

## World Heritage Sites

### Protected Areas and World Heritage



## NGORONGORO CONSERVATION AREA TANZANIA

*An immense concentration of wild animals live in the huge and perfect crater of Ngorongoro. It is home to a small relict population of black rhinoceros and some 25,000 other large animals, largely ungulates, alongside the highest density of mammalian predators in Africa. Lake-filled Empakaai crater and the active volcano of Oldonyo Lengua are nearby. Excavations in the Olduvai Gorge and Laetoli to the west, have resulted in discoveries such as Homo habilis and 3.5 million-year old human footprints which have made the area one of the world's most important for research on the evolution of the human species.*

*Threats to the site: The greatly increased pressures of tourism and high numbers of Maasai pastoralists and settlers have begun to degrade the quality of the site.*

### COUNTRY

Tanzania

### NAME

Ngorongoro Conservation Area

### MIXED NATURAL AND CULTURAL WORLD HERITAGE SITE

1979: Inscribed on the World Heritage List under Natural Criteria vii, viii, ix and x.

1984-1988: Listed as World Heritage in danger owing to conflict with the Maasai.

2010: Inscribed on the World Heritage List as a Cultural Landscape under Cultural Criterion iv.

### 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 Ngorongoro Conservation Area (809,440 ha) spans vast expanses of highland plains, savanna, savanna woodlands and forests, from the plains of the Serengeti National Park in the north-west, to the eastern arm of the Great Rift Valley. The area was established in 1959 as a multiple land use area, with wildlife coexisting with semi-nomadic Maasai pastoralists practising traditional livestock grazing. It includes the spectacular Ngorongoro Crater, the world's largest caldera, and Olduvai Gorge, a 14km long deep ravine. The property has global importance for biodiversity conservation in view of the presence of globally threatened species such as the black Rhino, the density of wildlife inhabiting the Ngorongoro Crater and surrounding areas throughout the year, and the annual migration of wildebeest, zebra, Thompson and Grant gazelles and other ungulates into the northern plains.

The area has been subject to extensive archaeological research for over 80 years and has yielded a long sequence of evidence of human evolution and human-environment dynamics, collectively extending over a span of almost four million years to the early modern era. This evidence includes fossilized footprints at Laetoli, associated with the development of human bipedalism, a sequence of diverse, evolving hominin species within Olduvai gorge, which range from Australopithecus such as Zinjanthropus boisei to the Homo lineage that includes Homo habilis, Homo erectus and Homo sapiens; an early form of Homo sapiens at Lake Ndutu; and, in the Ngorongoro crater, remains that document the development of stone technology and the transition to the use of iron. The overall landscape of the area is seen to have the potential to reveal much more evidence concerning the rise of anatomically modern humans, modern behavior and human ecology.

**Criterion (iv):** Ngorongoro Conservation Area has yielded an exceptionally long sequence of crucial evidence related to human evolution and human-environment dynamics, collectively extending from four million years ago to

the beginning of this era, including physical evidence of the most important benchmarks in human evolutionary development. Although the interpretation of many of the assemblages of Olduvai Gorge is still debatable, their extent and density are remarkable. Several of the type fossils in the hominin lineage come from this site. Furthermore, future research in the property is likely to reveal much more evidence concerning the rise of anatomically modern humans, modern behavior and human ecology.

**Criterion (vii):** The stunning landscape of Ngorongoro Crater combined with its spectacular concentration of wildlife is one of the greatest natural wonders of the planet. Spectacular wildebeest numbers (well over 1 million animals) pass through the property as part of the annual migration of wildebeest across the Serengeti ecosystem and calve in the short grass plains which straddle the Ngorongoro Conservation Area/Serengeti National Park boundary. This constitutes a truly superb natural phenomenon.

**Criterion (viii):** Ngorongoro crater is the largest unbroken caldera in the world. The crater, together with the Olmoti and Empakaai craters are part of the eastern Rift Valley, whose volcanism dates back to the late Mesozoic / early Tertiary periods and is famous for its geology. The property also includes Laetoli and Olduvai Gorge, which contain an important palaeontological record related to human evolution.

**Criterion (ix):** The variations in climate, landforms and altitude have resulted in several overlapping ecosystems and distinct habitats, with short grass plains, highland catchment forests, savanna woodlands, montane long grass plains and high open moorlands. The property is part of the Serengeti ecosystem, one of the last intact ecosystems in the world which harbours large and spectacular animal migrations.

**Criterion (x):** Ngorongoro Conservation Area is home to a population of some 25,000 large animals, mostly ungulates, alongside the highest density of mammalian predators in Africa including the densest known population of lion (estimated 68 in 1987). The property harbours a range of endangered species, such as the Black Rhino, Wild hunting dog and Golden Cat and 500 species of birds. It also supports one of the largest animal migrations on earth, including over 1 million wildebeest, 72,000 zebras and c.350,000 Thompson and Grant gazelles.

### **Integrity**

The property was inscribed under natural criteria (vii), (viii), (ix) and (x) in 1979 and under cultural criterion (iv) in 2010. Thus, the statement of integrity reflects integrity for natural values at the date of inscription of 1979, and for the cultural value in 2010.

In relation to natural values, the grasslands and woodlands of the property support very large animal populations, largely undisturbed by cultivation at the time of inscription. The wide-ranging landscapes of the property were not impacted by development or permanent agriculture at the time of inscription. The integrity of the property is also enhanced by being part of Serengeti - Mara ecosystem. The property adjoins Serengeti National Park (1,476,300 ha), which is also included on the World Heritage List as a natural property. Connectivity within and between these properties and adjoining landscapes, through functioning wildlife corridors is essential to protect the integrity of animal migrations. No hunting is permitted in Ngorongoro Conservation Area (NCA), but poaching of wildlife is a continuing threat, requiring effective patrolling and enforcement capacity. Invasive species are a source of ongoing concern, requiring continued monitoring and effective action if detected. Tourism pressure is also of concern, including in relation to the potential impacts from increased visitation, new infrastructure, traffic, waste management, disturbance to wildlife and the potential for introduction of invasive species.

The property provides grazing land for semi-nomadic Maasai pastoralists. At the time of inscription an estimated 20,000 Maasai were living in the property, with some 275,000 head of livestock, which was considered within the capacity of the reserve. No permanent agriculture is officially allowed in the property. Further growth of the Maasai population and the number of cattle should remain within the capacity of the property, and increasing sedentarisation, local overgrazing and agricultural encroachment are threats to both the natural and cultural values of the property. There were no inhabitants in Ngorongoro and Empaakai Craters or the forest at the time of inscription in 1979.

The property encompasses not only the known archaeological remains but also areas of high archaeo-anthropological potential where related finds might be made. However the integrity of specific paleo-archaeological attributes and the overall sensitive landscape are to an extent under threat and thus vulnerable due to the lack of enforcement of protection arrangements related to grazing regimes, and from proposed access and tourist related developments at Laetoli and Olduvai Gorge.

### **Authenticity**

In general, the authenticity of the fossil localities is unquestionable, however given the nature of fossil sites, the context for the fossil deposits needs to remain undisturbed (except by natural geological processes). As the nomination dossier does not contain sufficient detailed information on most of the sites to delineate their extended areas or the areas of archaeological sensitivity, or sufficient guarantees in terms of management arrangements to ensure that the sites will remain undisturbed and not threatened by visitor access, construction or grazing cattle, their authenticity is vulnerable.

### **Protection and Management Requirements**

The primary legislation protecting the property is the Ngorongoro Conservation Area Ordinance of 1959. The property is under the management of the Ngorongoro Conservation Area Authority (NCAA). The Division of Antiquities is responsible for the management and protection of the paleo-anthropological resources within the Ngorongoro Conservation Area. A memorandum of understanding should be established and maintained to formally establish the relations between the two entities.

Property management is guided by a General Management Plan. Currently, the primary management objectives are to conserve the natural resources of the property, protect the interests of the Maasai pastoralists, and to promote tourism. The management system and the Management Plan need to be widened to encompass an integrated cultural and natural approach, bringing together ecosystem needs with cultural objectives in order to achieve a sustainable approach to conserving the Outstanding Universal Value of the property, including the management of grasslands and the archaeological resource, and to promote environmental and cultural awareness. The Plan needs to extend the management of cultural attributes beyond social issues and the resolution of human-wildlife conflicts to the documentation, conservation and management of the cultural resources and the investigation of the potential of the wider landscape in archaeological terms.

It is particularly important that NCAA has the capacity and specialist skills to ensure the effectiveness of its multiple-use regime, including knowledge of management of pastoral use in partnership with the Maasai community and other relevant stakeholders. There is also a need for NCAA to ensure staff have skills in natural and cultural heritage to achieve well designed, integrated and effective conservation strategies, including effective planning of tourism, access and infrastructure.

A thorough understanding of the capacity of the property to accommodate human use and livestock grazing is required, based on the needs of the Maasai population and the assessment of the impact of the human populations on the ecosystems and archaeology of the property. An agreed joint strategy between the NCAA, Maasai community leaders as well as other stakeholders, is required to ensure human population levels, and levels of resource use are in balance with the protection of its natural and cultural attributes, including in relation to grazing and grassland management, and the avoidance of human-wildlife conflict. The active participation of resident communities in decision-making processes is essential, including the development of benefit-sharing mechanisms to encourage a sense of ownership of, and responsibility for, the conservation and sustainable use of the property's natural and cultural resources.

An overall tourism strategy for the property is a long term requirement, to both guide the public use of the property and ways of presenting the property, and to prioritize the quality of the tourism experience, rather than the quantity of visitors and tourism facilities. Vehicle access to the crater and other popular areas of the property requires clear limits to protect the quality of experience of the property and to ensure natural and cultural attributes are not unduly disturbed. Developments and infrastructure for tourism or management of the property that impinge on its natural and cultural attributes should not be permitted.

Considering the important relationship, in natural terms of the property to adjoining reserves, it is important to establish effective and continuing collaboration between the property, Serengeti National Park, and other areas of the Serengeti-Mara ecosystem to assure connectivity for wildlife migrations, and harmonize management.

### **INTERNATIONAL DESIGNATION**

1979: Ngorongoro designated a Biosphere Reserve under the UNESCO Man & Biosphere Programme (828,800 ha);

1981: Serengeti-Ngorongoro designated a Biosphere Reserve under the UNESCO Man & Biosphere Programme (2,305,100 ha; 828,800 ha in the Ngorongoro Conservation Area).

### **IUCN MANAGEMENT CATEGORY**

VI Managed Resource Protected Area

### **BIOGEOGRAPHICAL PROVINCE**

East African Woodland/Savanna (3.05.04)

### **GEOGRAPHICAL LOCATION**

In the far north of Tanzania 90 km west of Arusha, adjoining the southeastern edge of Serengeti National Park between 2°30' to 3°30'S and 34°50' to 35°55'E.

## **DATES AND HISTORY OF ESTABLISHMENT**

- 1928: Hunting in the area prohibited;
- 1929: Serengeti Game Reserve created;
- 1951: Ngorongoro Reserve made part of the new Serengeti National Park;
- 1959: The Ngorongoro Conservation Area (NCA) established by Ordinance 413 as a multiple land use area to accommodate the existing Maasai pastoralists;
- 1975: The Ordinance redefined by the Game Parks Law Act 14 to prohibit cultivation in the crater, removing its natural guardians, resulting in an increase of poaching;
- 1981: Recognised as a part of Serengeti-Ngorongoro UNESCO Biosphere Reserve;
- 1984-88: Listed as endangered by conflict between the Maasai and the guards with consequent loss of wildlife;
- 2010: Inscribed on the World Heritage List as a Cultural Landscape under Cultural Criterion iv.

## **LAND TENURE**

State, in Arusha province. Administered by the Ngorongoro Conservation Area Authority (NCAA).

## **AREA**

809,440 ha within the 828,800 ha Ngorongoro Conservation Area which is contiguous with Serengeti National Park (1,476,300 ha) and Maswa Game Reserve on the west (220,000 ha) and Loliondo Game Controlled Area (400,000 ha) on the north; it is 15 km northwest of Lake Manyara National Park (32,500 ha).

## **ALTITUDE**

± 960m to 3,648m (Mt. Loolmalasin).

## **PHYSICAL FEATURES**

Ngorongoro Crater is the largest unbroken caldera in the world which is neither active nor flooded, though it contains a small saline lake, Lake Makat, and the Gorigor swamp. Its floor, at an elevation of approximately 2,380m, measures 17.7 by 21 km and is 26,400 ha in area (3% of the NCA), with a steep rim rising 400-610m above the floor. The Conservation Area rises 1,000m from the plains of the eastern Serengeti, over the Ngorongoro Crater Highlands to the western edge of the Great Rift Valley. Its highlands have four extinct volcanic peaks over 3,000m, including the massifs of Loolmalasin (3,648m), Oldeani (3,188m) and Lomagrut, the vulcanism of which dates from the late Mesozoic/early Tertiary periods. The formation of the crater and highlands were created by massive rifting which occurred to the west of the Great Rift Valley. The area also includes Empakaai Crater, Laetoli and Oldupai Gorge, famous for their geology and the associated palaeontological studies, and borders the large Lake Eyasi in the south. The highland forests form an important water-catchment for surrounding agricultural communities. To the north is the Loliondo Game Control Reserve, and to the south are densely populated farmlands.

## **CLIMATE**

Because of the range in relief and the dynamics of its air masses, there is great variation within the climate of the area. In the highlands, it is generally moist and misty, while temperatures in the semi-arid plains can fall as low as 2°C, and often rise to 35°C. The annual precipitation falls between November and April and varies from under 500mm on the arid plains in the west, to 1,700mm on the forested slopes in the east, increasing with altitude.

## **VEGETATION**

The variations in climate, landforms and altitude have resulted in several overlapping ecosystems and distinct habitats. Within Tanzania the area is important for retaining uncultivated lowland vegetation, for the arid and semi-arid plant communities below 1300m, for its abundant shortgrass grazing and for the water catching highland forests. Scrub heath, montane long grasslands, high open moorland and the

remains of dense evergreen montane forests cover the steep slopes. Highland trees include peacock flower *Albizia gummifera*, yellowwood *Podocarpus latifolia*, red thorn *Acacia lahai*, *Hagenia abyssinica* and sweet olive *Olea chrysophylla*. The upland woodlands of red thorn and gum acacia *Acacia seyal* are critical for protecting the watershed (Kayera, 1988). There is an extensive stand of pure bamboo *Arundinaria alpina* on Oldeani Mountain and of pencil cedar *Juniperus procera* on Makarut Mountain in the west. Woodlands of *Croton* species dominate lower slopes above rain-shadowed grasslands.

The crater floor is mainly open shortgrass plains with fresh and brackish water lakes, marshes, swamps and two patches of Acacia woodland: Lerai Forest, with co-dominants yellow fever tree *Acacia xanthophloea* and African quinine *Rauvolfia caffra*; and Laiyanai Forest with pillar wood *Cassipourea malosana*, peacock flower *Albizia gummifera*, and *Acacia lahai*. The undulating plains to the west are grass-covered with occasional umbrella acacia *Acacia tortilis* and *Commiphora africana* trees, and become almost desert during periods of severe drought. Blackthorn *Acacia mellifera* and zebra wood *Dalbergia melanoxylon* dominate in the drier conditions beside Lake Eyasi. These extensive grasslands and bush are rich, relatively untouched by cultivation, and support very large animal populations.

## FAUNA

The Park is best known as the ecosystem with the greatest concentration of large mammals in the world, both grazers and browsers, and the carnivores which live off them, totalling more than 2.5 million animals. Many of these migrate between seasonal water sources and grasslands, starting in May and June from the central plains to the western corridor and then northwards across the Mara river into Kenya in July to September, dispersing to the southeast in October and November to calve in midsummer in the south. It is dominated by wildebeest *Connochaetes taurinus* in enormous numbers, which numbered ~190,000 in the 1950s, some 1.69 million in 1989 (SRCS, 1992), but 1.27 million in 1991 (TWCM, 1992); also by plains zebra *Equus quagga* (about 200,000), Thomson's gazelle *Gazella thomsoni*, with some eland *Tragelaphus oryx* and topi *Damaliscus lunatus*, each harvesting the grass most suited to it. The herds are followed by prides of lion *Panthera leo* (VU) numbering up to 3,000 individuals (Packer, 1996), spotted hyena *Crocuta crocuta*, striped hyaena *Hyaena hyaena*, golden jackal *Canis aureus*, side-striped jackal *C. adustus* and black-backed jackal *Canis mesomela*. The last packs of wild dog *Lycaon pictus* (EN) disappeared from the park in 1991. A rabies epidemic killed three of the packs, but there is no agreement on the full cause of the disappearance (Morell, 1995; Dye, 1996; East & Hofer, 1996).

There are large herds of antelope of many species. On the grasslands are eland, lesser kudu *Tragelaphus imberbis*, roan antelope *Hippotragus equinus*, oribi *Oreibia oreibi*, Grant's gazelle *Gazella granti*, Coke's hartebeest *Alcelaphus buselaphus cokei*, steenbock *Raphicerus campestris*, topi and gemsbok *Oryx gazella*; also central African savanna buffalo *Syncerus caffer aequinoctialis*. In the woodlands are desert warthog *Phacochoerus aethiopicus*, bushbuck *Tragelaphus scriptus*, sitatunga *T. spekei*, grey duiker *Sylvicapra grimmia*, impala *Aepyceros melampus* and Kirk's dikdik *Madoqua kirkii*. In the swamps are reedbuck *Redunca redunca* and waterbuck *Kobus ellipsiprymnus*. Among the kopjes are klipspringer *Oreotragus oreotragus* as well as giraffe *Giraffa camelopardalis reticulata* and olive baboons *Papio anubis*; and on the mountains there are Chanler's mountain reedbuck *Redunca fulvorufula chanleri* (VU).

Other characteristic larger mammals are leopard *Panthera pardus*, cheetah *Acinonyx jubatus* (VU), caracal *Caracal caracal*, savanna elephant *Loxodonta africana* (VU), estimated to number 1,357 in 1994 (Said *et al.*, 1995), eastern black rhinoceros *Diceros bicornis michaeli* (CR) totalling 20 in 2005 with those in Ngorongoro (Mills *et al.*, 2006), and hippopotamus *Hippopotamus amphibius* (VU). Smaller mammals include numerous species of bats, thick-tailed bushbaby *Otolemur crassicaudatus*, green monkey *Chlorocebus aethiops*, patas monkey *Erythrocebus patas* and eastern black-and-white colobus monkey *Colobus guereza caudatus*, armadillo *Orycteropus afer*, ground pangolin *Smutsia temminckii*, Cape hare *Lepus capensis*, porcupine *Hystrix indica*, three species of hyrax and many other rodents, bat-eared fox *Otocyon megalotis*, African clawless and spotted-necked otters *Aonyx capensis* and *Lutra maculicollis*, ratel *Mellivora capensis*, zorrilla *Ictonyx striatus*, seven species of mongoose, aardwolf *Proteles cristata*, common genet *Genetta genetta*, large spotted genet *Genetta tigrina*, African civet *Civettictis civetta*, serval *Leptailurus serval*, golden cat *Profelis aurata*, African wildcat *Felis lybica* and bushpig *Potamochoerus larvatus*. Reptiles include crocodile *Crocodylus niloticus*, Nile monitor lizard

*Varanus niloticus*, African rock python *Python sebae*, blacknecked spitting cobra *Naja nigricollis* and puff adder *Bitis arietans*.

The Park lies within a one of the world's Endemic Bird Areas. Over 500 bird species include 34 raptors, 6 vultures and aggregations of over 20,000 waterbirds. There are ostrich *Struthio camelus*, Madagascar pond heron *Ardeola idae* (EN), marabou stork *Leptoptilos crumeniferus*, lesser flamingo *Phoenicopterus minor*, African fish-eagle *Haliaeetus vocifer*, tawny eagle *Aquila rapax*, lesser falcon *Falco naumanni* (VU), pallid harrier *Circus macrourus*, secretary bird *Sagittarius serpentarius*, grey-breasted francolin *Fringilla monticola*, helmeted guineafowl *Numida meleagris*, grey-crowned crane *Balearica regulorum gibbericeps* (VU), kori bustard *Ardotis kori*, black-winged stilt *Himantopus himantopus*, avocet *Recurvirostra avosetta*, great snipe *Gallinago media*, blackwinged pratincole *Glareola nordmanni*, black-winged lapwing *Vanellus melanopterus*, Caspian plover *Charadrius asiaticus*, whitewinged black tern *Chlidonias leucopterus*, gull-billed tern *Sterna nilotica*, Fischer's lovebird *Agapornis fischeri*, giant eagle-owl *Bubo lacteus*, southern ground hornbill *Bucorvus cafer* (VU), yellow-billed barbet *Trachyphonus purpuratus*, red-throated tit *Parus fringillinus*, grey-crested helmet shrike *Prionops poliophus*, Karamoja apalis *Apalis karamojae* (VU), and several of restricted distribution such as rufous-tailed weaver *Histurgops ruficauda* (Stronach, 1990; Fishpool & Evans, 2001).

### CONSERVATION VALUE

Ngorongoro is the largest intact, inactive unflooded caldera in the world and the conservation area has one of Africa's largest aggregations of wildlife. It is home to a small and isolated relict of the black rhino population, and discoveries in the area round Oldupai gorge have made it one of the most important in the world for research on human evolution. The Area lies within a WWF Global 200 Freshwater Eco-region, is in one of the world's Endemic Bird Areas and also overlaps a UNESCO Biosphere Reserve

### CULTURAL HERITAGE

The area has palaeontological and archaeological sites from a wide range of eras. 1.9-1.2 mya this was a salt lake from the settled shores of which many fossils have been found. The four major sites are Oldupai gorge, Laetoli and Lake Ndutu all near the Serengeti, and the Nasera rock shelter in the Gol Mountains. The variety and richness of the fossil remains, including those of early hominids, has made the area one of the most important in the world for research on the evolution of the human species. As a result of the work of the anthropologists Louis and Mary Leakey, Oldupai Gorge yielded an invaluable sequence of evolving hominoid species from early forms including, in 1959, *Australopithecus boisei* (*Zinthanthropus*), 1.75m years old, to *Homo habilis* and *Homo erectus*, as well as fossil bones of many extinct animals and remains recording the development of stone technology and the transition to the use of iron. At Laetoli nearby, fossil footprints of an upright hominid 3.6m years old were found in 1975. This extraordinary record of human evolution over almost four million years to early modern times is recognized in its designation as a site of global cultural significance

### LOCAL HUMAN POPULATION

The Maasai, nomadic cattle herders, entered the crater around 1840. Since the multi-use protection of the area was proposed in 1959, the population of the area exploded beyond the numbers of cattle able to support it without farming, aggravating tensions with the conservation-oriented administration. In 1966 there were 8,700 people in the NCA. After their eviction by the NCAA in 1974, there were no permanent inhabitants in Ngorongoro and Empakaai Craters or the forest (National Park Service, pers. comm., 1995). In 1994, the Maasai population was estimated at about 40,000 (one quarter of those living in Tanzania), with some 300,000 head of livestock which grazed approximately 70-75% of the conservation area. In 2007 resident Maasai were estimated at 64,000 with 300,000 cattle, plus 1,725 immigrants, to whom in 2009, farming was banned and voluntary relocation was offered. In general, livestock numbers are declining and the Maasai are growing poorer; many are now dependent on agriculture but may profit from greater participation in the prosperity brought by tourism (IUCN, 2008; UNESCO, 2010).

### VISITORS AND VISITOR FACILITIES

The spectacular wildlife, geology and archaeology of Ngorongoro-Serengeti are major tourist attractions spread across an area the size of Rwanda or Sicily. About 24% of all tourists visiting the parks of

northern Tanzania stop at Ngorongoro. These totalled 35,130 in 1983, 140,000 in 1989 in at least 30,000 vehicles (Fosbrooke, 1990), 210,257 in 2002, 40% being local, and in 2006 there were 359,000 (70% foreign). The NCAA aims to increase this number to one million by 2010 (UNESCO, 2007). There are four lodges in the crater and one at Lake Ndutu on the edge of Serengeti, with a total of 620 beds; Rhino Lodge is to be enlarged by 20 beds. Vehicles and guides can be hired from the Conservation Authority to enter the crater. There is an interpretive centre at the Lodoare entrance and another at Oldupai, which focuses on the interpretation of the Gorge and its excavations. An information centre to promote wildlife tourism to Tanzanians opened in Arusha in 2002. Measures are being taken to the damage caused by the high numbers of tourists and tourist vehicles (IUCN, 2008).

## **SCIENTIFIC RESEARCH AND FACILITIES**

The area, with Serengeti, is one of the best studied areas in Africa. Work in the contiguous Serengeti National Park, based at Seronera Wildlife Research Centre (SWRC, formerly the Serengeti Research Institute) includes the monitoring of climate, vegetation and animal populations. The level of research into human and range ecology is low. Long-term studies in the crater have been on lion, serval, rhinoceros and elephant behavioural ecology (SWRC, 1993). From 1988, the Ngorongoro Ecological Monitoring Programme has been individually identifying black rhinoceros, and monitoring breeding and movement patterns (Moehlman *et al.*, 1996). Seronera Research Centre provides a research station and accommodation for scientists. There is a small research cabin within the crater. The IUCN/SSC Antelope Specialist Group has just reported on the decline of the crater's antelope species and increase in buffaloes (IUCN/SSC). Management programs are regularly based on scientific ecological studies. The livestock and wildlife carrying capacities were assessed by a California State University team and a similar assessment is planned with input from the Maasai Pastoral Council. (UNESCO, 2007).

## **MANAGEMENT**

Ngorongoro was originally established as a multiple-use conservation area which would accommodate both the existing Maasai as well as tourists. This has created some conflict. The Ordinance of 1959 established the Ngorongoro Conservation Area Authority (NCAA). Its objectives were to conserve and develop the NCA's natural resources, promote tourism, and safeguard and promote the interests of the Maasai. By 1960 a draft management plan was prepared. On Independence in 1961 Prime Minister Julius Nyerere issued the Arusha Manifesto of support for the preservation of the country's wildlife. The government conducted a pioneer experiment in multiple land use (one of few such in Africa) which attempted to reconcile the interests of wildlife conservation and Maasai pastoralism. It failed through a lack of rapport between government officials and the tribesmen who were seen as degrading the land and competing with the wildlife for the crater's resources. In 1974 tribesmen farmers living in the craters were summarily evicted. The 1975 Ngorongoro Conservation Area Ordinance was redefined and in 1976 cultivation was banned as incompatible with conservation. The removal of these natural (and low-cost) guardians resulted in an increase of poaching and the subsequent near extinction of the rhinoceros population. An IUCN/WWF project was set up in 1981 and two vehicles and radios were provided to combat rhinoceros poaching in the Lake Eyasi area. Between 1984 and 1989 the property was on the WHC danger list as a result of these conflicts.

In 1985, following the Serengeti Workshop, convened by the Ministry of Natural Resources and Tourism, the Government of Tanzania and IUCN initiated the Ngorongoro Conservation and Development Project. Its main objectives were to identify the requirements for long-term conservation of the area by assessing land use pressures in and adjacent to the conservation area; to determine the development needs of resident pastoralists; to review and evaluate management options; to formulate conservation and development policies to fulfil the needs of both in-migrating Maasai locals and conservation priorities; and to develop proposals for follow-up activities (IUCN, 1987). Zones were defined for scenic and archaeological quality, wildlife forest, pastureland and infrastructural development. Priorities identified by the community included food security, livestock health and infrastructure such as better water supply, housing, clinics and schools. Some of these have been provided in an attempt to lessen conflicts (Leader-Williams *et al.*, 1996). Since the problems were identified, the NCAA has set more funds aside for appropriate solutions: veterinary services and water have been provided and the relationship between the tribesmen and the NCAA has been improved by the establishment of a Community Development Department and a joint Management-Resident Representative Council (Leader-Williams *et al.*, 1996). In 1995 the Maasai Pastoral Council was set up

to involve the Maasai community in the planning and management decisions, especially on community development, education and food security though their involvement in capacity building and income sharing is not yet enough (UNESCO, 2007). In 2002 the NCAA was reported to have set up an NGO, ERETO, to support local communities with free services (Kangera, 2002).

The contiguous and nearby protected areas provide key feeding grounds for a number of species such as buffalo, wildebeest, zebra and Thomson's gazelle that migrate out of the crater during periods of drought, and much effort is made to prevent migration routes from being encroached on by settlements and agricultural developments. Efforts to control poaching have been made with the aid of the Frankfurt Zoological Society, the African Wildlife Foundation, the Tanzania Wildlife Protection Fund, WWF and the police. In an attempt to reduce pressure on the natural forest for fuel wood the NCAA produce up to 40,000 tree seedlings annually. Proposals for a first Ngorongoro Conservation Area Management Plan were rejected by the Chief Conservator, but in 2000 a General Management Plan was approved. Main measures included demarcation of boundaries, regulation of water flows, controlled burning to banish invasive species, closing roads to rehabilitate worn areas and assessment of the problem of vehicle congestion. Despite nominal participation in management of the resident communities through the Pastoral Council, tensions remain. The voluntary relocation of immigrants was to be done by 2008 by providing land and facilities with an access road, 70 km north. The shops and 360 staff families (3,000 people) and lodge staff (2,000) now inside the crater were to be located to a nearby site by 2012, but progress is slow. Improved cooperation with the Serengeti National Park staff to co-manage the two areas is being considered in the 'Serengeti Ecosystem Form'.

## MANAGEMENT CONSTRAINTS

Threats to the site include the increase in the numbers of Maasai, their cattle and more recent cultivation, immigration, agricultural encroachment, poaching, invasive species, soil erosion by cattle some 500 of which may enter daily, forest destruction, a growing lack of water and an increase in peripheral developments. Clear policies from the state are needed on monitoring the numbers and condition of the fauna and on other issues, especially tourism. A strategy to guide the fast expanding tourist development; the pressure of high tourist numbers, the heavy traffic, which overstresses the infrastructure of roads and water supplies and lodge development on the crater rim.

The most serious land-use conflict in the area is the persistent cultivation caused by immigrant and local populations as the Maasai have become more numerous and turned to cultivation to supplement their previously cattle-based diet. The assumed carrying capacity of the Area is 25,000 people with their cattle. The number was nearer 65,000 in 2010 when grazing and widespread agriculture although banned were still tolerated (UNESCO, 2010). The Authority hopes to voluntarily relocate 200 families in the near future. The past decline in numbers of livestock was aggravated by inadequate veterinary services, which the NCAA had difficulties providing as income from tourism decreased (Leader-Williams *et al.*, 1996): in the 1960s each man had 12 cattle to sustain him; by 1989 this had become five (Fosbrooke, 1990). In response to the scarcity of food, residents were allowed to practise cultivation temporarily. More than 2,200 ha were estimated to be under cultivation in 1993 (TWCM, 1993). Much of this was on areas too steep for agriculture, causing erosion. Encroachment on the slopes of Empakaai and Kapenjiro has been so extensive that they may be excised from the Conservation Area. This has had serious impacts on the vegetation which protects water catchments, and on wildlife corridors (J. Thorsell, pers. comm., 1993). In addition, disease followed by a plague of flies killed at least 600 animals in 2000 (Nuhu, 2001).

Overgrazing also causes problems. Access by livestock is supposed to be by permit but this is ignored. Rights exists for ten nearby villagers for access to salt licks and to pools in the crater for 500 cattle daily, which has caused erosion. Grasslands are degrading with the extensive spread of the unpalatable grass *Eleusine jaegeri*, and other weeds which compete aggressively with palatable grasses, invade overgrazed land, crowding out both crops and the native plants which sustain the existing wildlife. Mauritius thorn *Caesalpinia decapetala*, black wattle *Acacia mearnsii*, *Eucalyptus* species, thorn apple *Datura stramonium* and, in pools, red water fern *Azolla filiculoides* are persistent pests, but the worst, the poisonous Mexican poppy *Argemone mexicana*, is reported to be eradicated (UNESCO, 2007). The invasions also may be partly due to the prevention of fire because of drought which may contribute as much as emigration, disease or disturbance by tourists to the change in the animal populations. The

forests to the north-east are increasingly threatened by illegal logging, fuelwood gathering, grazing and cultivation by people living in the Conservation Area and in villages in the Karatu and Kitete areas along the eastern boundary. A number of poorer Maasai from the area make a living collecting honey from wild bee colonies in the forest, frequently burning trees in the process. About five percent of the area has been degraded by trampling and overgrazing, and vehicle-tracks become excessively enlarged, mainly by tourist activity.

There has been continued poaching of black rhinoceros and leopard which is difficult to suppress due to the lack of equipment and fuel, the rough terrain and low staff morale. The rhinoceros population, owing to its small size, is extremely vulnerable to poaching, and faces genetic threats from inbreeding and loss of genetic variation (Moehlman *et al.*, 1996). The spread of malignant catarrh fever which kills cattle, although it has little effect on wildebeest, has been reduced since wildebeest numbers (and those of other antelopes) have markedly declined. There is a problem with securing water, caused by the neglect of the dams, boreholes and pipelines installed during the 1950s and 1960s, by the commandeering by tourist lodges of local supplies, and by road widening and canals which have blocked and diverted streams, the Gorigor swamp and Lake Makat. The crater no longer floods during the rains (IUCN, 2002).

The disadvantages suffered by the Maa-speaking Maasai are slowly being addressed by NGOs who are providing primary education in Kiswahili. There has been improvement in management and more commitment to human development on a similar level to the conservation of the wildlife. The uncertainty caused by this has led to under-investment in the area, which the employment and empowerment of local people would begin to improve. But in 2001 the World Heritage Committee urged a moratorium on further development until an assessment of environmental impacts, and a hydrological survey of water resources had been completed. It also recommended a scientific overseeing committee, ecologically based burning, mitigation of road works, an improved road plan, and limiting the effect of tourist numbers (IUCN, 2002). However, the ever increasing tourist numbers bringing overcrowding and heavy traffic congestion, off-road driving and proliferating tracks and the pressures have forced the NCAA to propose limitations on the traffic.

The high numbers of tourists and their vehicles are degrading the property, especially through their demands on the limited water supply and the wear and tear of its traffic which can become very congested. A suite of measures taken to lessen tourist pressures and diversify their activities is beginning to succeed. The NCAA has been forced to propose limitations on traffic, including larger less frequent tourist buses limited to 100 a day, 30 kph speed limits, a 3km distance between vehicles, cementing the main 7 km ascent and 4 km descent and improving road surfaces. Also proposed are a tour booking system, shorter half-day tours, increased visitor fees, development of a crater rim viewing platform, a visitor information centre, walking safaris, and promotion of wildlife viewing in Olmoti and Empakaai Craters (IUCN, 2008; UNESCO, 2005). Lodges and tourism facilities are developed with no overall tourism strategy: in 2007 a new five-star 120 bed hotel on the rim, the Kempinski Lodge, was advertised although the NCAA did not approve or recommend it because of visual disruption, the lack of water and other hotel-related impacts, already bad enough (UNESCO, 2007).

## **STAFF**

Chief Conservator, 3 directors, of Conservation & Community Development, Operations, and Finance & Administration, 12 Managers and Section Heads (UNESCO, 2007). There was a staff of some 360 in 1994 (National Park Service, pers. comm., 1995). In 2007 a helicopter was to be bought to improve monitoring of the property (IUCN, 2008).

## **BUDGET**

During the 1980s and 90s, development was subvented via the IUCN by several international organisations, especially the Frankfurt Zoological Society in support of the rhinoceros. In 2001 US\$10,000 was provided to study of vehicle congestion in the Ngorongoro crater. In 2004 USD19,294 funded the nomination of an extension to the site and in 2009 USD29,920 funded management effectiveness evaluations (shared with Kilimanjaro). The substantial annual income totalled about Tsh39 billion (US\$31 million) in 2007. Some 60% is derived from visitor entrance fees, with the balance coming from concession fees, lodge services, fines and investments (UNESCO, 2007; 2010).

## LOCAL ADDRESSES

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Director General, Serengeti Wildlife Research Institute, P.O.Box 661, Arusha, Tanzania.

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