

Wilderness Conservation in a Biodiversity Hotspot

BY RUSSELL A. MITTERMEIER, FRANK HAWKINS, SERGE RAJAOBELINA,
and OLIVIER LANGRAND

Endemic Richness

The island of Madagascar is one of the world's highest biodiversity conservation priorities. It is considered one of the most important of the world's 18 megadiversity countries (Mittermeier et al. 1997) and one of the very highest priority biodiversity hotspots as well (Mittermeier et al. 1999; 2004). Madagascar's privileged position in terms of biodiversity is based on its geological history and geographic placement. The world's largest oceanic island—and the fourth largest island overall—has been separated from the African mainland for more than 160 million years, so most of its plant and animal life evolved in isolation. This resulted in very high levels of endemism at the species level. Madagascar is situated largely in the tropics (between 11° 57' S and 25° 37' S) and also has very high species richness, especially given its relatively small size (587,041 km²) (226,600 mi²). For example, although Madagascar occupies only about 1.9% of the land area of the African region, it has more orchids than all of mainland Africa, and indeed is home to perhaps as much as a third of all African plant species. Overall, about 83% of Madagascar's plant species are endemic (Goodman and Benstead 2003), and for animals the proportion is usually even higher, the best example being the primates, which are 100% endemic.

While Madagascar's species richness and endemism is impressive, it excels in endemism at higher taxonomic levels. As a country, Madagascar's numbers of endemic plant and animal families and genera are rivaled only by Australia, which is 13 times larger. As a hotspot, Madagascar is simply unmatched in these categories. Indeed, the Madagascar and Indian Ocean Islands hotspot has unsurpassed endemism at the family and genus level, with a staggering 24 endemic families and 478 genera of vascular plants and vertebrates. The next highest on the list at the family level are the New Caledonia, New Zealand, and the Chilean Winter Rainfall/



Co-authors Russell A. Mittermeier (left) and Frank Hawkins.

Valdivian Forests hotspots, each with seven, and for genera the Caribbean, with just 269 (Mittermeier et al. 2004). This means that Madagascar is critically important not just for conservation of species, but for conserving a whole array of deep evolutionary lineages representing a significant portion of our planet's evolutionary history.

This evolutionary history is demonstrated by lemurs that are the nonhuman primate radiation in Madagascar, arguably the single highest primate conservation priority on Earth. The 69 lemur species and subspecies found there are divided into five families and 15 genera, all of which are endemic, a level of endemism simply unmatched on our planet. Brazil, the world's single richest country for primates, with 104 species, also has five families and a total of 18 genera; however, none of the families and only three of the genera are endemic in a land area many times larger than Madagascar. Furthermore, if one takes into consideration the lemurs that existed on Madagascar until very recently, the numbers are even more striking. When our species first arrived on Madagascar just 2,000 to 2,500 years ago, there were eight other genera and at least 16 other species of lemurs present in addition to the extant forms. These extant forms were all larger in size than the living lemurs, some of them giants, with one species growing to be

larger than an adult male gorilla. Some of these survived until perhaps as recently as 300 to 400 years ago, but all are now extinct.

The statistics for other animal and plant groups are comparably impressive. Plant endemism is extremely high at seven to eight endemic families; there are five endemic bird families; reptiles are represented by 340 species, of which 314 are endemic; and amphibians are at about 217 species, of which 215 are endemic. Invertebrate diversity and endemism are extremely high, but we are only now starting to fully understand it.

Environmental Impacts

Sadly, Madagascar is also one of the world's leaders in environmental loss. The threats to Madagascar are well documented, with forest destruction through slash-and-burn agriculture, mining, and logging being the primary causes of habitat loss. It is estimated that around 90,000 km² (34,740 mi²) of closed-canopy primary forest and woodland remained as of 2000, with an average annual rate of loss during the 1990s of 0.9% per year (M. Steininger 2005). Burney (2003) estimates that historically most of the island would have been covered in forested or densely vegetated habitats, so nowadays only around 15 to 20% of original primary vegetation remains. However, after spending a lot of time flying over many different parts of Madagascar, we doubt that more than 10% of the forest remains sufficiently intact to be the subject of concerted conservation efforts, much of it being so fragmented that little can be done to save it at this time. At best, we believe that perhaps 50,000 to 60,000 km² (19,300 to 23,160 mi²) remains in a state that is still worth protecting. If this is so, then the sobering fact emerges that all the amazing biologi-

cal wealth of Madagascar is packed into a tiny land area.

Erosion in some parts of Madagascar, especially in extensive areas of the central plateau, is simply staggering, and as severe as anywhere on Earth. Indeed, when flying over parts of the country, one is almost brought to tears by enormous erosion gullies, locally known as *lavaka*, and by the fragmentation and continuing burning of small patches of vegetation to achieve only a couple of years of low-level agricultural productivity—a tragic loss of biodiversity and a loss of future potential for the human population as well. Wetlands, including lakes, rivers and marshes, are under threat from transformation to rice fields, siltation from soil erosion, and introduced nonnative species.

Lemurs and other mammals such as carnivores, tenrecs, fruit bats, some birds, and some reptiles (e.g., tortoises) are very susceptible to hunting. The importance of hunting is now emerging as a much more serious environmental problem than previously believed. The international pet trade has had a serious impact on endemic plants and animals of Madagascar, especially amphibians, reptiles, and succulent plants. In addition, the proliferation of exotic plant species is recognized as a major threat affecting the biodiversity of Madagascar, and freshwater ecosystems, in particular, have been seriously impacted by alien plants such as *Eichhornia crassipes* (Langrand and Goodman 1995). This combination of very high biodiversity, amazing levels of endemism, and severe threat have combined to make Madagascar one of the world's highest biodiversity conservation priorities. Indeed, in the opinion of many, it should be considered the single highest priority biodiversity hotspot, and the international community needs to make serious investments now. New invest-



Figure 1—Highway of the Baobabs, near Morondava in southwest Madagascar. Photo by Russell A. Mittermeier, Conservation International.



Figure 2—Devastating erosion in Madagascar. Photo by Russell A. Mittermeier, Conservation International.

ments need to be far in excess of what has been invested in the past. New viable long-term plans developed by working closely with the government of Madagascar and private initiatives



Figure 3—Local Antanjaka people waiting for us at our vehicles, Mahabo Forest Reserve, June 19, 2005. Photo by Russell A. Mittermeier, Conservation International.

could support conservation and environmentally sound development.

Protected Areas

Clearly much needs to be done, and, fortunately, good things are beginning to happen. Protected areas are critical. At present, the protected area network of Madagascar (IUCN Categories I–VI) covers some 1.7 million hectares, (4.2 million acres) or about 3% of the country. Recent gap analyses conducted by Conservation International and partner organizations (including the Missouri Botanical Garden, the Wildlife Conservation Society, the World Wildlife Fund, the Durrell Wildlife Trust, and the Malagasy NGO Fanamby), indicated that the coverage of Madagascar's unique biodiversity by this network was far from adequate and that a significant increase in protected area coverage was necessary. President Marc Ravalomanana, who took power in 2002, recognized the value of protecting the country's natural heritage, and, to demonstrate his commitment, made an historic declaration to triple his country's protected area coverage at the World Parks Congress in Durban, South Africa, in September 2003. At the same time, he requested the sup-

port of the international community to the tune of a \$50 million trust fund to help make this all a reality. This was met with much international approval and has resulted in a great deal of conservation activity within Madagascar. The international community has already committed \$40 million toward this fund in less than two years, while the government has created a Durban Vision Group to identify new areas to be protected. By the end of 2005, it is expected that some 1.5 million

hectares (3.7 million acres) of new areas will have been designated and on the path to the ultimate total of 6 million hectares (14.9 million acres).

In addition, Madagascar has received a totally unexpected and quite amazing windfall from Hollywood, in the form of a new full-length animated film entitled *Madagascar*, produced by DreamWorks, one of the Hollywood's leading companies. This film, which premiered at the end of May, portrays Madagascar in a very positive light and is in the process of making it a household word in North America, Europe, and around the world. Preliminary indications are that it will be seen by 100 million in theaters and by another 200 to 300 million in their homes using DVD versions. This movie is likely to stimulate a great increase in tourism to Madagascar. Both the international conservation community and the government of Madagascar are moving quickly to take advantage of this unique and historic opportunity. The president has created a Task Force on Ecotourism reporting directly to his office, and Conservation International has placed a highly experienced ecotourism specialist in the president's office. Other national and international

organizations are moving quickly to stimulate investments in tourism. The most recent unofficial reports indicate that there has already been a substantial increase in tourist interest for 2006.

All of this bodes well for the future, but what is the role of the wilderness concept in a country like Madagascar, where so much has already been lost and where most of the protected areas are significantly smaller than 100,000 hectares (247,000 acres)? We believe that the wilderness concept does in fact have great value in Madagascar and that it fits in very well with the conservation corridor concept that organizations such as Conservation International, World Wildlife Fund, the Wildlife Conservation Society, the Institute for the Conservation of Tropical Environments, and the Malagasy NGO Fanamby are trying to promote. This is especially relevant in the eastern rain forest region of the country, where much of Madagascar's biodiversity is concentrated. There the vision is to create corridors in excess of several million hectares, although the single largest existing protected area is Masoala National Park covering only 230,000 hectares (572,700 acres). Perhaps the best example of a forest ecosystem corridor is the Zahamena-Mantadia Corridor, which connects two of the country's most important parks—the 63,800-hectare (158,860 acres) Zahamena National Park and the 10,000 hectare (24,900 acres) Mantadia National Park—and would cover some 450,000 hectares (1.1 million acres) when completed. Farther to the south, the Ranomafana-Andringitra Corridor will eventually cover some 180,000 hectares (448,200 acres). Eventually the idea would be to have what Alison Jolly, one of the leading advocates for conservation in Madagascar, has called “a string of pearls”—a series of corridors around

the periphery of the island where much of the remaining natural vegetation is to be found. This approach would ensure the long-term survival of this country's wonderful biological heritage. Some of the new protected areas being proposed are mini-wilderness areas in their own right, perhaps the best example being the magnificent Makira Forest in northeastern Madagascar, which covers some 350,000 hectares (871,500 acres) and is contiguous with the 230,000-hectare (572,700 acres) Masoala National Park on the peninsula of the same name. Within these corridors, there exists the possibility of declaring "wilderness core areas," which would be off-limits to tourism and restricted to only the most important forms of scientific research.

The fact that Madagascar has seen human presence for such a short time—it was colonized at about the same time as many of the islands of the central Pacific—means that people have not had enough time to even explore the entirety of the forests of the island, particularly in the east. Indeed, for the first few hundred years of occupation of Madagascar there is no evidence that humans lived in highland or forested areas at all. Although not large by neotropical or central African standards, it is still possible to explore forested valleys, particularly those with dense vegetation high on the slopes of mountains such as Marojejy and Andringitra, that have in all likelihood never been visited by humans. Rural Malagasy people do visit forests to hunt and collect forest products, but these highland valleys do not hold much in the way of interesting prey or forest products, and the vegetation is so dense that one has to crawl on one's belly in many areas. Although such areas are probably quite small, in the tens or low hundreds of hectares, the idea that such genuine wilderness areas still exist is very inspiring, and is a phenomenon unlikely to be

duplicated in much of the rest of the tropics, which have seen human habitation for much longer. As befits the nature of these sites, their fauna and flora are very poorly known, and they have yielded a startling range of new species of insectivore and rodent, with several new genera and around 20 new species over the last 15 years, and even new primates, a total of 19 since 1994 and with several more awaiting formal description. Doubtless there is much more to be learned about these mysterious valleys.

The fact that one can think about actual and potential wilderness in what is often considered to be the classic highly impacted biodiversity hotspot, once again gives us hope for the future. **IJW**

REFERENCES

- Burney D. A. 2003. Prehistoric ecosystems. In *The Natural History of Madagascar*, ed. S. M. Goodman and J. P. Benstead, pp. 47–51. Chicago: The University of Chicago Press.
- Goodman, S. M., and J. P. Benstead, eds. 2003. *The Natural History of Madagascar*. Chicago: The University of Chicago Press.
- Langrand, O., and S. M. Goodman. 1995. Monitoring Madagascar's ecosystems: A look at the past, present and future of its wetlands. In *Ecosystem Monitoring and Protected areas*, ed. T. B. Herman, S. Bondrup-Nielsen, J. H. M. Willison, and N. W. P. Munro. Wolfville, Canada: Science and Management of Protected Areas Association,.
- Mittermeier, R. A., and C. G. Mittermeier. 1997. *Megadiversity: Earth's Biologically Wealthiest Nations*. Garza Garcia N.L. Mexico: CEMEX.
- Mittermeier R. A., N. Meyers, Gil P. Robles, and C. G. Mittermeier. 1999. *Hotspots*. Garza Garcia N.L. Mexico: CEMEX.
- Mittermeier, R. A., Gil P. Robles, M. Hoffmann, J. Pilgrim, T. Brooks, C. G. Mittermeier, J. Lamoreux, and G. A. B. da Fonseca. 2004. *Hotspots Revisited*. Garza Garcia N.L. Mexico: CEMEX.
- Steininger, M. 2005. Personal communication.

Continued on page 6



Figure 4—Ring-tailed lemur (*Lemur catta*) basking in the early morning sun, Berenty Private Reserve, Madagascar. Photo by Russell A. Mittermeier, Conservation International.

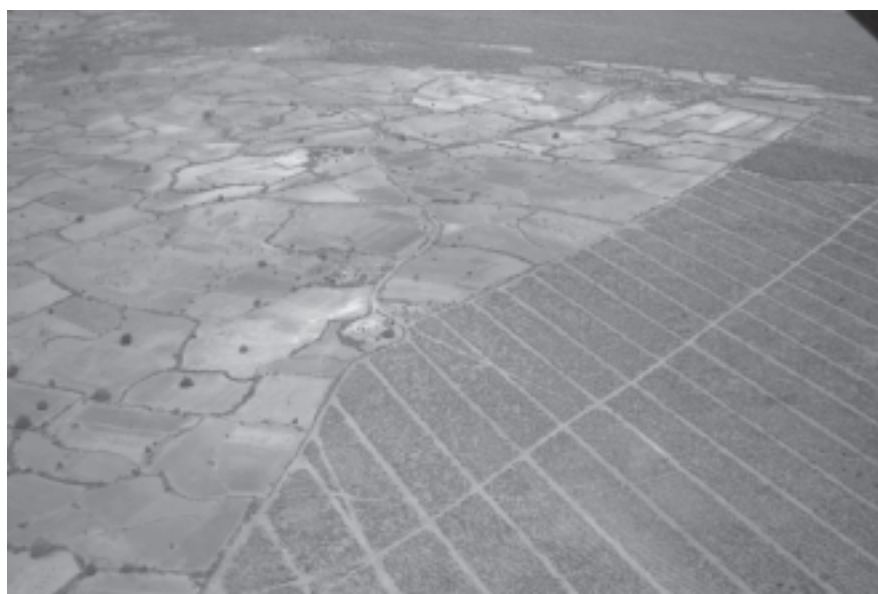


Figure 5—Sisal fields along the Mandrare River, Madagascar. Photo by Russell A. Mittermeier, Conservation International.



Figure 2—Juniper Springs run in the Juniper Prairie Wilderness located in Florida (USDA Forest Service). Photo by Deborah Caffin.

overwhelming task ahead, a recovery program was put in motion. Land managers from the national forests in Florida and the Nez Perce and Clearwater National Forests in Idaho designed a plan to promote stronger partnerships among local forests, historical societies, and the FTA in order to complete the work in an economic fashion. Long-term plans were developed to promote these partnerships and cooperation into the future.

Upon arrival in Florida, tool trainers from the western regions of the U.S. Forest Service met with local land

management employees and volunteers to embark on a four-day training program with classroom and practical sessions. Learning about traditional tools is more than just learning how to swing an ax or run a saw in the woods. Good tool usage is part skill and physical ability, but efficient work takes place when planning and layout are present in the working process.

The practical sessions were designed to let everyone involved learn how to use the hand tools and rigging equipment to their full advantage. Participants quickly understood that

traditional crosscut saw and ax skills along with skyline logging techniques will continue to play an important part in trail and bridge maintenance and restoration in backcountry areas. With a never-ending need to continue trail maintenance, there will be plenty of time to perfect technique.

The training was geared toward teaching and reviving skills; however, it was also about learning how these tools coupled with unlimited imagination can be used to solve all sorts of trail construction and reconstruction problems in the backcountry. As trainers, the best feedback we can receive is seeing ideas and thoughts taking root in participants. By the end of the training, what began as a four-day session stretched into five, and FTA volunteers from around the state began to reevaluate methods of construction for future Florida National Scenic Trail projects using the traditional tool skills they had learned. **IJW**

SUSAN JENKINS was formerly a wilderness ranger on the Nez Perce National Forest in Idaho and is now on the Tongass National Forest in Alaska. E-mail: sjenkins02@fs.fed.us.

From BIODIVERSITY HOTSPOT on page 45

RUSSELL A. MITTERMEIER, Ph.D., is president of Conservation International and is a prominent primatologist, herpetologist, and wildlife conservationist with more than 30 years of field experience. He also serves as chairman of IUCN's Primate Specialist Group, IUCN's Regional councillor for North America and the Caribbean, and has a long history of professional involvement in Madagascar. Email: r.mittermeier@conservation.org.

FRANK HAWKINS is technical director for Conservation International in Madagascar. Originally from the UK, he has lived in Madagascar for nearly 20 years, starting out with research on the conservation biology of birds. He has also worked on the biogeography, conservation, and distribution of Malagasy carnivores and primates.

SERGE RAJAABELINA is the secretary general of Association Fanamby, a conservation organization in Madagascar. E-mail: s.rajaobelina@fanamby.org.

OLIVIER LANGRAND, Ph.D., is senior vice president of Conservation International's Africa and Madagascar Division. He has 20 years of experience in international biodiversity conservation program planning, and management, and is an expert on the birds of the southwestern Indian Ocean islands.