



there are an estimated 12,000 Dorcas gazelle (V), 170 Dama gazelle (E), 3,500 Barbary sheep or aoudad (V), occasional addax (E) and possibly slender-horned gazelle (E). Carnivores include healthy populations of fennec fox (K), Rüppells fox (K), and a small and probably declining population of 15 - 20 cheetah (V). About 85 of the bird species recorded are Palaearctic migrants; of the remainder the estimated 800 - 2,000 ostrich represent the last viable population of the West African race, and there are substantial numbers of Nubian bustard. The reptilian fauna include the desert monitor lizard, the sand viper and various species of sand boa and gecko.

Archaeological sites from the Palaeolithic and Neolithic periods are found at many locations in the reserve, as are rock engraving sites. The 3,500 - 7,000 Twareg inhabitants for the most part maintain a lifestyle of transhumant pastoralism, raising goats and camels. The settled population practises irrigated agriculture, growing wheat, fruit, vegetables and dates.

#### **4. STATE OF PRESERVATION / CONSERVATION**

The area has been under active management since 1981, seven years before the official gazetting of the reserve. A preliminary management plan was drafted in 1984 and a revised one was prepared in 1990. The reserve authorities place equal emphasis on policing and education of local people and tourists to prevent infractions of the law. The aim is to integrate the local Twareg into reserve management, and aid them in their socio-economic development, while at the same time ensuring the sustainability of natural resources. Patrols are conducted by vehicle and camel, and an annual meeting is held between the reserve authorities and the local people.

The most noticeable problem is poaching of gazelles and ostriches within the reserve by military personnel.

#### **5. JUSTIFICATION FOR INCLUSION ON THE WORLD HERITAGE LIST**

The Réserve Naturelle Nationale de l'Air et du Ténéré Nomination, as presented by the Government of Niger provides the following justification for designation as a World Heritage property:

##### **D) Natural property**

- (i) **Outstanding examples of stages in the Earth's geological formation** The Air massif constitutes a remarkable assemblage of examples of metamorphic and eruptive activity on the ancient African baseplate. Particularly noteworthy are the spectacular intrusions of "younger granites" which confer a unique appearance to the landscape.

- (ii) **Outstanding examples of ongoing geological processes** The "live dunes" of the Ténéré are an example of erosion under way: the landscape is rapidly modified on a geological time scale by the displacement and deposition of sand.
- (ii) **Outstanding examples of biological evolution** Since the Holocene the area has experienced the effects of desertification which has modified the distribution of animal and plant species.
- (ii) **Outstanding examples of man's interaction with his natural environment** Man has been continuously present in the Air since the Palaeolithic. This presence continues thanks to the rational management of environmental resources.
- (iii) **Outstanding examples of natural phenomena and beauty** The Air constitutes a Sahelian island (climate, flora, fauna) isolated in a Saharan desert environment. It represents a remarkable assemblage of relict ecosystems, coupled with a landscape of exceptional aesthetic interest.
- (iv) **The most important and significant natural habitats where species still survive** The reserve contains important natural habitats for the survival of three Saharan desert antelope species internationally threatened with extinction: addax, dama gazelle and slender-horned gazelle. The situation of the addax, the largest wild animal of the Sahara, is particularly critical. The reserve also contains populations of animals (olive baboons, patas monkeys, rock hyraxes, caracal etc.) and plants which have been isolated in the Air for thousands of years and which therefore constitute an unique genetic entity.

WORLD HERITAGE NOMINATION - IUCN TECHNICAL EVALUATION

573: RESERVE DE L' AIR ET DU TENERE (NIGER)

1. DOCUMENTATION

- i) IUCN Data Sheet
- ii) Additional Literature Consulted: J.M. Durou, 1990, Ténéré-Désert d' absolus AGEP. 215p.
- iii) Consultations: Niger Government Officials, P. Tunley, H. Jungius, J. Verschuren, J. Newby.
- iv) Field Visit: February 1991, Jim Thorsell, P. Hislair, G. Sournia, Anada Tiega.

2. COMPARISON WITH OTHER AREAS

The Air/Ténéré Reserve extends over two biogeographical provinces: the Sahara and the Western Sahel. In the former there are 69 other protected areas, including the Tassili N' Ajjer World Heritage site and in the Western Sahel there are 22 protected areas including the two World Heritage sites Djoudj and Banc D' Arguin. Air/Ténéré is an arid desert landscape and has little in common with these latter two wetland sites but it does have certain affinities with the Tassili, 600 km to the north. Both are arid desert reserves that have shared a similar climatic history. Both contain a mix of Saharo - Mediterranean biota and both are inhabited by Twareg people. Both are important for resting palearctic migratory birds and share a number of mammals typical of the region (dorcass gazelle, barbary sheep). Both are significant sites for prehistoric remains - rock paintings and engravings and neolithic artifacts and both contain geological and botanical features of great scientific interest. Finally, each of the reserves is comparable in size and each is experiencing a similar management problem - tourism.

Despite these many similarities, Air/Ténéré is distinctive for its greater abundance of wildlife, particularly ungulates. The Ténéré portion also has a much more extensive "sand sea" and its dunes are considered the most spectacular in the Sahara. Situated astride the Saharan/Sahelian zone, it is also more influenced by Afrotropical elements.

Another area of comparable conservation interest is the Tibesti-Ennedi region and Ouadi Rimé-Ouadi Achim Reserve in neighbouring Tchad. The Tchadian areas, however, have suffered from armed conflict for over 20 years and very little wildlife is thought to remain - in sharp contrast to the Air/Ténéré which has been under active management since 1981.

### 3. INTEGRITY

The 1988 legislation gazetting the reserve followed active management which commenced with the assistance of an IUCN/WWF project in 1980. This project is continuing through to 1993 with support from the Swiss and Danish governments, with a 1991 budget of \$US1.4 million. The reserve authorities are well-equipped with vehicles, radios and a headquarters and there is a strong training component. Boundaries are marked at all key entry points and there is a new visitor center in Iférouane. There are some innovative activities such as the promotion of woodless building techniques, tree planting, an education magazine for children and regular meetings with local people and related government agencies.

Although there has been a gradual decline in environmental quality and some species losses this has largely been arrested over the past 10 years. Wildlife populations have stabilised or increased except for both the Scimitar-horned Oryx which has not been sighted in Niger since 1983 and the Addax which is also nearing extinction in the country. Vegetation monitoring is also undertaken but it is too early to determine trends.

Management issues include control of poaching by the military and certain government officials from Agadez but recent arrests have signalled a reduction in this activity. Tourist harassment of wildlife, which is particularly damaging due to heat stress, is less a problem due to education of tourist operators and the tourists themselves. The Paris/Dakar road race no longer is allowed to pass through the Reserve.

The local Twareg population in the reserve numbers between 2000-2500 in two confined settlements at Iféroune and Tin Telloust. There is also a nomadic population of 1500-2000 pastoralists. The settled population practise irrigated agriculture and keep fluctuating numbers of livestock. Heavy domestic stock grazing pressure (camels, goats, donkeys) occurs throughout the reserve except in the 12% of the central region which has been legislatively defined as a sanctuary. Human access to the sanctuary is banned except by permit. This has not greatly affected the Twareg who rarely entered the area as very little pasture is found there and it does not lie across any of the ancient caravan routes.

Despite regulations to the contrary, many tree species have been heavily exploited especially during past periods of drought. As a part of the Sahel region, the Air can sustain only dispersed human use, even in good rainfall years.

The size of the total area (7.7 million ha) makes it the largest protected area in Africa although the area under strict sanctuary status is relatively moderate (1.3 million ha). As desert species are found in very low densities, this large size is essential to their survival. The boundaries encompass the major features of both the Air mountains and the Ténéré desert. There is some consideration of an extension in the south-west to include a site for wildlife under certain rainfall conditions and to take into account a recently observed migration of Addax south-east to the Mt Termit region.

The challenge remaining is to devise a management system which will withstand the phasing out of substantial aid subsidies. It is hoped that the management plan now being prepared (draft due in November 1991) will lay the foundation for this in terms of the equilibrium between human needs and conservation and that revenues generated by tourism and independent research will provide the authorities with the resources to maintain the reserve.

#### 4. ADDITIONAL COMMENTS

The Air-Ténéré has been a testing ground for the "new generation" of protected areas in Africa. Operating in the very harsh and degraded Sahelian environment, the project has achieved considerable recognition for its innovative approach. Activities began with a concern for protecting biodiversity and expanded to include promotion of sustainable resource use and rehabilitation of habitats. Camel-mounted extension agents, a programme of watershed management (involving the construction of drystone barrages), tree planting, training of masons in woodless construction and a network of 47 Twareg headmen and clan chiefs responsible for surveillance are all part of this new approach.

After an initial period of uncertainty, both the local people and the local tourist agencies have now come to cooperate more fully with reserve authorities. The reserve has still not received full recognition within the various government departments of Niger which leads to occasional conflicts of authority with more influential ministries. This problem should diminish as the reserve gains a higher public profile and if it receives World Heritage status.

#### 5. EVALUATION

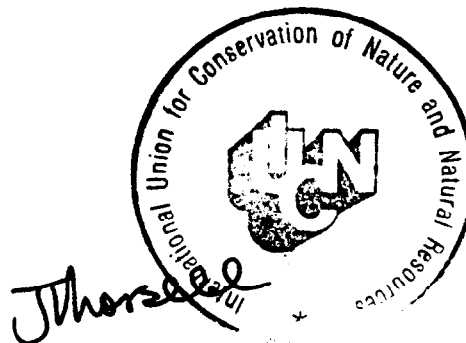
The Air-Ténéré possesses an exceptional natural assemblage of landscapes, vegetation and wildlife, unsurpassed in the region and is the last stronghold of Saharo-Sahelian wildlife in Niger. The interaction of human activity and ecological processes has created a unique and spectacular environment. The area has been settled for over 30,000 years, and the many archaeological sites present are of great historic and cultural value. Owing to the remoteness of the Air and the low intensity of settlement over the past 2,000 years, much of the wildlife that has been eliminated elsewhere in the Sahara and Sahel survives. The effects of overgrazing and over-exploitation of resources widely observed in the Sahel have been mitigated by severe droughts (e.g. in the 1970s and 1980s) which caused huge stock losses and emigration, preventing overstocking. The mountain massifs have been likened to biological islands in a sea of sand, a Sahelian enclave in the Sahara. The reserve harbours internationally important populations of five species of threatened fauna (Dorcas gazelle, Dama gazelle, addax, mouflon, ostrich) and three species of flora.

On this basis the Reserve meets the following three criteria for natural properties:

- ii) **Outstanding example of geological processes, biological evolution and man's interaction with his natural environment.** The "live dunes" of the Ténéré are rapidly modifying the landscape by the displacement and deposition of sand. Since the Holocene the area has experienced drastic effects of climatic change and major shifts in species distribution. Man has been continuously present since the Paleolithic and has developed a unique cultural history.
- iii) **Outstanding examples of natural phenomena and beauty.** The Aïr constitutes a Sahelian island (climate, flora, fauna) isolated in a Saharan desert environment. It represents a remarkable assemblage of relict ecosystems, coupled with a landscape of exceptional aesthetic appeal.
- iv) **The most important and significant natural habitats where species still survive.** The reserve contains important natural habitats for the survival of three Saharan desert antelope species internationally threatened with extinction: addax, dama gazelle and slender-horned gazelle. The situation of the addax, the largest wild animal of the Sahara, is particularly critical. The reserve also contains populations of animals (olive baboons, patas monkeys, rock hyraxes, mouflon, caracal etc.) and plants which have been isolated in the Aïr for thousands of years and which constitute a unique genetic entity. The area is also an important stopover point for palearctic migrant birds.

## 6. RECOMMENDATION

The Aïr/Ténéré should be inscribed on the World Heritage list. The Government of Niger, particularly the Direction de la Faune, Pêche et Pisciculture should be commended and encouraged in their efforts to continue to protect and restore the area.



NAME Réserve Naturelle Nationale de l'Air et du Ténéré (includes the Réserve Naturelle Intégrale called the "Sanctuaire des Addax")

MANAGEMENT CATEGORY IV (Managed Nature Reserve). The central region of the reserve, the Sanctuaire des Addax, is Category I.

BIOGEOGRAPHICAL PROVINCE 2.18.07 (Sahara)/3.12.07 (Western Sahel)

GEOGRAPHICAL LOCATION The reserve is located in the north-central region of that part of the Sahara belonging to Niger, approximately 160km north east of the major town of Agadez, in the Department of Agadez. The northern and central parts of the reserve lie in the administrative zone or arrondissement of Arlit, while part of the southern region falls within the arrondissement of Tchighazerene. One national standard un-made road passes through the reserve, from Agadez through Timia and Iférouane north to the Algerian border at I-n-Azaoua. A dirt track also runs from Arlit to Iférouane, while the southern part of the reserve is accessible from the Agadez/Fachi track. Some 35-40% of the reserve consists of the eastern and northern region of the Air Mountains, rugged massifs separated by intervening low rocky plateaux. The remainder consists of the western part of the Ténéré desert, one of the major "sand seas" of the Sahara.

The reserve is roughly rectangular in shape, its long axis running north-south. The southern boundary follows the Agadez/Fachi track from its junction with the Barghot wadi at 17°12'N, 09°09'E to 18°00'N, 10°57'E. The eastern boundary runs due north to Balize Berliet No. 15 at Grein, 20°30'N, 10°57'E. The northern boundary runs from this point almost due west to Adrar Bous, and then follows the Adrar Bous/Arlit track around the north side of the Greboun massif to its junction with the I-n-Azaoua/Agadez road at 20°10'N, 08°06'E. This road forms the western boundary of the reserve south through Iférouane to Assodé. The western boundary then follows the centreline of the Ounan Kerad, In-Fissek, Tamanet, Barghot and several smaller wadis until it rejoins the Agadez/Fachi track. The perimeter of the reserve is 1,218km.

The sanctuary lies completely within the reserve. Its southern boundary runs due east from the wadi of Anakom at 18°40'N, 09°44'E to 18°40'N, 10°00'E. The eastern boundary runs due north to 20°00'N, 10°00'E. The northern boundary runs due west to the wadi of Temet 20°00'N, 08°47'E. The western boundary follows the main tourist track from Temet down the east side of the Air massifs via the wadi of Emzeggar to Tezirzek and Ifinyane at 19°21'N, 09°12'E. From Ifinyane() this western boundary continues in a straight line south-south-east to 19°01'N, 09°21'E at Issaouan, and then follows another tourist track for 92km via Arakao to Anakom. The perimeter of the sanctuary is 563km.

DATE AND HISTORY OF ESTABLISHMENT The reserve was gazetted by Decree No.



CLIMATE The reserve lies entirely within the 100mm average annual isohyet defining the climatic Sahara (Smith 1984). The region experiences a hot arid desert climate strongly influenced by the annual movements of the Inter-Tropical Convergence Zone. The year may be divided into three seasons: the "cold season" from November to February, the "hot season" from March to June, and the "rainy season" from July to October. The average annual temperature is around 28°C; minimum temperatures of below freezing are recorded in January and February, while the maximum temperatures of approximately 50°C are recorded in May and June. Rain tends to fall mainly in July and August, but there are frequently successions of drought years in which little or no rain falls. Rainfall is higher in the Air Mountains than in the surrounding areas of the desert due to orographic precipitation. Generally, rainfall declines along the south-north and west-east axes. Annual precipitation at Iférouane averages around 50mm a year. Rainfall is always scattered and unpredictable, and the drier eastern regions of the Ténéré may receive only a few millimetres once every 20 years. VEGETATION The flora of the reserve has been described in Newby, Dulieu and Lebrun (1982) and Monson (1985). Over 350 species of plant have been identified. The Air Mountains can best be characterised as a Sahelian enclave within a Saharan environment, although some relict Sudanese and Mediterranean species also occur. Although the actual annual precipitation in the region is usually less than 100mm, the effective precipitation is much higher in some areas, since the bare rock surfaces of the massifs and plateaux concentrate large volumes of water run-off into the wadis and temporary pans, which as a result are often thickly vegetated. The Sahelian element is found around these wetter areas of the Air Mountains. The principal tree species are Balanites aegyptiaca, Salvadora persica, Ziziphus mauritania, Boscia senegalensis, Acacia laeta and A. albida. The grasses Panicum laetum, Eragrostis pilosa, Cenchrus biflora, Dactyloctenium aegyptium, Pennisetum violaceum, Cymbopogon shoenanthus and Chrysopogon aucheri have been identified. In the drier Sahel-Saharan transition zone, species include Panicum turgidum, Lasiurus hirsutus, Aerva javanica and the trees Maerua crassifolia and Leptadenia pyrotechnica.

The Saharan element includes the trees Acacia raddiana on sandy substrates and A. ehrenbergiana on stoney and clay soils, while in the rocky wadis of the massifs there are stands of Hyphaene thebaica. Elsewhere in the inter-montane areas, the vegetation is sparse and consists mainly of Fagonia brugeri, Zygophyllum simplex, Cornulaca monocantha, Citrullus colocynthis, Tephrosia and Indigofera spp. and the grasses Stipagrostis vulnerans and S. plumosa. The green, fleshy, annual herb Shouwia thebaica grows on silty-sandy soils after floods, and is an important component of the diet of both wildlife and domestic stock at the end of the "cold season". Away from the massifs on the sands of the Ténéré, vegetation is more or less absent. The only plant species are ephemeral annuals growing in response to scattered rain showers. The three main species found are Tribulus longipetalus, Cyperus conglomeratus and Stipagrostis acutiflora.

The relict Sudanese and Mediterranean elements are found above 1,000m in the sheltered wetter localities in the massifs. Sudanese species include the trees Grewia tenax, Grewia villosa, Cordia sinensis and several species of Ficus. Mediterranean species include wild olive Olea lapperinei - which

species of smaller mammals (orders Rodentia, Chiroptera, and Insectivora) with stable non-threatened populations (Magin, 1990a).

The resident avifauna of the region consists of Saharan, Saharo-Sahelian and Saharo-Montane residents (Newby et al., 1987). Sand grouse (Pteroclididae), doves (Columbidae), barbets (Capidonidae), larks (Alaudidae), crows and ravens (Corvidae), buntings (Emberizidae) and weavers (Ploceidae) are the most conspicuous residents. The last significant population of the West African race of the ostrich, Struthio camelus camelus, estimated at 800 - 2,000 head, and substantial numbers of Nubian bustard, Neotis nuba also occur (Magin, 1990a). The reserve is visited by some 85 species of Palaearctic passage and overwintering migrants, particularly herons (Ardeidae), birds of prey (Accipitridae and Falconidae), waders (Charadriidae), thrushes (Turdidae) and warblers (Sylviidae). During the wet season there is an influx of various Afro-tropical local migrants from the south (Newby et al., 1987).

The reptilian fauna include desert monitor lizard Varanus griseus, sand viper Cerastes cerastes, and various species of sand boa and gecko (Newby et al., 1982).

CULTURAL HERITAGE The Air has been settled for at least 30,000 years, and prehistoric Palaeolithic and Neolithic archaeological sites abound (Roset 1987). The Neolithic population of the Air, about whom very little is known, was probably obliged to leave the region when the climate became too dry to support their pastoral system. A wave of semi-nomadic agriculturists later arrived from the south, and were finally displaced by the first Berbers (the ancestors of the present Twareg inhabitants) in an invasion occurring in three phases (Newby et al., 1982). Most archaeological sites are situated along the edges of "fossil" rivers and lakes, which probably last contained water 4,000 years ago in a wetter phase of the climatic cycle (Smith 1984). The sites are rich in artifacts, such as arrow-heads, axe-heads, mortars and grindstones. Notable rock-engraving sites are present at Arakao, Agamgam, Anakom and Tagueit. Animals feature prominently among the images. Elephant and giraffe belong to the vanished fauna of the wetter past, while more recent engravings depict the current fauna of addax, oryx, gazelles and ostrich, together with phrases of Tiffinah, the written version of Tamasheq, the language of the Twareg. Pre-islamic tombs are common along the edge of the Ténéré (e.g. at Tafidet). The Air also contains numerous ruined villages (e.g. at Assodé at Tchin Telloust). Most were abandoned in the last 200 years, but the oldest houses probably date from the 11th to 14th Century, corresponding to the last wave of Twareg invasion (Newby et al., 1982). The Air was colonised by the French from 1898 onwards, but the Twareg were not completely subjugated until the 1920s, when an uprising led by a chieftain called Kaoussan was quashed (Salifou 1973). Several fortifications from that period survive.

LOCAL HUMAN POPULATION The current population of the reserve is virtually all Twareg. Estimates of the nomadic population vary from 1,500 - 4,500, while the sedentary population of Iférouane and Tin Telloust is probably around 2,000 - 2,500 (Magin, 1990a). Numbers of nomads fluctuate greatly

according to the pasture available: in drought years many leave the area and migrate to nearby towns and villages to obtain famine relief, returning when conditions improve. The nomadic population is transhumant pastoralist, raising mainly goats and camels with a few sheep, donkeys and cattle. Where the water table is high enough along the major wadis, the settled population - consisting mainly of the former slaves of the nomadic aristocracy - practises irrigated agriculture. The main crops are wheat, fruit, vegetables and dates (Magin, pers. obs.).

Historically, the Twareg of the Aïr dominated one of the most important trans-Saharan trade routes (Barth, 1857-8). This was undoubtedly adversely affected by the opening up of coastal trade routes. In the more recent past the Aïr was part of a trade triangle. Livestock and garden produce were transported by camel caravan east across the Ténéré Desert to the oases of Bilma, where they were traded for salt and dates. These were taken to the agricultural zone in the south of Niger and exchanged for millet, which forms the basis of the diet of the Twareg of the Aïr. The caravan trade is now declining owing to competition from motorised transport (Newby and Grettenberger 1986).

VISITORS AND VISITOR FACILITIES In 1988, some 2,000 - 3,000 tourists visited the reserve (Newby 1989). The majority of tourists are French, and numbers are steadily increasing from year to year. Access to the reserve is usually by vehicle, although a number of airstrips suitable for light aircraft also exist. All vehicle routes within the reserve are unsurfaced tracks, which for the most part follow the major seasonal watercourses or wadis. Visitors travel almost entirely in convoys of from two to five four-wheel drive vehicles organised by travel agencies based in Agadez and Arlit, and camp in the bush. There are only two small rest houses in the reserve, both locally run, at Iférouane. Tourism is steadily increasing, and in 1990 a visitor centre was constructed by the IUCN/WWF Project at Iférouane, incorporating a museum display. A village cooperative has been formed to promote tourist trips on camel- and donkey-back, in an effort to increase the proportion of tourist revenue accruing to 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 a European, Barth, in 1850. The technical notes made by Barth (1857-8) have been augmented, among others, by Foureau (1902), Buchanan (1921), and Rodd (1926). The current phase of scientific study dates from a joint WWF/ZSL mission to the Aïr in 1979, which gave rise to IUCN/WWF Project No. 9607/1624. Most research results have been written up as internal project documents, available on application from IUCN, Niamey, Niger, but research on the ecology of the Dorcas and Dama gazelle has been published (Grettenberger 1987, Grettenberger and Newby 1986). Research in the latest phase of the Project from 1988 to 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). Newby (1989 and 1991) gives a fairly complete bibliography of project documents and pre-project research.

Reserve headquarters Iférouane house a small but poorly-equipped laboratory, a small museum, a herbarium containing specimens of all the common plants in the reserve, and a library. All scientific projects in the reserve must be arranged in cooperation with the authorities, who would provide accommodation for visiting scientists.

**CONSERVATION VALUE** The reserve possesses an exceptional natural assemblage of landscapes, vegetation and wildlife, unsurpassed in the Saharo-Sahelian region, and is the last stronghold of Saharo-Sahelian wildlife in Niger. The interaction of human activity and ecological processes has created an unique and spectacular environment. The area has been settled for over 30,000 years, and the many archaeological sites present are of great historic and cultural value. Owing to the remoteness of the Aïr and the low intensity of settlement over the past 2,000 years, much of the wildlife that has been eliminated elsewhere in the Sahara and Sahel survives. The effects of overgrazing and over-exploitation of resources widely observed in the Sahel have been mitigated by severe droughts (e.g. in the 1970s and 1980s) which caused huge stock losses and emigration, preventing overstocking. The mountain massifs have been likened to biological islands in a sea of sand, a Sahelian enclave in the Sahara. The reserve harbours internationally important populations of five species of threatened fauna (Dorcas gazelle Gazella dorcas, Dama gazelle Gazella dama, addax Addax nasomaculatus, aoudad Ammotragus lervia, ostrich Struthio camelus) and three species of flora (Olea lapperinei, Pennisetum glaucum, and Sorgho aethiopicum). Areas potentially of comparable conservation interest include Tassili N'Ajjer Parc National in Algeria, the Tibesti-Ennedi region and Ouadi Rimé-Ouadi Achim Reserve in Chad. However, the Chadian areas have suffered from an armed conflict for over 20 years and very little wildlife is believed to remain - in sharp contrast to the reserve which is under effective active management. Tassili N'Ajjer is situated further north than the Aïr, is more purely Saharan in character, and thus has a much lower level of biological diversity.

**CONSERVATION MANAGEMENT** The reserve is administered by foresters of the Nigerien Government's Service Faune, a subdivision of the Direction de la Faune, Pêche et Pisciculture. This Direction is currently part of the Ministère de l'Hydraulique et de l'Environnement, but has also operated under the Ministère de l'Agriculture et l'Environnement in recent years. The reserve has been created and administered largely with the help of IUCN/WWF Project No. 9607/1624 entitled "Conservation et gestion des ressources naturelles dans l'Aïr et le Ténéré" which has been running for almost 10 years.

The legislation enacted in 1988 gazetting the reserve for the most part recapitulates existing national laws prohibiting hunting of wild animals and exploitation of certain tree species. In addition, all commercial collection of firewood, abusive cutting or pruning of any tree or bush species, and

organised motor sports are banned (the Paris-Dakar Rally formerly used to pass through the area). All development activities within the reserve are to be coordinated in principal by the reserve authorities.

Infobase produced by WCMC, January 1992

The only existing management zonation is defined in the legislation, classing 12% of the central region of the reserve as the sanctuary, which was designed specifically to protect the small population of Addax from tourist and other disturbance. Human access to the sanctuary is now banned without express permission from the Minister in charge of Forests and Wildlife. This has not greatly affected the local Twareg, who rarely entered the area since very little pasture occurs in the sanctuary and it does not lie across any of their traditional caravan routes.

In 1989 the reserve authorities possessed a fleet of 11 Land Rovers and 1 Mercedes truck. The reserve headquarters, consisting of offices, a fully equipped garage, laboratory, library, and accommodation for senior staff and technical advisers, are situated in the village of Iférouane, where the majority of the staff and vehicles are located. A small forestry post exists at the hamlet of Tin Telloust, where one forester, one driver and one vehicle are permanently stationed. The buildings were all erected by the project as part of the "woodless construction" programme, designed to address the local shortage of timber. Local masons were trained in the technique of building domed houses from adobe mud bricks during the construction of the headquarters. Although the reserve headquarters at Iférouane possesses a generator, there are no telephone, telex or fax links because there is no mains electricity. A VHF radio network links the fixed bases of Iférouane and Tin Telloust with the regional forestry headquarters at Agadez, the overall headquarters and the IUCN office in Niamey, and Parc "W" in the extreme south-west of the country. In addition, some six vehicles are fitted with mobile radio units, so communications can be maintained while on patrol.

The area of the reserve has been under active management by the Nigerien Forestry Service since 1981, seven years before the official gazetting. A tentative management plan was drafted by Grettenberger *et al.* (1984), and a revised version prepared by Grettenberger and Newby (1990), but it has not yet been officially implemented. Major management activities centre around the preservation of biological diversity, the sustainable use of natural resources, and the rehabilitation of degraded environments. Protection and surveillance by patrols of foresters and camel-mounted extension agents, a programme of watershed management (involving the construction of drystone barrages) and tree planting, and the training of masons in woodless construction and improved well-building techniques were all in progress in 1990. Ecological monitoring is recognised as an important component of management, enabling the effect of interventions to be distinguished from background changes (Newby, 1989).

Training is an important part of the reserve authorities' objectives and methodology. By 1990, locals had been trained as masons, construction workers, tree nurserymen, first aiders, midwives, mechanics, guides, and drivers. A large number of unskilled labourers had been employed on a short-term basis to construct dry-stone barrages (or check-dams) and plant trees. Several Nigerien foresters had been sent abroad on study scholarships funded by the IUCN/WWF Project.

88-019/PCMS/MAG/E of the 22 January 1988. The sanctuary was gazetted on the same date by Decree No. 88-020/PCMS/MAG/E. The decrees appeared in the official journal on 15 March 1988.

AREA 7,736,000ha (1,280,500ha of this area comprise the sanctuary)

LAND TENURE State

ALTITUDE The majority of the reserve lies between 400 and 800m. The massifs rise abruptly to over 1,500m from the surrounding plains. The highest recorded altitude is 1,998m in the Tamgak massif.

PHYSICAL FEATURES The basal geology of the area is an ancient, heavily-eroded metamorphic plate formed in the Cambrian period. The western part of this plate is interrupted by the Air Mountains. Nine massifs (Greboun, Adrar Bous, Tamgak, Adrar Chiriet, Taghmert, Agueraguer, Takaloukouzet, Adrar Madet and Bundai), composed of igneous intrusions of Younger Granites from the Nigerian series, provide dramatic relief in the western part of the reserve. Several prominent volcanic features were also formed in the Tertiary and Quaternary periods, including the extinct caldera of Arakao and one of the largest ring-dike systems in the world. Other notable features include the Takaloukouzet massif, which contains a high proportion of conglomerate rocks, the marble Blue Mountains at Izouzadene in the sanctuary, and the white marble hills at Kogo in the lower Zagado. Between the massifs lie extensive low rocky plateaux. Both massifs and plateaux are deeply dissected by seasonal drainage systems or wadis. Soils are sparse and composed mainly of coarse sands, although in wadis and inundation zones there are often thick water-borne clay and silt deposits.

The eastern portion of the reserve consists of the Ténéré desert, one of the largest "sand seas" in the Sahara, which completely covers the underlying metamorphic plate. Several "ergs" or sand dune fields occur: the Erg du Bréard, the Erg Brusset and the Erg Capot-Rey. Where the ergs are piled against the massifs by the prevailing north-easterly winds some of the highest sand dunes in the Sahara are found, reaching approximately 300m in height at Arakao and Temet. Surrounding the ergs are extensive areas of "reg" or flat plains of coarse sand, gravel and stones. Other areas have fields of smaller more mobile "rif" and "barkhan" dunes.

With the exception of a few small rivulets and "gueltas" or rock pools in the massifs, there is no permanent water in the Air. The drainage system consists of seasonal water courses or wadis, which flow for a few hours only after heavy rainfall. Three of the main wadi systems (the Zagado, Tafidet and Ajirrugdou) drain eastwards from the massifs and peter out in the sands of the Ténéré. Several wadis end in temporary inundation zones or pans, which can be thickly vegetated and are important to the ecology of the desert margin areas. The other main wadis (the Tamgak, Zilalet and Tamanet / Barghot) drain to the west and south, terminating in the plains of Talek and Tamesna. In the distant past these wadis reached as far as the River Niger.

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is listed as Vulnerable by IUCN (1978) - found above 1,500m on rocky slopes in the Greboun and Tamgak massifs, the tree Rhus tripartita, and the forb Salvia aegyptiaca.

The reserve harbours significant populations of the wild relatives of several important crop species: wild olive, millet Pennisetum glaucum and sorghum Sorgho aethiopicum. All have been the subject of genetic studies by the French Institute for Scientific Research and Cooperative Development (ORSTOM) and the International Board for Plant Genetic Resources (IBPGR) (e.g. Ingram, 1990).

**FAUNA** Over the past 10 years biologists have identified at least 40 species of mammal, many of which are internationally threatened (IUCN 1990); 165 birds; some 18 reptiles; and 1 amphibian. The Air is the only mountain system in the world outside Antarctica that contains no species of fish (Newby *et al.* 1982). No inventory has yet been made of the invertebrate fauna. As with the flora, both Sahelian and Saharan elements occur. The many Sahelian species present are relicts from the last wet climatic period, and have been isolated from populations further south for thousands of years.

The Air harbours significant populations of several threatened Saharan desert ungulate species. Magin (1990a) estimated that approximately 12,000 Dorcas gazelle Gazella dorcas, 170 Dama gazelle Gazella dama, and 3,500 Barbary sheep, or aoudad, Ammotragus lervia were present in the reserve. Numbers of Dorcas gazelle and aoudad are believed to have been increasing over the series of high-rainfall years since the creation of the reserve, but Dama gazelle seems to be declining due to continued military poaching and tourist disturbance. In addition, a few - perhaps 15 - addax Addax nasomaculatus may frequent the desert pastures in the sanctuary, although sightings - and therefore presumably numbers - have declined steadily since 1979 (Newby and Magin 1989). Slender-horned gazelle Gazella leptoceros has been recorded once. Scimitar-horned oryx Oryx dammah used to migrate north into the southern half of the reserve in the wet season from its main habitat in the Sahelian savanna zone, but none has been seen since 1983 and the species is now feared to be extinct throughout Niger (J. Newby, pers. comm.).

There are healthy populations of the smaller carnivores, including Asiatic or golden jackal Canis aureus, fennec fox Fennecus zerda, Rüppells sand fox Vulpes rüppelli, caracal Felis caracal and sand cat Felis margarita. The larger carnivores were mostly exterminated early this century by hunting and poisoning (e.g. lion Panthera leo and African wild dog Lycaon pictus) but about 15 - 20 cheetah Acinonyx jubatus and possibly a few striped hyaena Hyaena hyaena persist (Magin, 1990a).

Sahelian species include an extremely isolated and presumably highly inbred population of around 70 olive baboons Papio anubis, which survives in the Tamgak massif, and an estimated 500 Patas monkeys Erythrocebus patas which inhabit the massifs and inter-montane plateaux. Both populations are of subspecies endemic to the Air (Magin, 1990a). In rocky areas there are colonies of rock hyrax Procavia ruficeps. In addition, there are many

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The nomadic population is kept apprised of the authorities' intentions and changes in reserve legislation by periodic "sensibilisation" visits from forester patrols, and from four camel-mounted extension workers, who can visit areas of the reserve inaccessible by vehicle. A network of 47 Twareg headmen and clan chiefs has been appointed as "local representatives" responsible for reporting any infractions of the law in their assigned areas. An annual reunion of the local representatives and the reserve authorities is held once a year. Discussions last 3 - 4 days and are a two-way process.

A subsidiary IUCN project funds the production of a conservation magazine for free distribution to primary and secondary school children in the departments of Agadez and Tahoua. Called "Alam" (= camel in Tamasheq) the magazine highlights conservation issues and environmental problems. Its area of distribution includes the reserve and its surroundings.

MANAGEMENT CONSTRAINTS The Twaregs traditionally hunted gazelle, aoudad, addax and occasionally ostrich, utilising snare traps and packs of dogs. Wildlife has declined to the point that for the most part this is no longer practised. The decline was caused by uncontrolled illegal hunting with firearms and motor vehicles by military and mining personnel (both foreign and Nigerien). Tourists also played a part, frequently chasing addax and gazelle until they died of heat exhaustion. Tourist harassment of wildlife has decreased, aided by improved surveillance and heightened environmental awareness among Europeans, but poaching by the Nigerien military continues and is currently the greatest challenge facing the reserve authorities (Newby, in prep.).

The local tourist agencies were initially hostile to the idea of a reserve, believing it would restrict their independence. They are gradually becoming convinced that the reserve will ensure the conservation of the desert landscape and wildlife that the tourists come to see. Certain problems, such as the pillaging of archaeological sites for souvenirs can only be overcome with the cooperation of the tourists themselves, since it is too difficult to police the sites.

After an initial period of mistrust, local people are beginning to cooperate more fully with the reserve authorities. The main management problems have been tackling the questions of livestock predation (by golden jackals and cheetah) and the replacement of locally produced wooden mortars with imported ones. Both problems have now been solved in consultation with the local representatives at Annual Reunions (Newby, in prep.).

The reserve has still not achieved full recognition within the various government departments of Niger, which leads to occasional conflicts of authority. The government network is strongly hierarchical, and Ministries which are more politically influential than that administering the reserve continue to sanction projects and actions without its knowledge or approval. This practice will undoubtedly diminish as the reserve gradually gains a higher public profile (Magin, pers. obs.).

STAFF In 1988 the IUCN/WWF funded project administering the reserve

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employed 34 staff, an increase of 100% from 1987. The breakdown of personnel was as follows: 5 Government foresters, 2 expatriate salaried 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, 1 night watchman.

**BUDGET** In 1987 and 1988 WWF/IUCN contributed 2,728,000 SFR (approximately 550,000,000 CFA or US\$ 1,750,000) to the operation of the project entitled "Conservation des Ressources Naturelles dans l'Aïr et le Ténéré - Niger". A large part of this funding was provided by the DDA of the Swiss government. The Nigerien government contributed counterpart funding of 40,000,000 CFA (approximately US\$ 130,000). The breakdown of the budget for these two years is not known.

**LOCAL ADDRESSES** Directeur du Projet Faune Iférouane, B P 312, Arlit

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ADDITIONAL NOTES Throughout this document "The Reserve" is used to refer to the Réserve Naturelle Nationale de l'Air et du Ténéré and "The sanctuary" to the Réserve Naturelle Intégrale. The term "Twareg" is used in preference to the Anglicised spelling "Tuareg" for the inhabitants of the Air, since it is phonetically more correct, and is used throughout all documents relating to the IUCN/WWF Project.

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DESIGNATION POUR LA LISTE DU PATRIMOINE MONDIAL - RESUME PREPARE PAR L' UICN

573: RESERVE NATURELLE NATIONALE DE L' AIR ET DU TENERE (NIGER)

Résumé préparé par le CMSC/UICN (avril 1991) d' après la désignation d' origine soumise par le gouvernement du Niger. L' original et tous les documents présentés à l' appui de cette désignation seront disponibles pour consultation aux réunions du Bureau et du Comité.



1. SITUATION

Située dans la région saharienne du Niger, à environ 160 km au nord-est d' Agadez, la Réserve comprend une petite réserve naturelle intégrale centrale dénommée "Sanctuaire des Addax". 7 736 000 ha (le sanctuaire couvre 1 280 500 ha).

2. DONNEES JURIDIQUES

La Réserve et le sanctuaire ont été classés par décret en janvier 1988. Les décrets ont paru au Journal officiel en mars 1988. La Réserve est propriété du gouvernement du Niger.

3. IDENTIFICATION

La Réserve se trouve dans une région aride du Sahara où la pluviosité annuelle moyenne est de 50 mm. Elle comprend deux zones principales: le massif montagneux de l' Air qui atteint 2000 mètres d' altitude et la vaste plaine du désert du Ténééré.

Les biotopes sont divers, allant de communautés aquatiques qui vivent dans les bassins rocheux permanents ou queltas des montagnes aux vallées densément boisées et au désert de sable. Le massif de l' Air est en fait une enclave sahélienne dans un milieu saharien mais on note aussi la présence d' éléments soudaniens et méditerranéens.

Les éléments soudaniens et méditerranéens rélictuels se rencontrent au-dessus de 1000 mètres dans les zones abritées et plus humides du massif. Les espèces soudaniennes comprennent notamment Grewia et plusieurs espèces de Ficus. Parmi les espèces méditerranéennes, on note l' olivier sauvage. La Réserve compte d' importantes populations d' espèces sauvages apparentées à des espèces cultivées : olivier, millet, sorgho.

40 espèces de mammifères, 165 oiseaux, 18 reptiles et un amphibien ont été identifiés dans la Réserve. D' importantes populations d' espèces d' ongulés du Sahara menacées au plan international sont présentes:

environ 12 000 gazelles Dorcas (V), 170 gazelles Dama (E), 3500 mouflons à manchettes ou aoudad (V), quelques addax (E) et peut-être des gazelles leptocères (E). Parmi les carnivores on note des populations prospères de fennecs (K), de renards de Rüppells (K) et une petite population probablement en déclin de 15 à 20 guépards (V). Environ 85 espèces d'oiseaux parmi celles qui ont été décrites sont des migrateurs du Paléarctique; parmi les autres, les 800 à 2000 autruches constituent la dernière population viable d'Afrique de l'Ouest. Les effectifs de l'outarde de Nubie sont importants. Les reptiles comprennent le varan du désert, la vipère des sables et diverses espèces de boas et de geckos.

En bien des endroits de la Réserve on trouve des sites archéologiques paléolithiques et néolithiques ainsi que des sites de gravures rupestres. Les 3500 à 7000 Touaregs qui y vivent pratiquent, pour la plupart, un pastoralisme transhumant, élevant des chèvres et des dromadaires. La population sédentaire pratique l'agriculture irriguée, cultivant du blé, des fruits, des légumes et des dattes.

#### **4. ETAT DE PRESERVATION / CONSERVATION**

La Réserve est gérée de manière active depuis 1981, soit sept ans avant son classement officiel. Un plan d'aménagement préliminaire a été élaboré en 1984 et le texte révisé a été préparé en 1990. Les autorités de gestion mettent un accent égal sur la surveillance et sur l'éducation de la population locale et des touristes afin d'éviter les infractions. Le but est de faire participer les Touaregs à la gestion de la Réserve et de contribuer à leur développement socio-économique tout en assurant la pérennité des ressources naturelles. Les patrouilles se font avec des véhicules ou à dos de dromadaire. Une réunion annuelle a lieu entre les autorités responsables de la Réserve et la population locale.

Le problème le plus évident est le braconnage des gazelles et des autruches dans la Réserve, par le personnel militaire.

#### **5. RAISONS JUSTIFIANT LA DESIGNATION POUR LA LISTE DU PATRIMOINE MONDIAL**

Pour justifier la désignation de la Réserve Naturelle Nationale de l'Air et du Ténéré, en tant que bien du patrimoine mondial, le gouvernement du Niger a donné les raisons suivantes:

##### **D) Bien naturel**

- (i) **Exemples éminemment représentatifs des stades de la formation géologique de la terre.** Le massif de l'Air est un ensemble remarquable d'exemples d'activité métamorphique et éruptive sur le socle africain ancien, avec en particulier les intrusions spectaculaires de "younger granites" qui confèrent au paysage son aspect original.

- (ii) **Exemples éminemment représentatifs des processus géologiques en cours.** Les dunes vives du Ténéré sont un exemple d'érosion en cours: le paysage se modifie rapidement à l'échelle géologique par déplacement et accumulation des sables.
- (ii) **Exemples éminemment représentatifs de l'évolution biologique.** Depuis l'Holocène, la région a connu les effets de la désertisation qui a modifié la distribution des espèces animales et végétales.
- (ii) **Exemples éminemment représentatifs de l'interaction de l'homme avec le milieu naturel.** L'homme est présent de façon continue dans l'Air depuis le Paléolithique. Cette présence est le résultat d'une gestion raisonnable des ressources de l'environnement.
- (iii) **Exemples éminemment représentatifs de phénomènes et de beauté naturelle.** L'Air est un îlot de type sahélien (climat, flore et faune) isolé dans un milieu désertique saharien. Il constitue un ensemble d'écosystèmes relictuels remarquables, allié à des paysages d'un intérêt esthétique exceptionnel.
- (iv) **Habitats naturels les plus importants et les plus représentatifs où survivent des espèces menacées.** La Réserve contient des habitats naturels importants pour la survie de trois espèces d'antilopes déserticoles sahariennes menacées d'extinction au niveau mondial : addax, gazelle Dama et gazelle leptocère. La situation de l'addax, la plus grande espèce animale sauvage du Sahara est particulièrement critique. La Réserve contient aussi des populations d'animaux (babouins doguéras, patas, damans de rochers, caracals, etc.) et de plantes isolés dans le massif de l'Air depuis des millénaires et qui constituent, de ce fait, une entité génétique originale.

DESIGNATION POUR LE PATRIMOINE MONDIAL - EVALUATION TECHNIQUE DE L' UICN

573: RESERVE NATURELLE NATIONALE DE L' AIR ET DU TENERE (NIGER)

1. DOCUMENTATION

- i) Fiches de données de l' UICN
- ii) Littérature additionnelle consultée: J.M. Durou, 1990, Ténéré, Désert d'absolus, AGEF. 215p.
- iii) Consultations: fonctionnaires du gouvernement du Niger, P. Tunley, H. Jungius, J. Verschuren, J. Newby.
- iv) Visite du site: février 1991, Jim Thorsell, Peter Hislair, Gérard Sournia, Anada Tiega.

2. COMPARAISON AVEC D' AUTRES AIRES

La Réserve de l' Air et du Ténéré s' étend sur deux provinces biogéographiques: le Sahara et le Sahel occidental. Dans la première, il y a 69 autres aires protégées, y compris le Bien du patrimoine mondial du Tassili N' Ajjer et, dans la deuxième, 22, notamment deux biens du patrimoine mondial: le Parc national des Oiseaux du Djoudj et le Parc national du Banc d' Arguin. La Réserve de l' Air et du Ténéré est un paysage aride et désertique n' ayant pas grand chose en commun avec les deux derniers biens cités qui sont des zones humides. En revanche, elle présente certaines affinités avec le Tassili, situé à 600 km au nord. Les deux réserves sont arides et désertiques et ont connu une histoire climatique semblable. Toutes deux contiennent une faune et une flore mixtes, saharo-méditerranéennes, et sont habitées par des Touareg. Toutes deux sont importantes comme sites de repos des oiseaux migrateurs du paléarctique et possèdent certains mammifères typiques de la région (gazelles dorcas, mouflons à manchettes). Toutes deux sont des sites archéologiques importants pour leurs peintures et gravures rupestres ainsi que pour leurs vestiges du Néolithique et toutes deux présentent des caractéristiques géologiques et botaniques de très grand intérêt scientifique. Enfin, les deux réserves sont de taille comparable et sont en butte à un problème de gestion commun: le tourisme.

Or, malgré ces similitudes nombreuses, l' Air-Ténéré se distingue par l'abondance de la faune sauvage, notamment les ongulés. Le Ténéré possède également une portion plus vaste de "mer de sable" et l' on considère que ses dunes sont les plus spectaculaires du Sahara. Située à la limite des zones saharienne et sahélienne, la réserve est également plus influencée par les éléments afro-tropicaux.

Les autres aires présentant un intérêt comparable du point de vue de la conservation sont la région du Tibesti-Ennedi et la Réserve Ouadi Rimé-Ouadi

Achim, au Tchad. Toutefois, les réserves tchadiennes ont beaucoup souffert des conflits armés, depuis 20 ans et on pense qu'il y reste bien peu d'animaux sauvages - la différence est flagrante avec l'Air-Ténéré bénéficiant d'une gestion active depuis 1981.

### 3. INTEGRITE

La loi de 1988, portant création de la réserve faisait suite à des efforts de gestion active commencés en 1980, avec l'aide d'un projet UICN/WWF. Ce projet se poursuivra jusqu'en 1993, avec l'aide financière des gouvernements du Danemark et de la Suisse. Il est doté d'un budget de 1,4 million de dollars US. La réserve possède un siège et le personnel dispose de véhicules et de radios. L'accent est mis sur la formation. A tous les points d'accès principaux, les limites sont marquées et un nouveau centre d'accueil des visiteurs fonctionne à Iférouane. Certaines activités originales sont à noter: techniques de construction sans bois, plantation d'arbres, magazine pédagogique pour les enfants et réunions régulières avec la population locale et les organismes publics concernés.

On constate un déclin progressif de la qualité du milieu naturel et quelques disparitions d'espèces mais cette tendance est globalement enrayée depuis dix ans. Toutes les populations d'animaux sauvages se sont stabilisées ou ont augmenté à l'exception de l'oryx algazelle que l'on n'a pas observé au Niger depuis 1983 et de l'addax qui est au bord de l'extinction dans ce pays. On a entrepris une étude de la végétation mais il est encore trop tôt pour dégager des tendances.

Les problèmes de gestion sont, entre autres, la lutte contre le braconnage pratiqué par des militaires et certains officiels d'Agadez. De récentes arrestations ont induit un ralentissement de cette activité. Le harcèlement des animaux sauvages par les touristes, particulièrement préjudiciable à cause de la chaleur, a diminué grâce à la sensibilisation des organisateurs et des touristes eux-mêmes. Le Paris-Dakar n'a plus le droit de traverser la réserve.

Dans la réserve, la population touareg est de l'ordre de 2000 à 2500 personnes réparties dans les deux villages enclavés d'Iférouane et de Tin Telloust. Il y a aussi une population nomade de 1500 à 2000 pasteurs. La population sédentaire pratique l'agriculture irriguée et élève du bétail dont le nombre fluctue. Dans toute la réserve, à l'exception de la région centrale formant 12% de l'ensemble qui a été légalement constituée en sanctuaire, on note de fortes pressions du pâturage par les animaux domestiques (dromadaires, chèvres, ânes). L'accès au sanctuaire est interdit sauf avec permis spécial mais cette interdiction n'a pas affecté les Touareg outre mesure car ils entraient rarement dans cette portion de la réserve où il y a peu de pâturages et qui ne se trouve sur aucune ancienne route caravanière.

Malgré l'interdiction, de nombreuses essences ont été lourdement exploitées, en particulier pendant les périodes de sécheresse. Partie intégrante du Sahel, l'Air ne peut supporter qu'une exploitation limitée, même dans les années de bonnes pluies.

Les dimensions totales (7,7 millions d'hectares) en font la plus grande aire protégée d'Afrique même si la région bénéficiant du statut de sanctuaire intégral est relativement modeste (1,3 million d'ha). Les espèces du désert étant présentes en très faible densité, ces dimensions sont essentielles à leur survie. Dans les limites de la réserve sont incluses les caractéristiques principales des monts de l'Air et du désert du Ténéré. On envisage une extension au sud-ouest pour inclure un site utile à la faune dans certaines conditions de pluviosité et pour tenir compte de la migration récemment observée de l'addax au sud-est, vers la région du mont Termit.

Il reste à trouver un système de gestion qui résistera au tarissement de subventions importantes. On espère que le plan de gestion actuellement en préparation (l'avant-projet est attendu en novembre 1991) posera les fondations de la nouvelle situation en assurant l'équilibre entre les besoins de l'homme et la conservation et que les recettes du tourisme et de la recherche indépendante donneront aux autorités les ressources nécessaires à l'entretien de la réserve.

#### 4. COMMENTAIRES ADDITIONNELS

L'Air-Ténéré a servi de terrain d'essai à la "nouvelle génération" d'aires protégées africaines. Opérant dans le milieu ingrat et dégradé du Sahel, le projet est tenu en haute estime pour sa démarche originale. La motivation première était la protection de la diversité biologique puis les activités ont été élargies pour inclure la promotion de l'utilisation durable des ressources et la restauration des habitats. Agents de vulgarisation se déplaçant à dos de dromadaire, programme de gestion du bassin versant (comprenant la construction de barrages en pierres sèches), plantation d'arbres, formation de maçons à la technique de la construction sans bois et constitution d'un réseau de 47 chefs touareg et chefs de clans chargés de la surveillance: toutes ces mesures font partie de la nouvelle démarche.

Après un moment d'incrédulité, la population locale et les agences locales de tourisme en sont venues à collaborer plus étroitement avec la direction de la réserve. Cette dernière n'est toujours pas pleinement reconnue par les divers ministères nigériens, ce qui occasionne des conflits d'autorité entre ministères plus ou moins influents. Ce problème devrait s'atténuer à mesure que la réserve gagnera en réputation auprès du public mais aussi si elle obtient le statut de bien du patrimoine mondial.

#### 5. EVALUATION

L'Air-Ténéré possède un ensemble naturel exceptionnel de paysages et d'espèces végétales et animales sauvages, sans égal dans la région. C'est, en outre, le dernier bastion de faune saharo-sahélienne au Niger. L'interaction entre l'homme et l'écologie a engendré un milieu naturel unique et spectaculaire. La région est occupée par l'homme depuis 30 000 ans et les nombreux sites archéologiques qu'elle recèle ont un grand intérêt historique et culturel. Etant donné l'isolement dans lequel s'est trouvé



l'Air et la présence peu marquée de l'homme au cours des derniers 2000 ans, beaucoup d'espèces sauvages éliminées d'autres régions du Sahara et du Sahel, survivent ici. Les effets du surpâturage et de la surexploitation des ressources que l'on constate généralement au Sahel ont été atténués par de graves sécheresses (dans les années 70 et 80) qui ont entraîné la perte de nombreuses têtes de bétail et le maintien des effectifs dans des limites raisonnables. Les massifs montagneux ont été comparés à des îlots biologiques dans une mer de sable, enclave sahélienne au Sahara. La réserve contient des populations importantes au niveau international de cinq espèces menacées de la faune (gazelle dorcas, gazelle dama, addax, mouflon à manchettes, autruche) et de trois espèces de la flore.

La réserve satisfait aux trois critères suivants qui justifient le statut de bien naturel du patrimoine mondial:

- ii) **Exemple éminemment représentatif de processus géologiques, de l'évolution biologique et de l'interaction entre l'homme et son environnement naturel.** Les dunes vives du Ténéré modifient rapidement le paysage par déplacement et dépôt de sable. Depuis l'Holocène, la région a connu les effets draconiens des changements climatiques et des modifications profondes dans la distribution des espèces. L'homme est présent, de manière continue, depuis le Paléolithique et la région est le berceau d'une histoire culturelle unique.
- iii) **Contient des phénomènes naturels uniques ou de beauté exceptionnelle.** L'Air est une île sahélienne (climat, flore, faune) isolée dans un milieu saharien désertique. Il représente un ensemble remarquable d'écosystèmes reliques associés à un paysage d'une beauté esthétique exceptionnelle.
- iv) **Habitats naturels les plus importants et les plus représentatifs où survivent des espèces de plantes et d'animaux menacés.** La réserve contient des habitats naturels importants pour la survie de trois antilopes du désert du Sahara menacés d'extinction sur le plan international: l'addax, la gazelle dama et la gazelle leptocère. La situation de l'addax, plus grand animal sauvage du Sahara est particulièrement critique. La réserve contient aussi des espèces animales (babouins doguéras, patas, damans des rochers, caracals, etc.) et végétales qui ont été isolées dans l'Air pendant des milliers d'années et constituent une entité génétique unique. L'aire est aussi une étape importante pour les oiseaux migrants du Paléarctique.

## 6. RECOMMANDATION

La Réserve naturelle nationale de l'Air et du Ténéré devrait être inscrite sur la Liste du patrimoine mondial. Le gouvernement du Niger, et en particulier la Direction de la Faune, Pêche et Pisciculture doit être félicité pour les efforts déployés en vue de la protection et de la restauration de l'aire et encouragé à poursuivre ces efforts.