

World Heritage Sites

Protected
Areas and
World
Heritage



AÏR AND TÉNÉRÉ NATURAL RESERVES NIGER

This is the largest protected area in Africa, covering over 7.7 million hectares. It includes the volcanic massif of the Air Mountains, a Sahelian island isolated in climate, flora and fauna in the Saharan desert of Ténéré. It contains an outstanding variety of landscapes, plant species and wild animals. A sixth of the reserve is set aside as a sanctuary for addax.

Threats to the Site: The region suffered from military and civil disturbance in the 1990s, six members of the Reserve staff being held hostage when the site was inscribed on the List of World Heritage in Danger in 1992. A peace agreement with rebels was signed in 1995 when their impact on the site was found to have been less severe than expected. But conflict intermittently recurs.

An IUCN/WWF project has since helped to re-establish a management regime. The numbers of most wildlife species have been recovering and the flora is mostly intact except in some valleys over-used by the local people. The international trade in live animals and animal by-products had locally extinguished the ostrich population, and rare species continue to be seriously threatened by poaching. There is an emergency program for rehabilitating the site, but by 2008, owing to the continued conflict and lack of resources to manage and patrol the Reserves, the need for action had become acute if the main World Heritage values of the site were to be preserved.

COUNTRY

Niger

NAME

Air and Ténéré Natural Reserves

NATURAL WORLD HERITAGE SERIAL SITE IN DANGER

1991: Inscribed on the World Heritage List under Natural Criteria vii, ix and x.

1992+: Listed as a World Heritage site in Danger owing to destruction caused by civil conflict.

STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The UNESCO World Heritage Committee issued the following Statement of Outstanding Universal Value at the time of inscription:

Brief Synthesis

The Air and Ténéré Natural Reserves is one of the largest protected areas in Africa, covering 7,736,000 hectares. It is the last bastion of Saharo-Sahelian wildlife in Niger. It comprises two main zones: the mountain massifs of Aïr rising up to 2000 m in altitude and the vast plain of the Ténéré desert. In the heart of a desert environment, the Aïr represents a small pocket of Sahelian plant life with Sudanese and Saharo-Mediterranean elements.

Criterion (vii): The Aïr constitutes a Sahelian enclave surrounded by a Saharian desert, thus forming a remarkable assemblage of relict ecosystems combined with mountain and plain landscapes of outstanding esthetic value and

interest. The live dunes of the Ténéré rapidly modify the landscape through displacement and deposition of sand. The region contains the blue marble mountains that represent an exceptional aesthetic interest.

Criterion (ix): The Reserve of Aïr and Ténéré is the last bastion of Saharo-Sahlien wildlife in Niger. The isolation of the Aïr and the very minor human presence are the reasons for the survival in this region of numerous wildlife species that have been eliminated from other regions of the Sahara and the Sahel. The property contains a wide variety of habitats (living dunes, fixed dunes, stoney gravel desert, cliff valleys, canyons, high plateaus, water holes, etc.) necessary for the conservation of the Saharo Sahelian biological diversity.

Criterion (x): The property contains important natural habitats for the survival of the three antelopes of the Sahara Desert on IUCN's Red List of threatened species: the Dorcus gazelle (*Gazella dorcas dorcas*); the Leptocere gazelle (*Gazella leptoceros*); and the Addax (screwhorn antelope) (*Addax nasomaculatus*). About a sixth of the Reserve benefits from the statute of sanctuary for the protection of the Addax. The property contains important populations of species of ungulates of the Sahara and species of carnivore such as the fennec fox, Rüppells fox, and the cheetah. The massif of the Aïr also constitutes a transit zone for a large number of afrotropical and palaeartic migratory birds. In total, 40 species of mammals, 165 species of birds, 18 species of reptiles and one amphibian species have been identified in the Reserve. As concerns the flora, the steppe contains species of *Acacia ehrenbergiana*, *Acacia raddiana*, *Balanites aegyptiaca*, *Maerua crassifolia*, and at lower altitudes species of *Panicum turgidum* and *Stipagrostis vulnerans*. In the larger valleys where water in the alluvial reservoirs is plentiful, a very specific habitat has developed associating a dense ligneous stratum of doum palms, date palms, *Acacia nilotica*, *Acacia raddiana*, *Boscia senegalensis*, *Salvadora persica*, and a herbaceous stratum with among others, *Stipagrostis vulnerans*.

Integrity

The property is one of the largest protected areas in Africa covering a surface of 7,736,000 ha. Its central part (1,280,500ha) is listed as a strict reserve (Addax Sanctuary). As the desert species are found in very low densities, this large size is essential for their survival. In the boundaries of the Aïr mountains and the Ténéré desert, the boundaries are marked at all the principal entry points. An extension in the south-west to include a site for wildlife under certain rainfall conditions and to take into account a migration of Addax south-east to the Mt Termit region is under consideration.

Protection and Management Requirements

The property was inscribed on the List of World Heritage in Danger in 1992 due to political instability and dissention among the populations. The property benefits from legal protection and satisfactory management, with technical and financial support from the State and development partners. It does not have a management plan. Hunting and exploitation of wood products are forbidden in the Reserve; and access to the Addax Sanctuary is also strictly forbidden. Poaching and illegal grazing are the main threats that endanger the property. These threats are finding the beginnings of a solution with surveillance and awareness raising activities but much remains to be done to completely eliminate them. To minimize these problems, the physical presence of the management authorities in the Reserve needs to be strengthened; the respective land-use rights and access to resources by the local populations requires clarification, monitoring and surveillance of the property needs to be improved to combat the problems of poaching and the illegal extraction of natural resources and halt the collection of wood and haulm in the property for commercial purposes. The sustainable development and conservation of this property requires the strengthening of financial and technical support from the State and the development partners, in order to establish a development and management plan for the site, for efficient implementation a framework for inter-communal concertation, and to agree on the co-management of the natural resources of the property by the State and the concerned communities.

INTERNATIONAL DESIGNATION

1997: Designated a Biosphere Reserve under the UNESCO Man and Biosphere Programme (24,400,070 ha).

IUCN MANAGEMENT CATEGORIES:

Aïr and Ténéré Natural Reserve: IV Managed Nature Reserve
Addax Sanctuary: Ia Strict Nature Reserve

BIOGEOGRAPHICAL PROVINCE

Western Sahel (2,18.07) / Sahara (3.12.07)

GEOGRAPHICAL LOCATION

The Reserve is in the south-central Sahara and north-central Niger, approximately 160 km north east of Agadez, between 08° 00'E to 10° 57'E and 17° 14'N to 20° 30'N. Two fifths of the Reserve lies in the

northeastern half of the Air Mountains, the rest is in the western half of the desert of the Ténéré du Tafassasset. The Sanctuaire des Addax lies in the Ténéré at the foot of the mountains, north of the centre of the Reserve and covers a sixth of its area.

DATES AND HISTORY OF ESTABLISHMENT

1981: The area came under the administration of foresters of the *Service Faune*;

1988: The Reserve and Sanctuary were established by Decrees 88-019 & 88-020 PCMS/MAG/E;

1992+: Listed an endangered World Heritage site because of the destruction of wildlife and disorder caused by political instability and civil strife;

1997: Designated a UNESCO Biosphere Reserve.

LAND TENURE

Republic of Niger in the *Département d'Agades* and *arrondissements* of Arlit and Tchighazerene. Administered by the *Direction de la Faune, de la Pêche et de la Pisciculture* (DFPP) and the *Ministère de l'Hydraulique et de l'Environnement* (MH/E).

AREA

Total area: 7,735,370 ha: Air & Ténéré Natural Reserve: 6,456,392 ha. Addax Sanctuary: 1,278,978 ha.

ALTITUDE

440m-1,988m. Six peaks are over 1,750m; the plateau averages 700m; the Ténéré plain averages 450m.

PHYSICAL FEATURES

The Reserve, which is the world's third largest, comprises two geomorphic units: the Air mountains, nine roughly circular rugged massifs rising above a rocky plateau, and the sand dunes and plain of the Ténéré to its east. The Reserve surrounds the Sanctuary which is in the sands to the northeast of the massif.

The bedrock is an ancient, heavily eroded Cambrian metamorphic plateau dramatically punctuated by a chain of isolated flat-topped mountains. Those in the reserve are, from north to south: Adrar Bous, Fadei, Greboun, Tamgak (1988m), Chirriet, Taghmert, Agueraguer, Takaloukouzet, and Goundai. These are granite intrusions except for the largely conglomerate Takaloukouzet massif. Tertiary and Quaternary volcanic features include the extinct caldera of Arakao and one of the largest ring-dike systems in the world. Other features are the marble Blue Mountains at Izouzaoene in the Sanctuary, and white marble hills in the lower Zagado valley. The massifs and plateaux are deeply dissected by ancient canyons and seasonal wadis. Soils are sparse, mainly coarse sands, although in wadis and inundation zones there are often thick water-borne clay and silt deposits. The eastern three-fifths of the Reserve is in the Ténéré desert, one of the largest sand seas in the Sahara, which completely covers the underlying bedrock plate. Several sand dune fields (*erg*) occur: the Ergs du Bréard, Brusset and Capot-Rey. The *ergs* piled against the massifs by the prevailing north-easterly winds are some of the highest sand dunes in the Sahara, reaching ~300m at Arakao and Temet. South of the *ergs* are extensive flat plains (*reg*) of coarse sand, gravel and stones. There are also fields of small mobile *rif* and barkhan dunes.

Except for a few rivulets and pools (*gueltates*) in the massifs, there is no permanent water though the mountains are essential to recharging the groundwater supply of northern Niger. Wadis flow for a few hours after heavy rain. Seven drain east from the massifs into the sands of the Ténéré. Several end in temporary inundation pans which can be thickly vegetated and are important to the ecology of the desert margin. Three main wadis drain to the south and five to the west, ending in the plains of Talak and Tamesna. In the distant past these wadis reached the River Niger.

CLIMATE

The Reserve has a hot arid continental desert climate and lies just beyond the 100mm average annual

isohyet. It is strongly influenced by the annual movements of the inter-tropical convergence zone: the resultant desiccating prevailing winds are north-easterly (Smith, 1984). There are three seasons: a relatively cold season, September to February, a hot season, March to June, and a humid season, June to September. The average annual temperature ranges between 15° and 35°C, the mean being 28°C. The mean range in January is 10°-29°C and in June is 25°-44°C. Extremes of -1°C and 52°C have been recorded at Iférouane (Messan, 2001). The rainfall, resulting from the Guinean monsoon, is always scattered and unpredictable, declining towards the north and east. It falls mainly in July and August and is higher in the Air Mountains due to orographic cooling. There it averages 75mm a year, with 52mm recorded at Iférouane. In the Ténéré it averages 20mm a year (Messan, 2001) but often little or no rain falls: the eastern edge may receive only a few millimetres once every 20 years. Annual evaporation is 3-4000mm (Newby, 1990).

VEGETATION

The Air Mountains are the first green land seen by birds flying south from the Mediterranean hills. They are a Sahelian floristic enclave within the Sahara which also contains relict Sudanese and Mediterranean species. and as such is within a local WWF/IUCN Centre of Plant Diversity. Although rainfall is low, the bare rock surfaces of the massifs and plateaux concentrate run-off into wadis and temporary pans, which are relatively well wooded oases, even having gallery woodland with understorey. Sahelian species grow in the wetter parts of the mountains. The principal trees are *Balanites aegyptiaca*, *Salvadora persica*, *Ziziphus mauritiana*, *Boscia senegalensis*, *Acacia laeta* and *A. albida*. Grasses identified are *Panicum laetum*, *Eragrostis pilosa*, *Cenchrus biflorus*, *Dactyloctenium aegyptium*, *Pennisetum violaceum*, *Cymbopogon schoenanthus* and *Chrysopogon aucheri*. In the drier Sahel-Saharan transition zone, the tree species include *Maerua crassifolia* and *Leptadenia pyrotechnica* with the herbs *Aerva javanica*, *Panicum turgidum* and *Lasiurus hirsutus*. However, overbrowsing, overgrazing and tree-felling means that few young trees come up and there are local patches of erosion.

The relict Sudanese and Mediterranean species grow above 1,000m in sheltered more humid localities in the massifs. Sudanese species include the trees *Acacia nilotica*, *Grewia tenax*, *Grewia villosa*, *Cordia sinensis*, *Tamarix gallica* and several species of *Ficus*. Damp areas have *Phragmites australis*, *Typha latifolia* and *Scirpus holoschoenus*. Mediterranean species include the nationally threatened wild olive *Olea europea* spp. *laperrinei*, found above 1,500m on rocky slopes in the Greboun and Tamgak massifs, *Rhus tripartita*, and *Salvia aegyptiaca*. The reserve harbors wild relatives of several important crop species: wild olive, millet *Pennisetum glaucum* and sorghum *Sorghum aethiopicum*, which have been the subject of genetic studies by the French Institute for Scientific Research and Cooperative Development and the International Board for Plant Genetic Resources (Ingram, 1990).

Saharan species include the trees *Acacia tortilis raddiana* on sandy substrates, *A. ehrenbergiana* on stony and clay soils and a few stands of *Hyphaene thebaica* in rocky wadis. Elsewhere in the inter-montane areas, the vegetation is sparse, mainly *Fagonia bruguieri*, *Zygophyllum simplex*, *Cornulaca monocantha*, *Citrullus colocynthis*, *Tephrosia* and *Indigofera* spp. and the grasses *Stipagrostis pungens* and *S. plumosa*. The green fleshy annual herb *Schouwia thebaica* grows on silty-sandy soils after floods and is an important part of the diet of both wildlife and domestic stock at the end of the cold season. On the sands of the Ténéré, there is almost no vegetation except for a few ephemeral annuals growing in response to scattered showers, mainly *Tribulus longipetalus*, *Cyperus conglomeratus* and *Stipagrostis acutiflora*.

Over 350 species have been recorded by Newby, Dulieu & Lebrun (1982), Monson (1985) and by MH/E *et al.* (1996), which lists 289 species from 191 genera and 63 families. Most of this vegetation is drought-adapted but slow to recover from prolonged stress such as the long droughts of the 1970s and 1980s, and many of the trees are heavily over-utilised. Tree-cutting has been curtailed and the relatively unspoilt flora of the reserve is more or less intact in most areas apart from a few overused valleys, but overall the vegetation cover has decreased since inscription in 1991 and invasion by alien species such as *Prosopis* spp. has increased (IUCN, 2008).

FAUNA

Because of their diversity and inaccessibility the Air mountains harbour viable populations of several internationally threatened species. Both Saharan and relict Sahelian species occur, the Sahelian species having been isolated from populations further south for thousands of years. Several of the Saharan species can survive without drinking, but many of the other animals can be found between the Tamgak and Takaloukouzet massifs where there are watered valleys. IUCN field missions in 2001 supported by the World Heritage Fund confirmed the relative abundance and diversity of wildlife: 40 species of mammal, 165 birds, some 18 reptiles and 1 amphibian have been recorded. A list with habitat preferences is given in MN/E *et al.* (1996). This is the only mountain system in the world outside Antarctica without fish (Newby *et al.*, 1982). The invertebrate fauna is not yet inventoried. In 2001 protected key species were recovering from recent disturbance by conflict and droughts. However, some are still at serious risk. In 2008 the IUCN reported that addax *Addax nasomaculatus* (CR), ostrich *Struthio camelus* and several species of vultures and eagles have become locally extinct due to poaching for the wild animal trade. Only one male ostrich was reported to remain in the wild.

The Air harbours important populations of several threatened Saharan ungulates. The numbers of addax (CR) declined steadily since 1979. In 1989 the population was down to 15 (Newby & Magin 1989) though a 1997 IUCN field mission found a population of more than 100 in the southeastern part of the Ténéré. However, by 2008 addax were locally extinct. In 1990 Magin estimated that there were about 12,000 dorcas gazelle *Gazella dorcas* (VU), 170 dama gazelle *Nanger dama* (CR) and 3,500 Barbary sheep or aoudad *Ammotragus lervia* (VU), some 70% of the Barbary sheep population of Niger (Magin 1990a; Shackleton, 1997). Dorcas gazelle numbers actually increased after creation of the reserve but the population fell from 12,000 to 7,000 by 2000. With dama gazelles they are now in serious decline due to continued military poaching and tourist disturbance (IUCN, 2008). Another species in serious decline is the Barbary sheep (VU). Slender-horned gazelle *Gazella leptoceros* (EN) has been recorded only once and no scimitar-horned oryx *Oryx dammah* (EX) was seen after 1983. The species is now extinct in the wild (IUCN, 2010)

Most larger Sahelian carnivores like lion *Panthera leo* (VU) and African wild dog *Lycaon pictus* (EN), were exterminated earlier this century by hunting and poisoning, but about 15-20 Saharan cheetah *Acinonyx jubatus hecki* (CR) and a few striped hyaena *Hyaena hyaena* persist, preying on feral donkeys (Magin, 1990a). These are now also on the brink of extinction. Smaller carnivore populations are healthy. They include Asiatic or golden jackal *Canis aureus*, fennec fox *Fennecus zerda*, sand fox *Vulpes rueppellii*, caracal *Caracal caracal* and sand cat *Felis margarita*. Striped polecat, zorilla or striped polecat *Ictonyx striatus* is recorded (Messan, 2001). Other Sahelian mammal species include an isolated and presumably highly inbred population of around 70 olive baboons *Papio anubis*, in the Tamgak massif, and an estimated 500 Patas monkeys *Erythrocebus patas* in the central massifs and plateaux. Both are of subspecies endemic to the Air (Magin, 1990a). In rocky areas there are colonies of rock hyrax *Procavia capensis* and there are stable unthreatened populations of smaller mammals: burrowing rodents, insectivores and bats (Magin, 1990a). Crested porcupines *Hystrix cristata* and hedgehogs *Atelenix alboventris* are serious pests in the cropland (Newby, 1989).

The resident avifauna are Saharan, Saharo-Sahelian and Saharo-montane species (Newby *et al.*, 1987): crowned sandgrouse *Pterocles coronatus*, doves Columbidae, barbets Capidonidae, larks Alaudidae, buntings Emberizidae, weavers Ploceidae, ravens and crows Corvidae are conspicuous. African red-billed hornbill *Tockus erythrorhynchus* is recorded. There are substantial numbers of Nubian bustard, *Neotis nuba*, and eagle owl *Bubo bubo*. The last large population of the west African race of the ostrich, *Struthio camelus*, living west of the Takaloukouzet massif, estimated in 1990 at 800-2,000 (Magin, 1990a) was almost extinct in 2008. The reserve hosts some 85 species of palaeartic passage and overwintering migrants, particularly herons Ardeidae, birds of prey Accipitridae and Falconidae, waders Charadriidae, thrushes Turdidae and warblers Sylviidae. The pallid harrier *Circus macrourus* is one such visitor. During the wet season there is an influx of local Afro-tropical migrants from the south (Newby *et al.*, 1987). The herpetofauna includes black-necked spitting cobra *Naja nigricollis*, African puff adder *Bitis arietans*, west African sand boa *Eryx muelleri*, sand viper *Cerastes cerastes*, desert monitor lizard *Varanus griseus* and several species of gecko (Messan,

2001; Newby *et al.*, 1982).

CONSERVATION VALUE

The Reserve has a range of landscapes with dramatic granite intrusions and live dunes, and vegetation and wildlife unsurpassed in the region. The massifs are biological islands in the heart of the Sahara of Sahelian wildlife. Internationally important populations of five species of threatened fauna survive: dorcas and dama gazelle, aoudad, and ostrich. Comparable areas include the more Saharan Tassili N'Ajjer National Park in Algeria, the Tibesti-Ennedi region and Ouadi Rimé-Ouadi Achim Reserve in Chad which however has suffered from civil conflict for over twenty years and little wildlife is believed to remain. Owing to the remoteness of the Aïr and Ténéré Reserve and low recent intensity of settlement, signs of the interaction of ecological processes with man over millennia are revealed in a spectacular environment with rock art and archaeological sites of great value, not yet seriously damaged. The site lies within in an immense UNESCO Biosphere Reserve.

CULTURAL HERITAGE

The Aïr has been settled for at least 30,000 years: prehistoric palaeolithic and neolithic sites abound (Roset 1987). Later semi-nomadic agriculturists from the south were displaced by the first Berbers, ancestors of the present Twareg inhabitants (Newby *et al.*, 1982). Most archaeological sites are sited along former rivers and lake margins in wooded savanna on the edge of the Ténéré desert, which probably last held water 4,000 years ago (Smith 1984). The sites are rich in arrow-heads, axe-heads, mortars and grindstones. There are notable sites at Iwelene, Areschima, and Adrar Bous and rock-engravings at Arakao, Agamgam, Anakom, Tagueit, and Afis: petroglyphs of elephant and giraffe, addax, oryx, gazelles and ostrich, and phrases of Tifinagh, the written form of the Tamasheq language of the Twareg.

Pre-islamic tombs are common along the edge of the Ténéré (as at Tafidet). The oldest houses are probably C11th to C14th, built during the last wave of Twareg invasion, but most were abandoned during the last 200 years and there are ruined villages at Tin Telloust, Assodé and Ekpouloulef (Newby *et al.*, 1982; Messan, 2001). The Aïr was colonised by the French from 1898, but not subjugated until the defeat of Kaoussan's rising in the 1920s (Salifou 1973). Fortifications from that period survive. The colonisation disturbed the balance of the traditional Twareg social structure and pattern of land use. Owing to its cultural richness the site is a potential World Heritage Mixed site but due to poor surveillance is subject to archaeological looting and continues to need better protection.

LOCAL HUMAN POPULATION

The Twareg (*Imajaghen*) of the Aïr once dominated one of the most important trans-Saharan trade routes (Barth, 1857-8) and were undoubtedly hurt by the opening of coastal routes. The Aïr was also a part of a triangle of trade: livestock and garden produce were taken by camel caravan across the Ténéré to the oases of Bilma, traded for salt and dates, which were then taken to the south of Niger and exchanged for millet, the basis of the diet of the Twareg of the Aïr. This trade has declined due to drought and competition from vehicles, and the economy's survival now depends on being as widely based as possible (Newby & Grettenberger, 1986; Newby, 1989) but the population remains poor (IUCN, 2008).

The current population of Twareg within the Reserve is about 5,000 of which some 1,000 are both cultivators and herders (GEF, 1999); the sedentary population at Iférouane and Tin Telloust, is about 1,500 (Messan, 2001). The nomads are transhumant pastoralists, raising many thousands of goats and camels with a few sheep, donkeys and cattle who still live in balance with their harsh environment despite the stresses caused by social change. But their numbers fluctuate greatly according to the pasture available: in drought years many migrate to nearby mining towns and villages to obtain famine relief, returning when conditions improve where their livestock competes with the wild animals for fodder. The settled population of about 5,000 consists mainly of the descendents of former slaves (*Iklan*) of the nomadic aristocracy and artisans (*Imaden*), who farm nearly 100 small irrigated gardens in the major wadis where the water table is high enough, raising wheat, fruit, vegetables and dates (Newby 1989). Civil conflict which followed destructive droughts in the 1970s and 1980s disrupted the area during the early 1990's but regularly re-erupts.

VISITORS AND VISITOR FACILITIES

In 1988, some 2,000-3,000 mostly French tourists visited the Reserve, (Newby, 1989) and after a lull in the 1990s numbers are steadily increasing: 4,000 were expected in the year 2000. Access is usually by vehicle, although there are airstrips suitable for light aircraft. One national standard unmetalled road passes through the Reserve from Agadez through Iférouane to the Algerian border. All tracks within the reserve are unsurfaced and most follow the major wadis. Nearly all visitors travel in the security of convoys of 4WD vehicles organised by travel agencies based in Agadez and Arlit, camping in the bush. There are two small rest houses in the Reserve, both locally run, at Iférouane. In 1990 a visitor centre with museum was built at Iférouane as an IUCN/WWF project. A village cooperative has been formed for camel and donkey trekking, to increase the tourist revenue reaching the local population.

SCIENTIFIC RESEARCH AND FACILITIES

Owing to its topographic and biological diversity, the Aïr has been of interest to scientists since the first visit by Barth in 1850. His technical notes, published in 1857-8, were augmented by, amongst others, Foureau (1902), Buchanan (1921) and Rodd (1926). Current scientific studies date from a joint WWF/ZSL mission to the Aïr in 1979, leading to an IUCN/WWF project initiated in 1982. Most of its researches are internal project documents, available from IUCN, Niamey, Niger, but research on dorcas and dama gazelle has been published (Grettenberger 1987, Grettenberger & Newby 1986). Research in the first phase of the project (1988-1990) focused on wildlife and domestic stock censuses, vegetation dynamics, ostrich breeding biology, and the ecology of aoudad and baboon (Magin 1990a-e; Castanuela 1989). A bibliography of project documents and pre-project research is given in Newby (1989 and 1991). The Ministry of Water Resources & Environment (MH/E) with WWF and IUCN published in French a record of recent research covering both human and environmental factors with an exhaustive bibliography (1996). The reserve headquarters at Iférouane house a small (poorly-equipped) laboratory, a small museum, a herbarium of the common plants in the Reserve, and a library. All scientific projects must be arranged in cooperation with the authorities, who provide accommodation for visiting scientists.

MANAGEMENT

Since 1981 the Reserve has been administered by foresters of the government's *Service Faune*. A Reserve rather than a National Park was mandated to allow people to continue living on their land (Newby, 1989). It was created and has been run since 1988 with the help of an IUCN/WWF project initiated in 1982 (MNE *et al.*, 1996). The 1988 legislation recapitulates existing national laws which prohibit hunting of wild animals and exploitation of certain tree species, all commercial collection of firewood, abusive cutting or pruning of any tree or bush for fodder, artifacts or fuel, and organised motor sports (the Paris-Dakar Rally used to pass through the area). The legislation defined 16% of the centre of the Reserve as a Sanctuary to protect the small population of addax from tourist and other disturbance. Access to it is now banned without express permission from the Minister in charge of wildlife. This has not greatly affected the local Twareg, who rarely entered the area since there is very little pasture there and it does not lie across any of their traditional caravan routes (Newby, 1992).

Training has been an important objective of the IUCN/WWF project. By 1990, locals had been trained as masons, construction workers, tree nurserymen, first aid helpers, midwives, mechanics, guides, and drivers. A large number of unskilled short-term labourers had been employed to build dry-stone barrages and to plant trees. Several Nigerien foresters had been sent abroad on study scholarships funded by the project. The nomads are told about the authorities' intentions and changes in reserve legislation during periodic visits from forester patrols and from four camel-mounted extension workers who visit areas inaccessible by vehicle. To integrate the people into the Reserve's management, a network of 47 headmen and clan chief representatives was appointed to report infractions of the law in their areas. A reunion of these men and the reserve authorities is held once a year when discussions are two-way and last three to four days.

A subsidiary IUCN project funds a magazine called *Alam* (Tamasheq for camel) which highlights conservation issues and environmental problems. This is distributed free to schoolchildren in the departments of Agadez and Tahoua and within the Reserve. IUCN Niger is now also working on a conservation project based on co-

operation between local stakeholders and institutions. This aims to increase the economic value of the reserves to the local people by developing decentralised and sustainable ecotourism, agriculture and animal husbandry. Some specific projects are: tree planting, methods of construction without wood, better market farming and plant nurseries, producers' cooperatives, check dams, maintaining wells and more efficient wood-burning ovens (Messan, 2001).

A peace accord with the Twareg was signed in 1995: there were no longer serious security problems in the area, but some wildlife populations had declined (UNESCO, 1997). Realising its benefits, the local people restarted the development project after the civil unrest had declined. Peace encouraged a plan for rehabilitating the Reserves for submission to prospective donors such as the GEF, Band Aid and the Swiss and Danish governments. The plan, *Programme D'appui À La Gestion Des Ressources Naturelles Dans l'Air Et Le Ténéré* (PAGRAT) included the restoration of sites used as rebel bases, improved surveillance, rapid evaluation of the impacts of disturbances on wildlife, establishing management structures for the development and management of the Reserves, training for Reserve staff, police and customs officers about threats to wildlife, and the encouragement of ecotourism, agriculture and animal husbandry (UNESCO, 1998,1999; IUCN, 2003). By 2001 a WHF funded assessment report concluded that the main large mammal populations had recovered but were not yet assured and ostriches were locally extinct. However, addax were rare and reliable survey techniques were needed, as was also a wildlife census including the participation of local people. Reintroduction of the ostrich from Chad and the breeding of ostriches and large mammals for reintroduction was to be encouraged and had local support. The *Fonds Francais de l'Environnement Mondiale* with the *Direction Nationale de la Faune* had initiated a 5-year support program for equipment and reintroductions and for monitoring, in cooperation with IUCN, GEF and UNDP (UNESCO, 2002). In 2005 the project Co-management of Natural Resources in Air and Ténéré Natural Reserves and Adjacent Areas (COGERAT) was approved by UNDP with funding from the GEF and other donors. It aims to encourage sustainable land use practices, but given the land's state of degradation and the need to change land and resource use practices, this was a long-term aim.

MANAGEMENT CONSTRAINTS

In 1992, the site was placed on the list of World Heritage in Danger as a result of conflict between the government and the Twareg. The Twareg traditionally hunted gazelle, aoudad, addax and occasionally ostrich, using snare traps and dog packs, but as wildlife has declined so has hunting. The decline was caused by uncontrolled illegal hunting with firearms and motor vehicles by military and mining personnel both foreign and Nigerien. Tourists also frequently chased addax and gazelles until they died of heat exhaustion. Harassment temporarily decreased due to improved surveillance and greater environmental awareness amongst Europeans, although the guard force cannot control marauders. Unpunished tree-cutting, pillaging of archaeological sites and fossils, poaching of gazelle and ostrich by the Nigerien military continued during the 1990s (Newby, 1996), and rebel activity still disturbed the area in 2002 (IUCN, 2002). By 2003 the ostrich population had been destroyed (IUCN, 2003). Successive droughts also caused competition for grazing land with livestock which increased with the increasing population (Shackleton, 1997).

Other management problems have been livestock predation by golden jackals and cheetah which the locals countered by indiscriminate poisoning; and destruction of trees for fodder, fuel, thatch, and wood-working which has been reduced by replacing local wooden artifacts by imported ones. Both problems were solved in consultation with the local representatives at the annual reunions (Newby, 1992). The local tourist agencies initially opposed a Reserve as a restriction on their independence, but they have gradually realised that the reserve protects the landscape and wildlife that tourists come to see. But pillaging archaeological sites for souvenirs can only be overcome with the cooperation of the tourists and agencies themselves, since it is too difficult to police the sites. However, by 2001, management of the Reserve was seen to have deteriorated, UNESCO supplies were not reaching it from the capital (IUCN, 2002) and vehicles provided through the WHF had disappeared (UNESCO, 2003).

By 2003, the Reserves had been without adequate guards and administrators for ten years owing to armed conflict and the lack of resources. Warlords and locals freely poached the remaining animals and used the

reserve for military exercises. The PAGRNAT program had stopped, and according to the Secretary-General of the leading local NGO, GAGE, the need for cooperation with other government departments and between agencies and local people had become acute if the extinction of the major World Heritage values of the site was to be prevented (IUCN, 2003, UNESCO, 2004). In 2007 there was another Twarag rebellion and the northern half of the Reserve became inaccessible to park staff. There was a need to physically re-establish the management authority in Iférouane, provide it with adequate resources, establish land commissions to clarify land-use and resource access rights for local residents; to improve monitoring and surveillance, to limit poaching, illegal firewood and thatch collection, and to control erosion (UNESCO, 2007). In 2008, aided by the COGERAT program, staff began to return and monitoring of the greatly increased poaching, agricultural encroachment and illegal use of resources was reinstated. By 2009, a peace accord was signed and security had improved although the site was still considered in danger. 11 community surveillance brigades, 20 environmental co-management committees and 4 co-management bodies were set up and a 200 km fire barrier created. Degraded habitat was re-seeded and reintroduction of ostrich, addax and dama gazelle planned (UNESCO, 2010).

STAFF

In 1988 the IUCN/WWF-funded project *Conservation et Gestion des Ressources Naturelles dans l'Air et le Ténéré* which helped to administer the reserve employed 34 staff as follows: 5 government foresters, 2 salaried expatriate advisers, 4 expatriate volunteer advisers, 5 drivers, 2 guides, 4 extension agents, 2 midwives, 2 apprentice mechanics, 4 tree nurserymen, 1 secretary-radio operator, 1 driver-aide and 1 night watchman. In 2001 there were 41 staff, 7 working in the DFPP, 47 local auxiliary guardians, 11 vehicles and radio facilities (Messan, 2001). In 2009 a Park Director and Associate Park Director based on Iférouane were designated and forest ranger posts at Timia and Tabelot established (UNESCO, 2010).

BUDGET

In 1987-88 WWF/IUCN contributed 2,728,000 SFr (US\$1,750,000) for Project 9607/1624. Much of this funding was provided by the Swiss government which from 2003 will use the monies for rural development and the alleviation of poverty. The Nigerien government contributed 40,000,000 Fr.CFA* (US\$130,000) but the breakdown of the budget for these years is not known. In 1999 the WH Fund granted US\$75,000 in emergency assistance which is held however in Niamey (UNESCO, 2000; IUCN, 2002). In 2000 the WHF granted US\$15,000 to support nomination for cultural heritage status (UNESCO, 2001) and in 2001 granted US\$25,000 towards ostrich reintroduction. The budget for the next three years except for salaries was 70,000,000 Fr.CFA (US\$73,000 per year). The total amount provided to the property by the WHF in 2005-6 was US\$143,250 including US\$108,250 for urgent rehabilitation projects and inscription of the property as a mixed property. In 2005 the COGERAT project was approved by UNDP with funding from the GEF for US\$4 million over the six years 2006-2012 with US\$5 million co-funding from other donors (UNESCO, 2006).

* Franc du Communauté Financiere d'Afrique

LOCAL ADDRESSES

M. le Directeur, Direction de la Faune, Pêche et Pisciculture, Ministère de l'Hydraulique et de l'Environnement, BP721, Niamey, Niger.

M. le Directeur du Projet Faune, Iférouane, B.P.312, Arlit, Agades, Niger.
The Secretary-General, GAGE, BP: 95, Agadez, Niger.

REFERENCES

The principal source for the above information was the original nomination for World Heritage status.

Barth, H. (1857-8). *Travels and Discoveries in North and Central Africa*. Longmans, London.

Buchanan, A. (1921). *Out of the World North of Nigeria*. Murray, London.

Campbell, A. & Coulson, D. (2001). *African Rock Art*. Abrams, New York, 224 pp.

Castanuela, A. (1989). *The Olive Baboon Population of the Tamgak Massif - A Preliminary Study*. IUCN/WWF, Niamey, Niger.

Foureau, F. (1902). *D'Alger au Congo par le Tchad*. Masson, Paris.

Fishpool, L. & Evans, M. (eds) (2001). *Important Bird Areas in Africa and Associated islands. Priority Sites for Conservation*. Pisces, Newbury / BirdLife International, Cambridge U.K.

Giazzi, F. (ed.) (1996). *La Réserve Naturelle Nationale de l'Aïr et du Ténéré (Niger)*. MHE, WWF & IUCN, Gland, Switzerland.

Global Environmental Fund (1999). *Proposal for a PDF Block B Grant*.

Grettenberger, J. (1987). Ecology of the dorcas gazelle in northern Niger. *Mammalia* 51(4):

Grettenberger, J., Newby, J. & Monson, K. (1984). *La Réserve Naturelle Nationale de l'Aïr et du Ténéré: Proposition pour un Plan Directeur d'Aménagement pour la Conservation et l'Utilisation des Ressources Naturelles*. IUCN/WWF, Niamey, Niger (unpublished report).

Grettenberger, J. & Newby, J. (1986). The status and ecology of the Dama Gazelle in the Aïr and Ténéré National Nature Reserve, Niger. *Biological Conservation* 38: 207-216.

----- (1990a). Plan d'aménagement pour la Réserve Naturelle Nationale de l'Aïr et du Ténéré. Concepts et cadre general. *Série des Rapports Techniques* No.1, IUCN/WWF, Niamey.

----- (1990b). A landscape classification for the Aïr and Ténéré National Nature Reserve, *Ser.Rapp.Tech.* No.2, IUCN/WWF, Niamey, Niger.

Hagener, L. (1990). Gestion des pâturage dans la Réserve Naturelle Nationale de l'Aïr et du Ténéré. *Ser.Rapp.Tech.* No.10, IUCN/WWF, Niamey, Niger.

Hammer, D. (1990). Traditional garden systems in the Aïr mountains of Niger. *Ser.Rapp.Tech.* No.13. IUCN/WWF, Niamey, Niger.

Ingram, G. (1990). Multi-gene pool surveys in areas with rapid genetic erosion: An example from the Aïr mountains, northern Niger. *Conservation Biology* 4(1): 78-90.

IUCN (2010). *The Red List of Threatened Species*. IUCN, Cambridge, U.K.

----- (2008). *State of Conservation Report Air and Ténéré Natural Reserves*. Gland, Switzerland.

----- (2003). *Will Niger's Aïr And Ténéré Natural Reserves Be Abandoned?* Gland, Switzerland.

----- (2002). *Report on the State of Conservation of Natural and Mixed Sites Inscribed on the World Heritage List*. Gland, Switzerland

----- (2001). *Report on the State of Conservation of Natural and Mixed Sites Inscribed on the World Heritage List and the List of World Heritage in Danger*. Gland, Switzerland.

Lhote, H. (1961). *L'Épopée du Ténéré*. Gallimard, Paris.

Magin, C. (1990a). The status of wildlife populations in the Aïr and Ténéré National Nature Reserve 1988-

1990. *Ser.Rapp.Tech.* No.14. IUCN/WWF, Niamey, Niger

----- (1990b). Seasonal changes in habitat preferences of domestic livestock and wildlife in the Aïr and Ténéré National Nature Reserve 1988-1990. *Ser.Rapp.Tech* No.15, IUCN/WWF, Niamey.

----- (1990c). The breeding biology of the ostrich *Struthio camelus camelus* in the Aïr and Ténéré National Nature Reserve 1988-1990. *Ser.Rapp.Tech* No.16, IUCN/WWF, Niamey, Niger.

----- (1990d). The ecology of the aoudad (*Ammotragus lervia*) in the Aïr and Ténéré National Nature Reserve 1988-1990. *Ser.Rapp.Tech* No. 17, IUCN/WWF, Niamey.

----- (1990e). Long-term monitoring of woody vegetation in the valleys of Aza-n-Ghraidene and Teloua: A preliminary report. *Ser.Rapp.Tech* No.18, IUCN/WWF, Niamey, Niger.

Messan, E. (2001). *Les Réserves Naturelle de l'Aïr et du Ténéré*. Delegation report to UNESCO.

MH/E (Min.de l'Hydraulique et de l'Environnement), WWF & IUCN (1996) *La Réserve Naturelle Nationale de l'Aïr et du Ténéré (Niger). Étude Initiale: Analysis Descriptive*. IUCN, Gland, Suisse.

Monson, K. (1984). *Catalogue of Vascular Plants from the Aïr and Ténéré National Nature Reserve, Niger*. IUCN/WWF, Niamey, Niger.

Morel, A. (1985). *Les Hauts Massifs de l'Aïr (Niger) et leurs Piedmonts*. Université de Grenoble.

Newby, J. (1989) (ed.) *Conservation des Ressources Naturelles dans l'Aïr et le Ténéré - Niger. Documentation Generale*. IUCN, Gland, Switzerland.

----- (1992) Parks for people: a case study from the Aïr mountains of Niger. *Oryx* 26(1).

----- (1996). Parks for people: a case study from the Air mountains of Niger. *The George Wright Forum* 13 (4):40.

Newby, J., Dulieu, D. & Lebrun, J-P. (1982). *Avant-Projet de Classement d'une Aire Protégée dans l'Aïr et le Ténéré (République du Niger)*. IUCN, Gland, Switzerland.

Newby, J., & Grettenberger, J. (1986). The human dimension in natural resource conservation: a Sahelian example from Niger. *Environmental Conservation* 13(3): 249-256.

Newby, J., Grettenberger, J. & Watkins, J. (1987). The birds of the northern Aïr, Niger. *Malimbus* 9(1).

Newby, J. & Magin, C. (1989). Addax in Niger: distribution, status and conservation options. In: *Proceedings of CBSG Arid land Antelope Workshop*, San Antonio, Texas, pp. 159-170.

Rodd, R. (1926). *People of the Veil*. Macmillan, London.

Roset, J-P. (1987). Néolithisation, néolithique et post-néolithique au Niger nord-oriental. *Bulletin de l'Association Française pour l'Etude du Quaternaire* 32(4): 203-214.

Salifou, A. (1973). *Kaoussan ou la Révolte Sénoussiste*. Etudes Nigériennes No.33. CNRSH, Niamey.

Shackleton, D., (ed.) (1997) *Wild Sheep and their Relatives*. IUCN/SSC Caprinae Specialist Group. Gland, Switzerland and Cambridge, U.K.

Smith, G. (1984). Climate. In: Cloudsley-Thompson, J. (ed.) *Sahara Desert*. Pergamon, Oxford, pp. 17-30.

UNESCO World Heritage Committee (1997) *Report on the 20th Session of the Committee, 1996*.

----- (1998) *Report on the 21st Session of the Committee, 1997*.

----- (1999) *Report on the 22nd Session of the Committee, 1998*.

----- (2000) *Report on the 23rd Session of the Committee, 1999*.

----- (2001) *Report on the 24th Session of the Committee, 2000*.

----- (2002) *Report on the 25th & 26th Sessions of the Committee, 2001/2002*.

----- (2003) *Report on the 27th Session of the Committee, 2003*.

----- (2004) *Report on the 28th Session of the Committee, 2004*.

----- (2006) *Report on the 30th Session of the Committee, 2006*.

----- (2010) *Report on the 34th Session of the Committee, 2010*.

DATE

1991. Updated 6-1993, 7-1997, 10-1998, 4-2002, 2-2005, 2-2009, 12-2010, November 2011.