DOI: 10.2305/DXXK3113
Short Communication Gajah 56 (2023) 36-39

Private Electric Fences: A Novel and Effective Approach to Preventing Elephant Depredation

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Introduction

Increasing human-elephant conflict (HEC) has been attributed to the rising human population, their needs including agriculture, and the fragmentation and reduction of forest cover (Fernando *et al*. 2011). Nineteen administrative districts out of 25 in Sri Lanka have reported HEC (Prakash *et al*. 2020). During 2010 to 2019, a total of 14,516 incidents of HEC have been reported in Sri Lanka including the death of 807 people, injuries to 579 people, 10,532 incidents of property damage and 2,631elephants deaths (Prakash *et al*. 2020). HEC mitigation attempts by the state include distributing elephant thunder flashes (large firecrackers), capture and translocation, elephant drives, erecting electric fences and paying compensation (Prakash *et al*. 2020). Electric fences are one of the most effective methods for mitigating HEC (Fernando *et al*. 2008). However, in Sri Lanka they have been mostly erected around protected areas of the Department of Wildlife Conservation (DWC) restricting elephant movements (Fernando & Leimgruber 2011). In addition to the impossibility of restricting elephants to protected areas using electric fences, some elephants whose movements are obstructed by electric fences may search for new locations and thereby electric fences could even aggravate HEC (Gunaratne & Premarathne 2005). Wild elephants occur on both sides of many of the electric fences that have been constructed by the DWC, hence do not prevent elephant depredation (Fernando *et al*. 2008). Because the fences are constructed by the DWC, people have no sense of ownership of the fences and do little to maintain them and many such fences become dysfunctional after a few years (Fernando 2020).

Many of the weaknesses in the current approach to electric fences as a HEC mitigation measure could be remedied if electric fences were erected around human dwellings (Fernando 2020) and especially if individuals had full ownership of them. Here we present the results of 60 electric fences erected around private properties of villagers frequently affected with HEC.

Materials and methods

The fences were constructed by the Nano Vision Company (NVC), Anuradhapura, Sri Lanka, Publicity for this initiative by NVC was gained through various state organised public exhibitions and by word of mouth. All fences were erected on HEC affected individuals' requests, around their properties, except for one fence, which was erected around an office. All houses and paddy fields included within fences were permanent. Some fences included 'chenas' in which slash and burn method was practiced seasonally. The mean length of the fences was 1228.7 ± 680.5 m, range 250–3500 m. The area enclosed was not measured nor its ownership questioned. The mean duration the fences were in place was 3.5 ± 2.6 years, range 0.5–13 years. Fences were constructed by NVC workers. Customers were given training on electric fence maintenance by the NVC as part of the process.

Two main designs of fences were used: screen (hanging) and regular. In screen fences 15-foot-high galvanised iron (GI) posts were used. A horizontal high tensile 2.5 mm gauge GI wire

 Manuscript Editor: Prithiviraj Fernando

was strung between the highest points of the posts. Vertically hanging 1.8 mm gauge, GI wires of around 13 feet in length were attached every 2 feet along the length of the top horizontal wire. Screen fences were used without an Earth where the ground was moist and with an Earth where it was dry. The cost of a screen fence was 2105 USD per km (calculated at 1 US$ = SL Rs. 200).

In regular fences, posts were 8 feet tall with 2 feet buried in the ground. Wooden, concrete or GI posts were used. The fences had two live wires and an earth wire in the middle, all of which were 2.5 mm gauge GI. In locations which already had a non-electrified fence with concrete posts, the same posts were used to reduce the cost. They were modified by connecting iron bars to which the live wires were attached (Fig. 1). If the pre-existing fence had barbed wires, they were not removed during the modification. In places where elephants damaged posts regularly, bent GI posts were used. An electric supply was given to the bent post with a 2–3 foot polyvinyl chloride (PVC) socket used in the bottom of the posts to prevent current leakage or vertical guard wires hung from the top of the post. The top of bent GI posts was 6–7 feet height from the ground and 2 feet of the post was buried under the soil. At a height of 2 feet from the ground, the posts were bent 45° to 30° (Fig. 2). The cost for a fence using timber posts was 1086 USD per km and with GI posts 1613 USD per km.

Figure 1. Modified concrete post.

The energiser used was manufactured by NVC. The input was 12 V and the output had a pulse rate of 40–72 per minute at 9–12 kV at an amperage of less than 25 mA and 4–19 joules. The energiser was powered by main grid (domestic) power and a step-down transformer to reduce input voltage to 12 V or with a solar panel system and a rechargeable 7 Amp 12 V battery. Where there was no access to grid power and a solar system was not installed (in slash and burn (chena) cultivation fields), the battery was brought home to recharge and fixed back to the electric fence at night. Main grid electricity supply was the source of power for the energiser in 23 fences, another 16 used main grid supply and when possible solar power, and 21 fences used only solar power. All customers were given an extra energiser and educated on changing the energisers on their own.

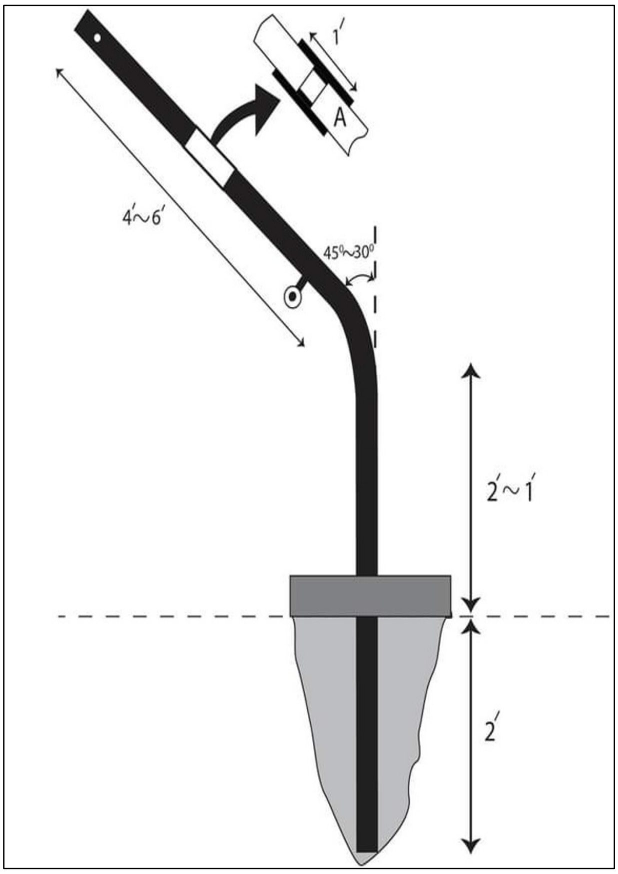

Figure 2. Galvanised bent post. A = PVC socket applied to the post.

The 60 electric fences were located in the Anuradhapura (n = 31), Kurunegala (n = 9), Polonnaruwa (n = 8), Badulla (n = 8), Matale (n = 3) and Hambantota (n = 1) Districts. A total of 50 fences included cultivated land with 24 including paddy fields and 5 seasonal agriculture lands. A total of 39 electric fences included a house. Whenever a fence breakdown was identified, the first author was informed by the customer. According to the electric fence installation agreement with NVC, it was attended to within 3 days or depending on the nature of the complaint, instructions given over the telephone.

Information on elephant sightings, conflict experienced by fence owners before and after fence implementation and fence functioning was obtained by telephone interviews.

Results

None of the fence owners had conflicts with elephants, after fence installation. Before the fences were erected 24 (40.0%) had observed elephants once a week and the remainder less frequently. After erecting the electric fences, 30 (50%) of respondents sighted elephants weekly or more frequently and 5 (8.3%) about once a month. Most frequently observed type of elephants before the electric fence was installed were herds, which were observed by 54 (90.0%). Lone male elephants were observed by 50 (83.3%) and male groups by 29 (48.3%), before fences were erected. After the electric fences were erected, 16 (26.7%) had not seen elephants around their property, 45 (75.0%) had seen herds, 49 (81.7%) had seen lone males and 28 (46.7%) had seen male groups. In the opinion of the respondents, most probable reason (n=47) for frequent elephant visits was the presence of palatable food either in their cultivated lands, home garden, paddy fields, in chenas or stored at home.

Malfunctioning or break downs in the fence were observed by 20 (33.3%) respondents, up to date. A total of 3 (5.0%) of respondents experienced such malfunctioning 4 times, two respondents (3.3%) 3 times, three respondents (5.0%) twice and 12 (20.0%) once, after installation. A total of 57 (95.0%) respondents indicated that their fence is currently fully functional and are satisfied with it. A total of 37 (61.6%) respondents indicated that crop damage by other animals including wild boar, deer, giant squirrel and porcupine also have been reduced after the electric fence was installed.

Discussion

Our results demonstrate that erecting electric fences around private properties is very effective, as no HEC incidents were experienced after erecting the electric fences and none of the respondents had given it up. The types of elephants and frequency in which respondents observed elephants around their protected property did not substantially change after erecting the electric fences. This suggests that the elephants did not change their movement patterns due to the fences, hence that the fences did not obstruct elephant movement. These privately erected electric fences have continued to work well over the years possibly because fence maintenance is the responsibility of the owner who is also the investor. As a result, they have a high sense of ownership of the fence and since it is around their residence or cultivation, regular maintenance is not a problem for them.

Currently there are resident people in 69.4% of elephant range in Sri Lanka (Fernando *et al.* 2021). Thus, HEC which is mostly due to crop raiding is a major issue. Over 4,500 km of electric fences have been erected by the government with public funds but have failed to resolve the conflict, which has been steadily increasing (Fernando *et al.* 2011; Prakash *et al.* 2020). The obstruction of elephant movement by such fences constructed on administrative boundaries of protected areas has also been very detrimental to elephants (Fernando 2020). Our results suggest that electric fences around private properties are very efficient at preventing elephant depredation and do not harm or disturb elephants. Electric fences erected by the government around protected areas, incur repeated breakdowns and have to be repaired frequently, incurring government expenditure. For the private electric fences reported herein, the government did not invest any funds, human or other resources in construction or maintenance. Therefore, facilitating individuals getting their own electric fences could significantly reduce HEC, without burdening the government. Our results seriously question continued erection of electric fences around protected areas and instead support the proposed paradigm shift in managing HEC, in which parties who are protected by electric fences should construct and maintain them (Fernando 2015).

Reference

Fernando P, Kumar, MA, Williams AC, Wikramanayake E, Aziz T & Singh SM (2008) *Review of Human-Elephant Conflict Mitigation Measures Practiced in South Asia*. WWF, Gland, Switzerland.

Fernando P, De Silva MCR, Jayasinghe, LKA, Janaka HK & Pastorini J (2021) First country-wide survey of the endangered Asian elephant: Towards better conservation and management in Sri Lanka. *Oryx* **55:** 46-55.

Fernando P (2015) Managing elephants in Sri Lanka: Where we are and where we need to be. *Ceylon Journal of Science (Biological Sciences)* **44:** 1-11.

Fernando P, Jayewardene J, Prasad T, Hendavitharana W & Pastorini J (2011) Current status of Asian elephants in Sri Lanka. *Gajah* **35:** 93-103.

Fernando P & Leimgruber P (2011) Asian elephants and seasonally dry forests. In: *The Ecology and Conservation of Seasonally Dry Forests in Asia*. McShea WJ, Davies SJ, Phumpakphan N & Pattanavibool A (eds) Smithsonian Institution Scholarly Press. pp 151-163.

Fernando P (2020) *Guide for Implementing Community-Based Electric Fences for the Effective Mitigation of Human-Elephant Conflict*. The World Bank, Washington DC.

Gunaratne LHP & Premarathne PK (2005) *Elephants and Electric Fences: A Study from Sri Lanka*. IDRC Regional Office for Southeast and East Asia, EEPSEA.

Prakash TGSL, Wijerathne AW & Fernando P (2020) Human-elephant conflict in Sri Lanka: Patterns and extent. *Gajah* **51:** 16-25.