# A stakeholder assessment of human–elephant conflict in Benin

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## Introduction

This field note has been adapted from a project report following a study on elephant-related conservation work in the buffer zones of the Pendjari Biosphere Reserve in Benin and the Benin portion of the transnational W Biosphere Reserve (W-Benin) (Fig. 1). The two Biosphere Reserves are part of the transnational W-Arly-Pendjari (WAP) complex, the largest and most important continuum of terrestrial, semi-aquatic and aquatic ecosystems in the West African savannah belt. The WAP comprises protected areas in the Sudanian savannah of Benin, Burkina Faso and Niger and covers an area of about 50,000 km$^2$ (UNDP 2004).

Information for the study was collected through participatory field work with local communities and protected area management agencies. The study will enable decision makers to determine priority areas where elephant populations are more liable to become vulnerable as a result of human–elephant conflict (HEC). Some strategies for sustainable elephant conservation were also proposed.

In West Africa, the African elephant (*Loxodonta africana*) range currently covers approximately 221,000 km$^2$, representing less than 7% of the area occupied by elephants in 1900; HEC has become increasingly significant as human populations expand and encroach on elephant habitat (Bouché et al. 2011). Thus, mitigating HEC is critical to the success of conservation efforts for this charismatic flagship species. Elephants in the WAP complex migrate in and out of the protected areas (Tehou 2002). Hence interactions with farmers, and specifically crop-raiding by elephants, pose serious social, economic and conservation problems in Benin as in many other parts of Africa (Osborn and Parker 2003; Balfour et al. 2007).

The Pendjari and W Biosphere Reserves contain some of the last refuges in West Africa for herds of large terrestrial mammals, most notably elephants, and represent a unique heritage site for the conservation of western African ecosystems (Lamarque 2004). Farming and cattle rearing are the main sources of subsistence for local communities living in the buffer zones around the Reserves and cattle densities are high in these areas (estimated at 8.62 ind./km$^2$), based on the result of an



Figure 1. The W–Pendjari complex in Benin.

aerial survey carried out in 2015 (Bouché et al. 2015). Some elephant populations currently reside outside of the protected areas in close proximity to farmland, where they raid crops. This reduces local support for elephant conservation which is seen as threatening local livelihoods. Poaching and illegal grazing inside the protected areas activities are also viewed as a significant threat to biodiversity conservation in the WAP complex. There is an urgent need to determine and implement appropriate strategies to counter these threats. However local communities and the forestry department lack the financial capacity to manage HEC, which limits their ability to implement mitigation and conservation measures.

## Data collection

The study was carried out between 15 November and 15 December 2014 in 15 villages located in the 5 km wide belt that forms the buffer zone of the Pendjari and W-Benin Biosphere Reserves. We sampled 7 villages in Pendjari and 8 in the W Biosphere Reserve. In each village, semi-structured interviews with 10 farmers were followed by focus group discussions. The interviews aimed to solicit information on (a) elephant sightings, (b) occurrence and characteristics of HEC, (c) attitudes towards elephants, and (d) techniques for mitigation of HEC. In addition, on 27 December 2014 we conducted a community capacity building workshop with 25 farmers from villages in the Pendjari Biosphere Reserve. The aim of the workshop was to raise awareness among farmers and map the prevalence of HEC around the Reserve. In addition, mitigation measures were evaluated using a scoring approach. Data recorded by the rangers was obtained from the Pendjari Surveillance Service

and used to compile an elephant kernel density map based on rates of human–elephant contact. A final workshop was organized on 18 February 2015, attended by 20 persons including the forest officers, park managers, researchers, an African Wildlife Federation (AWF) representative, and members of local NGOs.

## Results and discussion

### Seasonal elephant sightings

Based on results of the interviews with farmers, there was a clear seasonal pattern of elephant sightings around both Biosphere Reserves. The frequency of reported sightings increased during the wet season, i.e. from August to November (Fig. 2). This is the season when crops such as maize and sorghum are harvested and the pattern of sighting suggests that the availability of a ready food source lures the animals to the agricultural fields. W Biosphere Reserve recorded higher sightings compared to Pendjari Biosphere Reserve throughout the year. The elephant population in the two protected areas was estimated at 2,985 individuals in 2015 with 1,719 individuals for Pendjari and 1,266 for W (Bouché et al. 2015). Disturbance caused by the permanent presence of the herdsmen with zebu cattle in the W park (Bouché et al. 2015) might explain the greater frequency of elephant sightings in the villages around the W Biosphere Reserve compared to Pendjari.
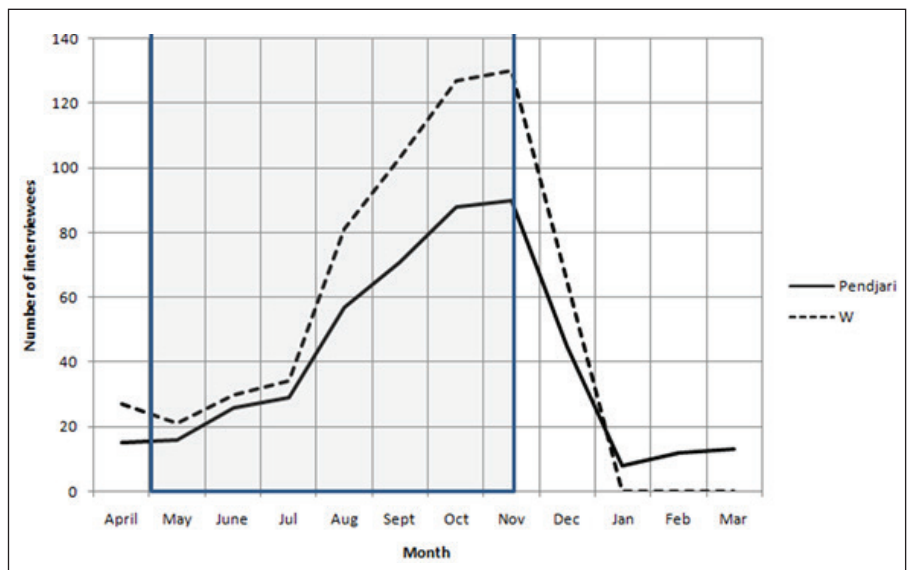


Figure 2. Monthly elephant sightings in buffer zones of the Pendjari and W Biosphere Reserves, Benin, based on interviews with local farmers.
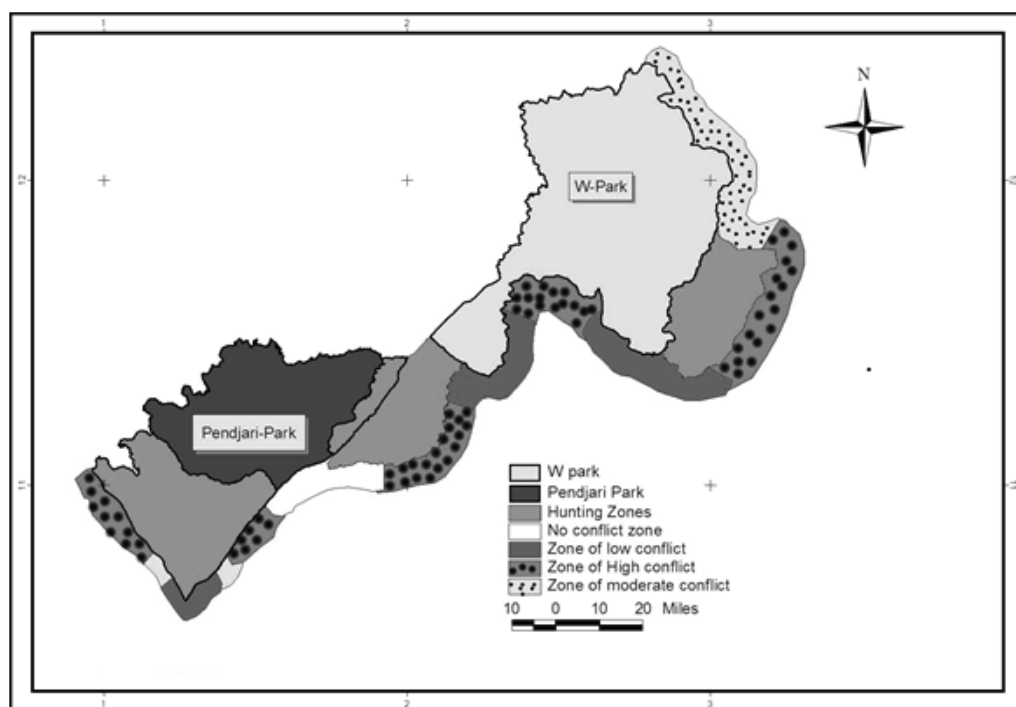
Figure 3. Human–elephant conflict zones in the buffer zones of Pendjari and W Biosphere Reserves, Benin, based on information provided by local farmers.

## Spatial distribution of human–elephant conflict

The spatial distribution of HEC was assessed using three different methods: (1) interviews with farmers, (2) participatory mapping by local villagers during the workshop with farmers living in the buffer zone of the Pendjari Biosphere Reserve and (3) heat kernel density mapping of human–elephant contact within the Pendjari Biosphere Reserve (National Park and adjacent hunting zones) based on data supplied by rangers and obtained from the Pendjari Surveillance Service. Five areas were identified as high conflict zones by the Farmers interviewed (Fig. 3), where the risk of people being injured by elephants is exacerbated by the density of the villages and settlements. A broadly similar pattern of HEC in the zones around Pendjari Biosphere Rerserve was identified by participants at the workshop (Fig. 4). Moreover patterns of conflict in the Penjari buffer zone, in both maps based on results of our fieldwork, corresponded closely to the pattern of elephant presence shown by the heat map of the Pendjari (Fig. 5).

## Evaluating mitigation measures

Based on responses to the interviews, the most common mitigation measures used by the farmers to keep elephants away from farms include noise deterrents such as shouting at elephants and rattling tins and drums, the burning of wood, torches lighted at night, guarding crops at night, burning chili, and installation of chili fences. Making noise and fires on the farm were the most frequently mentioned methods in both biosphere reserves (Fig. 5) and famers indicated that the more people who take part, the greater the deterrent effect is. However there were some notable dissimilarities in how farmers from the two reserves scored the effectiveness of different methods (Fig. 5); for example cord chili fences were highly rated by farmers from W but not considered effective by farmers in Pendjari. This suggests it would be useful to organize exchange visits between the farmers from Pendjari and W Biosphere Reserves to allow them to compare their experiences and share successful stories. Our survey also revealed that to increase the effectiveness of the repelling methods some villagers used a combination of several methods such as lighted torches combined with banging tins and drums.

Figure 4. Patterns of human–elephant conflict in the buffer zone of the Pendjari Biosphere Reserve, shown on a map produced by local farmers at a workshop in 2014. The size of the circles represents intensity of conflict, based on farmers' perceptions, as high, medium or low.
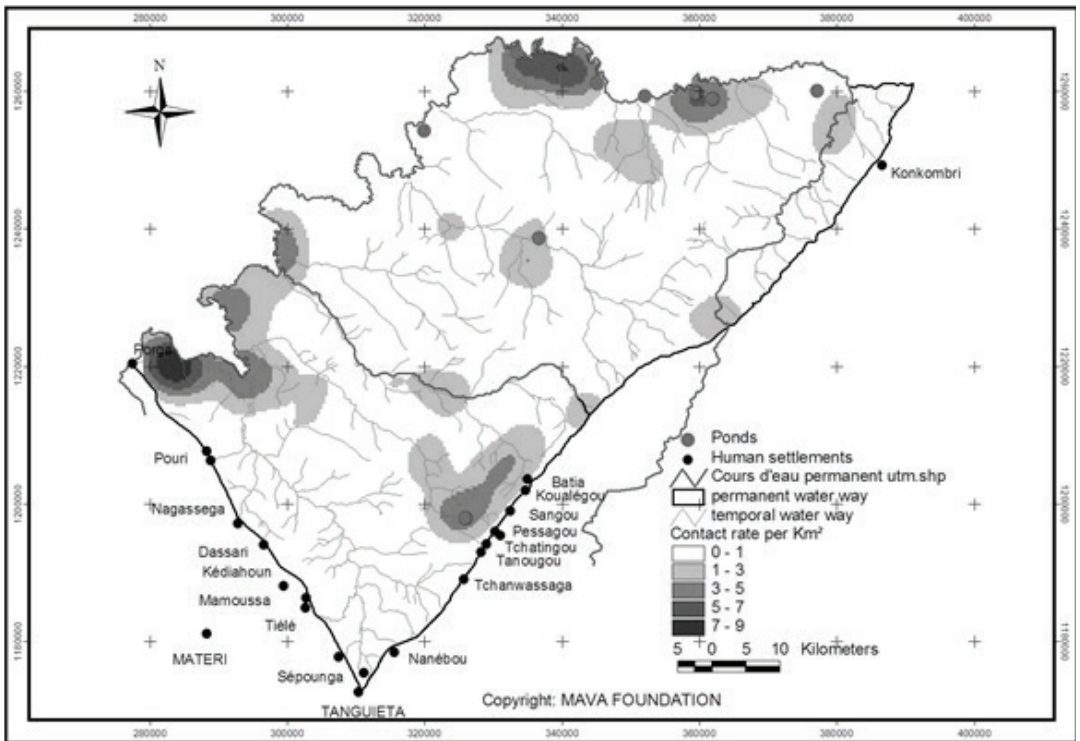


Figure 5. Heat kernel density map of human–elephant contacts in the Pendjari Biosphere Reserve. Data source: Pendjari Surveillance Service.
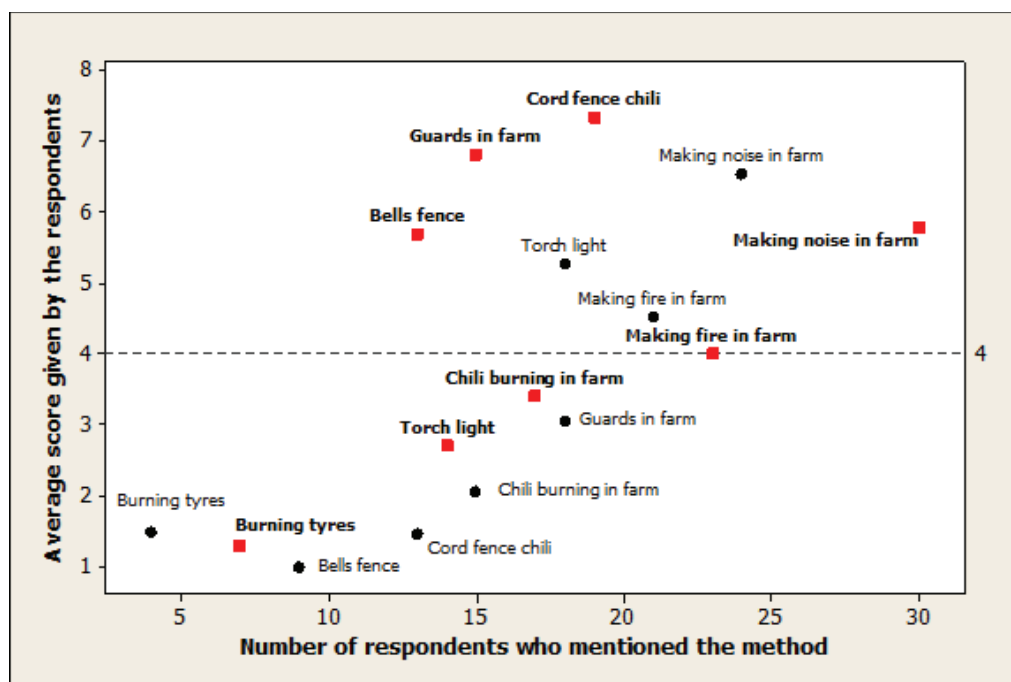
Figure 6. Frequency and effectiveness of different HEC mitigation methods in Pendjari (circles) and W (squares) Biosphere Reserves, based on information provided by local farmers. Effectiveness was scored by farmers on a scale ranging from 8 (highly effective) to 1 (very ineffective).

## *Evaluation by elephant stakeholders*

At the feedback workshop held with stakeholders on 18 February 2015, participants indicated that the presence of poachers and herdsmen with zebu cattle are in the national parks (especially in W Biosphere Reserve) leads to increased crop raiding by elephants and exacerbates HEC, since elephants fleeing zebu and poachers inside the Park take refuge in the surrounding villages in the buffer zone. A number of weaknesses in the management of the biosphere reserves were also identified. There is limited presence of management personnel in the two reserves: Decision-making authorities are based in towns located up 60 km from the park boundaries, while foresters and rangers also reside in and mainly frequent towns. Mobility of the guards will remain insufficient as long as vehicles are not assigned to law enforcement operations. This mobility issue also involves the necessity of regular road network maintenance. The participants also stated that more effort needs to be made on training rangers in best practice methods.

## Conclusion

The encroachment of the elephant's natural habitat and ongoing conversion of forest lands to settlements and pastoral land use is exacerbating HEC in the study area. A clear seasonal pattern of elephant sightings was recorded at both study sites, with more frequent sightings during the wet season, from August to November, when maize and sorghum are harvested. There was a high degree of correspondence between zones where elephants were concentrated inside the biosphere reserves, based on the results of kernel density analysis, and the areas in the buffer zones identified by the local communities as high conflict zones. The presence of poachers and herdsmen in W National Park may contribute to the greater presence of elephants in the buffer zone of this reserve, compared to Pendjari. Farmers indicated that they are familiar with a wide range of deterrent measures used to keep elephants away from farms, but the differences in evaluation of their effectiveness between W and Pendjari reserves suggests the need for further participatory research. Further efforts are also required to raise farmers' awareness of the importance of protecting elephants in the biosphere reserves. However the management authorities also need to do more to support farmers in their efforts to mitigate

human–wildlife conflict, including the clamping down on cattle herding and poaching within the national parks. This will require increased presence of management staff in the reserves, improved mobility, and further training for rangers.

The following urgent measures are needed to secure the park, its habitat and wildlife and contribute to reducing HEC to an insignificant level in the buffer zones and around the Park:

1.  Support the ranger capacity resources in the Pendjari and W Park;
2.  Establish management bases in the Parks (1/1000 km) where park decision-makers and rangers will be based and render anti-poaching plans, efforts and reporting honestly and efficiently;
3.  Completely eliminate herding of zebu in the Parks (currently the approach is to reduce rather than eliminate the several hundred thousand Zebu cattle inhabiting the park);
4.  Restore/recreate the former network of permanent water holes in the Park;
5.  Open additional vehicle access tracks so that all water points have an access route and no area of the park is farther than 5 km away from an access route (or the water points form the poachers bases in the Park);
6.  A recognized anti-poaching expert with a proven track record in reducing elephant poaching and HEC, is needed to help guide Park protection in the Pendjari and W Parks to combat poaching;
7.  Secure elephant corridors in the Pendjari and W Park landscape, especially the one connecting W Park in Benin to Pendjari and Arly National Parks;
8.  Create income for the surrounding communities, through eco-tourism activities that are linked to successful management of elephant, to improve tolerance of elephant for village actors.

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