

## **Biodiversity studies through public-private partnership (PPP): The case of Fazenda São Nicolau in the northwest of Mato Grosso**

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### **Abstract**

The Amazon Forest has been under deep deforestation process, particularly within the North West of Mato Grosso State, Brazil. Following a different path is the Peugeot-ONF Forest Carbon Sink Project, located at Fazenda São Nicolau in Cotriguaçu Municipality. The Project is a public-private initiative and has been supported by several French and Brazilian institutions. Its Research Program includes studies aiming Biodiversity Conservation, Ecology, Carbon Dynamics, Silvicultural Techniques and local workers training on non-destructive ways to use the Forest. Fazenda São Nicolau comprises a high richness of species with more than 20 new species of beetles (Histeridae, Scarabaeidae e Melolonthidae) described among them one endemic genus. A quick overview of the SuperFamily Scarabaeoidea from individuals collected in the Private Natural Reserve within the Fazenda São Nicolau area registered 260 species, 45% could not be positively identified and 100 species might be new to the scientific knowledge. With 120 species of Scarabaeinae the Fazenda São Nicolau is the richest site in the Neotropical zone, followed by two other sites at the Madre de Dios River in Peru. At least one new species of fish was also described from material collected at the Fazenda São Nicolau. Research with amphibian toxins as tools to treat cancer and malaria are also done with material collected at the Fazenda São Nicolau. Ecological aspects of the recovering capacity of the decomposer's fauna at reforestation sites showed that after 10 years of reforestation, such places were more similar to native forest sites than pastures or abandoned pastures. Finally large mammals studies using camera traps have showed that the deforestation process occurring nearby the Fazenda São Nicolau are inducing many large mammals to use the Fazenda São Nicolau as a refuge adding up pressure on some species as the tapir and the puma. We stress the importance to keep the Fazenda São Nicolau linked with the Juruena National Park, as well as to protect the more than 50 fluvial islands in the Juruena River. The whole area nearby the Fazenda São Nicolau is under heavy deforestation pressure and losing the connectivity between the remaining vegetation areas will increase the loss of species in the region.

### **Introduction**

Fazenda São Nicolau is the headquarter of Peugeot-ONF Forest Carbon Sink Project located at Cotriguaçu municipality, Northwest of Mato Grosso State in Brazil's Midwest. The Project was idealized by Peugeot and has been implemented by the French National Forestry Service (ONF) since its beginning in 1998. Both Peugeot and ONF have been funding the Project with the main objective of reforesting 2,000 hectares of pasture and monitor the associated carbon sequestration until 2038.

Fazenda São Nicolau, a rural property of 10,000 hectares is divided in three major areas, including a surrounding belt of 7,000 hectares of native forest, including 1,815 hectares designated as a Natural Heritage Private Reserve (RPPN); 2,000 hectares

of reforestation over old pasture; 1,000 hectares of abandoned pasture and riparian vegetation.

Reforestation was mainly conducted from 1999 to 2004 with over two million trees planted which included 48 native species and two exotic species (*Tectona grandis* and *Syzygium jambolanum*). Ten species were successful and constitute the bulk of the planted trees, with exotic species trees corresponding to less than 20%.

Carbon sequestration recovered close to 1 million ton of CO<sub>2</sub> from the atmosphere since 1999. Most of the reforestation site is already certified by the Verified Carbon Standard (VCS) ([http://www.vcsprojectdatabase.org/#/project\\_details/665](http://www.vcsprojectdatabase.org/#/project_details/665)) and steps have been taken to obtain carbon credits in the Voluntary Carbon Market. All the income obtained with carbon credits is invested in the Project Research Program.

Although not being conceived as an academic research project, the Peugeot-ONF Forest Carbon Sink Project has been assisted by a volunteer Consultative Scientific Committee (CSC) since 2001. Members of the CSC are well known senior researchers from International and Brazilian universities and research institutes. The CSC helped shape and develop a Research Program for the Carbon Sink Project, and advised research projects conducted in the area.

### **Research Programs**

The main research areas of the Project are Carbon Dynamics, Biodiversity, Forestry, Socio-economic Studies and Environmental Education. Nearly 10,000 visitors have already attended to the Environmental Education Program, including school students and teachers of the Cotriguaçu and Juruena municipalities.

Studies of Carbon Dynamics and Forestry are closely associated as carbon sequestration progress is measured throughout tree growing measurements (Nunes et al., 2013) and allometric equations. Some carbon studies addressed soil carbon dynamics (Cerri, et. al., 2007, Moreira et. al., 2009) and some forestry studies are currently developing the local models to recover depleted riparian vegetation zones.

Socio-economic studies are based on the Project's understanding that preservation of the native forest and reduction of deforestation pressure requires the assessment of the needs of the population living in nearby settlements. The Project encouraged peasants to collect Brazil nuts inside the Fazenda São Nicolau and to sell them for their own profit. Other similar initiatives were proposed and tested by the Project, such as agroforestry systems, woodwork professional capacitation classes, and detailed studies of the productive chain in the region. Socio-economic studies were implemented through a program titled Experimental Platform for Amazon Rural Territories Management (PETRA) funded by the French Global Environment Facility (FFEM), implemented from 2013 to 2018.

Biodiversity studies are also very productive within the many natural and man-made landscapes of the Fazenda São Nicolau. After the main part of the reforestation was established, researchers started to increase their activities at Fazenda São Nicolau. Ecology field classes for Post-Graduate Programs of the Federal University of Mato Grosso, several masters dissertations and doctoral thesis from Brazilian and French

universities were also conducted in the area. The close partnership between researchers and the Project has produced over 40 scientific publications, most of them in the Biodiversity field of knowledge.

New species have been discovered in the Fazenda São Nicolau, including a species of fish (Ingenito et al., 2013), 23 species of beetles (Genier, 2010, Frolov et al., 2017, Nunes et al., 2018), comprising eight species of Scarabeidae and 15 species of Histeridae. Six of the new species of Scarabeidae have their holotype designated from material collected in the Fazenda São Nicolau, and four are exclusively known from the Fazenda São Nicolau. Currently one species of bird is being studied as a possible undescribed species. Many more are yet to be described based on material that is still under examination by specialists.

Biodiversity components with medical applications are also under investigation, including frogs that produce toxins that can provide treatments for malaria and cancer (Ferreira et. al., 2013, Banfi et. al., 2016, Kerkhoff, et. al, 2016, Ferreira et. al., 2017). Other studies targeted the value of reforestation comparing undisturbed native forest sites with pasture and abandoned pasture sites. These sites were compared based on species abundance, species richness and functional diversity of termites as indicators of nutrient availability through decomposition. Reforestation sites were found to be similar to undisturbed native forest sites, showing that after 15 years the young planted forest developed a healthy nutrient cycling process (Paula et al., 2015).

A doctoral study of mammal activity using camera traps has shown that nearly half of the large mammals have been affected by deforestation outside the Fazenda São Nicolau. In native forest sites 25% of the large mammals increased their presence as a result of escaping from habitat loss outside the Fazenda, and 12% decreased their activity in the area, possibly as a consequence of the rising activity of other species. Jaguar (*Panthera onca*) increased its activity both at the native forest and the reforestation sites. This increase was closely followed by the reduction of activity of the tapir (*Tapirus terrestris*), and the elimination of puma (*Puma concolor*) in both areas (Trinca, 2014).

### **Final remarks**

Considering the steady increasing loss of habitat due to deforestation near the Fazenda São Nicolau, it is recommended ecological corridors connect the Fazenda São Nicolau to other large areas of forest, such as indian reservations and conservation units.

The Project has achieved considerable success assessing the biodiversity in the area, particularly identifying and describing new species. Very little is known of the biodiversity in the Northwest of Mato Grosso, and not much is understood about the process of recovery of abandoned pasture areas or the best model to recover deforested areas. The need for such knowledge makes the Peugeot-ONF Forest Carbon Sink Project a high-value open natural laboratory. Further research is encouraged and new partnerships are always welcomed.

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