Correspondence

Poaching empties critical Central African wilderness of forest elephants

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Elephant populations are in peril everywhere, but forest elephants in Central Africa have sustained alarming losses in the last decade [1]. Large, remote protected areas are thought to best safeguard forest elephants by supporting large populations buffered from habitat fragmentation, edge effects and human pressures. One such area, the Minkébé National Park (MNP), Gabon, was created chiefly for its reputation of harboring a large elephant population. MNP held the highest densities of elephants in Central Africa at the turn of the century, and was considered a critical sanctuary for forest elephants because of its relatively large size and isolation. We assessed population change in the park and its surroundings between 2004 and 2014. Using two independent modeling approaches, we estimated a 78–81% decline in elephant numbers over ten years — a loss of more than 25,000 elephants. While poaching occurs from within Gabon, cross-border poaching largely drove the precipitous drop in elephant numbers. With nearly 50% of forest elephants in Central Africa thought to reside in Gabon [1], their loss from the park is a considerable setback for the preservation of the species.

Change in the elephant population was determined by comparing data from two large-scale surveys of elephant dung from 2004 to 2014. To ensure that the observed decline was not an artefact of different rainfall regimes between survey periods, we employed both the conventional distance-sampling method and a dung-rainfall model that makes no assumptions of steady-state dung decay (Supplemental information). With distance-sampling, we estimated a

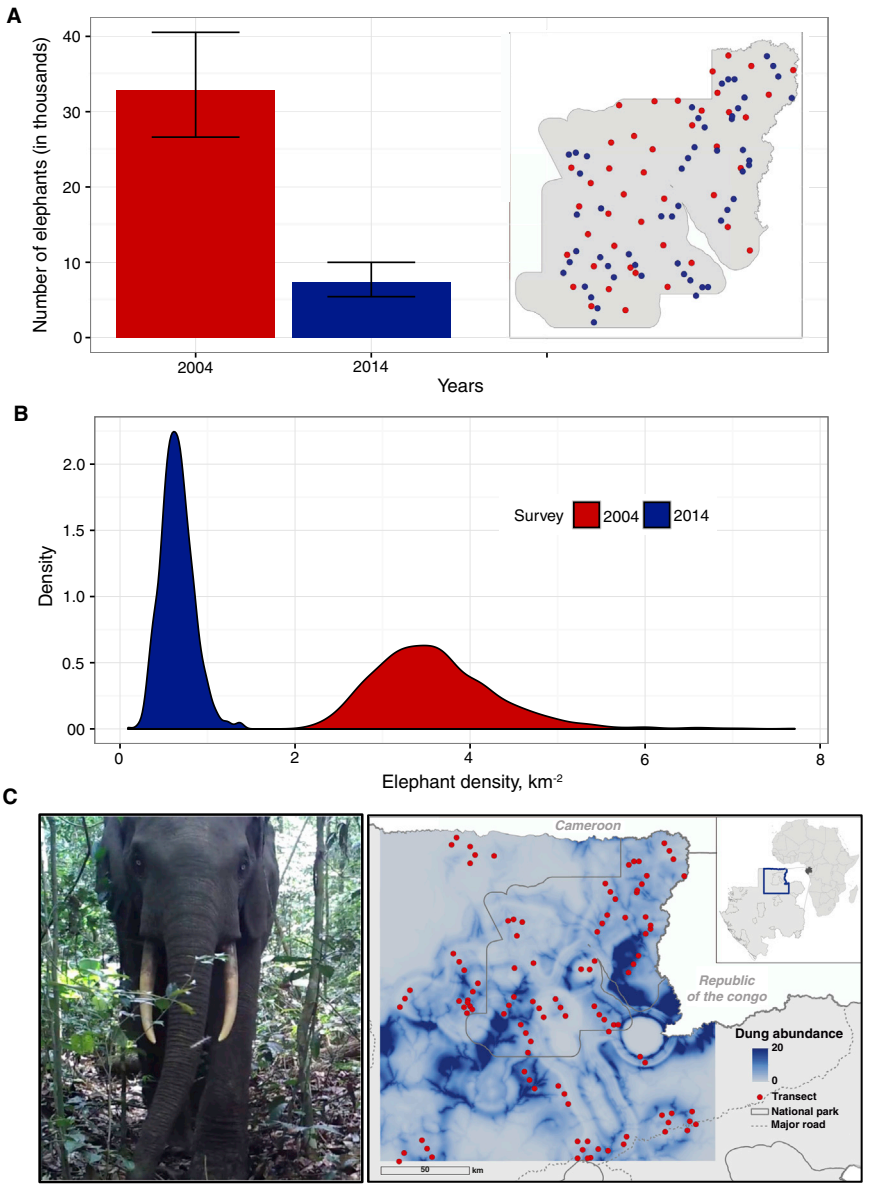

Figure 1. Forest elephants in Minkébé National Park, Gabon.
We estimated forest elephant numbers in the Minkébé National Park, Gabon (including a 5-km buffer zone) from 643 dung piles observed along 43 transects (43 km) in 2004 and 919 dung piles observed along 106 transects (199 km) in 2014. (A) Number of forest elephants (and 95% confidence intervals) in 2004 and 2014 estimated with distance sampling, and (inset) the location of survey transects. (B) The bootstrapped densities of forest elephants for both survey periods from the dung-rainfall model. Note that the dung-rainfall model makes no assumption of steady-state dung decay; thus, unlike previous studies [1] declines in numbers are unambiguously attributable to real losses of elephants and not changes in precipitation regimes or other environmental variables (Supplemental information). (C) Forest elephant distribution map in 2014. The abundance of forest elephant dung was predicted across the study area using a density surface model. Dark blue indicates areas of high abundance, and the red points represent transects from the 2014 survey. Hotspots of high elephant density occur in the southeast corner of the park — far from villages and the Cameroon border — and the southwest corner of the park extending into the periphery zone. Areas of extremely low dung abundance occur in the northern portion of the study area abutting Cameroon, the southern portion of the study area near the Gabonese national road, and along a corridor through the park that coincides with the Ivindo River. From the model, we estimate 20,227 elephants in the study region with 7,206 elephants inside the park (Supplemental information): these estimates are within 2.2% of distance sampling results and 10.0% of dung-rainfall results. The inset shows the location of the study area in Africa and in Gabon.

population in 2004 of 32,851 elephants in the park compared to just 7,370 elephants in 2014 (Figure 1A), a 77.6% decrease (Supplemental information). Similarly, with the dung-rainfall model, we estimated a population of 35,404 elephants in the park in 2004, compared to only 6,542 elephants in 2014, a loss of 81.5% of the population (Figure 1B).

The documentation of significant declines in forest elephant populations is not new [1,2], but a 78–81% loss of elephants in a single decade from one of the largest, most remote protected areas in Central Africa is a startling warning that no place is safe from poaching. At 7570 km^2, MNP is the largest protected area in Gabon (34% larger than the average park in West and Central Africa) and lies 58 km from the nearest major national road. Strong evidence suggests that poaching is the cause of the precipitous drop in elephant numbers: ecoguards recorded 161 carcasses of poached elephants between 2012 and 2015; and much of the ivory seized on the international market has been traced back to the tri-national area of Cameroon, Gabon and Congo that includes MNP [3].

Our results suggest two fronts of poaching pressure on MNP (Supplemental information). Poaching from within Gabon reduced elephant numbers in the south of the park, whereas poaching from Cameroon emptied the northern and central sections of the park (Figure 1C). Declining dung abundance with distance from the park demonstrates that, while the park is under pressure, it is still buffered from Gabonese villages and cities that would be sources of poaching pressure from within the country. In the absence of effective law enforcement, timber concessions to the west and south of the park — accessible by logging roads — are easier poaching grounds than undisturbed forest [4]. But the strong, negative effect of the Cameroon border on elephant dung abundance suggests much of the poaching originated from Gabon's northern neighbor and emphasizes the importance of cross-border poaching. Cameroon's national road lies 6.1 km from MNP at its nearest point, making access to the park relatively easy. Cameroon plays a major role in ivory trade, with Douala serving as an important exit point for ivory [5]. In 2011, the National Parks Agency (ANPN) expelled over 6,000 illegal immigrants, mostly Cameroonians, from an illegal gold mining camp at the center of the park. The site was a hub of criminal activities, including poaching, originating from the Cameroonian town of Djoum.

The government was unable to detect or stem the poaching of elephants for most of 2004–2014. Prior to 2011, the government invested little in park management: ANPN was under-resourced and under-staffed. Because of reports of poaching, the government raised the status of the forest elephant to 'fully protected', doubled ANPN's budget, and created the National Park Police. In 2012, Gabon became the first Central African country to burn its ivory stock. While laudable, these actions are clearly insufficient, as elephant poaching is an international problem driven by distant markets [5,6] and facilitated by cross-border poaching. To save elephants, nations must cooperate by designing multinational protected areas, coordinating law enforcement, and prosecuting nationals who commit or encourage wildlife crimes in other countries.

At the CITES CoP17 in October 2016, efforts to list African elephants under Appendix 1 failed because of fears that some nations would pull out of all ivory trade restrictions. Similar reasoning prevented the IUCN African Elephant Specialist Group from recognizing the species. Our study supports listing forest elephants on CITES Appendix 1, and recognizing them as 'Critically Endangered' under the IUCN Red List. The international community must recognize the species to engender the multinational support necessary to prevent its extinction.

SUPPLEMENTAL INFORMATION

Supplemental Information including the experimental procedures, one table and one figure can be found at http://dx.doi.org/10.1016/j.cub.2017.01.023.

AUTHOR CONTRIBUTIONS

Conceptualization, J.R.P., C.J.C., L.J.T.W., J.O., and M.F.; Methodology, J.R.P and V.P.M; Formal Analysis, J.R.P., S.M., C.R., A.M., and S.E.K.; Writing – Original Draft, J.R.P., S.M., and S.E.K.; Writing – Review & Editing, J.R.P., S.B., L.J.T.W., C.R., A.M., C.J.C., S.E.K, J.O., M.F.; Funding Acquisition, L.J.T.W., C.J.C., and M.F.; Supervision, J.R.P.

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