

Chapter 2. Current conservation trends in the Beanka Reserve, Melaky Region, western Madagascar

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Abstract

Beanka Reserve, located in central western Madagascar, consists of a dry deciduous forest growing on exposed limestone (*tsingy*). With less than 3% of Madagascar's dry deciduous forests remaining, this 17,000 ha reserve is of significant ecological value, harboring a rich diversity of plants and animals. A Malagasy non-governmental organization (NGO), Biodiversity Conservation Madagascar (BCM), established and supported by Bioculture (Mauritius) Ltd. has been managing the reserve since 2007. BCM employs and trains people from the local communities surrounding Beanka as forest guards and conservationists. Currently, one of the greatest threats to dry deciduous forests is the uncontrolled burning of surrounding fire-prone grasslands. Fires, which are often deliberately set in the grasslands to stimulate vegetational growth for cattle pasture, can on occasion spread to the adjacent forests. As the forest formations of this critically endangered habitat are very susceptible to fire damage, there is little potential for the vegetation to regenerate after the passage of wildfires. Reintroducing giant tortoises, which once foraged as herbivores in grassy vegetation and, hence, limited the intensity and frequency of fires, could be a landscape-based approach to managing and conserving the dry deciduous forests of Beanka. Not only would Aldabra giant tortoises (*Aldabrachelys gigantea*), believed to be synonymous to the extinct Madagascan giant tortoise (*A. abrupta*), help to control wildfires, but they will also play an important role in dispersal of many large-seeded plants, which are believed to have lost their dispersal partners following the extinction of Madagascar's megafauna.

Keywords: Biodiversity Conservation Madagascar, conservation activities, dry deciduous forest

Résumé détaillé

La réserve de Beanka, située dans le Centre-ouest de Madagascar, est peuplée d'une forêt sèche décidue sur calcaires (*tsingy*), qui abrite une grande diversité de plantes et d'animaux. Tenant compte du fait qu'il reste moins de 3 % de ce type de forêt à Madagascar, les 17 000 ha de cette réserve ont une valeur écologique de premier ordre. Une organisation non-gouvernementale malgache, Biodiversity Conservation Madagascar (BCM), mise en place et financée par Bioculture (Mauritius) Ltd., a pris en charge la gestion de la réserve depuis 2007. BCM emploie et forme les habitants des communautés locales voisines de la réserve comme gardes forestiers et acteurs de la conservation.

En échange de leur apport à la conservation de la forêt, les communautés locales sont récompensées par des indemnités écologiques, mais aussi par des formations sur la production agricole, ainsi que la mise à disposition de plants d'arbres fruitiers et d'infrastructures. Cette approche doit assurer la viabilité à long terme des projets de conservation de BCM. Une autre facette dans la conservation du milieu et de ses habitants à long terme proposée par BCM est la réintroduction de la tortue géante. Actuellement, la menace la plus importante qui pèse sur les forêts sèches est la propagation des feux incontrôlés des prairies environnantes. Ces feux sont souvent allumés intentionnellement pour améliorer le pâturage. La végétation des forêts est très sensible aux feux et se régénère très difficilement après leur passage. Chaque année, en conséquence, la lisière forestière recule, menaçant la survie d'une flore et d'une faune caractérisées par de hauts taux d'endémisme spécifiques, génériques et familiaux. La réintroduction de la tortue géante, qui jouait autrefois un rôle important dans le contrôle de la fréquence et de l'intensité des feux, pourrait constituer une approche paysagère pour la gestion et la conservation des forêts sèches décidues. La tortue géante d'Aldabra (*Aldabrachelys gigantea*), qu'on considère comme vraisemblablement

consécutive de la tortue géante de Madagascar (*A. abrupta*) aujourd'hui éteinte, pourrait jouer ce rôle. Elle permettrait par ailleurs d'augmenter le potentiel de dispersion des espèces végétales à grosses graines, dont les vecteurs de distribution, à savoir la mégafaune est aujourd'hui éteinte. Le retour d'une lignée de ces tortues disparues pourra vraisemblablement aussi contribuer à assurer des gains socio-économiques pour les populations locales.

Mots clés : Biodiversity Conservation Madagascar, activités de conservation, réserve de Beanka, forêt sèche décidue

Introduction

Beanka Reserve is situated approximately 60 km east of Maintirano in the Melaky Region in the central west of Madagascar. It covers an area of approximately 17,000 ha. The majority of the reserve consists of western dry deciduous forest growing on limestone (*tsingy*) (Chatelain *et al.*, 2013; Rakotozafy *et al.*, 2013), but also includes degraded deciduous forest areas growing on red soil and some open areas around the main forest block. Although the limestone of Beanka is not contiguous with that of the Bemaraha National Park to the south, it is often described as the 'northern projection of Bemaraha'.

The reserve was named Beanka by Greg Middleton, based on a name for the limestone region to the northeast of Ambinda village (now the southern part of the reserve) as indicated on the Institut Géographique National (Paris) topographic sheet "Antranogoika" F-45; 1:100,000 of 1965. *Beanka* means 'the place of many owls' in the local Sakalava dialect. More specifically, *hanka*, refers to the Madagascar Long-eared Owl (*Asio madagascariensis*), which is still notably common in the local forests.

Biodiversity Conservation Madagascar (BCM)

BCM is a registered non-governmental Malagasy Association dedicated to conservation. The organization was established in 2002 (registration n° 409/02-PA/ANT/SPAT/ASS) and serves as the Madagascar conservation arm of Bioculture (Mauritius) Ltd.; it is fully funded by this Mauritian company. The Bioculture Group is involved in the commercial captive breeding of monkeys, crocodiles, and tortoises and has a strong philosophy of

conservation and animal welfare. The development of its conservation project on Madagascar stemmed from the idea that as Bioculture uses a non-human primate (*Macaca fascicularis*) for its breeding operations, it should thus contribute to primate conservation. As there are no native non-human primates on Mauritius, Bioculture channeled its conservation efforts to protect these animals in nearby Madagascar. Hence, BCM's main goal is to conserve threatened forests with high biodiversity value, particularly those rich in lemurs.

BCM's first conservation project involved the lowland rainforest of Sahafina – a 2,400 ha block of forest to the west of Brickaville – Région Antsinanana. This forest was selected by BCM because it is rich in lemurs and because of imminent danger of destruction by commercial loggers. There are nine lemur species present (including a recently described species *Microcebus gerpi*) (Radespiel *et al.*, 2011) and a high density of indri (*Indri indri*). It is also the last forest block in the entire Brickaville District and is thus of the highest biodiversity value. BCM secured the "Conservation Lease" of Sahafina in 2003 (161 MIN.ENV.EF/SG/DIREEF5) and has since then been responsible for the protection of this forest. BCM employs 24 people at Sahafina, including 18 forest guards, four plant-nursery attendants, one agricultural extension officer, and a local manager. All the employees are from villages surrounding the forest and have been trained by BCM.

BCM and Beanka

After the Sahafina Forest project was well established, it was decided to look for a second site in Madagascar. We used the following criteria to select our second conservation site:

- 1) **Biodiversity value:** The site had to have important biodiversity value including high lemur and high land snail diversity. The latter group of organisms is of considerable research interest to certain members of BCM.
- 2) **Threat risk:** It was important to choose a site that needed protection i.e. habitat facing strong short to medium term destruction risks. There was no need to protect sites that were not under any threat. The forest also had to have the status of "*non-classée*" (unprotected), that is to say not already part of Madagascar's protected area system.
- 3) **Good chances of project success:** It was important to choose a site where we considered the existing threats were manageable. Thus,

we did not consider sites where the threat from activities such as artisanal (sapphire) and large-scale mining and clearing of forest for vanilla cultivation were judged to be un-stoppable. This was summed up as “choose battles you have a chance of winning”.

- 4) Competing NGOs:** We wanted to choose a site that would not put us in any “conflict” or “competition” with existing conservation organizations. It was felt that Madagascar was big enough and the threats to its biodiversity so great that there was no point in wasting resources by competing with existing conservation projects.

Using these criteria, we looked at sites in Madagascar’s northeast, northwest, and central west. On the basis of the above, Beanka was selected as the best potential site.

Following the identification of Beanka as our second proposed site, BCM entered into discussions and consultation with the local communities living adjacent to the forest. They were supportive of our

wish to protect the forest and the future its native plants and animals.

After completing a series of complex applications with the regional and central governments (Eaux et Forêts), the conservation management of Beanka was granted to BCM on the 13 April 2007 under “Convention de Gestion 143-07/MINENV/SG/DIREEF4”. This was formalized locally with a *joro* (Figure 2-1), that is to say a ceremony asking for the benediction of the ancestors, held on 27 October 2009 at Ambinda, which was attended by over 400 people, mostly from local communities, as well as government and NGO representatives.

BCM conservation programs at Beanka

The conservation project at Beanka is unique to Madagascar, as it was established before any major ecological problems, other than fire, existed. With respect to portions of western Madagascar in the immediate vicinity of the Beanka Forest, hunting of wild animals is notable reduced, but such



Figure 2-1. The official inauguration of the Beanka Forest conservation project took place on 27 October 2009 during a *joro* (known as *soloho* in the local Sakalava dialect), that is to say a ceremony asking for the benediction of the ancestors, held in the village of Ambinda. This ceremony was attended by over 400 people, mostly from local communities, as well as government and non-governmental representatives. Here is shown the site of the benediction with the heads of four sacrificed zebu. (Photograph by Achille P. Raselimanana.)

pressures do exist (Figures 2-2, 2-3 & 2-4). Our main proactive approach to protecting Beanka's forest uses 'conservation payments'. Essentially, the local communities receive direct material benefits in exchange for supporting the conservation project. The most direct benefits are in terms of employment.

BCM Beanka now employs 13 people: one local manager, two plant-nursery attendants, and 10 forest guards, with 12 of these employees coming from local villages such as Ambinda. In addition, BCM is committed to various programs to assist local communities.



Figure 2-2. Local hunting pressure in the Beanka Forest is relatively limited, but does occur. Here are shown three diurnal and endemic lemurs, *Eulemur rufus*, that have been trapped and to be consumed by local people. (Photograph by BCM.)



Figure 2-3. The largest endemic Carnivora on Madagascar, *Cryptoprocta ferox*, is normally forest dwelling. On occasion it enters into villages to predate on domestic fowl and in some cases is dispatched by local people. This is the case shown here of this endemic animal killed in Ambinda after it attempt to predate on fowl. (Photograph by BCM.)



Figure 2-4. During the warm and rainy period there is considerable local hunting of the endemic *Tenrec ecaudatus* (Tenrecidae). Here a local boy is shown returning to the village of Ambinda with his catch of *trandraka*, which is an important protein supplement in the diet of local people. (Photograph by Steven M. Goodman.)

These include:

- Growing and planting *Eucalyptus* trees as source of fuel and construction materials. Since 2010, over 7500 trees have been planted next to the villages adjacent to the forest: Ambinda, Ankilimanarivo, Belitsaky, Vohimiary, Kiranomena, Antsalovakely, and Mangabe. Survival rates of planted trees are high (75%).
- Growing and planting of fruit trees as a food/income supplement for local villages. Three tree species have been chosen: orange, coffee, and *Moringa* (the leaves of this tree are used as greens and medicinal qualities). To date around 3000 have been planted at the aforementioned villages. Survival rates are also high (75%). BCM intends to plant a wider range of fruit trees in the near future.
- Beanka is being developed as an ecotourist site and paths through the reserve are being constructed. Revenue from such visits will be reinvested into the village projects to support the local communities. A number of sign posts delimiting the reserve have also been installed (Figure 2-5).
- BCM provided materials to build four water wells: two at Ambinda (7 and 14 m deep), one at Vohimiary (6 m deep), and one at Kiranomena (10 m deep). These have considerable importance to assure water quality for local people (Figure 2-6).
- Local village communities have received training in how to effectively grow the following vegetables: carrots, green vegetables, onions, tomatoes, and cucumber (Figure 2-7). In addition, approximately 300 seed packets are supplied annually by BCM.
- Training to improved rice growing techniques have included the demonstration at Ambinda of a particular growing procedure (*système de riziculture améliorée*). With this system, yields are estimated to be around 4-5 tons per hectare, which represents a significant improvement from traditional methods (Figure 2-8).
- Proposed future projects also include building a primary school and a health clinic at Ambinda.
- Environmental awareness and education programs, which include regular communications with the local communities, have raised their awareness of the importance of preserving the forest and its biodiversity (Figure 2-9).

We adopt this conservation payment approach, as we believe that it will be an effective, long-term solution to conserving the Beanka Forest and its unique plants and animals.



Figure 2-5. In order to help with the management of the reserve, BCM has installed delimitation posts around the periphery. It is noted on the sign here, “protected forest – no trespassing – attention fire! Punishable by a fine (BCM)”. (Photograph by BCM.)



Figure 2-6. BCM has financed the digging and installation of wells in villages in close proximity to the Beanka Forest, which have had important implications to assure the quality of drinking water for local people. (Photograph by BCM.)



Figure 2-7. Local people have received training on how to better grow a number of different vegetable crops, which has an important impact on nutrition and the creation of a local market economy. (Photograph by BCM.)



Figure 2-8. A considerable effort has been made to augment local rice production using new techniques that increase yields from traditional methods. (Photograph by BCM.)



Figure 2-9. Education programs, including environmental awareness, is an important aspect to advance local conservation programs. Local communities surrounding the Beanka Forest have taken part in regional meetings, such as this group of women from the village of Ambinda. The sign the young girl is carrying reads “women of Ambinda protect the environment”. (Photograph by BCM.)

Giant tortoise re-introduction at Beanka

As part of another long-term approach to conserving and protecting the forest, BCM is currently advancing a program to reintroduce giant tortoises to Beanka. The plan is this will take place sometime before 2018. The rationale for introducing Aldabran giant tortoises is not such a strange idea. The richness and spectacular array of Madagascar’s native wildlife is a fraction of what once resided on the island a few millennia ago (Goodman & Jungers, 2013). Elephant birds, pygmy hippos, giant lemurs, and giant tortoises were an important ecological component of the landscape before the arrival of humans, which is estimated to have taken place about 2,500 years ago. Subsequently, all of the large-bodied animals disappeared, and until recently were believed to be extinct. However, there is growing evidence that a surviving lineage of one of Madagascar’s extinct giant tortoises is alive today in the form of the Aldabran giant tortoise, *Aldabrachelys gigantea*. Aldabra is an atoll in the western Seychelles and

265 km to the northeast of northern Madagascar. Of the two species of extinct Malagasy giant tortoises, *A. grandidieri* and *A. abrupta*, genetic and morphological evidence indicates that the living form of *A. abrupta* is the animal from Aldabra (Arnold, 1979; Palkovacs *et al.*, 2002; Pedrono *et al.*, 2013). Indeed, fossil evidence indicates that giant tortoises once occurred throughout the western lowland regions of Madagascar (Pedrono, 2008) and they would have presumably roamed throughout the forests of Beanka.

Our rationale for reintroducing giant tortoises is because of their importance in helping to support and protect the forest. Giant tortoises are ecological keystone species and ecosystem engineers, particularly in island communities (e.g., Hansen *et al.*, 2010; Griffiths *et al.*, 2011). This means that they have a disproportionately large effect on their environment and play a critical role in maintaining the structure of a natural ecological community. The loss of such important species such as giant tortoises can lead to

considerable changes in the ecosystem. For instance, it has been documented that the loss or decline in abundance of giant tortoises, often concurrent with the loss of other large-bodied terrestrial vertebrates, has had considerable impact on the interactions of different organisms within the local system and caused other extirpation or extinction events (Owen, 1980; ESKILDSEN *et al.*, 2004; HANSEN *et al.*, 2008, 2010; HANSEN & GALETTI, 2009; GRIFFITHS *et al.*, 2010, 2011).

In Madagascar, giant tortoises would have influenced plant species composition and structure and nutrient cycling by seed dispersal, grazing, browsing, trampling, digging, urinating, and defecating (ANDRIANTSARALAZA *et al.*, 2010, 2013; GIBSON & HAMILTON, 1983; GRIFFITHS *et al.*, 2010, 2011, 2013; PEDRONO *et al.*, 2013). By consuming the vegetation and leaf litter, they played a crucial role in reducing the amount of flammable above ground biomass and therefore reduced the intensity and frequency of fires (BURNLEY *et al.*, 2004).

While Beanka's dry deciduous forests are characterized by very high local plant and animal endemism at the species, genera and family levels (RAVELOMANANA & FISHER, 2013), they are also heavily threatened. Over 97% of Madagascar's dry deciduous forests have been destroyed by uncontrolled burning and clearing for grazing and agriculture (SMITH, 1997; WHITEHURST *et al.*, 2009). Fires, which are often started deliberately in the surrounding grasslands to renew and improve cattle pasture, spread to the adjacent forests. As the trees and shrubs of these forest habitats are very susceptible to fire damage being generally thin-barked, there is little potential for the forest flora to regenerate after wildfire damage (BLOESCH, 1999). Further, these fires presumably have a negative impact on the seed bank resting in shallow portions of the soil.

Grasses, which have low faunal and floral diversity, dominate the resultant secondary savannas and have been described as virtually sterile



Figure 2-10. La Vanille Réserve des Mascareignes (another Bioculture Group company) has a breeding colony of Aldabra giant tortoises. Portions of this captive population have been introduced to the François Leguat Giant Tortoise and Cave Reserve on Rodrigues Island. A remarkable transformation of the local vegetation has taken place in a period of just a few years. (Photograph by Arnaud Meunier.)

landscapes (WWF, 2013). With an expanding rural population and increasing degradation of existing arable lands, the pressure on Beanka's dry forest is forecasted to increase, and the remnants of this critically endangered habitat could disappear. Hence, finding effective long-term, low cost solutions to conserve the dry deciduous forests of western Madagascar are paramount.

Another threat to the Beanka Forests, albeit less obvious, has been the loss of large seed dispersers, best associated with habitat loss and humans hunting wild animals (Dirzo & Miranda, 1990; Wright, 2003; Stoner *et al.*, 2007). Large-seeded plants, which are reliant on large frugivores-grainivores for the dispersal of their seeds, are especially at risk following the extinction of or decline in abundance of large frugivores. Since seed dispersal is critical for healthy plant populations as it allows plants to colonize new areas or recolonize naturally disturbed or human degraded areas, preserving and restoring

plant-frugivore interactions is thus a key priority for biodiversity maintenance (Jordano, 2000).

At BCM, we recognize that restoring large grazers and seed dispersers, which once created and maintained Beanka's ecosystems, is vital for its future. Hence, BCM in collaboration with La Vanille Réserve des Mascareignes (another Bioculture Group company) and Bioculture Ltd. in Mauritius propose to return at Beanka native giant tortoises to their natural habitat after an absence of something approaching at least 750 years (Figures 2-10 & 2-11). This reintroduction is expected to fulfill multiple functions:

- 1) Conserve the dry deciduous forests of Beanka by reducing the fire fuel load in more grassland areas and thereby minimizing the impact of annual fires.
- 2) Restore key ecosystem functions once performed by the extirpated *A. abrupta*, which in turn will bolster natural ecosystem functioning and preserve the remnant flora and fauna.



Figure 2-11. The transportation of Aldabra giant tortoises from La Vanille Réserve des Mascareignes in southern Mauritius to the Beanka forest will be an important undertaking. In the context of another project, here is shown a not fully grown animal being prepared for translocation. (Photograph by Arnaud Meunier.)

- 3) Provide a low-cost, landscape-based solution to conserving Madagascar's dwindling dry deciduous forests.
- 4) Secure socio-economic gains for the local populace by providing jobs; and
- 5) attracting eco-tourists to the western forests to appreciate their rich biodiversity.

The procedures to begin this re-introduction are only now being undertaken. When the project is fully operational it is proposed to re-introduce approximately 1000 tortoises over the next 5-10 years.

Conclusion

BCM plans to continue to work with local communities to protect its two threatened forests of high conservation value, Beanka and Sahafina. Both reserves are now registered under and listed as part of the country's Nouvelles Aires Protégées (NAP) of the Système des Aires Protégées de Madagascar (SAPM). We are confident that our community-based approach to conserving the Beanka Forest is successful, as we have seen significant declines in illegal logging and hunting activities. While the reserve is now a sanctuary for different plants and animals, which have disappeared from surrounding areas, wildfires remain a constant threat to these fire-sensitive forests. Reintroducing giant tortoises could thus be a low-cost, landscape-based approach to limiting the damage caused by annual wildfires and restoring ecological balance.

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