

# In praise of pachyderms Conserve elephants. They hold a scientific mirror up to humans

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The biology and conservation of elephants



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THE symbol of the World Wide Fund for Nature is a giant panda. The panda's black-and-white pelage certainly makes for a striking logo. But, though pandas are an endangered species, the cause of their endangerment is depressingly quotidian: a loss of habitat as Earth's human population increases. A better icon might be an elephant, particularly an African elephant, for elephants are not mere collateral damage in humanity's relentless expansion. Often, rather, they are deliberate targets, shot by poachers, who want their ivory; by farmers, because of the damage they do to crops; and by cattle herders, who see them as competitors for forage.

In August 2016 the result of the Great Elephant Census, the most extensive count of a wild species ever attempted, suggested that about 350,000 African savannah elephants remain alive. This is down by 140,000 since 2007. The census, conducted by a team led by Mike Chase, an ecologist based in Botswana, and paid for by Paul Allen, one of the founders of Microsoft, undertook almost 500,000km of aerial surveys to come to its conclusion—though the team were unable to include forest elephants, a smaller, more reclusive type that live in west and central Africa, and which many biologists think a separate species.

That most of the decline has been brought about by poaching is scarcely in doubt. Seizures of smuggled ivory, and the size of the carved-ivory market compared with the small amount of legal ivory available, confirm it. But habitat loss is important, too—and not just the conversion of bush into farmland. Roads, railways and fences, built as Africa develops, stop elephants moving around. And an elephant needs a lot of room. According to George Wittemyer of Save

the Elephants (STE), a Kenyan research-and-conservation charity, an average elephant living in and around Samburu National Reserve, in northern Kenya, ranges over 1,500 square kilometres during the course of a year, and may travel as much as 60km a day.

The question, then, is whether elephants and people can ever co-exist peacefully. And many of those who worry that the answer may be “no” fear the loss of more than just another species of charismatic megafauna. Elephants, about as unrelated to human beings as any mammal can be, seem nevertheless to have evolved intelligence, and possibly even consciousness. Though they may not be alone in this (similar claims are made for certain whales, social carnivores and a few birds), they are certainly part of a small and select group. Losing even one example of how intelligence comes about and makes its living in the wild would not only be a shame in its own right, it would also diminish the ability of biologists of the future to understand the process, and thus how it happened to human beings.

Most of what is known about elephant society has been found out by STE’s study in Samburu and by an even longer-running project, led by Cynthia Moss, at Amboseli National Park, in the country’s south. Both use a mixture of good, old-fashioned fieldcraft and high-tech radio collars that permit individual animals to be tracked around by satellite.

Dr Moss began her work in Amboseli in 1972, after collaborating in Tanzania with Iain Douglas-Hamilton, a zoologist who had been studying the animals since 1965 (and who is, coincidentally, the uncle of our Books and Arts editor). In 1993 Dr Douglas-Hamilton, who had held various conservation-related jobs in the interim, followed suit by creating STE and recruiting Dr Wittemyer to set up a research project in Samburu. That project now monitors 70 family groups comprising about 300 adult females and their offspring, and also around 200 adult males. Since they began work, Dr Wittemyer and his team have collected more than 25,000 field observations of what the animals are up to, and around 4m individual satellite locations.

Dr Wittemyer argues that, human beings aside, no species on Earth has a more complex society than that of elephants. And elephant society does indeed have parallels with the way humans lived before the invention of agriculture.

The nuclei of their social arrangements are groups of four or five females and their young that are led by a matriarch who is mother, grandmother, great-grandmother, sister or aunt to most of them. Though males depart their natal group when maturity beckons at the age of 12, females usually remain in it throughout their lives.

Within a group, most adult females have, at any given moment, a single, dependent calf. They will not give birth again until this offspring is self-sufficient, which takes about four years. From a male point of view, sexually receptive females are therefore a rare commodity, to be sought out and often fought over. Such competition means that, though capable of fatherhood from the age of about 14, a male will be lucky to achieve it before he is in his 20s. Until that time arrives, he will be seen off by stronger rivals.

Were this all there was to elephant society, it would still be quite complex by mammalian

standards—similar in scope to that of lions, which also live in matriarchal family groups that eject maturing males. But it would not deserve Dr Wittemyer's accolade of near-human sophistication. Unlike lions, however, elephants have higher levels of organisation, not immediately obvious to the observer, that are indeed quite humanlike.

First of all, families are part of wider "kinship" groups that come together and separate as the fancy takes them. Families commune with each other in this way about 10% of the time. On top of this, each kinship group is part of what Dr Douglas-Hamilton, a Scot, calls a clan. Clans tend to gather in the dry season, when the amount of habitat capable of supporting elephants is restricted. Within a clan, relations are generally friendly. All clan members are known to one another and, since a clan will usually have at least 100 adult members, and may have twice that, this means an adult (an adult female, at least) can recognise and have meaningful social relations with that many other individuals.

A figure of between 100 and 200 acquaintances is similar to the number of people with whom a human being can maintain a meaningful social relationship—a value known as Dunbar's number, after Robin Dunbar, the psychologist who proposed it. Dunbar's number for people is about 150. It is probably no coincidence that this reflects the maximum size of the human clans of those who make their living by hunting and gathering, and who spend most of their lives in smaller groups of relatives, separated from other clan members, scouring the landscape for food.

Dealing with so many peers, and remembering details of such large ranges, means elephants require enormous memories. Details of how their brains work are, beyond matters of basic anatomy, rather sketchy. But one thing which is known is that they have big hippocampuses. These structures, one in each cerebral hemisphere, are involved in the formation of long-term memories. Compared with the size of its brain, an elephant's hippocampuses are about 40% larger than those of a human being, suggesting that the old proverb about an elephant never forgetting may have a grain of truth in it.

In the field, the value of the memories thus stored increases with age. Matriarchs, usually the oldest elephant in a family group, know a lot. The studies in Amboseli and Samburu have shown that, in times of trouble such as a local drought, this knowledge permits them to lead their groups to other, richer pastures visited in the past. Though not actively taught (at least, as far as is known) such geographical information is passed down the generations by experience. Indeed, elephant biologists believe the ability of the young to benefit by and learn from the wisdom of the old is one of the most important reasons for the existence of groups—another thing elephants share with people.

Group living brings further advantages, as well—most notably those of collective defence. For, though most predators apart from humans armed with rifles would hesitate to attack an adult elephant, they will happily take on a youngster. A lone mother would be able to defend her calf against a single such predator, but many carnivores, particularly lions and hyenas, come in prides or packs. The solidarity of sisterhood means a group of elephants can usually deter attacks by its mere existence, and if deterrence does not work, then collective defence usually

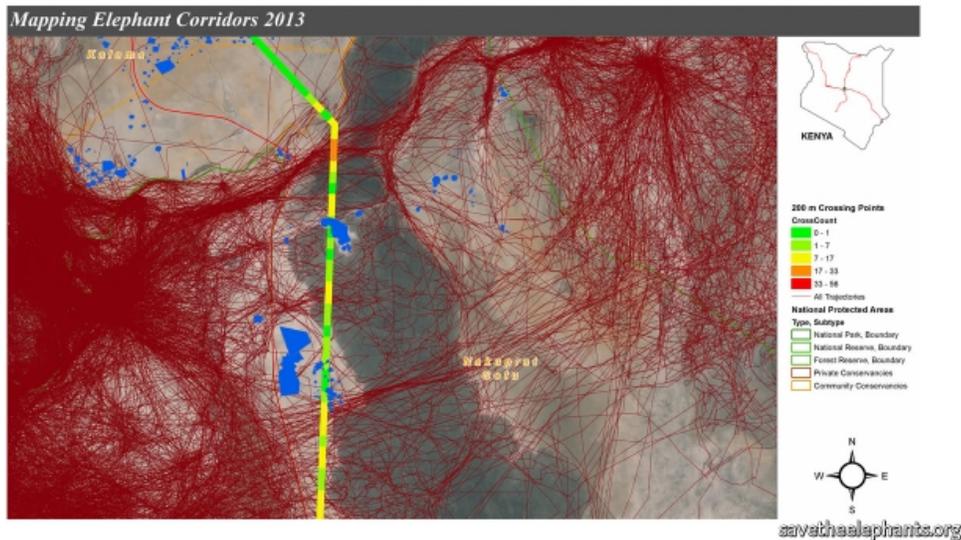
does. Here, again, experience seems to count. Data collected by Dr Moss's team suggest that groups led by young matriarchs are more vulnerable to predation than those with older leaders.

Nor is it only in their social arrangements that elephants show signs of parallel evolution with humans. They also seem to have a capacity for solving problems by thinking about them in abstract terms. This is hard to demonstrate in the wild, for any evidence is necessarily anecdotal. But experiments conducted on domesticated Asian elephants (easier to deal with than African ones) show that they can use novel objects as tools to obtain out-of-reach food without trial and error beforehand. This is a trick some other species, such as great apes, can manage, but which most animals find impossible.

Wild elephants engage in one type of behaviour in particular that leaves many observers unable to resist drawing human parallels. This is their reaction to their dead. Elephant corpses are centres of attraction for living elephants. They will visit them repeatedly, sniffing them with their trunks and rumbling as they do so (see picture overleaf). This is a species-specific response; elephants show no interest in the dead of any other type of animal. And they also react to elephant bones, as well as bodies, as Dr Wittemyer has demonstrated. Prompted by the anecdotes of others, and his own observations that an elephant faced with such bones will often respond by scattering them, he laid out fields of bones in the bush. Wild elephants, he found, can distinguish their conspecifics' skeletal remains from those of other species. And they do, indeed, pick them up and fling them into the bush.

Elephants, then, are of great scientific curiosity. But, as its name suggests, Save the Elephants was not set up solely for the disinterested pursuit of knowledge. Indeed, as has often proved the way in field studies of other species, the focus of almost all elephant researchers, not just those in Kenya, has shifted from understanding the animals to preserving them.

Though poaching is still a threat in Kenya, changes in land use now seem an equal hazard. The human inhabitants of the area around the Samburu reserve (some of whom have given their tribal name to the place) have traditionally made their livings as pastoralists, driving herds of cattle from grazing place to grazing place. One source of conflict with elephants has been competition for pasture as the herders' populations have grown. Indeed, the reserve itself is now sometimes invaded by cowherds and their stock. But, on top of this, some pastoralists have begun to settle down. Buildings and fences are appearing on land which, though outside the reserve, is part of the local elephants' ranges as they travel from one place to another.



Where elephants go. Red marks locations of radio-collared animals, sampled every hour over 60 months. The green line is a road

Here, the data Dr Wittemyer and his team have accumulated can help. Satellite tracking that shows exactly how elephants move about (see map) can be used to steer decisions concerning land use in ways that help pachyderms. As the map shows, elephants have places they prefer to live, which often correspond to protected areas, for the animals quickly work out where they are safe and where they are not. When travelling between these, which they usually do at night, they often follow narrow corridors.

Keeping such corridors clear of development is crucial to the well-being of the elephants which use them. Satellite maps are an important tool for doing so. Formal authorities in the country can take them into account, but, equally important, these maps are also quite persuasive in the public meetings at which local tribesmen agree on the use of what is collectively held land. Such meetings can assent to the legal “gazetting” of the corridors in question, to stop them being built on or fenced, so that elephants can pass freely.

This approach can work at a larger scale, as well. A new railway from Mombasa to Nairobi, for example, has been provided with elephant underpasses on routes used by the beasts—though an unintended consequence has been to encourage settlement near these transit points, which are useful for people, too. In the case of Samburu the satellite maps will be of great value if a proposed “development corridor”, running inland from a planned expansion of the port of Lamu, goes ahead, as this may bring a new highway, railway and oil pipeline through land much used by elephants.

Understanding elephants’ behaviour also permits it to be manipulated in ways that help reduce direct conflict between elephants and people. One such project harnesses elephants’ fear of bee swarms.



Bees are the only animals apart from humans that elephants seem truly afraid of. Anecdotally, this has been known for a long time. But the matter has now been studied scientifically by Lucy King, a researcher at Oxford University who is also part of STE. Dr King proved the anecdotes correct by playing the sound of a swarm of angry bees to wild elephants, and videoing the instant, panicked flight it provoked. The reason for this panic is that, although a bee's sting cannot penetrate most parts of an elephant's hide, swarms of bees tend to go for the eyes and the tip of the trunk, a pachyderm's most vulnerable parts. Bees are enemies that no amount of collective defence can discourage.

Armed with that knowledge, Dr King and her colleague Fritz Vollrath came up with the idea of protecting farms with bee fences. The sort of fence most Kenyan smallholders can afford is too flimsy to exclude an elephant. But a bee fence, though flimsier still, does the job. It consists of pairs of poles about three metres apart, between which beehives can be hung like hammocks. The hives themselves are ten metres apart, and the poles are all connected by a single strand of wire 1.5 metres above the ground.

This arrangement is enough to stop elephants in their tracks. Most are sufficiently wary of hives to avoid passing the fence in the first place—indeed, they are so wary that half the hives can be cheap dummies, rather than the real thing, without reducing a fence's effectiveness. Those that do try to pass between the poles blunder into the wire and shake the adjacent hives, with predictable results, and rarely attempt a second passage.

Bee-fenced farms, Dr King and Dr Vollrath have discovered, suffer only a fifth as many elephant raids as those with conventional protection. As a bonus, the honey the bees produce is a useful source of revenue. Indeed, the fences are so successful that they are being tried out in at least a dozen other countries. Though it seems almost a Heath-Robinson solution to the problem, bee fencing may be an important part of reconciling the interests of elephants and people.

All the bee fences in the world, however, will not help if the problem of poaching remains unsolved. And that, ultimately, means suppressing demand for ivory. For years this looked a fool's errand. Now, though, it does not, for good news has arrived from what many regard as an unexpected quarter: the government of China.

Though international trade in ivory is illegal, some countries permit internal sales—and do not always inquire too closely about where the tusks contributing to those sales have come from. In recent years China, which has permitted such sales, has been the world's largest ivory market, estimated to account for 70% of ivory sold. By the end of 2017, though, any sale of ivory in China will be illegal, and all licensed ivory dealers will have had to shut up shop.

The Chinese do seem serious about this. Not only are dealers actually closing down, but an anti-ivory propaganda campaign has begun, with stars such as Yao Ming, a basketball player, and Li Bingbing, an actress, being recruited to shame those who continue to buy objects made from elephant tusks.

Though there is evidence of new workshops opening, and others expanding, in some of China's neighbours such as Vietnam, many people hope that China's ivory ban will prove a tipping-point in the fight to preserve elephants. Already, the price of the stuff in China has come down by two-thirds, from a peak of \$2,100 a kilogram in 2014 to \$730 earlier this year. That is bad news for smugglers, and for the poachers who supply them. If the Chinese ban really does stick, rather than driving the trade underground, then it is just possible that historians of the future will record 2017 as having been the year of the elephant.