingu Seeds Network's seeds mimic the natural areas where these species naturally occur. This means that when seeds are collected from different sites and sold as seed mixtures, the resulting trees will have greater intraspecific genetic diversity, mimicking natural areas and validating this practice to provide good genetic material for restoration, regardless of the restoration approach.

This result supports the diversity claim made by seed collection associations that the genetic pool resulted from ARSX's nuclei governance, provides greater opportunity for the reproduction and survival of the two species.

"[The results of the study] will serve as a message for third sector and other important actors in the private sector that implement direct seeding restoration to communicate to the public that their restoration efforts also focus on biodiversity, leading to further interest in the direct seeding technique and revenue increase to seed collectors"

Pedro Ferro - Investment Manager at P4F.

Access the case-study '*From Seeds to Forests*' to learn more about how Partnerships for Forests has supported the Xingu Seeds Network to review and reorganise its governance structure – a move that has enhanced participation and representation, especially from local seed collector networks, and has also improved strategic decision-making.

Conclusion

This case study brought together how P4F has been supporting the Xingu Seeds Association in Brazil and how ARSX's approach supports intraspecific genetic diversity in areas restored with ARSX's seeds. While the direct seeding technique is well recognised for improving biodiversity through supporting the heterogeneity of species in an area, the genotyping work done by researchers at the UNEMAT has also revealed the genetic diversity of two particular tree species and demonstrates that the seeds from the Association not only improve biodiversity in a landscape, but they also have the ability to promote more resilient tree species that are more likely to reproduce and survive environmental stresses. In the face of climate change, greater genetic diversity is an important element to ensuring restoration efforts are effective.

The academic study will be finalised and submitted to a scientific journal in November 2021 for publication in 2022.

This case-study was developed by Partnerships for Forests in Latin America, in collaboration with the global Monitoring and Evaluation team

Marcio Sztutman
Regional Director

Felipe Faria
Regional Manager

Martin Belcher
Monitoring and Evaluation

Luiz Almeida
Monitoring and Evaluation

Isabella Granero
Monitoring and Evaluation

Juliana Tinoco
External Relations and Knowledge

Revision
Stephanie Andrei
Carlijn Freutel

Design
Estúdio da Julia

Partnerships for Forests

UK Government

Palladium
MAKE IT POSSIBLE

SYSTEMIQ