

# 4

## Beza Mahafaly Special Reserve: A Research Site in Southwestern Madagascar

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### 4.1. Lemur Studies at Beza Mahafaly

In the mid-1970s, R.W. Sussman received a late-evening phone call. “What can we do to save Madagascar’s wildlife!?” the caller exclaimed. The caller was Edward (Ted) Steele, a member of the board of directors of Defenders of Wildlife (DOW), a conservation organization based in Washington, D.C. Mr. Steele had recently returned from Madagascar and had fallen in love with its animals, plants, and people (Steele, 1975). It just so happened that Sussman along with Alison Richard, then at Yale University, and Guy Ramanantsoa, then at the School of Agronomy, University of Madagascar, had been discussing the possibility of establishing a unique type of reserve somewhere in Madagascar—a reserve that would protect the flora and fauna, be used as a teaching and education center, and that would be accepted, integrated, and user friendly and provide developmental assistance to the neighboring local inhabitants. Sussman explained our vision to Mr. Steele, and he set up a meeting of board members of DOW with A.F. Richard and R.W. Sussman. The board was impressed with the idea; however, DOW did most of its work within the United States and was mostly involved in litigation. Therefore, one of the board members, Dr. Richard Pough, who was also a member of the board of directors of World Wildlife Fund, volunteered to present our ideas to WWF, and that organization agreed to fund the project. At that point, Professor Ramanantsoa began to survey areas in western and southern Madagascar in an attempt to find an undisturbed area with a diversity of flora and fauna that was relatively accessible. Another criteria was that the local inhabitants would be agreeable to and would actively participate in the project.

At Beza Mahafaly, Guy Ramanantsoa found a beautiful region that represented the dry forest habitats of southern Madagascar and local inhabitants who were conscious of the necessity to preserve this unique natural habitat. In July 1978, the Popular Consul of the local government of Beavoha (Commune de Beavoha) agreed to officially cede two noncontiguous parcels of forest to the Department of Water and Forests of the School of Agronomic Sciences (Ecole Supérieure des Sciences Agronomiques, Département des Eaux et Forêts; ESSA/Forêts), University of Madagascar (now University of Antananarivo). Thus, ESSA/Forêts

began collaborative work with Yale University, Washington University, and with local, national, and international partners to establish the Beza Mahafaly Reserve. Research, education, and development projects were begun soon thereafter. On June 4, 1986, Beza Mahafaly was officially inaugurated as a Réserve Spéciale (Special Reserve) by official government decree No. 86-168. In 1989, WWF took over management of the reserve, and in November 1995, ESSA/Forêts officially became the principal operator and administrator of the Beza Mahafaly Project, with WWF continuing to be a major supporter through the refunding of debt program for the conservation of nature. Research, training and education programs, and local development projects have continued to flourish since ESSA/Forêts took over administration of the reserve. The site has hosted a multidisciplinary field course for fifth-year ESSA/Forêts students since 1986 (Ratsirarson, 2003). Additional support has been received from the Liz Claiborne and Art Ortenberg Foundation in collaboration with Yale University to involve the local community in research programs. Recently, in 2004, the management of Beza Mahafaly Reserve, like all the protected areas in Madagascar, has been transferred to ANGAP (National Agency to manage the network of protected areas in Madagascar), and the University of Antananarivo through ESSA/Forêts remains the main partner of ANGAP for research and training activities.

The Special Reserve of Beza Mahafaly is located 35 km to the northeast of Betioky-Sud, at 23 °41'60" latitude south, and 44 °32'20" and 44 °34'20" longitude east (Figure 4.1). The reserve is made up of two noncontiguous parcels separated by 10 km. The first parcel (parcel no. 1) is characterized by a gallery forest dominated by *Tamarindus indica*. It covers an area of 80 ha of fenced and protected forest but is contiguous with a relatively small area (possibly another 200 ha) of unprotected gallery forest. This forest is located on the banks of the Sakamena River, a tributary of the Onilahy River, which is approximately 8–10 km north of the reserve. Southern Madagascar is characterized by a long dry season (<40 mm of rain/month) and a short wet season (>50 mm rain/month), although the amount of rain can vary throughout the year. Annual rainfall in the region of the reserve is about 750 mm of which 600 mm falls during the austral summer, November–March. The Sakamena River is normally dry during the long dry season. The wet season is also characterized by high ambient temperatures, averaging around 34 °C and reaching highs of 48 °C. Temperatures during the coolest months (July–August) usually range between 23 °C and 30 °C, but can fall to 3 °C at night. Annual temperatures average 25 °C (Sussman and Rakotozafy, 1994; Ratsirarson et al., 2001, Ratsirarson, 2003).

The gallery forest (parcel no. 1) is divided by marked transects whose paths intersect to form squares of 100 m × 100 m. This parcel was completely enclosed by barbed wire fence in 1979. Before this, it was exposed to cattle and goats and used by the local people for various resources, as is the surrounding forest currently. This gallery forest lies on flat terrain at an altitude of 100–200 m. Fenced parcel no. 1 is surrounded by similar but unprotected and somewhat degraded gallery forest on the north and south. To the east of the parcel is the Sakamena River. To the west is contiguous dry forest. The parcel is also bounded on the

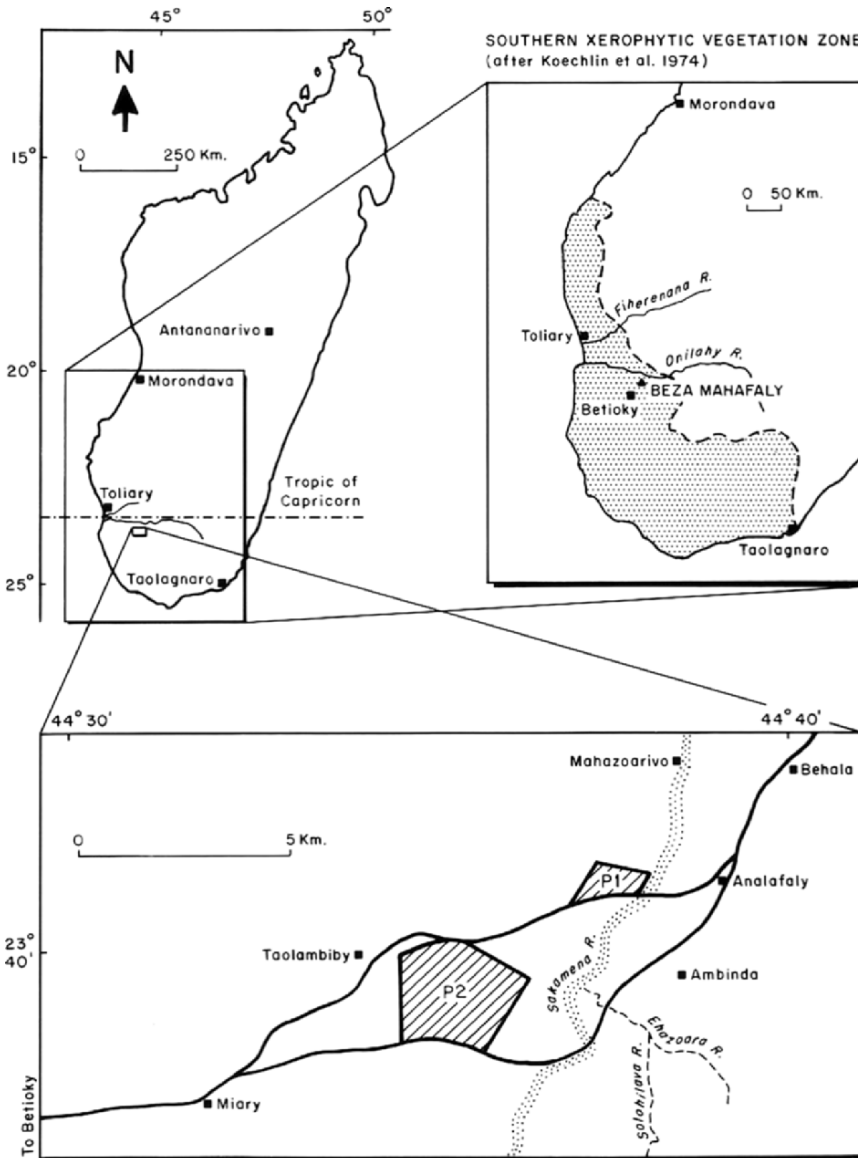


FIGURE 4.1. Location of the Beza Mahafale Special Reserve (P1, parcel no. 1; P2, parcel no. 2).

south by the dirt road that runs from Betioky to the reserve and on to the next small village of Analafaly about 2 km east. The reserve campsite and reception center is just south of the road adjacent to parcel no. 1. There is one large and another small wooden house, a museum, an office building, and a large open gazebo for courses and meetings. There is also open space for camping.

The forest represented in parcel no. 1 may be classified as western Malagasy dry deciduous forest (White, 1983). It has an average of 369 individual trees of  $\geq 2.5$  cm Diameter at Breast Height (DBH)/1000 m<sup>2</sup> (Sussman and Rokotozafy, 1994), which is typical of dry forests in continental Africa and the Neotropics (Gentry, 1993). In this parcel, vegetation varies according to the depth and moisture content of the soil. On drier soils away from the river there are fewer tall trees, but vegetation becomes denser. Distinctions between the canopy strata are obscured, and forest gradually passes into thicket. On more moist soils closer to the river, large *Tamarindus indica* trees are dominant. The proportion of trees over 10 cm DBH is similar in both microhabitats, and it is only in trees above 25 cm DBH that a distinction is seen between wet and dry soils.

On wet soils, the upper strata forms a closed canopy, mostly uniform in height (15–20 m). Members of the upper stratum are species whose trunks generally exceed 25 cm DBH and may attain 50 cm or more, especially on wet soils. The most common canopy species are *Tamarindus indica*, *Acacia royanae*, *Euphorbia tirucalli*, and *Salvadorea angustifolia*. Other species of large trees include *Commiphora* spp., *Gyrocarpus americanus*, *Terminalia* spp., *Quivisia the papinae*, and *Acacia bellula*. Most trees in the forest are small, constituting a middle stratum from about 2 to 15 m tall. The most common of these are *Azima tetracantha*, *Crateva excelsa*, *Gardenia* spp., *Gelonium adenophorum*, *Grewia* spp., *Rhizozum madagascariensis*, *Rhopalocarpus lucidus*, *Stereospermum variabile*, and *Tarenna pruinosa*. Only two species of tree are common throughout the forest: *Tamarindus indica* and *Azima tetracantha*. In general, those species found in both microhabitats are not equally distributed, and five of the most common species are found mainly on wet soils and eight mainly on dry soils.

In 25 identified transects, 25 plant families were represented with plants with Tiliaceae having the most species (15), followed by Burseraceae (7), Leguminosae (7), and Euphorbiaceae (6). At least two families, Sphaerosepalaceae and Didieriaceae, are endemic. Seventy-eight percent of 69 woody species  $\geq 2.5$  cm DBH in these transects were found to be native, and 26% of the 43 genera also were native (Sussman and Rokotozafy, 1994). Ratsirarson et al. (2001) found that, overall, this parcel contained approximately 120 species and 49 families of plants. However, half of the families were represented by a sole species.

The second parcel (parcel no. 2) is xerophytic, desert-like forest dominated by species adapted for the long dry season. This parcel is often referred to as spiny forest and is dominated by *Alluaudia procera* of the endemic family Didieriaceae. The second most common species is *Cedrelopsis grevei*. Other families represented are Burseraceae, Ptaeroxylaceae, Tiliaceae, Euphorbiaceae, and Combretaceae. The medium height of trees is 4.5 m, with a medium diameter of 6.5 cm (Ratsirarson et al., 2001). Parcel no. 2 is approximately 520 ha in size and is located southwest of parcel no. 1. This forest has been the subject of fewer studies than the gallery forest.

In a study of the phenology of Beza Mahafaly, Ratsirarson et al. (2001) found that most species lose their leaves during the long dry season, April to November. Most species produce fruit annually but there might be a massive production every other year in some species (such as *Azima tetracantha* and *Salvadorea*

*angustifolia*). The flowering season is normally between October and February with a peak in December (Ratsirarson and Silander, 2003). In general, flowering corresponds with the rainy season, but flower buds for most species begin to appear at the end of the dry season when the plants no longer have leaves. *Tamarindus indica*, generally, flower for 8 months of the year (November–June), but flowers are often present on some individual trees throughout the year. During the driest and hottest portion of the year, between June and September, leaves, flowers, and fruit are all rare (Ratsirarson et al., 2001).

The region between the two noncontiguous parcels of the reserve is represented by transitional vegetation between the gallery and the xerophytic habitat, dominated by smaller trees (such as *Grewia* spp.) and shrub. This vegetation is more or less degraded because of intensive utilization as grazing land and for the collection of various forest products for food, medicines, building, and so forth. As stated above, the gallery forests surrounding parcel no. 1 are also degraded.

## 4.2. Fauna

There are four species of lemurs at Beza Mahafaly. The diurnal species are *Propithecus verreauxi*, the Verreaux's sifaka; and *Lemur catta*, the ringtailed lemur. The nocturnal species are *Lepilemur leucopus*, the white-footed lepilemur; and *Microcebus griseorufus*, the gray-and-red mouselemur. *Cheirogaleus medius*, the fat-tailed dwarf lemur, has been recorded within a kilometer of the reserve. *Microcebus murinus*, the gray mouselemur, is not found in the reserve (Godfrey and Rasoazanabary; pers. comm. to M. Sauther).

There are four species of bats found in the reserve: *Pteropus rufus*, *Hipposideros commersoni*, *Tadarida jugularis*, and *Taphozous mauritanus*. *Preropus rufus*, the giant fruit bat, is rare at Beza Mahafaly and does not have a colony within the reserve. The other three species are Microchiroptera. They are small, insectivorous bats. Another small, insectivorous bat, *Mormopterus fugularis*, has been identified in the pellets of the long-eared owl (*Asio madagascariensis*). Other small mammals include the tenrecs: *Echinops telfairi*, the pseudohedgehog; *Geogale aurita*, the large-eared tenrec; *Setifer setosus*, the spiny tenrec; and *Tenrec ecaudatus*, the large tenrec. The highest known density of the large-eared tenrec is at Beza Mahafaly (Stephenson, 2003). Rodents include two introduced species, the black rat, *Rattus rattus*, and the mouse, *Mus musculus*. Both of these species reproduce prolifically and are considered serious pests (Youssof, 2004). The endemic Madagascar tree-rat, *Eliurus myoxinus*, is in the reserve but is rare.

Three species of carnivore exist at Beza Mahafaly. Two of these are introduced: *Viverricula indica* and the free-ranging, wild domestic-like cat, *Felis* spp. The latter species has larger and more pronounced ears than the domestic cat and shows some genetic differences (Goodman, pers. comm. to Ratsirarson et al., 2001).

The endemic fossa, *Cryptoprocta ferox*, is found here but is rare. The nocturnal, wild boar, *Potamochoerus larvatus*, lived in the reserve and was hunted for

meat by the local people (Ratsirarson, 2003), but has not been observed in the reserve for many years (Sauther pers. comm.).

One hundred two species of birds representing 43 families have been observed at Beza Mahafaly. More than half of the families are represented by only one species. Of the 102 species, 27 are endemic and approximately 40 species are seen year-round in both parcels of the reserve (Ratsirarson et al., 2001). Besides being the home for many of these birds, Beza Mahafaly is a resting or breeding stop for many migrating birds. The Madagascar blue pigeon, *Alectroenas madagascariensis*, was observed in the reserve once in 1998.

The Beza Mahafaly Reserve is home to at least 15 species of snakes, 18 species of lizards, 2 species of tortoises and 1 freshwater turtle, and 1 species of crocodile (Ratsirarson et al., 2001). Three species of amphibian also are found here. Among the snakes, 13 species are of the family Colubridae. The families Boidae and Tylopidae are monospecific. Five families of reptiles are represented: Chamaeleonidae (12 species), Gekkonidae (7 species), Iguanidae (3 species), Cordylidae (12 species), and Scincidae (4 species) (Ratsirarson 2003). One species of Scincidae, *Amphiglossus splendidus*, was recently discovered in this region. It is a rare, semiaquatic species that was previously only known from the Fort Dauphin area. The Iguanidae, *Oplurus fierinensis*, is unique to the southwest of Madagascar. The Gekkonidae is very diverse with six genera represented by seven species. The two species of tortoise found in the reserve are *Geochelone radiata* and *Pelusios subniger*; and the freshwater turtle is *Erymnochelys madagascariensis* (Brockman, pers. comm.). The crocodile, *Crocodylus niloticus*, is seasonal along the Sakamena River. Amphibians are represented by three species from two families: Mantellidae (*Mantella* spp.) and Ranidae (*Ptychadena mascareniensis*). Little is known of these amphibians.

There also is a notable diversity of insects at Beza Mahafaly. This includes 105 species of lepidopterans from 16 families, 46 species of beetles from 17 families, and 28 species of hymenopterans from 9 families (Ratsirarson, 2003).

### 4.3. Lemur Studies at Beza Mahafaly

As part of the process of establishing the Beza Mahafaly Reserve, a student of ESSA, Randrianaivo Raymond, completed an inventory of the lemurs in the region. This became his Memoire de Fin D'Etude for the University of Madagascar (Randrianaivo, 1979). Shortly after the reserve was established, Ratsirarson Joelisoa conducted the first study of lemurs in the reserve-proper. He compared the ecology and behavior of ringtailed lemurs in the two different habitats and was the first to capture and collar lemurs in the reserve (Ratsirarson, 1987). Since that time, many Malagasy students have taken courses at the reserve, and many Memoire de Fin D'Etudes for Malagasy students mainly from ESSA/Forêts have been completed from research on lemurs as well as on other fauna and flora at the reserve. This research also includes socioeconomic studies of people neighboring the reserve (see a partial list of references in Ratsirarson et al., 2001).

As part of the accord between the three universities, Antananarivo, Washington, and Yale, cooperative projects sponsored by the two U.S. institutions began shortly after the reserve was founded (Rakotomanga et al., 1987). In 1984, Alison Richard began capturing and collaring *Propithecus verreauxi*, beginning a long-term project on the ecology, behavior, health status, and demography of individually identified animals living in groups in parcel no. 1 (e.g., Richard et al., 1991, 1993, 2002). In 1987, Sussman began a similar project on *Lemur catta* groups in parcel no. 1 (e.g., Sussman, 1991, 1992). These projects continue today, and a number of student theses, a great deal of research, and a new generation of research projects has resulted from studies on these identified populations (e.g., Sauther, 1992; Brockman, 1994; Gould, 1994; Kubzdela, 1997; Yamashita, 1998). Diane Brockman has continued to work with Alison Richard and her colleagues on the sifaka population. Michelle Sauther and Lisa Gould and their students and colleagues have extended the research on the ringtailed lemur population at Beza Mahafaly and the surrounding region, as can be seen in papers in this volume. In addition Malagasy students, in particular from ESSA/Forêt, continue to have an important role in lemur studies, particularly outside protected parcel no. 1 as well as inside the second parcel of the reserve (Ranarivelo, 1993; Ravelonjatovo, 1997; Raveloarisoa, 2000; Razafinjato, 2003; Randrianarisoa, 2005).

Much less research has been conducted on the other species of lemur living in the reserve. Short-term studies have been done on *Lepilemur* (Nash, 1998; Randriamboana, 1998; Ratsirarson and Emady, 2000) and on *Microcebus* (Rasoloarison, 2000), and a study of predation on *Microcebus* at the reserve has been completed (Goodman et al., 1993). As can be seen from papers in this volume, research on the ringtailed lemur in and around the Beza Mahafaly Reserve is beginning to cover many aspects of ecology, behavior, health status, and conservation in this region.

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