

## Africa-wide elephant poaching associated with poor governance, limited law enforcement capacity, low human development, and global ivory price

The illegal wildlife trade is one of the highest value illicit trade sectors globally, threatening both human well-being and biodiversity. African elephant populations declined by ~30% between 2007 and 2014 due largely to ivory poaching, with significant development and security implications for African states. The programme for Monitoring the Illegal Killing of Elephants (MIKE) collates data from over 60 Protected Areas (sites) across Africa (2002-2020). Poaching levels are summarised for each site and year as the proportion of all elephant carcasses detected (mostly by rangers) that were illegally killed (PIKE). We collaborated with the MIKE programme to identify socio-economic and ecological factors/covariates that may explain variation in African elephant poaching levels (PIKE) across sites and over time. We seek to build upon similar previous work by using new covariate data and modified methods. We conducted an extensive literature review to identify covariates that may plausibly drive, facilitate, motivate, or curb elephant poaching, and fed covariates with higher plausibility and data quality into our statistical model. We used a Bayesian hierarchical Generalised Linear Mixed Model to match the data hierarchy (sites within countries, and years within sites) and the binomial PIKE metric. Our use of site, year, country, and site-year random effects and LASSO-regularisation (a form of model selection that shrinks estimated covariate effects) helped minimize type 1 errors, which are common in large covariate analyses like ours. Observed elephant poaching (as represented by PIKE) tended to be lower in countries with better governance quality, at sites with better law enforcement capacity, and at sites where adjacent households are wealthier and healthier (90% credible intervals for covariate effects do not include zero). The yearly trend in PIKE was strongly associated with the estimated annual trend in the global price of elephant ivory. We conservatively concluded that armed conflict intensity was not significantly associated with PIKE, though we did find some evidence for an effect. We found no evidence for effects on PIKE of precipitation, vegetation density, elephant population size and density, site accessibility, and site area (km<sup>2</sup>). The presenter will discuss what our results mean for elephant conservation.