

THE STATE OF MADAGASCAR'S BIRDS

INDICATORS OF ENVIRONMENTAL CHANGE



AAGE V.
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FOREWORD

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This report on the *State of Madagascar's Birds* provides a snapshot of the current conservation status of birds in our country, the pressures they face and the actions being taken to conserve them. Birds are among the best-

known and most widespread of our species - their beauty can be admired from the wildest corners of the country to the centre of Antananarivo. They are indicators of the health of ecosystems which are essential to human well-being, and have much to teach us about our impacts on all biodiversity, ecosystem processes, and ultimately ourselves. However, few of the Malagasy population know the status of these birds of Madagascar, it is for this reason that this study as well as the

dissemination of this report are very important. We know that our biodiversity and environment are under pressure, and this is of concern to many Malagasy people. The Government of Madagascar, working with civil society partners both national and international, is strong in both its commitment and action, to protect what we have and restore what we have lost and to make the benefits sustainable by placing people including local communities at the heart of conservation. As we face the interrelated crises of biodiversity loss and climate change, the next decade will be critical if we are to sustain ourselves and our biodiversity. We thank the authors and those who contributed to the development of the report. Let us all work together to ensure that future generations will be able to benefit from our country's spectacular diversity of birds and other wildlife.

BIODIVERSITY UNDERPINS OUR LIVES

Biodiversity—the variability among living things and ecological systems—is fundamental to human health and well-being. It is part of the world's natural wealth, offering multiple opportunities for development and improving livelihoods. It underpins ecosystem functions and delivers 'ecosystem services' such as pollination, water purification, and carbon sequestration, which in turn provide us

with the food, water, and clean air we need to survive. Access to nature has been shown to improve physical health, reduce chronic stress, anxiety, and depression, and boost concentration and self-esteem. Biodiversity also promotes ecotourism, providing local and national economic benefits through entrance fees, employment opportunities, and tourist expenditures. Every species, no matter how small, plays a role in maintaining a healthy, balanced ecosystem, therefore

their conservation is of critical importance.

Having evolved in isolation for millions of years, much of Madagascar's biodiversity is unique—many species are found nowhere else on the planet. Unfortunately, many of these species are also under significant threat of extinction due to anthropogenic activities. For this reason, Madagascar is considered one of 36 global "biodiversity hotspots", the conservation of which is a global priority.

Spending time in nature provides multiple benefits to our physical and mental wellbeing.
Photo © Jorlin Tsiavahananahary, Asity Madagascar



Birds are hugely popular and engaging. The Velvet Asity *Philepitta castanea* is Asity Madagascar's flagship species. Photo © Artush/ Shutterstock.com

STATE OF THE WORLD'S BIRDS

Over the last decade, the BirdLife Partnership has worked to assess the condition and trends of the world's birds, thereby gaining invaluable insight into the wider state of biodiversity. This information is published in the State of the World's Birds report, which is designed to make science-based evidence available to international decision-makers. See www.datazone.birdlife.org/sowb.

A number of BirdLife Partners, many supported through the project by the Aage V. Jensen Foundation, have also produced national reports that provide a detailed insight into the status of, and pressures faced by, birds and biodiversity in their own country. To view the full range of these reports, visit www.datazone.birdlife.org/sowb/sonb.

This report is arranged in the following chapters:

INTRODUCTION: The importance of birds and biodiversity

STATE: What we know about the changing state of Madagascar's birds

PRESSURE: Why birds are declining

RESPONSE: Conserving biodiversity

BIRDS ARE VALUABLE INDICATORS OF WIDER ENVIRONMENTAL HEALTH

The expense of comprehensively assessing biodiversity is enormous. One estimate is that an all-taxa inventory of just one hectare of tropical forest might take 50–500 scientist years to accomplish (Lawton *et al.* 1998). This has led to much interest in finding taxa that can act as indicators for biodiversity as a whole. Birds serve as unique barometers for environmental change because they:

- Have well understood, relatively stable taxonomy
- Are better studied than any other group of species
- Are easy to identify, survey and monitor
- Are found in every country and occur in nearly all habitats

- Typically have fairly specialised habitat requirements
- Usually occupy high trophic levels in food webs, and are relatively sensitive to environmental change
- Have trends that often mirror those of other species
- Have distributions that generally reflect those of many other wildlife groups
- Are economically important
- Are hugely popular and engaging, and can act as flagships for nature

By examining data on the state of Madagascar's birds, such as their population trends and the threats they face, we gain insight into the wider health of Madagascar's ecosystems and the conservation action required.



Madagascar Paradise-flycatcher *Terpsiphone mutata*.
Photo © David Cook Wildlife Photography

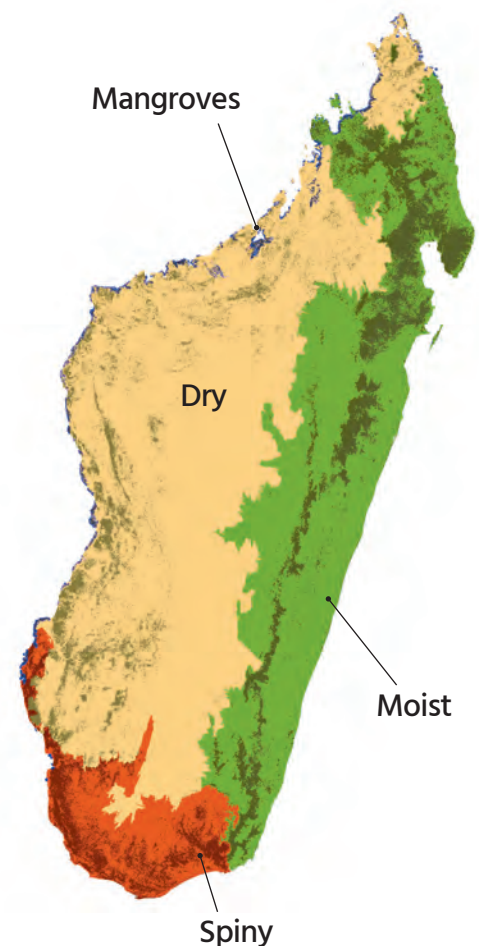


INTRODUCTION TO MADAGASCAR

One hundred and seventy million years ago, Madagascar was a landlocked part of the supercontinent Gondwana. Through movements of the earth's crust, Madagascar first separated from the land that would eventually become Africa and South America, then from Australia and Antarctica, and finally from India. Madagascar has been isolated from any other land mass for 88 million years. This long period of geographical isolation has led to the evolution of many species that are endemic, i.e. they are not found anywhere else in the world.

With a land area of 587,000 km², Madagascar is the fourth largest island in the world. It lies almost entirely in the tropical zone, approximately 400 km east of mainland Africa, and has two distinct

seasons—a cool, dry season from May to October and a hot, rainy season from November to April. Climate varies considerably across the island, with the west being significantly drier than the east due to the combined effects of the prevailing winds and offshore currents. The large size of the island and its varied climate means that it supports several distinct biomes, including four types of tropical forest: rainforest in the east, dry forest in the west, spiny forest or thicket in the south, and mangrove forest primarily along the north and west coasts. Grassland covers much of the highlands, while wetlands including rivers, lakes, swamps and marshes are found throughout the island. This range of habitats has given Madagascar's flora and fauna the opportunity to radiate into multiple species adapted to different environments.



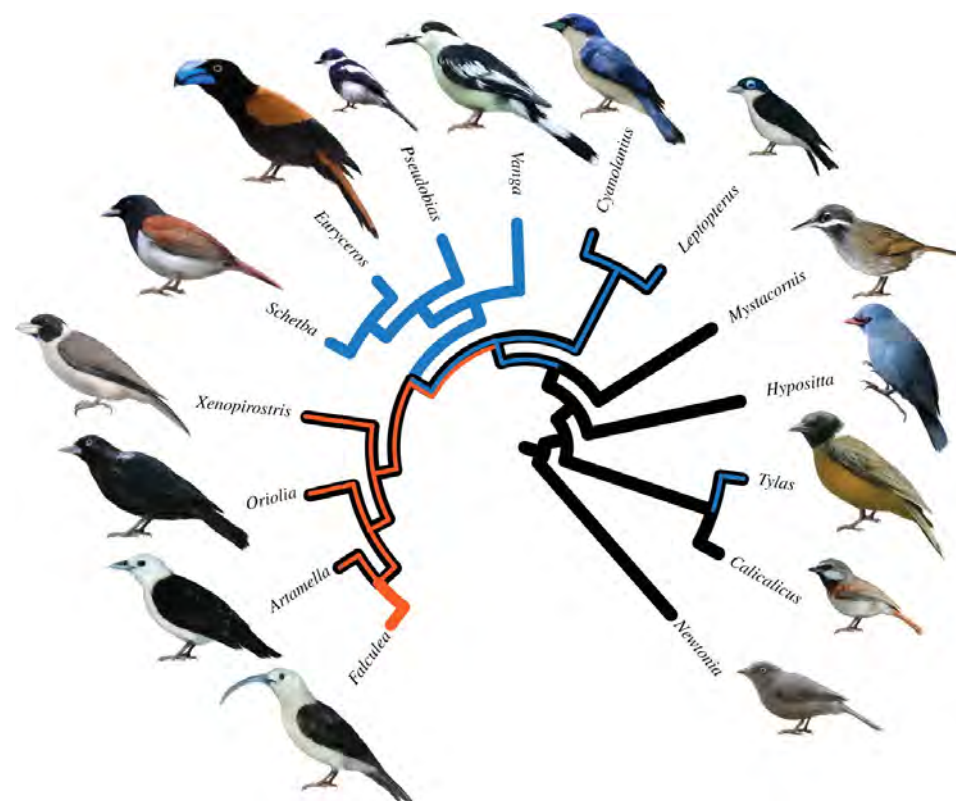
Madagascar's four ecoregions support different forest types—rainforest in the east (green), dry forest in the west (orange), spiny forest or thicket in the south (red) and mangroves along the west coast (blue). Darker areas represent remaining forest cover for the year 2014. Source: adapted from Vielledent et al. (2018)

THE BIRDS OF MADAGASCAR

Madagascar has around 307 bird species (209 breeding, 52 non-breeding migrants, 40 vagrants, and 6 non-native introductions). Of these, 115 are endemic to the country: 44% of the regularly occurring, native species. This number of endemic species relative to land area is unrivalled by any other large island. Many of Madagascar's birds are forest specialists, and the proportion of endemics within this group is particularly high (91%). In contrast, compared to other large tropical islands or countries of similar size on the African continent, Madagascar's avifauna is characterised by a relatively low species richness. Long duration of isolation is the most likely cause for both the high endemism and low species richness (Warren *et al.* 2013)

Evidence from living species and fossils suggests that all of the birds found on Madagascar today are descendants of species that colonised the island from other landmasses after the break-up of Gondwana (Yoder & Nowak, 2006). Many are most closely related to species found in Africa and Asia, with a few cases from Australasia.

Four surviving families of birds are endemic to Madagascar—the mesites (Mesitornithidae), ground-rollers (Brachypteraciidae), asities (Philepittidae) and Malagasy warblers or tetrakas (Bernieridae). Madagascar shares the family Leptosomidae (containing only one species—the Cuckoo Roller) with the Comoro Islands. Vangas (Vangidae) were until recently considered an endemic family, however new research has shown that some African and Asian species

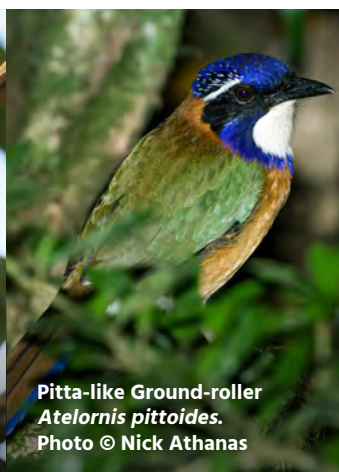


The diversification of vanga genera from a single common ancestor.
Source: Reddy *et al.* (2012)

should be included in the same family (Reddy *et al.* 2012). The vangas of Madagascar are an excellent example of adaptive radiation. Soon after colonising Madagascar, the single ancestral species showed an explosive burst of diversification, evolving a range of morphologies and feeding styles that allowed exploitation of the extremely varied climatic conditions and habitats of the island (Reddy *et al.* 2012). This led to

the evolution of vangas resembling birds from other families that fulfil similar ecological niches elsewhere, such as shrikes, warblers, wood-hoopoes, and woodpeckers.

The elephant-birds (Aepyornithidae), whose largest species weighed around 650 kg and stood 3 m high (Hansford & Turvey 2018), were an endemic family that went extinct around 1000 years ago, or perhaps less.

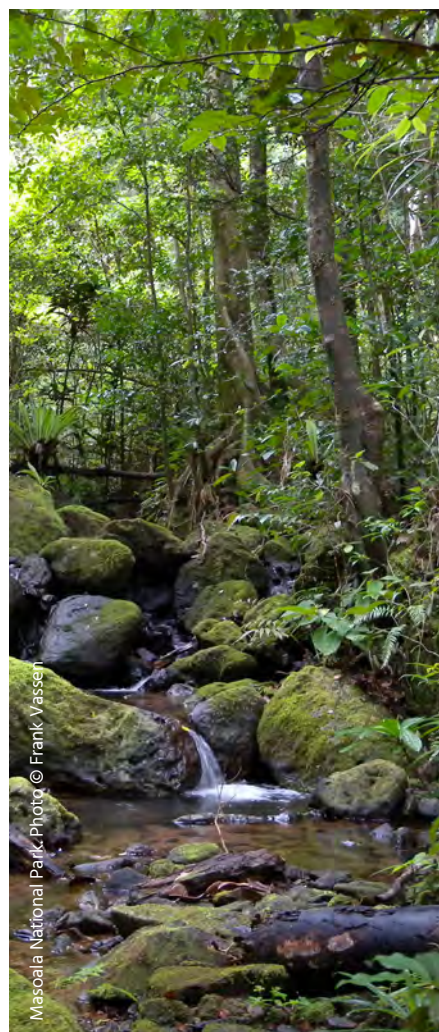


ENDEMIC BIRD AREAS IN MADAGASCAR

Endemic Bird Areas (EBAs) are areas in which the distributions of two or more endemic species overlap. These areas also support many more widely spread bird species and species

from other animal and plant groups (BirdLife International 2020). These landscapes are therefore high priorities for broad-scale ecosystem conservation. Five EBAs contain the great majority of important terrestrial habitats for birds in

Madagascar. Major habitat loss has occurred throughout all of these EBAs, therefore the total EBA area does not reflect the amount of suitable habitat.



Masoala National Park. Photo © Frank Vassen

EAST MALAGASY WET FORESTS

EXTENT: 160,000 km²
(Within green area on page 3 map)

CLIMATE: Humid, high rainfall year-round (often >2,500 mm per year)

ALTITUDE: 0–2,000 m. Majority (80%) at high to mid altitude. Avifauna varies depending on altitude.

CHARACTERISTIC SPECIES: Madagascar Serpent-eagle *Eutriorchis astur*, Scaly Ground-roller *Geobiastes squamiger*, Long-billed Tetraka *Bernieria madagascariensis*, Yellow-bellied Sunbird-asity *Neodrepanis hypoxantha*



Spiny forest near Ifaty. Photo © Jialiang Gao/Wikimedia Commons

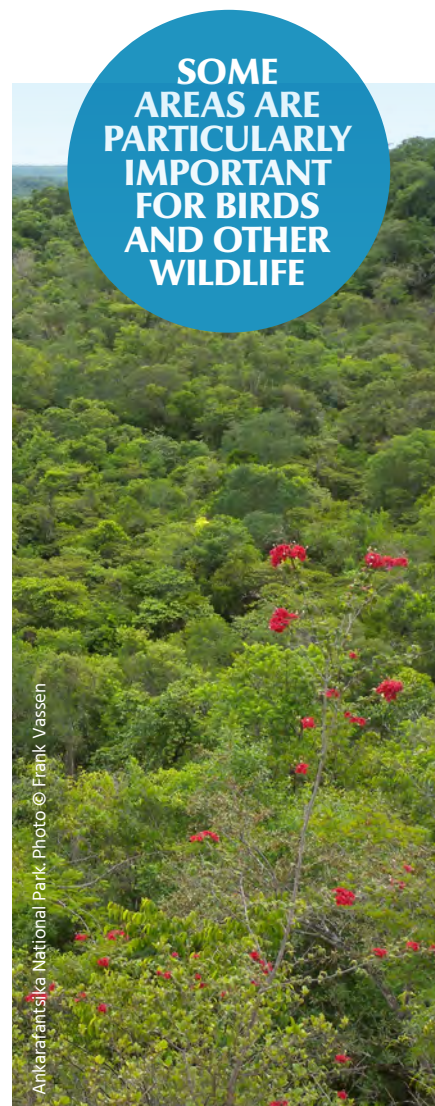
SOUTH MALAGASY SPINY FORESTS

EXTENT: 46,000 km²
(Within red area on page 3 map)

CLIMATE: Low rainfall (<500 mm per year)

ALTITUDE: <500 m

CHARACTERISTIC SPECIES: Subdesert Mesite *Monias benschi*, Running Coua *Coua cursor*, Verreaux's Coua *Coua verreauxi*, Long-tailed Ground-roller *Uratelornis chimaera*, Red-shouldered Vanga *Calicalicus rufocarpalis*



Ankarafantsika National Park. Photo © Frank Vassen

WEST MALAGASY DRY FORESTS

EXTENT: 150,000 km²
(Within orange area on page 3 map)

CLIMATE: Marked dry season, noticeable seasonal temperature changes, rainfall 600–1,500 mm per year

ALTITUDE: 0–800m

CHARACTERISTIC SPECIES: White-breasted Mesite *Mesitornis variegatus*, Coquerel's Coua *Coua coquereli*, Appert's Tetraka *Xanthomixis apperti*, Van Dam's Vanga *Xenopirostris damii*

SOME AREAS ARE PARTICULARLY IMPORTANT FOR BIRDS AND OTHER WILDLIFE

IMPORTANT BIRD AND BIODIVERSITY AREAS IN MADAGASCAR

Between 1997 and 1999, BirdLife International identified 84 terrestrial Important Bird and Biodiversity Areas (IBAs) in Madagascar, covering 6,001,853 hectares. IBAs are Key Biodiversity Areas (KBAs) identified for birds. They are identified using standardised criteria, and represent the minimum network of sites required for conservation of bird species across their ranges and throughout their life

cycles. Although triggered by bird species, IBAs are also important for a wide range of other taxa. An update of Madagascar's KBAs is ongoing, and is likely to identify a number of additional sites of importance for bird species. Although this process continues, the KBA network has already been the main basis for identifying priority areas for protection of all of Madagascar's biodiversity (see page 15).



Mangrove forest between Ifaty and Belandaia. Photo © Smileytoerist/Wikimedia Commons

WEST MALAGASY WETLANDS

EXTENT: 26,000 km²

HABITAT: Slow-flowing rivers, lakes, estuaries, swamps, marshes, mangrove forests

CHARACTERISTIC SPECIES: Madagascar Heron *Ardea humbloti*, Madagascar Teal *Anas bernieri*, Madagascar Fish-eagle *Haliaeetus vociferoides*, Sakalava Rail *Zapornia olivieri*, Madagascar Jacana *Actophilornis albinucha*, Black-banded Plover *Charadrius thoracicus*



Torotorofotsy wetland. Photo © Sam Whitfield/Flickr

EAST MALAGASY WETLANDS

EXTENT: 17,000 km²

HABITAT: Fast-flowing rivers, marshes, lakes

CHARACTERISTIC SPECIES: Meller's Duck *Anas melleri*, Slender-billed Flufftail *Sarothrura watersi*, Madagascar Rail *Rallus madagascariensis*, Madagascar Snipe *Gallinago macrodactyla*, Madagascar Grassbird *Amphilaus seebohmii*

MARINE IBAS

Madagascar has many seabird breeding sites of regional importance, and bird populations have greatly increased at several of these, thanks to protection from disturbance and egg-collection. The coastal and oceanic habitats of Madagascar's Exclusive Economic Zone (EEZ) are also important for non-breeding seabirds, including eight globally threatened species (page 7). Five marine IBAs have been identified in Malagasy waters, the largest of which are in the southern parts of the EEZ where the seamounts attract seabirds, particularly from the Southern Ocean, and a range of large marine mammals. The main threat to these seabirds is by-catch from industrial tuna and swordfish fisheries (Le Corre *et al.* in press).



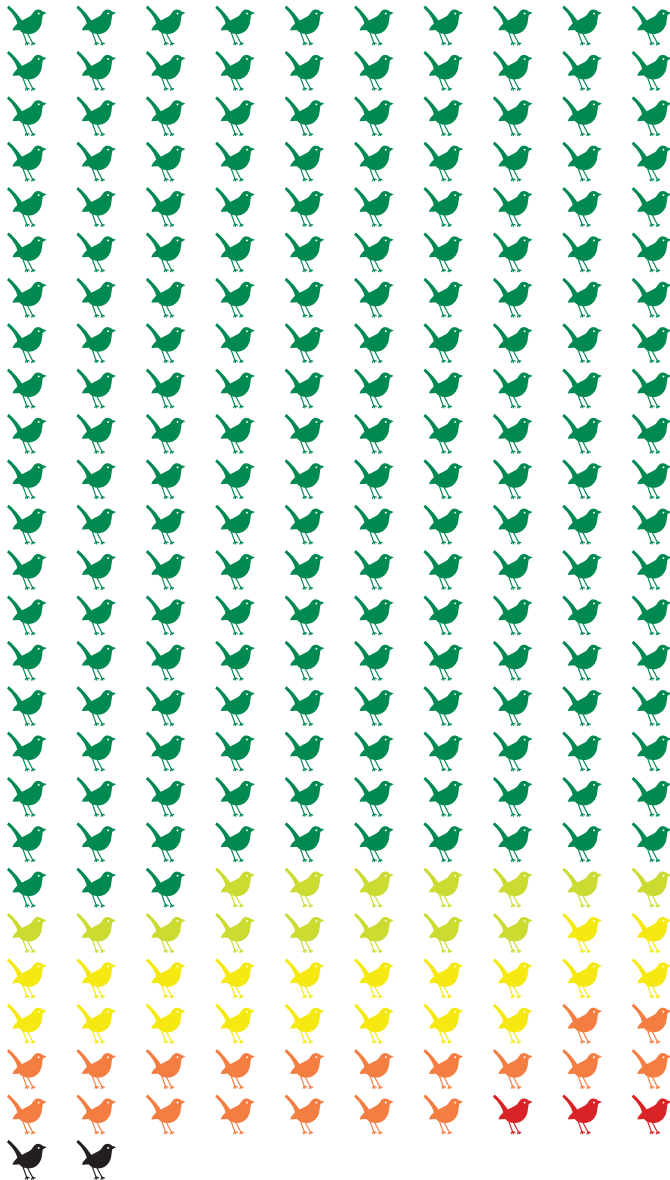
SOME SPECIES ARE AT RISK OF EXTINCTION

Two of Madagascar's bird species have become extinct in the last two centuries—Alaotra Grebe *Tachybaptus rufolavatus* and Snail-eating Coua *Coua delalandei*. Forty-two (16%) of Madagascar's regularly occurring, native species are listed as globally threatened on the IUCN Red List of Threatened Species, of which 29 are endemic to Madagascar and over 40% are forest specialists. The proportion of threatened species is greatest in wetland birds, of which 18% are globally threatened.



GLOBALLY THREATENED SPECIES

	SCIENTIFIC NAME	ENGLISH NAME	ENDEMIC	WETLAND BIRD	FOREST SPECIALIST	NON-BREEDING SEABIRD
CRITICALLY ENDANGERED	<i>Aythya innotata</i>	Madagascar Pochard	●	●		
	<i>Haliaeetus vociferoides</i>	Madagascar Fish-eagle	●	●		
	<i>Pseudobulweria aterrima</i>	Mascarene Petrel				●
ENDANGERED	<i>Actophilornis albinucha</i>	Madagascar Jacana	●	●		
	<i>Anas bernieri</i>	Madagascar Teal	●	●		
	<i>Anas melleri</i>	Meller's Duck	●	●		
	<i>Ardea humbloti</i>	Madagascar Heron		●		
	<i>Ardeola idae</i>	Madagascar Pond-heron		●		
	<i>Circus macroscelus</i>	Madagascar Marsh-harrier		●		
	<i>Diomedea amsterdamensis</i>	Amsterdam Albatross				●
	<i>Euryceros prevostii</i>	Helmet Vanga	●		●	
	<i>Eutriorchis astur</i>	Madagascar Serpent-eagle	●		●	
	<i>Monticola erythronotus</i>	Amber Mountain Rock-thrush	●		●	
	<i>Oriolia bernieri</i>	Bernier's Vanga	●		●	
	<i>Phoebastria fusca</i>	Sooty Albatross				●
	<i>Pterodroma baraui</i>	Barau's Petrel				●
	<i>Sarothrura watersi</i>	Slender-billed Flufftail	●	●		
	<i>Tachybaptus pelzelinii</i>	Madagascar Grebe	●	●		
	<i>Thalassarche carteri</i>	Indian Yellow-nosed Albatross				●
	<i>Threskiornis bernieri</i>	Madagascar Sacred Ibis		●	●	
	<i>Xenopirostris damii</i>	Van Dam's Vanga	●		●	
	<i>Zapornia olivieri</i>	Sakalava Rail	●	●		
VULNERABLE	<i>Accipiter henstii</i>	Henst's Goshawk	●		●	
	<i>Brachypteracias leptosomus</i>	Short-legged Ground-roller	●		●	
	<i>Calicalicus rufocarpalis</i>	Red-shouldered Vanga	●		●	
	<i>Charadrius thoracicus</i>	Black-banded Plover	●	●		
	<i>Diomedea exulans</i>	Wandering Albatross				●
	<i>Falco concolor</i>	Sooty Falcon				
	<i>Gallinago macrodactyla</i>	Madagascar Snipe	●	●		
	<i>Geobiastes squamiger</i>	Scaly Ground-roller	●		●	
	<i>Glareola ocularis</i>	Madagascar Pratincole	●	●		
	<i>Mesitornis unicolor</i>	Brown Mesite	●		●	
	<i>Mesitornis variegatus</i>	White-breasted Mesite	●		●	
	<i>Monias benschi</i>	Subdesert Mesite	●		●	
	<i>Neodrepanis hypoxantha</i>	Yellow-bellied Sunbird-asity	●		●	
	<i>Newtonia fanovanae</i>	Red-tailed Newtonia	●		●	
	<i>Procellaria aequinoctialis</i>	White-chinned Petrel				●
	<i>Pterodroma arminjoniana</i>	Trindade Petrel				●
	<i>Rallus madagascariensis</i>	Madagascar Rail	●	●	●	
	<i>Tyto soumagnei</i>	Madagascar Red Owl	●		●	
	<i>Uratelornis chimaera</i>	Long-tailed Ground-roller	●		●	
	<i>Xanthomixis apperti</i>	Appert's Tetraka	●		●	



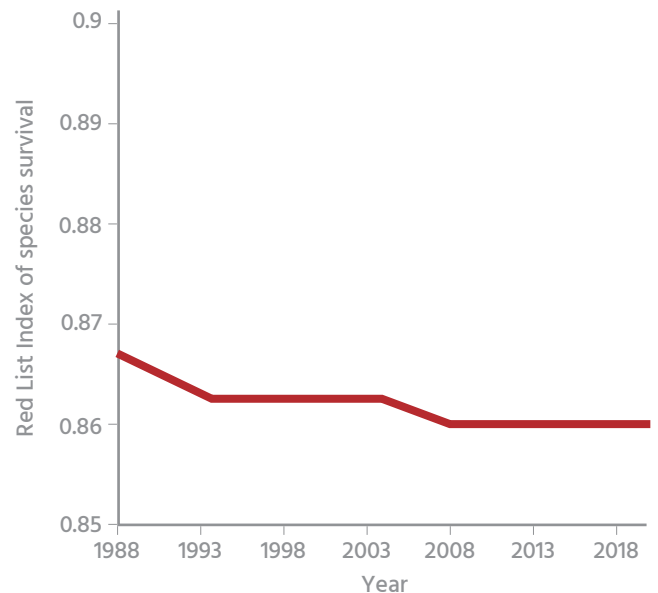
The number of regularly occurring, native bird species in each Red List category. Each icon represents one species.

Least Concern
 Near Threatened
 Vulnerable
 Endangered
 Critically Endangered
 Extinct

THE STATUS OF MADAGASCAR'S BIRDS IS DETERIORATING

The Red List Index (RLI) shows trends in the overall extinction risk for groups of species using changes in threat status over time. The RLI of Madagascar's birds has declined significantly since 1988, showing that more birds have moved to higher threat categories than have moved to lower threat categories. This means that the birds of Madagascar are becoming increasingly likely to go extinct.

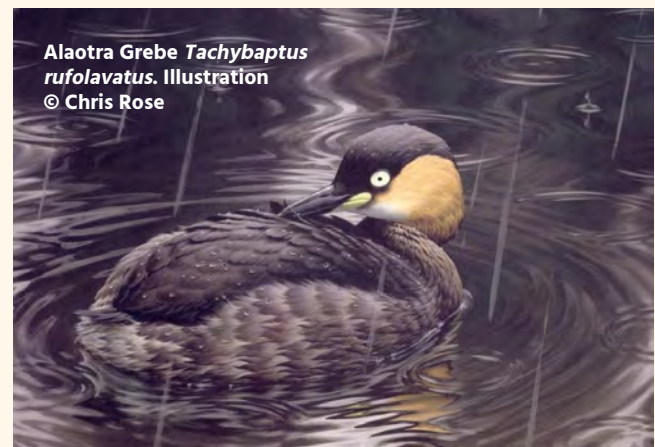
The Red List Index only captures changes in population status that are significant enough to trigger a change in Red List category. Given that these categories are broad, many species are in decline but have not yet been uplisted to a higher threat category. Many of Madagascar's Least Concern and Near Threatened birds, although not yet treated as threatened, are also experiencing population declines.



The Red List Index for Madagascar's birds. A value of 1.0 indicates that all species are Least Concern, while a value of 0 indicates that all species have gone extinct.

WETLAND BIRD DECLINE ON LAKE ALAOTRA

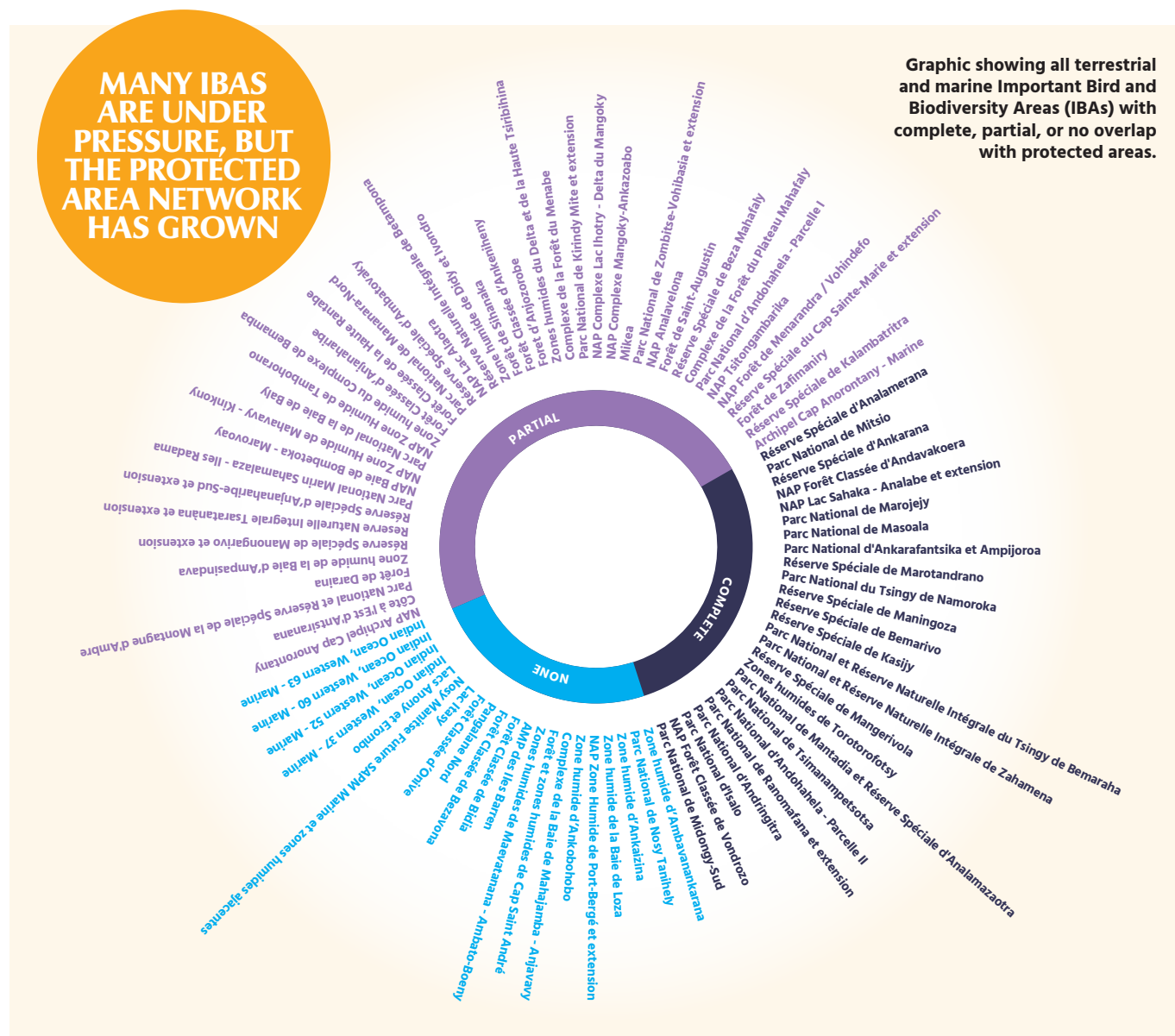
Lake Alaotra, situated in the north-east of the island, is Madagascar's largest freshwater lake. This important wetland habitat was once home to a thriving population of waterbirds, including the now-extinct Alaotra Grebe *Tachybaptus rufolavatus* and the Critically Endangered Madagascar Pochard *Aythya innotata*. However, soil erosion from deforested hillsides, extensive use of gill-nets, and the introduction of carnivorous fish has led to huge declines in waterbird populations on the lake (Hawkins *et al.* 2000), with ecosystem degradation exacerbated by marsh destruction, pollution and other fish introductions.



Alaotra Grebe *Tachybaptus rufolavatus*. Illustration © Chris Rose

COVERAGE OF IBAS BY PROTECTED AREAS

If effectively managed, formally designated protected areas play a key role in conserving biodiversity and associated ecosystem services. Most (80%) of Madagascar's 84 identified terrestrial Important Bird and Biodiversity Areas (IBAs) are either completely or partially covered by protected areas, and for most of those partially covered, it is the biologically richest areas that are protected; only 17 have no overlap with protected areas, and some of these are proposed for protection. Around 64% of the terrestrial IBA surface is protected. Progress is ongoing with protection of marine IBAs, particularly inshore, but the large offshore areas to the south of Madagascar remain unprotected. A similar analysis covering all KBAs and including marine areas is desirable in the future, but it can already be concluded that the high level of protection is highly significant for conservation of Madagascar's birds and other biodiversity.



Footnote: this analysis is based on protected areas with status listed as 'designated' in the World Database on Protected Areas, plus 'proposed' sites that have been verified as designated through consultation with national authorities and experts.

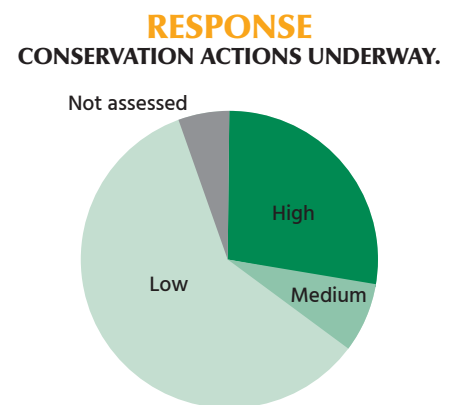
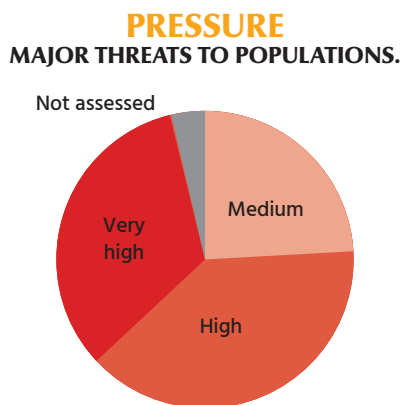
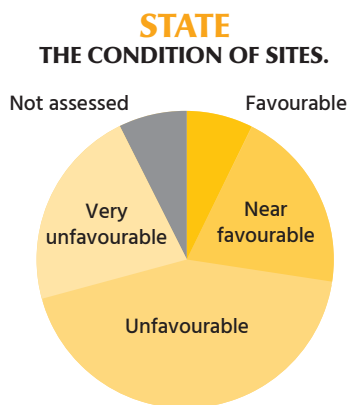
MONITORING PROVIDES ESSENTIAL INFORMATION ABOUT THE CONDITION OF IBAS

Monitoring of IBAs is central to conservation advocacy and action to protect these sites in perpetuity, both to assess the effectiveness of conservation measures and to provide an early warning of problems. BirdLife International has developed a framework for monitoring of

IBAs that can be implemented effectively across networks of sites. This was carried out in 2017 for 54 of Madagascar's 84 terrestrial IBAs. The exercise confirmed the high level of threat prevailing across many sites, the resulting unfavourable or very unfavourable condition of most, and the need for more action; however, a

significant number of sites were benefiting from high levels of conservation action, pointing to the potential to increase this proportion.

The analysis also permits the identification of sites under the highest pressure and in need of immediate action: these are IBAs in Danger.



Pie charts showing the proportion of Important Bird and Biodiversity Areas (IBAs) with different levels of State, Pressure and Conservation Responses. Note that monitoring data is only available for 54 sites.

BARREN ISLANDS: A VULNERABLE MARINE IMPORTANT BIRD AREA

The Barren Islands, comprising nine coral islets, are located in the Mozambique Channel about 10 km offshore near Maintirano in Melaky Region. They were recognised as an Important Bird Area (IBA) in 1999 because of the presence of the Endangered Madagascar Heron *Ardea humbloti* and an internationally important colony of Roseate Tern *Sterna dougallii*. The site also hosts other nesting seabird species and the surrounding waters hold rich marine biodiversity. Accordingly, they also form a Key Biodiversity Area (KBA). In the recent past, egg harvesting, bird hunting and probably predation by introduced rats have affected bird populations.

Certain islands have been mined for guano and resumption of this activity would cause destruction of island vegetation, coral reefs and seagrass beds.

The severity of these threats led to the Barren Islands being recognised as an IBA in Danger, but conservation measures in recent years have been significant. The islands were designated as a Ramsar Site in 2017, extending to the neighbouring coast of the mainland of Madagascar. An area of 431,700 ha including the islands and adjacent coast was granted temporary protected area status in 2014, with local fishing communities working alongside the NGO Blue Ventures and the Government towards their



The Barren Islands are home to some of the healthiest coral reefs in the western Indian Ocean.
Photo © Garth Cripps

permanent designation as a Marine Protected Area, protecting several additional waterbird species, the Critically Endangered Coelacanth *Latimeria chalumnae*, five threatened marine turtle species, eight threatened shark species and potentially the Vulnerable Dugong *Dugong dugon*. Management and advocacy by local communities will

allow the respect for local rights and livelihoods, including continuation of sustainable fishing for more than 4,000 artisanal fishermen thanks to the elaboration of the Melaky Fisheries Management Plan as part of the planning framework. Once again, the IBAs have proven to be an effective planning tool for biodiversity conservation.

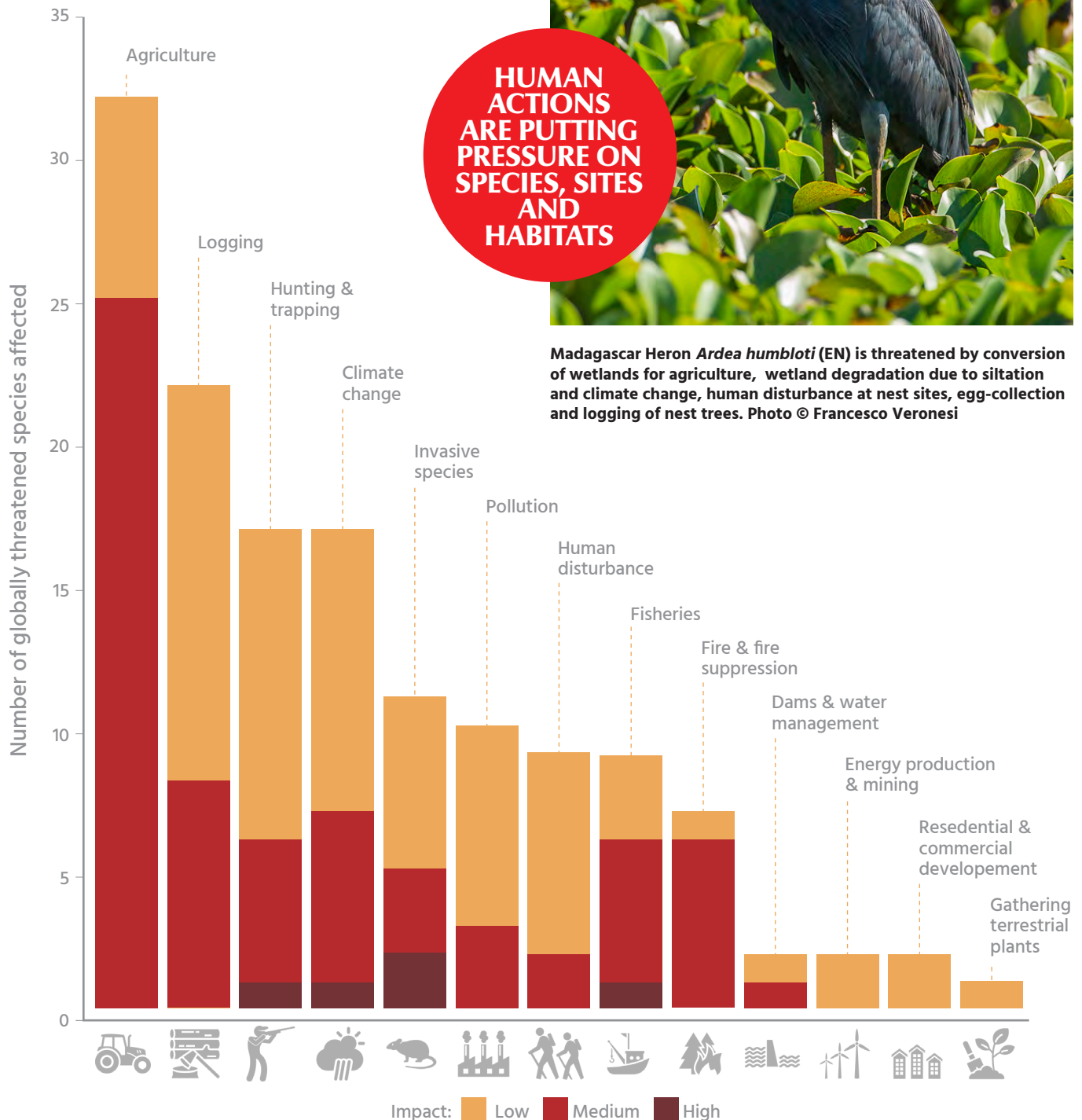
WHY MADAGASCAR'S BIRDS ARE DECLINING

A range of human activities threaten Madagascar's birds. These threats may increase the risk of species extinction through mechanisms such as habitat loss, competition for natural resources, direct exploitation, introduction of detrimental non-native species, or disturbance.



HUMAN ACTIONS ARE PUTTING PRESSURE ON SPECIES, SITES AND HABITATS

Madagascar Heron *Ardea humbloti* (EN) is threatened by conversion of wetlands for agriculture, wetland degradation due to siltation and climate change, human disturbance at nest sites, egg-collection and logging of nest trees. Photo © Francesco Veronesi



Bar chart showing the number of globally threatened bird species affected by various human activities in Madagascar (BirdLife International 2020)



Illegally harvested rosewood from Masoala and Marojejy in Antalaha. Photo © Erik Patel/ Wikimedia Commons

● DEFORESTATION

With nearly 50% of Madagascar's threatened bird species heavily dependent on forest habitats, deforestation and forest degradation is one of the greatest threats to their survival. From 2010–2014, Madagascar lost 223,000 hectares (5%) of rainforest, 139,000 hectares (5%) of dry forest, and 31,000 hectares (2%) of spiny forest—an average of 1.1% total forest loss per year (Vieilledent *et al.* 2018).

Agriculture

The predominant reason for deforestation is for the creation of agricultural land. Much agricultural expansion has resulted from large-scale illegal forest clearance. Forest clearance for subsistence is typically achieved through the traditional swidden method of tavy, in which trees are cut and then burned. The resulting nutrient-rich area is cultivated for a limited period before productivity declines and a new area of forest is cleared. On the abandoned land, depleted of nutrients, forest is often unable to regenerate.

Logging

The international demand for precious woods such as rosewood and ebony

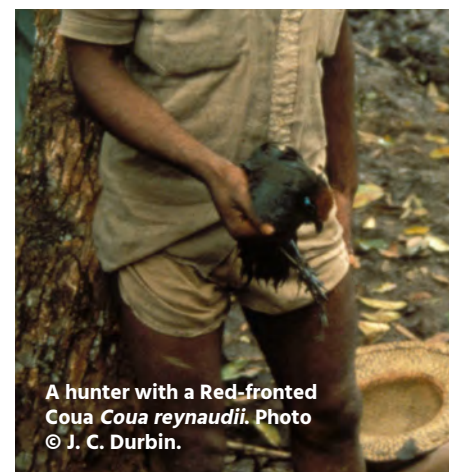
places a high monetary value on Madagascar's forests. A complete ban on the harvesting of precious timbers has been in place since 2006, however illegal logging activity is still commonplace. This problem reached a catastrophic peak during the economic crisis of 2009–2014, when widespread poverty and a lack of control by government led to an explosion in illegal logging. More than 350,000 trees were illegally felled inside protected areas between 2010 and 2015 (Ratsimbazafy *et al.* 2016).

● HUNTING

Twenty two of Madagascar's threatened species are threatened by hunting. Hunting predominantly affects waterbirds—especially ducks, flamingos, ibises, herons, and rails—however large and medium-sized landbirds such as couas, pigeons and ground-rollers are also targeted. Bird-hunting is commonly carried out for subsistence by people from nearby villages; waterbird hunting may be further driven by demand from restaurants. A survey conducted in villages on the Masoala Peninsula (one of Madagascar's richest rainforests) found that those surveyed had consumed 4,015 wild birds (approximately 10 per household) during the previous year (Borgerson *et al.* 2019).



The early stages of tavy—trees have been cut and the dried vegetation partly burned. Photo © Andriamandranto Ravoahangy/Asity Madagascar



A hunter with a Red-fronted Coua *Coua reynaudii*. Photo © J. C. Durbin.



A wetland that has been converted to a rice field.

Photo © Jorlin Tsiavahananahary, Asity Madagascar

● WETLAND DEGRADATION

Of Madagascar's 42 globally threatened species, 16 (38%) are waterbirds. Madagascar's wetlands have suffered significant degradation through conversion to cultivated fields (predominantly rice paddies), reduction in water quality due to soil erosion of deforested hillsides, over-fishing, and the introduction of non-native species. A recent survey of lakes in the north and central highlands and west coast region found that 82% of marshland at sample sites had been cleared for rice cultivation, and that this, along with other forms of human disturbance, had significantly affected avian diversity (Bamford *et al.* 2017).

● CLIMATE CHANGE

Madagascar is among the world's most vulnerable countries to the adverse effects of climate change. These will be felt by human societies, but will also profoundly affect biodiversity. By 2065, temperatures are predicted to increase by 1.1–2.6°C, whilst rainfall is projected to increase during the wet season and decrease during the dry season (World Bank 2020). These changes will influence the distribution of species and the timing of events such as reproduction and migration. The effect on species survival is likely to differ between species depending on their biology and ecology. Five forest-restricted bird species are predicted to lose over 90% of their original ecological niche by 2050: Madagascar Serpent-Eagle *Eutriorchis astur*, Yellow-bellied Sunbird-asity *Neodrepanis hypoxantha*, Helmet Vanga *Euryceros prevostii*, Brown Mesite *Mesitornis unicolor*, and Bernier's Vanga *Oriolia bernieri* (Andriamasimanana & Cameron 2013).



Helmet Vanga *Euryceros prevostii* is one of the species predicted to lose over 90% of its ecological niche due to climate change by 2050.

Photo © Robin Agarwal



Charcoal is the main fuel used for cooking in Madagascar. Photo © Wikimedia Commons User: Bluwood

CAUSES OF BIODIVERSITY LOSS ARE DEEP-ROOTED

It is not difficult to identify the main, immediate causes of the loss of biodiversity of Madagascar (pages 11–13).

Problems may be interrelated: for example, deforestation affects wetlands and marine and coastal areas through soil erosion. However, the drivers are less clear. Where the processes are illegal (as with hunting of protected species and trafficking of precious timbers), the factors that drive them to continue must be controlled; and where they are vital to the economy (as for agriculture and fisheries), the barriers to making them sustainable must be lifted. Some of the main drivers are:

COSTS OF CONSERVATION ARE NOT MET

At the local level, community-based natural resource management and conservation by local communities ('transfer of management' – see page 16) is recognised as an effective mechanism if it is well executed. Local communities care deeply for conservation of their natural resources but lack the means and support needed to better manage them and compensate for the opportunity costs of

conservation over exploitation. The administration often lacks the resources to carry out regulatory tasks. The root causes of these shortfalls are a combination of policy, legal and economic conditions, including insecurity, that do not encourage further investment in nature – at international as well as national levels.

DISINCENTIVES TO INVESTING IN SETTLED AGRICULTURE

Shifting or swidden agriculture is recognised as a cause of deforestation, particularly where primary forests have been cut and burned and the resulting plots abandoned after a few years; in most cases, secondary vegetation is not diverse. However, it is unfair to blame the poorest farmers for this: poverty reduces their livelihood options, and the support that could help them to adopt more sustainable practices, such as land tenure allowing land certification and support to enhanced agricultural production, is often lacking.

ENVIRONMENTAL CRIME

Madagascar has a strong legal framework

to regulate most threats, including a Protected Areas Code revised in 2015 to reflect global best practice. However, law enforcement is often lacking and many Protected Areas are still victims of rampant, illegal exploitation, with forest often cleared for cash crops while animal smugglers and timber traffickers are rarely prosecuted and punished. Despite the legal instruments for secured management of natural resources for communities, outside operators with legal authorisations still come to exploit their resources. These people are often protected by influential individuals, leaving local communities feeling helpless. The main reason for this is weak governance due to corruption and influence peddling.

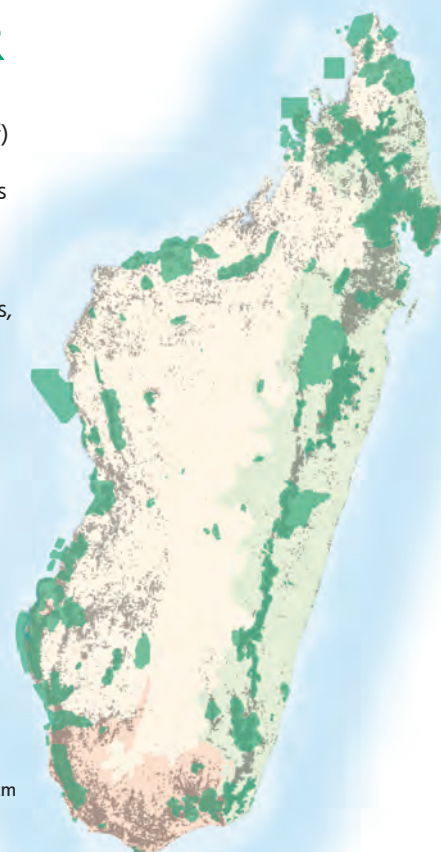
SHORTAGE OF EFFICIENT, NON-DAMAGING ENERGY SOURCES

The main fuel for cooking in Madagascar is still charcoal. Charcoal production is illegal in Protected Areas, but alternative sources (such as charcoal from woodlots, or other fuels) are absent or unaffordable, making the application of the law very difficult; illicit charcoal production is increasing.

PROTECTED AREAS IN MADAGASCAR

Since the 1990s, the Government of Madagascar has made significant efforts in the fight against biodiversity loss. New Protected Areas have been established throughout Madagascar to form the “Système d’Aires Protégées de Madagascar” (SAPM). The Protected Area coverage of Madagascar more than tripled between 2003 and 2016 following a pledge made by the Government at the World Parks Congress in Durban, South Africa. Madagascar currently has 171 Protected Areas, covering 7.49% (44,521

km²) of its land area and 0.91% (11,018 km²) of its coastal and marine area (UNEP-WCMC & IUCN 2020). The main objectives of the SAPM are to conserve Madagascar’s biodiversity and cultural heritage, to maintain sustainable use and equitable distribution of natural resources, and to promote research and ecotourism. The SAPM promotes Protected Area types that encourage local participation in management, including IUCN Categories V (protected landscape/ seascape) and VI (with sustainable use of natural resources).



Map of Madagascar’s Protected Areas, forming the “Système d’Aires Protégées de Madagascar” (SAPM). Source: World Database on Protected Areas, November 2020, including sites with status listed there as ‘proposed’. Some have now been permanently protected, and for others this is expected; see the Barren Islands case study (p. 10) for an example.



Tsitongambarika Forest, home to 62 endemic bird species, was recently designated as a Protected Area. Photo © Andriamandranto Ravoahangy, Asity Madagascar

MAHAVAVY-KINKONY WETLAND COMPLEX, A PROTECTED AREA CO-MANAGED BY ASITY MADAGASCAR



Black-banded Plover *Charadrius thoracicus*. Photo © Nick Athanas

The Mahavavy-Kinkony wetland complex is a Protected Area located in Northwest Madagascar. The site covers an area of 302,000 ha and includes a variety of ecosystems including riverine habitats, lakes, mangroves, beaches, marshes, dry forest, riverine gallery forests and palm savannah. Since 2002, Asity Madagascar has been responsible for its conservation and has established co-management arrangements with local communities. More than 100 bird species are present, including all 10 threatened waterbird species of western Madagascar, with particularly important numbers of Sakalava Rail *Zapornia olivieri* (EN), Madagascar Teal *Anas bernieri* (EN), Madagascar Sacred Ibis *Threskiornis bernieri* (EN), Madagascar Fish-eagle *Haliaeetus*

vociferoides (CR) and Black-banded Plover *Charadrius thoracicus* (VU). The site supports a wide range of other threatened fauna, including Ahmanson’s Sportive Lemur *Lepilemur ahmasoni* (CR, and known only from this site, which is thus an Alliance for Zero Extinction site). Asity Madagascar ensures the regulation of access to natural resources under community-based management agreements through monitoring and surveillance as well as patrols to reduce threats. Development activities are made at the local level to accompany these measures as well as to reduce dependence on unsustainable use of natural resources. Awareness-raising, education and information are cross-cutting activities of the program.



Village planning meeting.
Photo © Raveloson, Asity Madagascar

COMMUNITY EMPOWERMENT FOR CONSERVATION

Encouraging and empowering local communities to take responsibility for the management and sustainable use of their own natural resources can be an extremely effective conservation measure. In recognition of this, the Government has introduced two laws (known as Contracted Forest Management and Secured Local Management) allowing the transfer of management responsibility of renewable natural resources from the State to local communities. This can include Protected Areas.

For these ‘transfers’ to take place, a contract is drawn up between the State and a legally constituted community-based Association, with an agreed management plan. Periodic assessments are carried out to ensure that the terms of the contract are being met, and if they are not then management will revert to the State. In many cases, an NGO may be involved in a ‘co-management’ arrangement, as facilitator, providing technical and administrative support and capacity-building to the Association; the NGO and community both remain accountable to the Government for carrying out their roles.

For sites outside the Protected Area network that are important for wildlife, there is a possibility of customary management by local communities. Examples in Madagascar are few, but include the sacred forests of Etrobeke and Vohibe, where residents uphold strict resource use rules and have identified sacred areas that can only be used in exceptional circumstances. Recognition of the conservation value of these areas is increasing in Madagascar and worldwide; they are known generally as Indigenous Peoples’ and Community Conserved Territories and Areas (ICCAs).

CONSERVATION SUCCESSSES

Intensive efforts have been made to conserve the two Critically Endangered bird species in Madagascar. So far these have been successful, not only in preventing the birds' extinction, but also in protecting of some of Madagascar's most spectacular and biologically rich sites, of immense importance for many other species of both wetlands and forests.

MADAGASCAR FISH-EAGLE (ANKOAY)

The Madagascar Fish-eagle or Ankoay *Haliaeetus vociferoides* is a Critically Endangered species endemic to Madagascar. As its name suggests, this species feeds almost exclusively on fish. The population is now distributed along the west coast of Madagascar from Belo-sur-Tsiribihina north to Nosy Hara. A few individuals have been found further inland, such as at Lake Ravelobe in Ankarafantsika and along the Betsiboka River near Maevatanana.

Juveniles reach maturity at five years of age, after which they lay one or two eggs each year. Due to siblicide (in which the oldest chick kills its sibling),



Madagascar Fish-eagles
Haliaeetus vociferoides.
Photo © Lily Arison
Rene de Roland/ The
Peregrine Fund.

only one chick will be raised, therefore annual productivity is low. The species is found predominantly in wooded areas adjacent to waterbodies, favouring those with large trees, good fish populations and deep, clear water. The main threats to the species are human competition for fish stocks, wetland degradation, hunting of adults and collection of eggs and chicks.

Surveys carried out along the west coast of Madagascar in 2005 and 2006 suggest that the fish-eagle population is growing. Since the last count in 1995, the number of individuals had increased from 222 to 287, while the number of pairs had increased from 99 to 121. However, the population remains precariously small. The extremely small population size, alongside the potential threats from human activity, puts the Madagascar Fish-eagle at high risk of extinction. Significant efforts to conserve the

species have been made by The Peregrine Fund, in collaboration with other organisations and with the participation of local residents. These have included regular monitoring of the population, hand-rearing of younger nestlings, and a community-based conservation project aiming to prevent overfishing and habitat degradation. The two wetland areas holding the highest numbers of fish-eagles are both protected areas: Tsimembo-Manambolomaty managed by The Peregrine Fund and Sahamalaza mangroves managed by Madagascar National Parks. Other Protected Areas along the west coast also support Madagascar Fish-eagles and since 2016 The Peregrine Fund have been collaborating with the managers of these sites to incorporate these birds into conservation targets. A collaborative approach to wetland conservation will be vital to ensure the ongoing survival of this species.



Lake Ravelobe.
Photo © Frank Vassen



Madagascar Pochard *Aythya innotata*.
Photo © Dubi Shapiro

MADAGASCAR POCHARD (FOTSIMASO, ONJY)

Madagascar Pochard *Aythya innotata*, a brown, medium-sized diving duck, is one of the world's rarest birds. It feeds exclusively underwater, and is therefore highly dependent on healthy wetlands. Madagascar's wetlands have suffered widespread degradation (see page 13), leaving very little suitable habitat. Treated on the IUCN Red List as 'possibly extinct', having been last seen in 1991, the Madagascar Pochard was rediscovered in a group of four lakes in a forested region in north-western Madagascar in 2006. In 2009 it was estimated that there were only 20 Madagascar Pochards left in the world.

Several institutions, including Asity Madagascar, Durrell Wildlife Conservation Trust, Wildfowl & Wetlands Trust (WWT) and The

Peregrine Fund, formed a collaboration with the Ministry of Environment and Sustainable Development to ensure the long-term survival of the species. The site of the rediscovery is now included in the Bemanevika-Mahimborondro Protected Area, managed by The Peregrine Fund. A captive breeding programme was initiated with eggs collected from the wild, and a specially built breeding facility was opened in 2017. To establish a second population, Lake Sofia was identified as a potentially suitable release site for captive-bred birds. However, improvement of the habitat is also needed; this long-term process began before the pochard releases, and continues. To achieve it, a long-term community project was set up, using a combination of education and

sustainable fishing and agricultural practices to improve the wetland for both wildlife and people. Floating salmon farming cages were installed to act as aquatic aviaries for the birds while they adjusted to life on the lake. In December 2018, 21 Madagascar Pochards were released onto Lake Sofia. The following year two broods of ducklings were sighted on the lake, confirming that the released birds had successfully bred.

There is still a long way to go in the conservation of the Madagascar Pochard—widespread habitat restoration is required if the population is to continue to increase. However, initial signs are promising, and for now, at least, the species has been brought back from the brink of extinction.



ASITY Madagascar is a national (Malagasy) conservation organisation created in 1996, with a mission to promote “Action for better knowledge of Malagasy biodiversity and its conservation in its natural ecosystem, and promotion of its scientific, social, economic, cultural and ecological importance in Madagascar and world-wide”. It joined the BirdLife Partnership in 2008. As a membership-based, democratic organisation, ASITY Madagascar strongly believes in fostering Malagasy ownership and leadership in conservation, and is active nationwide to achieve this. It is delegated co-manager, with local communities, of four Protected Areas covering nearly 800,000 ha, including two of the largest wetland-and-forest complexes in the country (Mahavavy-Kinkony and Mangoky-Ihotry), one rainforest (Tsitongambarika) and one smaller wetland with associated forest (Torotorofotsy); it led the creation of three of these Protected Areas. It is in these remote sites that much of ASITY Madagascar’s work takes place, building local and national capacity and partnerships between community and other organizations and Government authorities.



Dr Rado Andriamasimanana (1969-2021), the lead compiler and author of this report, passed away on 11 April 2021, after the content had been completed. ‘Dr Rado’, a senior staffer and founding member of ASITY Madagascar and lecturer at the Ecole Supérieure Polytechnique d’Antananarivo, was a leader among Malagasy scientists and conservationists. His blend of technical and practical skills across many fields was unique, and his personality brought many a smile to all who knew him. His passing is a terrible blow to conservation and loss to his many friends in Madagascar and world-wide. This report is dedicated to his memory.

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Long-tailed Ground-roller *Uratelornis chimaera*. Photo © Dubi Shapiro

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