

LETTER FROM THE CONSERVATION FRONT LINE

From elephant memory to conservation action: using chili oil to mitigate conflict one elephant at a timeW. R. Langbauer Jr¹, M. Karidozo¹, M. Madden², R. Parry³, S. Koehler⁴, J. Fillebrown⁴, T. Wehlan⁴, F. Osborn¹ & A. Presotto⁴

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The conflict between humans and elephants is common wherever they coexist, causing significant loss of crops, property and even human life (Kiffner *et al.*, 2021). Some methods, such as the use of beehives, chili fences and electric fences, seem to reduce, but not eliminate, human/elephant conflict and property loss (Karidozo *et al.*, 2006). However, these methods require permanent infrastructure and are difficult to deploy quickly. As with most human/wildlife conflict, it is individual elephants, not the species as a whole, that are responsible for this conflict (*ibid.*). Elephants have large home ranges, and these individuals can shift the locus of their activity from one site to another. When conflict occurs, the most common solution is to kill the elephant (Karidozo & Osborn, 2015), even though both species of African (*Loxodonta africana*) and Asian (*Elephas maximus*) elephants are currently endangered. Here we present a case study of an alternate method to killing, *disruptive darting*, that can be deployed quickly on elephants visiting a location where they are not desired, with obvious ethical and conservation benefits.

The subject of this study is a male elephant ~35 years old, who carries a GPS collar as part of a larger study. His home range includes the town of Victoria Falls, Zimbabwe, a popular tourist destination. Located within Victoria Falls National Park, the town's tourism areas and residential properties connect directly to the surrounding wildlife areas. Therefore, it is common to observe wildlife traveling close to humans and their properties – sometimes even walking downtown during the daylight.

In July 2018, our subject began to feed on trees near the Victoria Falls Baobab Elementary School, which caused concerns when children were playing in the school yard. The school contacted the Zimbabwe Parks & Wildlife Management Authority (ZimParks), requesting he be 'removed' from their property. In an effort to keep the bull alive, and the children safe, ZimParks allowed us to anesthetize the animal and apply concentrated chili wax (>150 000 Scoville units) on sensitive parts of his body (avoiding the eyes). Based on

human reactions to the wax, this would have caused non-lethal, temporary but intense discomfort, lasting 45–90 min (Osborn and Karidozo, pers. comm.).

The bull approached within 375 m of the school buildings on three consecutive days immediately before the application of the wax, spending most of each day there. After application he immediately left and stayed away from the area around the school for 1 year and 2 months, never entering the school yard nor approaching closer than 375 m. After this period of complete avoidance, he came within 375 m of the school only three times, in September and October 2020. These visits were always during the night when no humans were present. This nocturnal behavior is consistent with other studies about elephants avoiding humans (Shaffer *et al.*, 2019). In the 2 years after the mitigation, he has yet to approach within 250 m of the school.

However, while he largely avoided the location of the mitigation event for over 2 years, and still seems to be avoiding humans in that area by visiting only at night, he did not generalize this avoidance to all humans, since he still visited other parts of the town, when people were present, during this period.

The movements of the bull 8 months before the application of the wax to 29 months afterward (Langbauer *et al.*, 2021) are summarized on a story map located at: (<https://storymaps.arcgis.com/stories/b5fecad6b544afb4afae42a0532089>).

Thus, this disruptive darting, while having notable implementation costs in terms of personnel and materials, produced a long-term effect that benefits the conservation of elephants and reduces human–elephant conflict. This may make the costs comparable to installing and maintaining infrastructure solutions like bee hives or fencing over a comparable period. Disruptive darting can be deployed quickly, and it keeps alive endangered elephants that would otherwise be killed. There is also the potential, yet to be explored, that an elephant initially treated with disruptive darting may associate the smell of capsicum with the experience, and thus be deterred by less invasive and less expensive mitigation methods, such as burning chili-infused dung bricks.

In addition to its practical benefits, the method described here has implications for the study of the cognitive behavior of elephants. Elephants are known to have excellent spatial memory (Polansky *et al.*, 2015) and the ability to discriminate between humans whom they perceive as a threat and those whom they perceive as safe (McComb *et al.*, 2014). Our study is consistent with these findings, in that the elephant seemed to associate the unpleasant event with a specific location, and perhaps with people at that location, rather than people in general. Further investigation of this technique may provide insight into the cognitive processes of an intelligent non-human animal.

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