
AFRICAN ELEPHANTS IN COASTAL REFUGES

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ABSTRACT

The history and status of relict elephant populations at three sites in coastal regions of Africa illustrate common elements affecting the survival of elephant populations within human-dominated landscapes. Habitat loss to agriculture and ivory hunting have been major factors driving the fragmentation, isolation and extinction of African elephant populations. Elephants survived within coastal regions in the three sites under discussion (Kakum, Ghana; Knysna, South Africa; Addo, South Africa), due to the presence of core habitat areas protected as government forest reserves. The presence of habitat refuges, not protected status for elephants *per se*, was the key factor in elephant survival at all sites. Genetic studies of small elephant populations with known histories may prove useful for the future management of genetic diversity in wild and captive populations of both species of elephants (*Loxodonta africana*, *Elephas maximus*).

INTRODUCTION

Humans and elephants have co-existed in Africa for at least the past million years, with the continent serving as their common centre of evolutionary development. The scope and scales for human-elephant interactions have altered markedly through time, first with the development of agriculture and more recently with the widespread availability of modern firearms. The earliest recorded extinctions (1,500-4,000 BC) of regional elephant populations occurred in major centres of early agricultural civilisation: North Africa, the Middle East, and the Yangtze Valley of China (Olivier, 1978; Cumming *et al.*, 1990). The ability and propensity of elephants to damage crops and the effectiveness of firearms as a tool for killing elephants have resulted in their extirpation throughout much of their range during the past century.

Human-elephant conflict

historically been major factors in eliminating African elephants from large areas of their historic range (Cumming *et al.*, 1990). Human population increases

are predicted to cause further major reductions in habitat for African elephants during the coming century (Parker & Graham, 1989). Habitat loss is currently the greatest threat to the survival of the Asian elephant (Santiapillai & Jackson, 1990), and will in all probability become the ultimate threat to survival of the African elephant (Cumming *et al.*, 1990). The long-term importance of habitat loss as a threat to the survival of the African elephant needs wider recognition (Armbruster & Lande, 1993).

Elephants are keystone herbivores whose foraging activities profoundly influence the structure, composition and productivity of vegetation communities within their habitats (Laws *et al.*, 1975; Eisenberg, 1981). This keystone ecological function of elephants often directly conflicts with the requirements of human agro-ecosystems. Agriculture, silviculture and human settlements within or adjacent to elephant habitats typically result in severe human-elephant conflicts (Pitman, 1934; Seidensticker, 1984; Eltringham, 1990; Newmark *et al.*, 1994). Competition for resources (e.g., water, grazing, trees) and physical confrontations may result in injuries and deaths among both humans and elephants (Pitman, 1934; Seidensticker, 1984). Free-ranging elephant populations are for the most part incompatible within or adjacent to areas of intensive agriculture. Habitat conversion and fragmentation caused by agriculture and deforestation greatly increase incentives and opportunities for the decimation or extermination of local elephant populations (Tchamba & Mahamat, 1992).

CASE STUDIES

The history and status of three sites in near-coastal regions of sub-Saharan Africa serve to demonstrate the interplay of ecological and cultural factors in the survival of elephant populations within areas where elephants have been largely extirpated due to habitat fragmentation and conversion. The sites under discussion are (Figure 1, Table 1):

- 1) Kakum National Park and Assin-Attandanso Wildlife Resource Reserve, Central Region, Ghana (Kakum).
- 2) Diepwalle and Gouna State Forests, Southern Cape Province, Republic of South Africa (Knysna).
- 3) Addo Elephant National Park, Eastern Cape Province, Republic of South Africa (Addo).

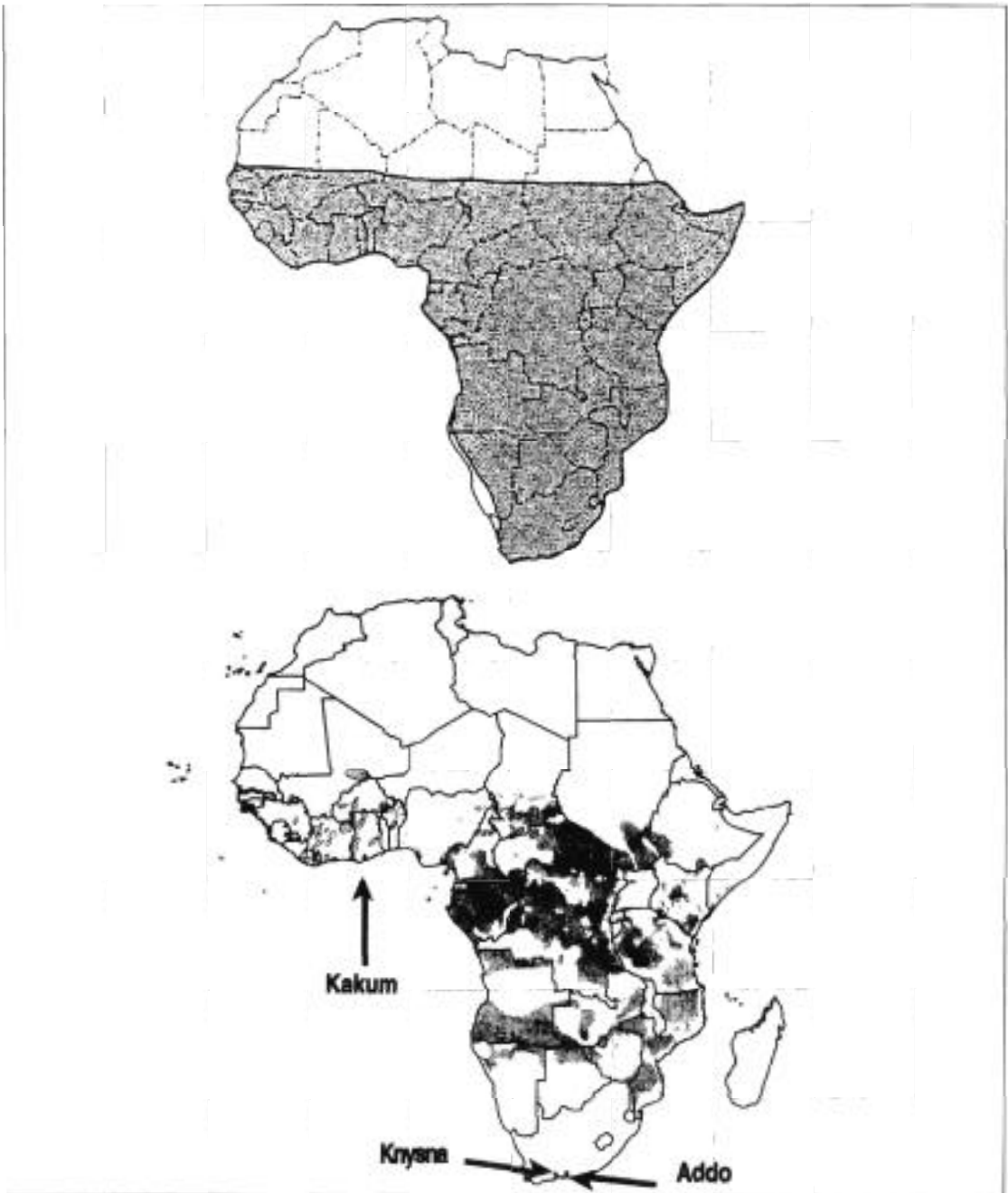


Figure 1. African elephant distributions in A) ca. 1600 (Cumming et al., 1990) and B) 1995 (Said et al., 1995) showing the three site locations.

All three sites are currently completely isolated from contact with other, elephant populations, over time spans of up to two hundred years (Table 2). All three sites were first protected under forest reserve status by British colonial administrations, with their protected area status maintained or upgraded to national park status by post-colonial national governments. All three populations were restricted to patches of dense native vegetation which survived within otherwise human-dominated landscapes under protection as forest reserve and/or national park status. Severe population bottlenecks occurred during the past century in at least two of these three sites (Addo & Knysna: Burton, 1968; Hall-Martin, 1993). None of these populations appears to have been significantly affected by ivory poaching during the past two decades (Dudley *et al.*, 1992; Hall-Martin, 1993).

The Kakum elephant population (estimated at 100-150 individuals) appears stable within a 347km² rainforest area recently converted from Forest Reserve to National Park/Game Reserve status as part of a regional tourism development and watershed

conservation project (Dudley *et al.*, 1992). The Addo elephant population, currently estimated at 212 individuals (Knight & Hall-Martin, 1995), is thriving within the fenced precincts of the long-established Addo Elephant National Park (120km²). In Knysna, there is only one survivor from the remnant population, which lives within a 150km² area of indigenous forest, fynbos scrubs, and pine/eucalyptus forestry plantations protected under State Forest status. A re-introduction programme is currently underway to supplement the Knysna population with juvenile female elephants salvaged from culls in Kruger National Park, South Africa.

Kakum National Park and AssinAttandanso Wildlife Resource Reserve, Ghana

Little is known of the history of the forest elephant (*L. africana cyclotis*) population inhabiting this 347km² rainforest fragment, of which the southern border lies 30km inland from the city of Cape Coast, Ghana. Elephants were present locally at the time of

Table 1. Descriptions of the three sites.

Kakum	350km ²	Tropical rainforest	National Park/Resource Reserve
Addo	120km ²	Arid subtropical evergreen succulent scrub	National Park
Knysna	150km ²	Moist temperate Afromontane forest/ fynbos scrubs	State Forest

Table 2. Population bottleneck estimations.

Site	N 1995	Minimum N	Bottleneck Date:N	time since isolation
Kakum	100-150	?	no data	<100 years
Addo	212	11	1920:16 1931:11	>100 years
Knysna	3*	3	1920: 7-13 1950:4-7 1980:3	>200 years

thedemarcation of the Kakum and Assin-Attandanso Forest Reserves in 1933-1935; the elephant population was later estimated by Paijmans & Jack (1959) at about 100 animals. A recent survey (Dudley *et al.*, 1992) has estimated the current elephant population at 100-150 individuals.

Ivory was a major item of commerce in this region during colonial times, which explains the origin of the name Côte d'Ivoire (Ivory Coast) for the country bordering Ghana to the west. Intense ivory hunting during colonial times caused reduced modal tusk sizes in West African forest elephant populations; ivory trade records indicate that the largest size class of tusks was eliminated from many West African elephant populations (Sikes, 1971). Ivory poaching does not appear to have been significant in Kakum during the period 1980-1990, although local sources indicate that sporadic shooting of elephants for ivory had occurred some years earlier (Dudley *et al.*, 1992).

The Kakum elephants are the eastern-most surviving population of forest elephant in the Upper Guinean forest region, and now appear to be completely isolated from possible contact with other elephant populations. The survival of elephants in the Kakum region is attributed to the refuge provided by their rainforest habitat and the limited scale of agricultural development in the surrounding region prior to the time of the gazettement of the forest reserves during the period 1933-1935. [However, there has been a noticeable increase in crop-raiding by the Kakum elephants which is hypothesised to be associated with the long-term effects of logging (Barnes *et al.*, 1995)]. Reserve boundaries correspond more or less exactly with the upper limit of perennial surface water within the streams draining the catchment areas of these reserves (Paijmans & Jack, 1959). Elephants obtain drinking water during dry periods from small pools and boggy areas within the reserves and from perennial streams which demarcate some sections of the reserve boundaries.

The southern Cape

Ivory hunting and loss of habitat to agriculture had all but exterminated elephants in southern Africa by 1900 (Burton, 1968; Hall-Martin, 1992). The last elephant in the vicinity of the Cape peninsula was killed in 1704 and elephant populations west of the Knysna region were extirpated prior to 1800 (Hall-Martin, 1992). By 1775 the remaining Cape elephants had retreated into forests along the foothills of the OutinequaTsitsikamma coastal ranges and dense scrub-thickets of the Addo bush (Smithers, 1983).

Although elephants inhabiting the Addo and Knysna regions were afforded statutory protection in 1860, forestry officials in 1876 and 1889 reported the continued destruction of elephants (Smithers, 1983). The Cape region's elephant populations were approaching extermination by 1900 due to the cumulative effects of ivory hunting and eradication campaigns by farmers. By 1920 relict herds of elephants were still present only in the impenetrable scrub-thickets of Addo (near Port Elizabeth) and the densely forested foothills of the Outiniqua coastal mountains around the port of Knysna, South Africa. By 1930 there were only some 22 elephants surviving within the entire Cape region: 11 in the Addo bush and another 11 in the Knysna forest (Burton, 1968; Hall-Martin, 1992).

The Addo and Knysna elephant herds suffered severe population bottlenecks in conjunction with their decimation and isolation within disjointed fragments of their original habitat. Total founder populations of the existing elephant herds are thought to have numbered at most 11 individuals in Addo (circa 1931) and no more than 13, and possibly as few as four to seven individuals in Knysna (circa 1950), as shown in Figure 2 (Burton, 1968; Koen, 1982; Hall-Martin, 1992).

IMPLICATIONS FOR ELEPHANT CONSERVATION

The detailed historical data available for the Knysna and Addo elephant populations represent a unique opportunity for investigating the genetic consequences of bottlenecks and re-introductions within isolated elephant populations. These data could be used to assess the likelihood of prior population bottlenecks within populations of elephants like those of Kakum, for which past histories are uncertain. Such information could also prove valuable to the future management of genetic diversity in wild and captive ("domesticated") African and Asian elephants.

CONCLUSION

Elephants survived in Kakum, Addo and Kynsna because difficult terrain and/or dense vegetation afforded them refuge during the critical period of intense ivory hunting and expanding agricultural development during the 19th and 20th centuries. Subsequent government protection of habitat as forest reserves and (later) as national parks, rather than protected status for elephants per se, was the key factor in the survival of elephant populations at all three sites.

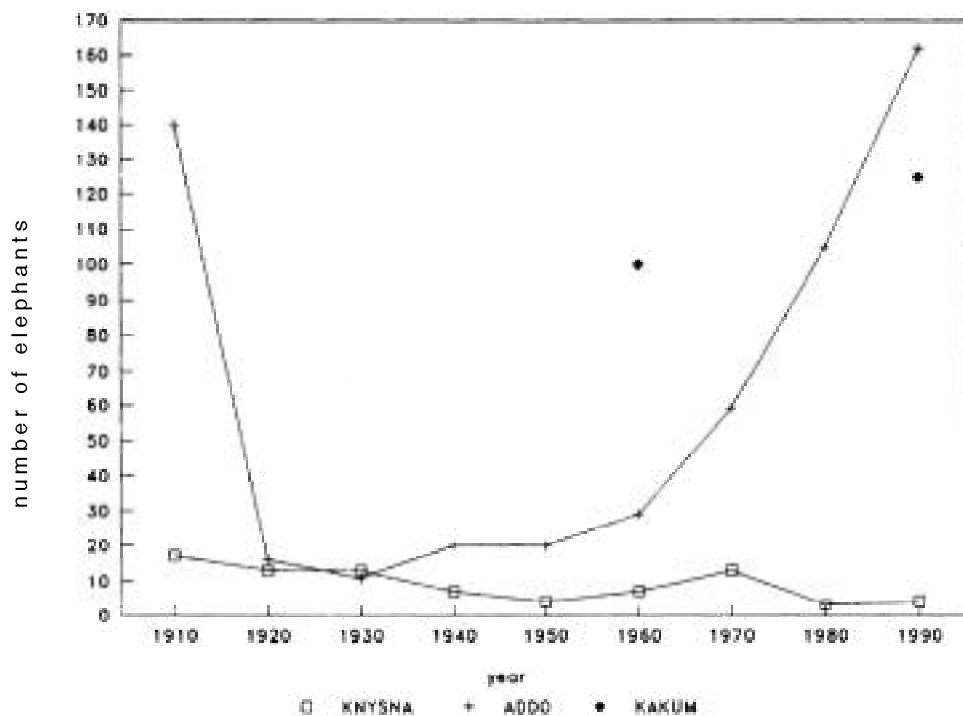


Figure 2 Population estimates for the three locations from 1910 to 1990.

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