Anita Chandrasekaran
DATA 606

Predicting Elephant Poaching

Project Overview

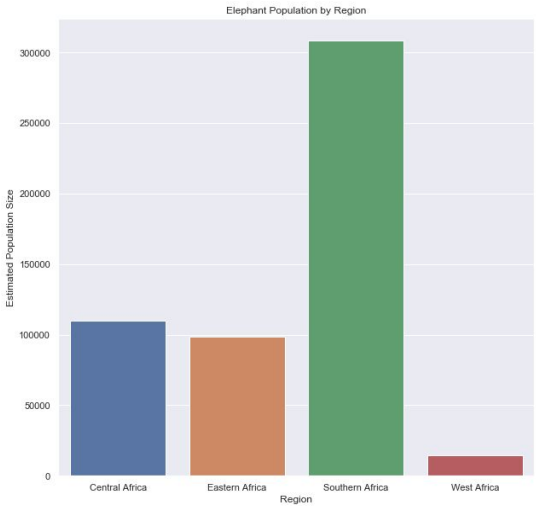
The aim of this project is to create a machine learning model which will aid in conservation efforts for the African elephant by examining patterns in illegal poaching and related factors. Factors that will be examined include geographic features where elephant carcasses are found, economic pressures such as ivory demand and illegal trade, and seasonality.

Data Sources

A variety of data sources were used in this analysis in order to gain a comprehensive view of the environment in which elephant poaching takes place. In addition to the Great Elephant Census (Allen, 2014), the Convention on International Trade in Endangered Species provided a number of resources for poaching statistics and detailed data points (CITES, 2019).

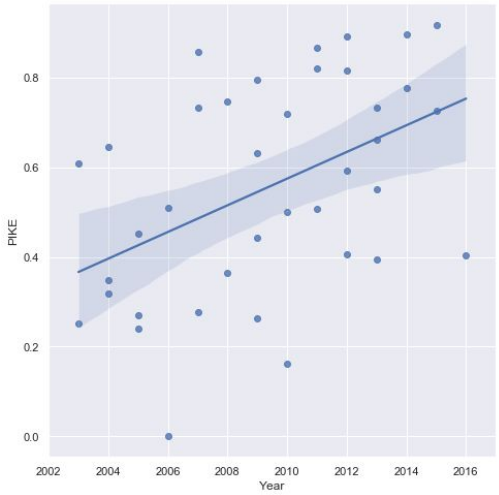
For the larger contextual data, references from previous literature reviews were examined to find other reliable data sources. Transparency International provided information on country-level corruption metrics (Pring, 2019); and the UN Development Programme reported a variety of development metrics useful for measuring economic, health, and social factors (UNDP, 2019).

Exploratory Data Analysis



Elephant population reports were restricted to specific sites used in the Monitoring of Illegal Killing of Elephants program, with regions defined therein (CITES, 2019). Approximately 200,000 elephants are currently in the South Africa region, 45,000 in Central and East Africa, and about 10,000 elephants in West Africa. This proportion has remained steady for the length of reporting recorded by the Great Elephant Census (approximately 20 years).

The chosen metric to quantify poaching was borrowed from CITES--this is called the Proportion of Illegally Killed Elephants (PIKE) and is calculated as a ratio of found carcasses with illegal causes of death to total carcasses. These values are reported by park rangers from the selected MIKE sites and are culled by CITES to add to its extensive database. This data is shared with all participant countries to encourage and facilitate exchange of intelligence related to poaching activities.



Data points represented on this graph show the selected MIKE sites with associated PIKE over time. The line of best fit depicts a general upward trend in PIKE, indicating increased poaching activities are likely to occur in the future at these sites.

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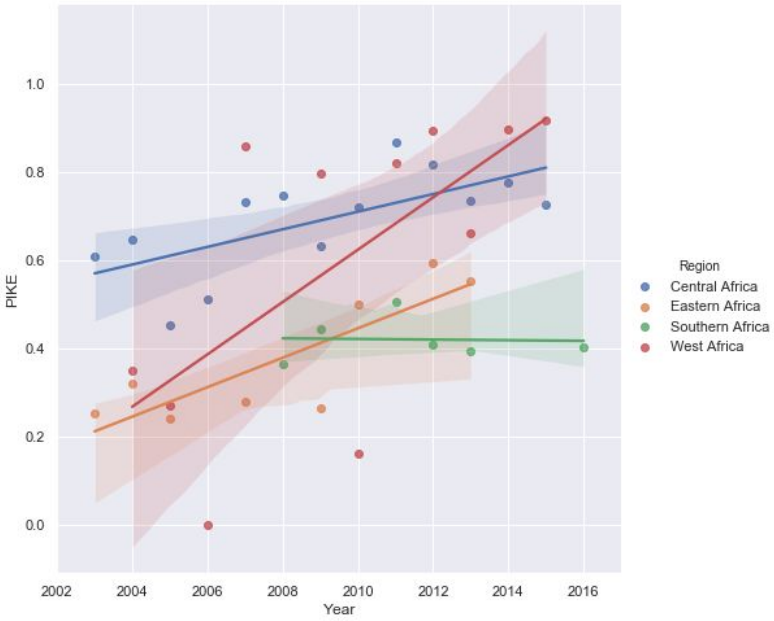
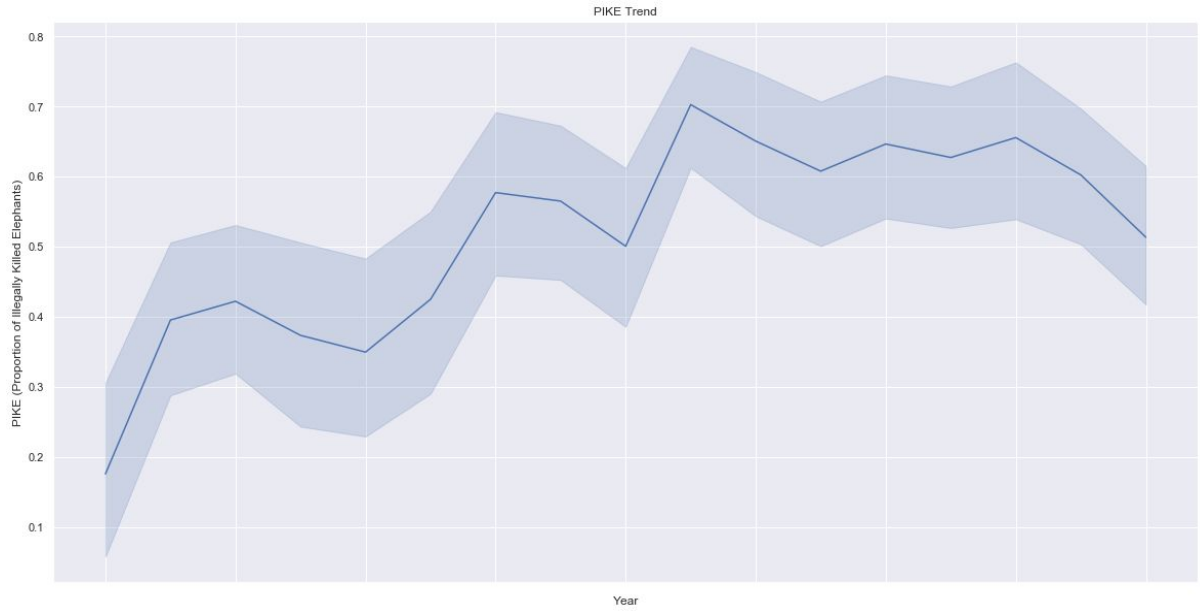


Regionally, PIKE over time shows similar upward trends over time, except for Southern Africa. There are limited data available for South Africa MIKE sites due to inconsistent reporting and reporting bias.

The validity of PIKE scores will be explored further in this project as the inherent bias in this data will greatly impact any machine learning model used to predict future poaching events. This bias is likely why continent-wide PIKE is often used in publications, but some further digging may reveal other sources with comparable data.

A larger scale PIKE graph over time shows the aggregated PIKE scores from all MIKE sites over time. This shows a slight downward trend in PIKE at the current time, but this may be preceding another upward trend as the line shows some seasonality.



Indicators

A variety of poaching indicators were examined in this EDA, including ivory trade, forest area, corruption, and human development.

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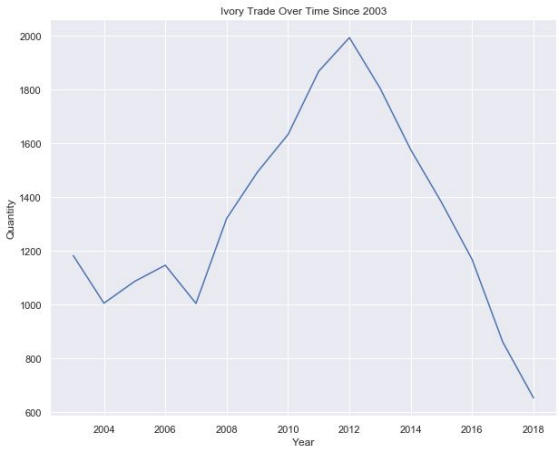
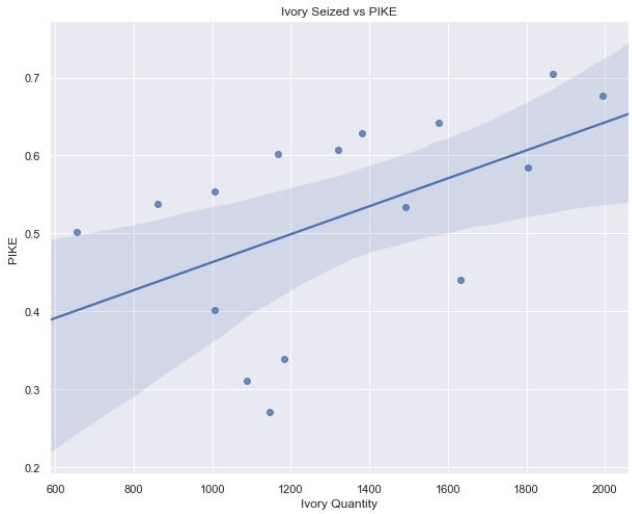
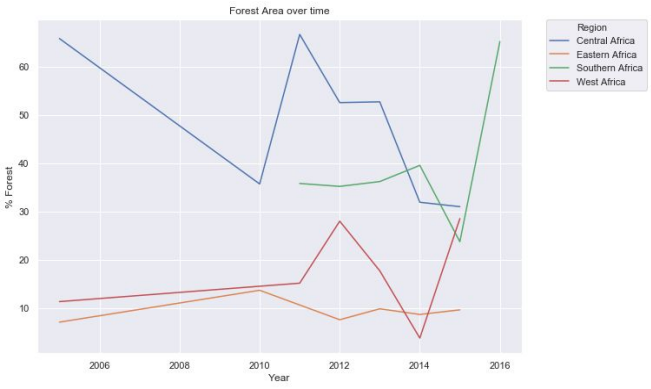
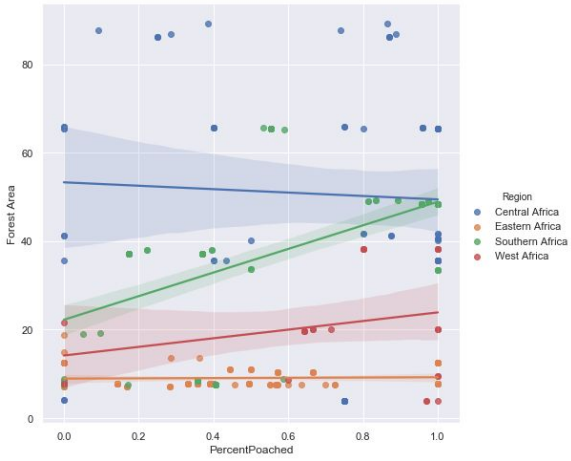
Ivory Trade. Using the CITES Elephant Trade Information System, a database on ivory imports and exports, a general positive correlation was observed between ivory quantity and PIKE. Since 2012, there has been a drastic decrease in ivory being imported and exported due to more stringent laws. This will likely remain the case going forward, so the ivory trade indicator may not be an accurate indicator in future (CITES).





Forest Area. Shown as a percentage of forested (or elephant-habitable) land area out of total land area, the forest area metric aids in determining the maximum capacity of elephants in a given region (UNDP). The upward trends in forested areas for Southern and Western Africa may be anomalous due to newly established protected zones, or because of inconsistent reporting. Further investigation is required. The positive correlation between forested area and PIKE seems counter-intuitive, and may be influenced by these odd values.

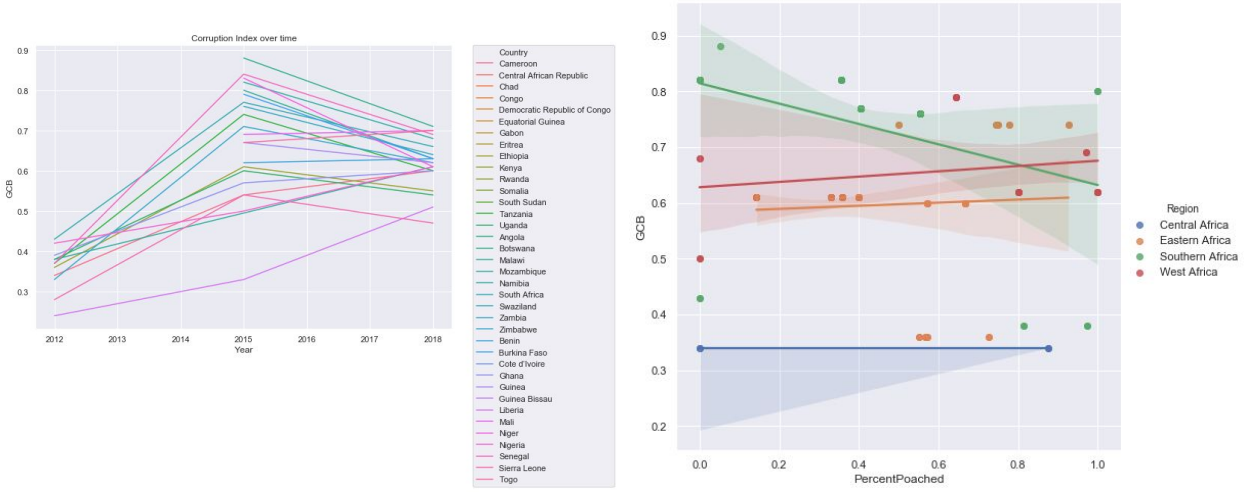




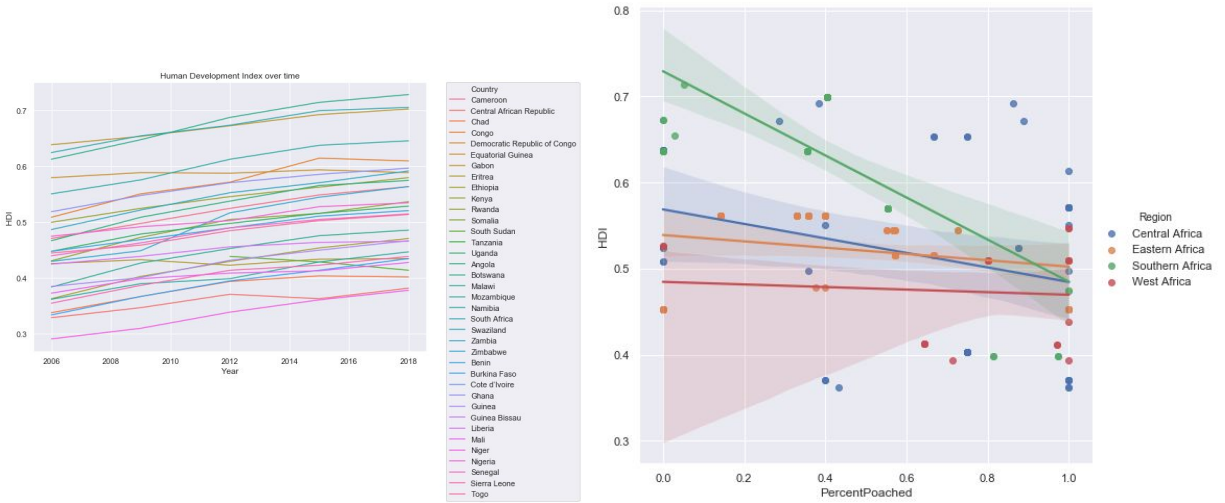
Anita Chandrasekaran
DATA 606

Predicting Elephant Poaching

Corruption. The Global Corruption Barometer is a quantifiable metric describing the influence of corruption on everyday lives. This indicator aids to determine how much political influence may be contributing to lax poaching efforts (Transparency International). The peak GCB in 2012 mimics the peak in ivory trading, along with a general decrease (though it is much less robust here). There isn't much correlation between GCB and PIKE except for Southern Africa.



Human Development. The Human Development Index is a composite score which factors in life expectancy, economic factors, and education to rank countries in their overall development (UNDP). HDI is gradually increasing for all countries, and there appears to be some kind of negative correlation between HDI and PIKE.



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