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# Study on the Elephants of Mago National Park, Ethiopia

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## ABSTRACT

A study was made on population estimates and movement patterns of elephants, *Loxodonta africana africana* Blumenbach 1797 in the Mago National Park, Ethiopia, from June 1997 to April 1998. The population size was estimated indirectly from the droppings using line transects within an area of 1,564 km<sup>2</sup>. The estimate of the elephant population for Mago National Park was between 387 and 575 and the observed density for the whole park was 0.3 elephant/km<sup>2</sup>. The maximum number counted from a total of seven sightings was 182. The present and former movement routes and areas of past distribution were identified. Elephants used to inhabit the surroundings of Jinka town, Woito valley, Hamer, adjacent areas of Omorate, and a large part of Tama Wildlife Reserve of South Omo Zone. However, a century ago, it was noted that people coming from the central and northern parts of the country had intensively exploited the elephants in order to demonstrate bravery and to gain ivory. Such continual activities have resulted in the extermination of elephants from most parts of South Omo. Data on elephant movement patterns suggest that at present, some of the elephants are moving south, travelling about 43 km outside the park boundary. The total range traversed from north to south by the elephants of Mago was 129 km. The calculated total home range was 1,597 km<sup>2</sup>. The study also assessed the extent of poaching on elephants. A total of 26 elephants was killed, mainly for ivory, between August 1997 and April 1998. Possible solutions to the current conservation problems were also enumerated.

## RESUME

Une étude sur les valeurs de population estimées et les migrations des éléphants *Loxodonta africana africana* Blumenbach 1797 a été conduite dans le Parc National Mago, Ethiopie entre juin 1997 et avril 1998. La taille de la population a été estimée indirectement à partir des excréments en utilisant des lignes de section sur une surface de 1 564 km<sup>2</sup>. La valeur estimée de la population d'éléphants du Parc National Mago se situe entre 387 et 575 et la densité observée pour l'ensemble du parc est de 0,3 éléphant par km<sup>2</sup>. Le nombre maximum compté sur un total de sept observations est de 182. Les itinéraires des migrations passées et actuelles ainsi que les zones de distribution antérieures ont été identifiées. Les éléphants étaient autrefois présents dans les environs de la ville de Jinka, la vallée de Woito, Hamer, les zones contiguës de Omorate et une large part de la réserve de faune Tama de la zone du Sud Omo. Cependant, il a été noté il y a une centaine d'années que les peuples provenant des zones centrales et nord du pays avaient exploité les éléphants de manière intensive afin de démontrer leur bravoure et d'obtenir l'ivoire. De telles activités continues ont conduit à l'extermination des éléphants dans la majeure partie du Sud Omo. Les données sur les types de mouvements actuels suggèrent qu'à présent certains éléphants migrent vers le sud, se déplaçant jusqu'environ 43 km à l'extérieur des limites du parc. La zone totale de déplacement des éléphants de Mago s'étend du nord au sud sur 129 km. La zone de résidence totale calculée est de 1 597 km<sup>2</sup>. L'étude a également déterminé l'étendue du braconnage envers les éléphants. Un total de 26 éléphants a été abattus, essentiellement pour l'ivoire, entre août 1997 et avril 1998. De possibles solutions aux problèmes de protection actuels sont également énumérées.

## INTRODUCTION

The subspecies *Loxodonta africana africana* Blumenbach 1797 is confined to south and southwest peripheral areas of Ethiopia. The available information suggests that, until the 1940s, they used to have a wide distribution (Largen and Yalden, 1987). However, at present the range of these animals is limited to small pockets in restricted localities of the country (EWCO, 1991; Yalden et al., 1986; Demeke, 1997b). As suggested by Kangwana (1993), this is because of the increased human population which provides intense competition with elephants for preferred habitats and water. This subspecies also occurs along the Mago Valley in the Mago National Park (MNP) inhabiting the bush, savanna and riverine vegetation.

Data from the field and interviews with local elders indicated that elephants had a very wide distribution and were comparatively common in the MNP and the adjacent areas (Demeke, 1994). However, in recent years, only small herds of elephants remain in the patchy forest and bush habitats of the park and its surroundings. This is mainly due to the pressure of hunting (Allen-Rowlandson, 1990; Largen and Yalden, 1987; Yalden et al., 1986; Demeke, 1994; (EWCO) 1991; Graham et al., 1997).

Attempts have been made to estimate the larger mammal populations of MNP (Stephenson and Mizuno, 1978; Graham et al., 1997). Since the initiation of elephant observations in the MNP (1972), a total of 35 sightings have been made: 14 from the air and the rest from the ground, by vehicle and on foot. Bolton (1971) was the first person to record about 60 animals in the MNP. The 1977 aerial surveys of Stephenson and Mizuno (1978) showed between 700-1000 individuals in Omo and Mago National Parks. In 1986, the staff of MNP counted about 400 elephants. About 900 elephants were also estimated to live in the MNP, Tama Wildlife Reserve and Murle areas by the staff of EWCO (Largen and Yalden, 1987). Since 1992, attempts have been made to assess their numbers, distribution and migration routes (Demeke, 1994). In addition,

Graham et al. (1996, 1997) made two aerial surveys in this national park and estimated 120 and 250 elephants in 1996 and 1997, respectively. However, all previous investigations dealt mainly with rough estimates and guesses within the shortest time possible. As a result, reliable estimates of the surviving elephant population in the national park have not been achieved.

Information about movements of elephants in the national park is scarce. The available reports indicate that herds of elephants have been sustained by seasonal migrations to the neighbouring areas of Omo National Park, Sudan and Kenya (Graham et al., 1996; Stephenson and Mizuno, 1978; Demeke, 1994). The 1992/93 study on elephant distribution and migration patterns indicated that there was a limited distance migration of the animal (to the south) outside the national park (Demeke, 1994). However, this information did not indicate the exact time taken or the localities to which the animals moved.

Lack of information was a major obstacle in developing the Mago's elephant management and conservation policy (EWCO, 1991; Hillman, 1993; Lamprey, 1994). Therefore, the present study aimed at collecting data from various methods of observation, in order to get a more accurate estimate of elephant numbers, together with realistic data on the range and movement patterns of elephants. The study also suggests possible solutions to the problem of the conservation status of elephants in this national park.

## STUDY AREA

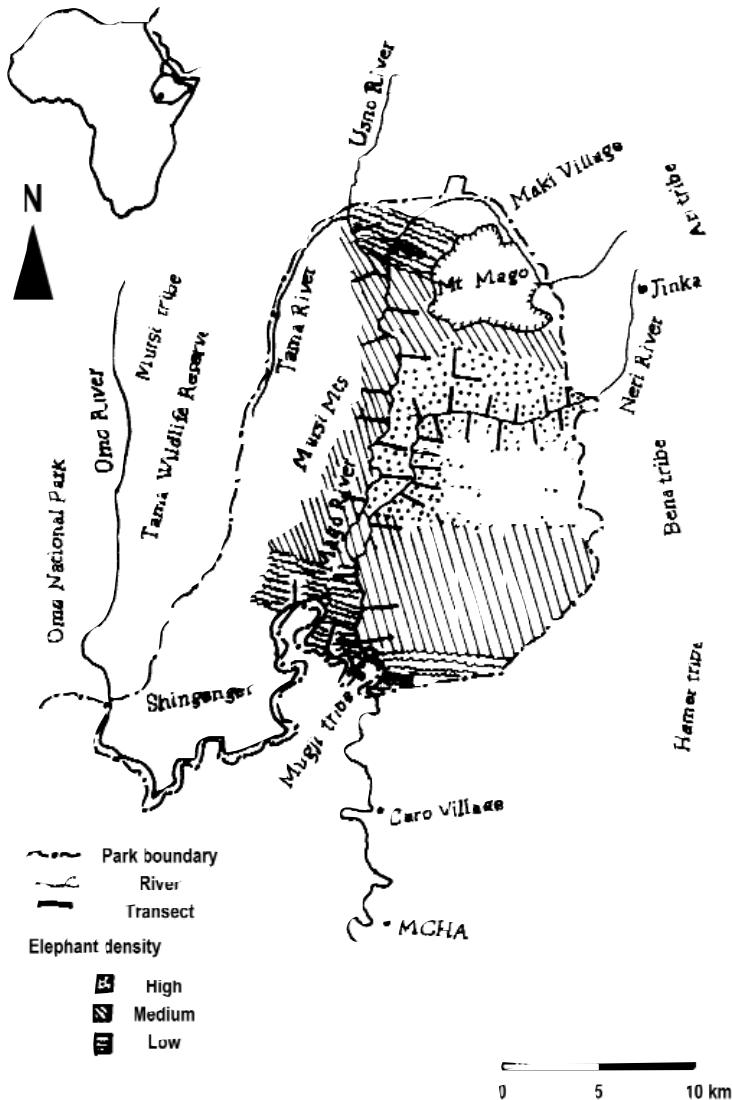
The study area is situated in southwestern Ethiopia, west of the main Rift Valley. It covers an area of 2,162 km<sup>2</sup> and lies between latitude 050 19'-050 56' N and longitude 350 56'-360 26' E. The altitude varies from 400 m - the low land plains in the south - to 1,776 m on top of Mt Mago. The central portion of the park area is flat plain, whereas the periphery is formed by mountains and chains of hills. Of the three permanent rivers, Mago and Neri traverse the park area from north to south. The Omo River bounds the park to the south and southwest.

Three conservation areas, Omo National Park to the southwest, Tama Wildlife Reserve to the west and Murle Controlled Hunting Area (MCHA) to the south, border the national park. The park is surrounded by settled agriculturists and semi-pastoralists consisting of six tribal groups (Figure 1).

Stephenson and Mizuno (1978) and Demeke (1994) described the characteristic climate of the study area as dry and semi-arid with a high mean annual temperature. The usual dry season

extends from December to early March. There are also two distinctly separate rainy seasons (Urban and Brown, 1968): the heavy rains from March to April and the lighter rains from August to September. The vegetation of the study area is described by Stephenson and Mizuno (1978) and is mainly bush (over 50%), savanna grassland, savanna bush land, open grassland and small patches of forest. *Tamarindus indica* Linnaeus 1735, *Terminalia brownii* Fresen 1837 and *Ficus sycomorus* Linnaeus 1735 are important components of the forest vegetation where transects

Figure 1. Elephant densities and location of transects in Mago National Park, Ethiopia.



were set up. The fauna of MNP is diverse. It is well documented by Stephenson and Mizuno (1978), Hillman (1993) and Demeke (1996a,b, 1997a).

## METHODOLOGY

### Sampling methods

The dropping count estimates, using transects, was carried out in this national park following the method of Barnes and Jensen (1987), Jachmann (1991), Dawson and Dekker (1992) and Barnes (1993). The basic concept is converting estimates of dung-pile numbers into estimates of elephant numbers. The method was employed based on the elephants' use of the habitats and the extent of human disturbance in the forest and other riverine vegetation of the park (following Omo, Mago and Neri Rivers). The study area was then divided into three strata: high, medium and low dung-pile densities see (see Figure 1). Transects were allocated in proportion to the approximate densities i.e. 1:2:3 for the low, medium and high density strata, respectively. A total of 36 transects, each of three km length, was run perpendicularly to the base-lines (Omo, Mago and Neri Rivers). Transects were placed at regular intervals: 2 km for the high density strata, 4 km for the medium and 6 km for the low. To complete a transect survey, a total length of 108 km of transects was covered on foot.

### Data analysis

The Elephant Programme recommended by Dawson and Dekker (1992) was used to analyze the dung-pile densities. The data for each stratum was analyzed separately and then combined to give an overall estimate for the whole study area following the work of Norton-Griffiths (1978) and Barnes et al. (1995).

It was impossible to carry out field work on defecation rate in the study area. This is because of the frequent mobility of the animal due to the pressure of hunting. Several field workers have estimated different figures (Wing and Buss, 1970; Merz, 1986; Tchamba, 1992). In this

study, the figure of Wing and Buss (1970),  $D = 17.0$  dung-piles per elephant per day, was used for the dry season data analysis. This figure was preferred because of the prolonged observation time (400 hr) in the Rwenzori National Park, Uganda.

Calculating decay rates is best described by Barnes and Jensen (1987) and Barnes and Barnes (1992). Since there was unusual rain in December, it was impossible to gather data on dung decay rate during the study period. Instead, the present investigators used the 1992/93 dry season figure of Demeke (1994) from Mago. Following the method of Barnes and Barnes (1992), the percentage for the daily decay rate of elephant droppings in the MNP for the dry season was 0.009.

### Movements and distribution

The park areas and adjacent localities were assessed to determine the seasonal movement patterns of elephants. These were monitored by following the animal and its characteristic tracks, droppings and feeding signs which elephant herds leave behind when passing through the bush, savanna grassland and riverine vegetation. To locate elephants and/or their signs, vehicle surveys were made on all available tracks at two week intervals between July 1997 and April 1998. These were made north to Mago bridge and further to Maki Village, south to Caro and Mugji roads (Figure 2) and additional drives to both sides of Neri river. In addition to vehicle drives, three long distance walks on foot were also undertaken: the first from 27 to 29 August 1997; the second from 19 to 22 February 1998, along the western side of the park, from Mago bridge following the eastern foothills of Mursi Mts via Bongoso to Mugji; and the third trip from Mago bridge south to Mago and Neri Rivers junction and then east to the park headquarters. In general, two circuits were made to assess movements across the park boundaries.

Questionnaires were also used to gather additional information about the present and/or past distribution and movement routes of elephants.

Interviews were conducted in six different tribal groups of twelve villages dwelling inside and outside the national park from 8 October to 12 November 1997. Traditional leaders, committee members and other settlers were selected systematically for the discussions.

To adequately represent the size of the home range of the animal, the method of Whyte (1993) was employed. The park areas and adjacent localities were assessed to locate elephants. This was done by following the animal and its char-

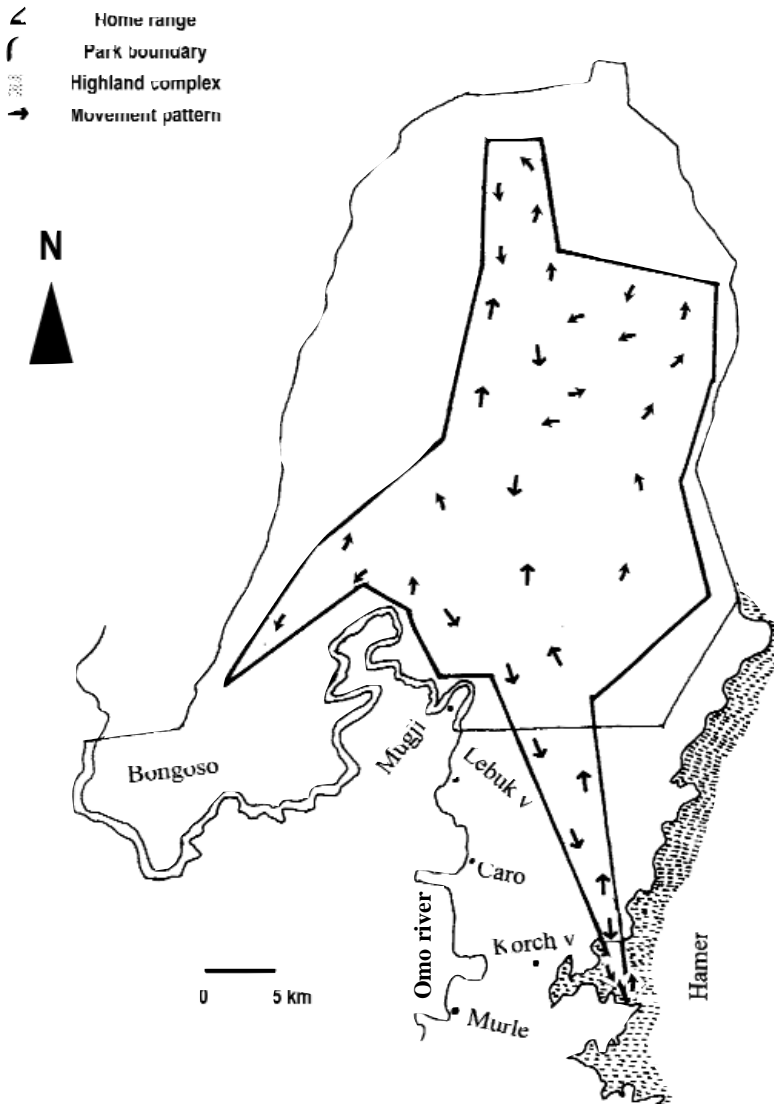
acteristic tracks, droppings and feeding signs. Extreme points reached by the animal were considered as fixes. Seventeen series fixes (four of them outside the national park) were produced and marked on a map (see Figure 2).

## RESULTS

### Sightings

Very few groups of elephants were observed along the tracks and paths of the park (Table 1).

Figure 2. Directions and patterns of movements of elephants in Mago National Park, Ethiopia.



Elephant numbers were also estimated from their droppings, based on the data using line transects from the forest and other riverine areas of the park (Table 2).

## Dung counts

Dung-pile visibility was limited due to dense vegetation. The number of dung-piles counted declined as the observer moved away from the centre line. The maximum recorded visible distances from the centre lines were 7.5, 6.5 and 6.4 m for the stratum 1, 2 and 3, respectively. The mean sighting distances for stratum 1, 2 and 3 were 2.2, 2.9 and 2.8 m, respectively. Dung-piles were seen better in the second and third strata than in the first. The majority of the dung-piles falls between 0 and 0.9 m.

Considering the mean decay rate of 0.009, defecation rate of 17 droppings per elephant per day and the mean dropping density of 738 drop-

pings/stratum the total estimate for the stratum area for the dry season was  $481 \pm 94$  elephants. Based on this estimate, the observed density for the home range (1,597 km<sup>2</sup>) park was 0.3 elephant/km<sup>2</sup>. The results of the transect survey, together with the low number seen, indicate that elephant numbers in this national park are low.

## Poaching

Shooting elephants has been a major problem in the national park. During the present study, three elephant carcasses, with skins and no tusks, were encountered in the central plain areas of the park. A few other skeletons were also found widely scattered on the riverine and forest areas of the Mago and Neri Rivers. A total of seven carcasses were sighted. In addition, information from the local people indicated that an additional 19 elephants were killed by people living adjacent to the park areas. This gives an estimate of 26 carcasses for the whole park area between

**Table 1.** Records of elephants during the study period.

Date	No. seen	Locality
19/7/97	87	Mago Omo-Mago junction
21/7/97	70	Kella
24/7/97	135	Observation site
25/7/97	45	Zingero Maderia
13/8/97	182	Lenin Meda
26/11/97	64	Dikule
08/3/98	80	South of Kurt Bahir

**Table 2.** Dry season dung-pile survey.

Stratum	Stratum area [km <sup>2</sup> ]	No. of transects	Transect length [km]	Sample area [km <sup>2</sup> ]	Number of droppings	Dropping density per stratum	Estimated elephant density per km <sup>2</sup>
1	397	19	57	0.13	129	992	0.53
2	540	11	33	0.09	56	622	0.33
3	292	6	18	0.04	24	600	0.32
<b>Total</b>	<b>1,229</b>	<b>36</b>	<b>108</b>	<b>0.26</b>	<b>209</b>		

August 1997 and April 1998. During the study period, three tusks were encountered in the Shingenger (Mursi) village. It was reported that there were many more kept in this village and other villages nearby. Most poaching activities took place in the dry season when the people were free from agricultural activities and were ready to collect honey.

During the study period, two movement patterns (one in September 1997 and the other in March 1998) were noted across the park boundaries. They moved south to MCHA travelling about 43 km outside the park boundaries. These animals moved between the eastern escarpment and parallel to the Omo River passing to the east of Lebuk, Karo and Korch Villages (see Figure 2). By passing through the broken terrain of the foothills which borders MNP to the east and southeast, the animals reach a small valley surrounded by ridges known as Thampa. To the east, the area is bordered by the Hamer escarpments. It is dominated by extensive bush vegetation. Elephants stay here for up to a week depending on the presence of people. Finally, the study showed that, at the time of the park's establishment, elephants were believed to move north through Maki and west to Tama, Omo National Park, and most of the eastern parts of MCHA. However, at present, all movements, except to the south, are totally closed (restricted inside the national park). Observations on elephant migrations show that elephants in the MNP are a resident population, though part of the population occasionally forage outside the park areas. However, they do not show what proportion of the elephant population was involved. These short distance movements to MCHA occur at night during the rainy season. Because of this, the activities of people in the national park were minimal during this period.

Photo credit: Yirmed Demeke



**Photo 1.** Boy from Bena carrying the flesh of a poached young waterbuck.

## Distribution and movements

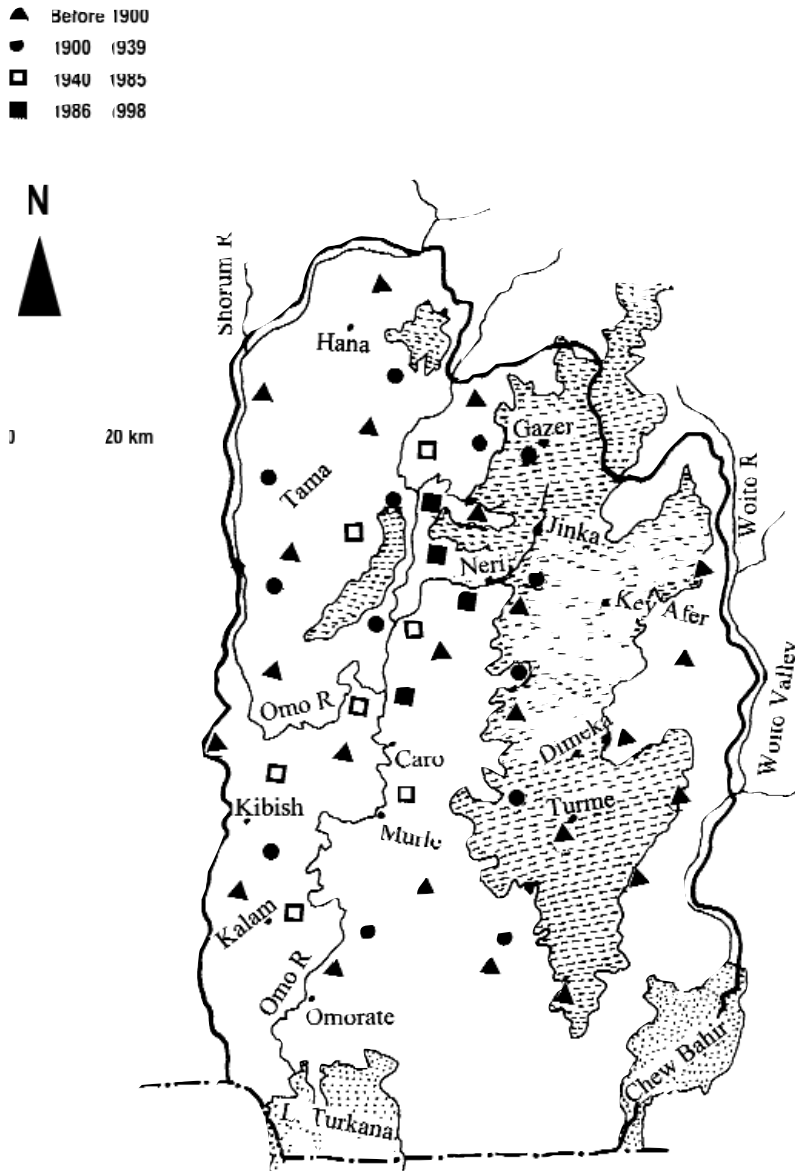
The present and former movement routes and areas of distribution were identified. Based on interviews with local people, in the previous century elephants used to inhabit the surroundings of Jinka town, Woito valley, Hamer area, adjacent areas of Omorate, and the large part of Tama Wildlife Reserve (Figure 3). However, it was noted that the people coming from the central and northern parts of the country had intensively exploited the elephants for different purposes, chiefly in order to demonstrate bravery and to gain ivory. Such continuous poaching activities have resulted in the extermination of elephants from most parts of the South Omo.

Accurate grid references of the location of elephants were mapped by demarcating various fixes from several elephant tracks and feeding signs. The range traversed by elephants of MNP from north (northwest of Mt Mago) to south (southeast of MCHA) was about 129 km. The calculated average home range of the animal was 1,597 km<sup>2</sup> (see Figure 2).

## DISCUSSION

The estimated number of elephants (481 ± 94) is in line with the earlier data suggesting that MNP supports a small number of elephants. It is not possible to accurately compare this study with the previous estimates, as they used different survey methods. However, one can surmise

Figure 3. Distribution of elephants in the area of today's Mago National Park before 1900 and up to 1998.



whether the population increases, decreases or remains stable, by assessing the number of elephants counted in various groups and evaluating the extent of poaching. As shown in Table 1, the number of elephants in a group during the study period was small compared to the previous records. The 1,242 elephants observed in 1993 were most likely including immigrants either from Omo National Park or northern Kenya.

Guesses by the park staff at different times of the study period were less than 300. The previous estimates of Allen-Rowlandson (1990), Demeke (1994), Graham et al. (1997) and the present study imply that there has been a serious decline in elephant numbers. In all of the direct sightings of elephants during the study period, large sized ones are rarely encountered since large bodied elephants might be hunted selectively.



Destruction of the natural habitat and harassment by an ever-increasing human population with an increasing demand for land, has undoubtedly contributed to the rapid decline of the species.

Direct counts, sexing and aging of elephants of Mago were difficult because of the animal's night time activity (due to continual harassment by poachers) and the dense vegetation. During the dry season, the encroachment of people in the national park was high. As a result, the activities of elephants in the nearby savanna and bush habitats were restricted during the night. This has brought difficulties in direct observation of elephants during the day time.

Several methods can be used to estimate elephant population size: aerial census, vehicle survey, foot survey, and dung count. However, the dropping count technique is the preferred method for estimating elephant numbers in forest areas (Barnes and Jensen, 1987; Jachmann, 1991; Dawson and Dekker, 1992; Barnes, 1993). The use of line transect method gives estimates that are less biased and has a lower standard error (Burnham et al., 1985). However, to appreciate and standardize the method, it is advisable to employ the technique repeatedly and compare the result with other aerial and ground census methods.

Villagers living inside and outside the park hunt larger game regularly, using automatic rifles, snares and traps (Demeke, 1996b). Formerly, poachers were few in numbers and used traditional weapons which did not have a serious effect upon the

Photo credit: Yirmed Demeke



**Photo 2.** The survey team handing over Hamer poachers carrying flesh of hartebeast.

larger animals. However, at present, the availability of various kinds of modern fire arms in the South Omo has changed the situation. As a result, the wild animals of Mago and the neighbouring areas are an open-access resource to poachers. This is because of the absence of patrols and the lack of a strict wildlife law. As has been observed for several years in this national park, hunting elephants for meat is not a frequent phenomenon. However, during a period of drought, people of Mugji and Mursi used to hunt elephants as a food source.

The discussion with the local people and park staff, and the work of EWCO (1991) and Demeke (1994) indicate that ten years ago, ele-

Photo credit: Yirmed Demeke



**Photo 3.** Talks were held with Mursi people at Maki village about protecting elephants.

phants from MNP used to visit Tama Wildlife Reserve, Omo National Park and the northern areas of Mt Mago. These areas are the most preferable habitats for elephants (Stephenson and Mizuno, 1978). However, currently, most of the home ranges of elephants and the migratory corridors of the areas have become closed due to progressive settlement, agriculture and poaching.

The size of the home range of an elephant is an indication of the availability of food and water resources and the extent of human disturbances in the surrounding areas. The estimated home range of elephants in MNP (1,597 km<sup>2</sup>) is relatively large compared to e.g. Kruger National Park in South Africa which is 909 km<sup>2</sup> (Whyte, 1993). However, in a resource scarce environment like Namibia, the average size of the home range was between 5,860 km<sup>2</sup> and 8,693 km<sup>2</sup> (Lindeque and Lindeque, 1991). The area of MNP is large with abundant forage and plenty of water. This can probably harbour a very large number of elephants - about 4,400 individuals (Parker and Graham, 1989).

It is believed that the very high densities of people and their consequent settlement, agriculture and livestock, have been permanently displacing the wildlife species (Alers et al., 1992; Barnes et al., 1991; Fay and Agnagna, 1993). As pointed out by Parker and Graham (1989), normally with a human density of around 10 individuals/km<sup>2</sup>, an elephant density of 0.5 animals/km<sup>2</sup> would be expected. In the MNP and adjacent areas, the constant increase of the Mursi people with their permanent and semi-permanent villages and herds of cattle, have pushed the wild animals to the interior of the park areas (Graham et al., 1997). Since the Mursi people are semi-nomadic and keep their cattle and goats on the move across the Mursi range, elephants have never visited this side of the park. As Graham et al. (1997) suggested, the number of cattle adjacent to MNP has increased by 11% per annum to a population of nearly 55,000. Incursions of the Hamar tribesmen with their cattle, goats and sheep, into the main plains to

the south is a very recent activity. As estimated by Graham et al. (1997), at least 40,000 people encroach into the park with 9,000 different types of fire-arms which are potentially available for hunting. This has resulted in shrinking wildlife range and is associated with serious ecological degradation. In general, the people living inside and adjacent to the park, together with the very poor management of the park, are responsible for the destruction which may ultimately exterminate elephants and other large game animals from this area.

This study was an attempt to describe the population size and movement patterns of elephants of MNP. However, it is quite useful to know all these parameters in depth, including other aspects of their ecology, such as the habitat types and how they are utilized together with the population dynamics (growth, age and sex structure and rates of population increase in relation to habitat conditions) for proper management of the species.

## CONCLUSIONS AND RECOMMENDATIONS

Elephants in the MNP are few in numbers and live in semi-arid bush and riverine forests. So far the national park has remained a protected area capable of harbouring a significant elephant population. Almost the entire area of the National Park (except the top of Mt Mago,

Photo credit: Yirmid Demeke



Photo 4. Tusk found in Shingenger, a Mursi village.

which is rocky) consists of suitable elephant habitat. Based on the previous data together with this study, it is clear that elephants in this Park are endangered, due to poaching and habitat destruction. If the present state of decline in elephant numbers is allowed to continue, extinction of elephants in the Park is inevitable.

Finally, the authors would like to recommend that the migratory routes and foraging areas should be given complete protection to maintain the animal's natural migratory patterns without disturbance. In addition, it is better to maintain free access (migratory corridors) between the study area and Omo National Park, Tama Wildlife Reserve and MCHA.

In general, if elephants are to be secured from the threat of eventual extinction in the MNP, urgent and effective conservation measures (promotion of policies, wildlife legislation, regulations and restriction of harmful human activities) are essential. This will help to ensure the long-term survival of this small number of elephants.

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