



Predicting Elephant Poaching

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DATA 606 Capstone in Data Science

400,000

African elephants today¹

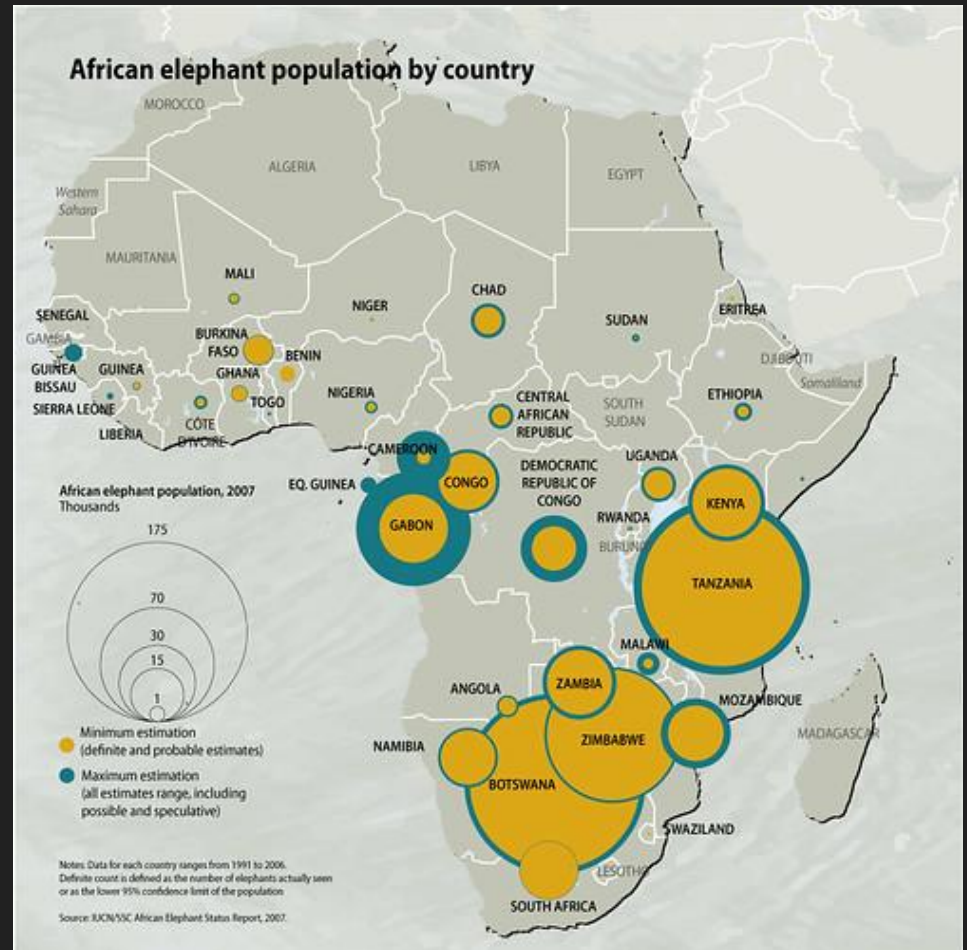
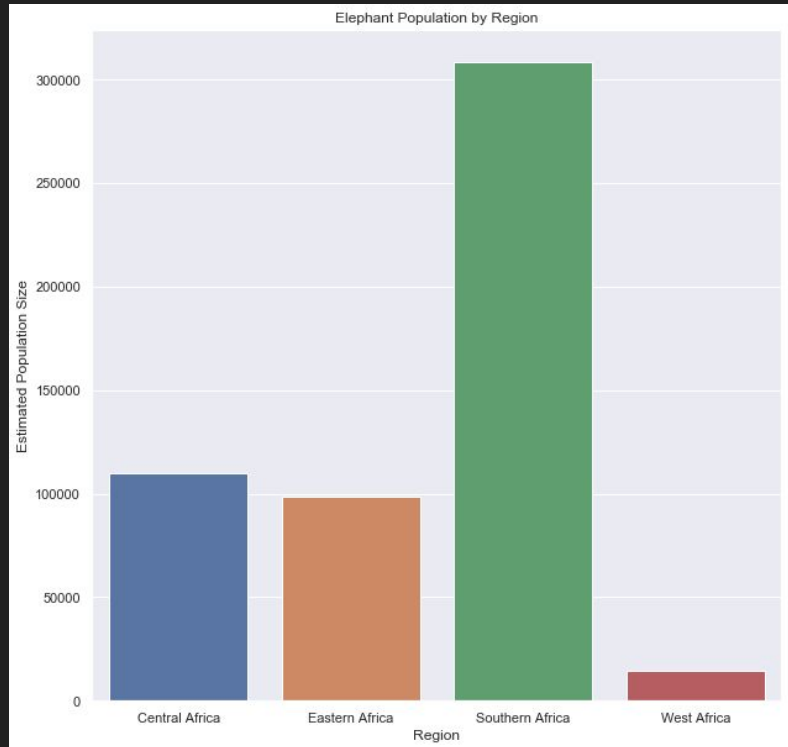


Image courtesy of Riccardo Pravettoni: <https://www.grida.no/resources/8029>

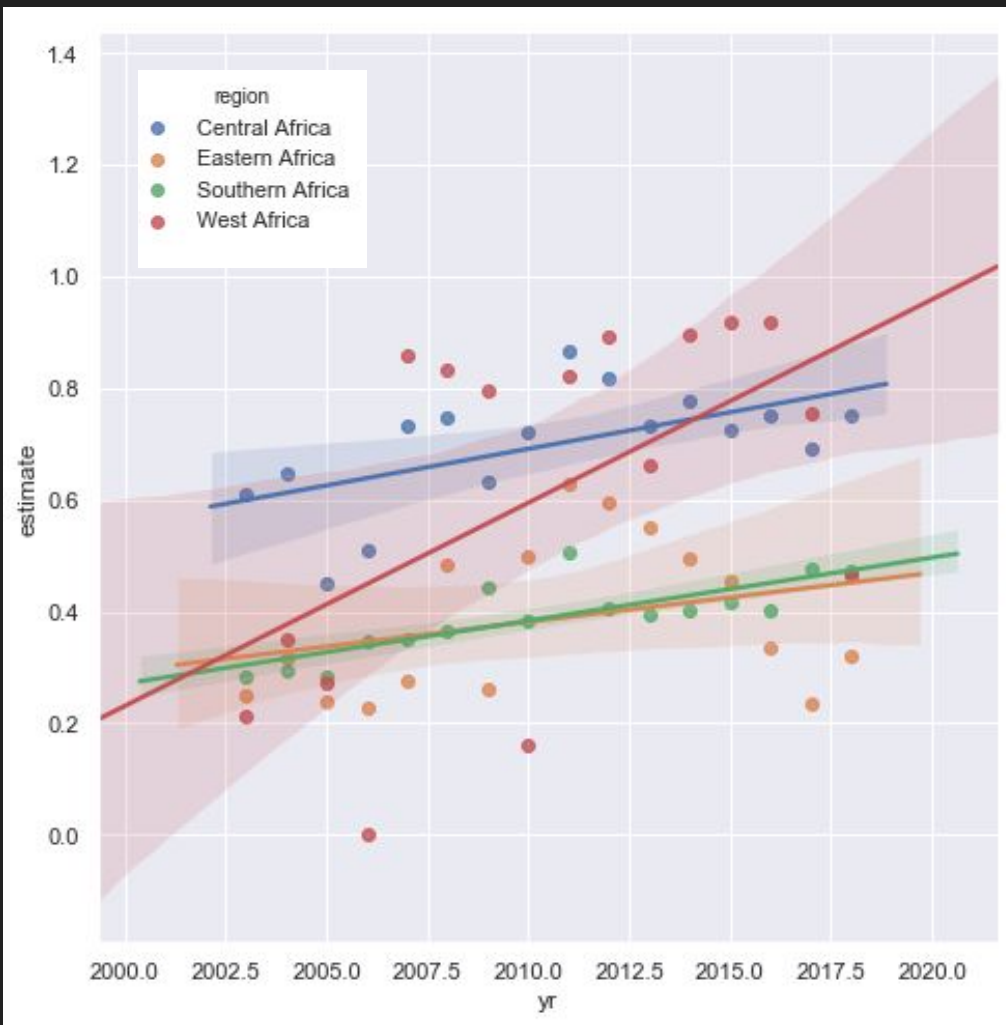
¹Thouless, Christopher, et al. "African elephant status report 2016." *Occasional Paper Series of the IUCN Species Survival Commission* 60 (2016).

Measuring Poaching

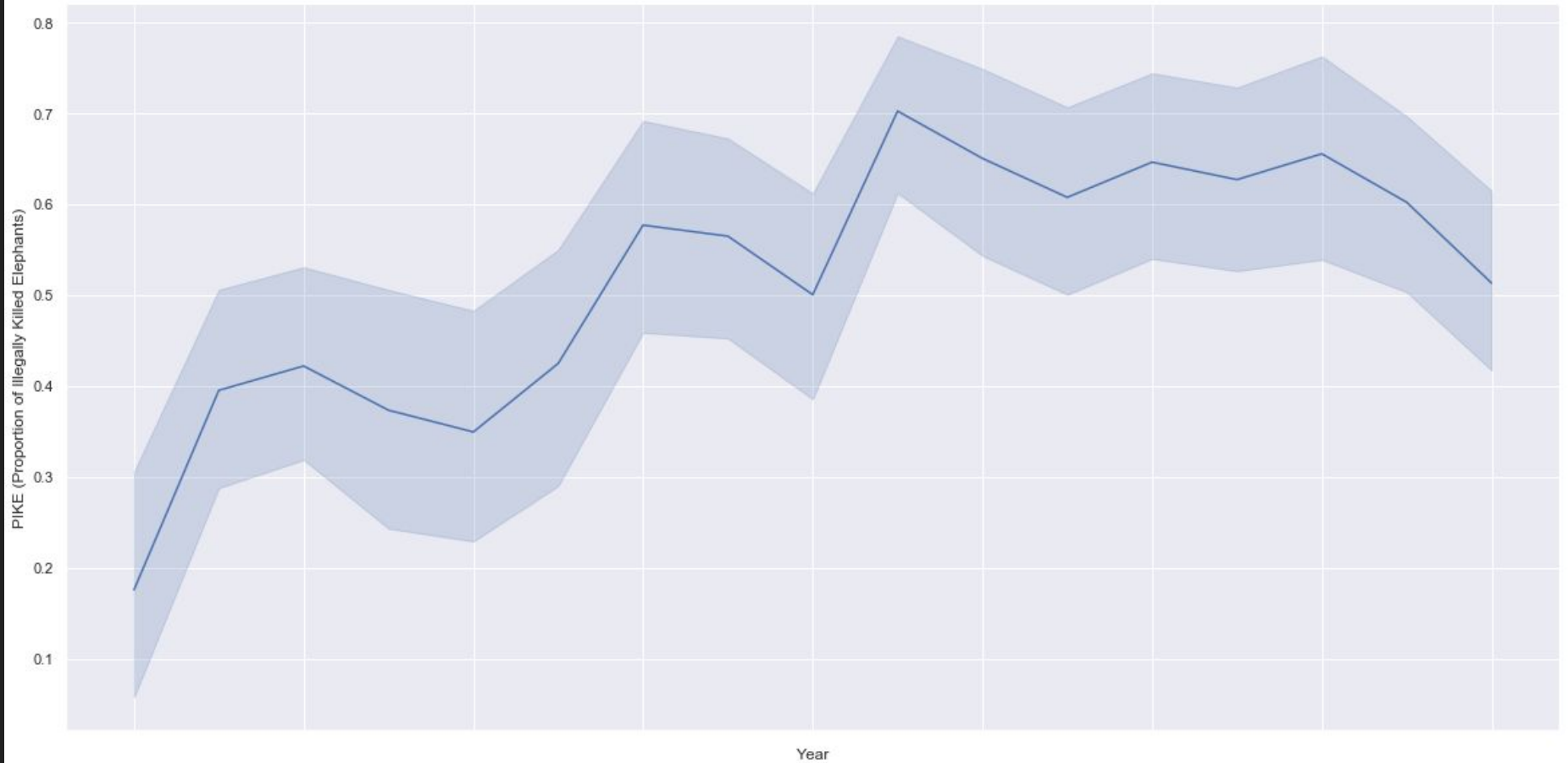
Proportion of Illegally Killed Elephants (PIKE)²

- Ratio of illegally killed elephants found to total carcasses found
- WHY?
 - Not influenced by population size
 - Standardized metric for all reporting sites

²Convention on International Trade in Endangered Species of Wild Fauna and Flora. "New report highlights continued threat to African elephants from poaching." *CITES Press Release*. 10 May 2019.



PIKE Trend



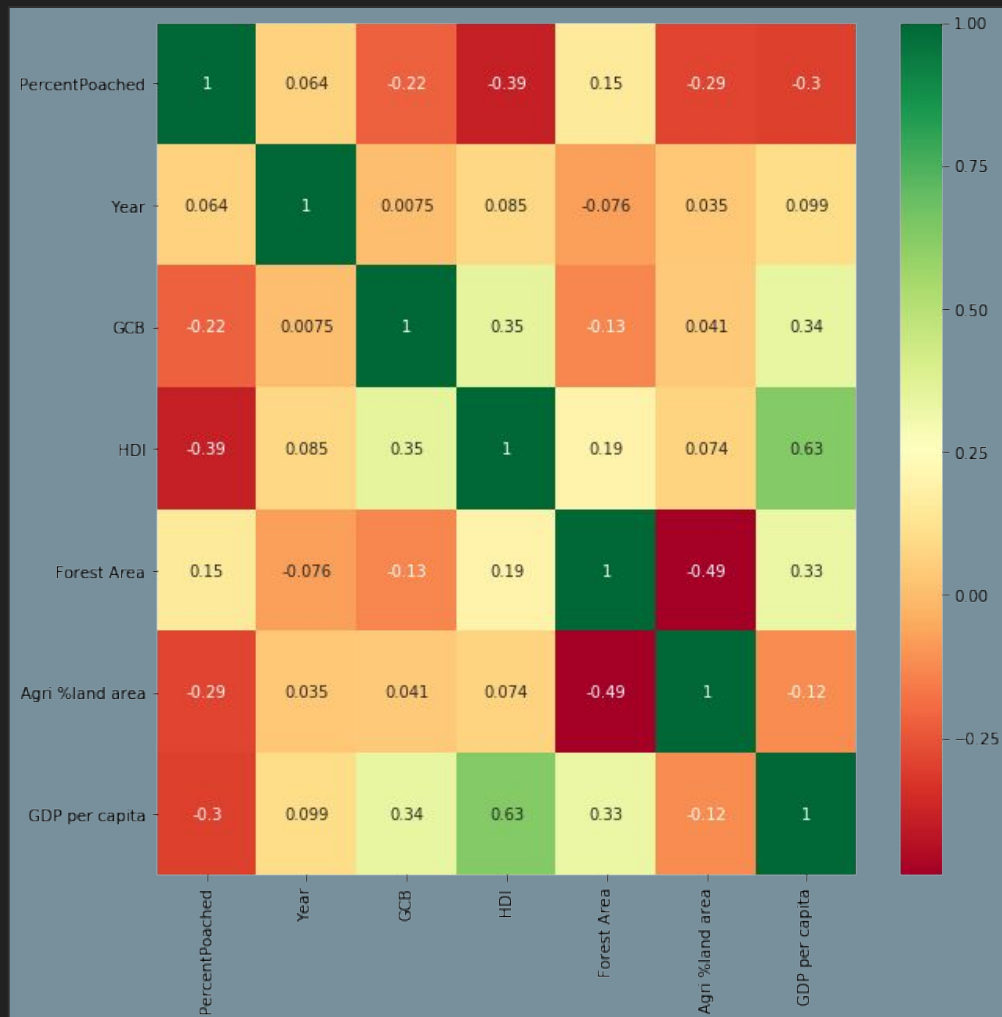
Poaching Indicators

Indicators used:

- Forest Area
- Agri Land
- GDP
- HDI

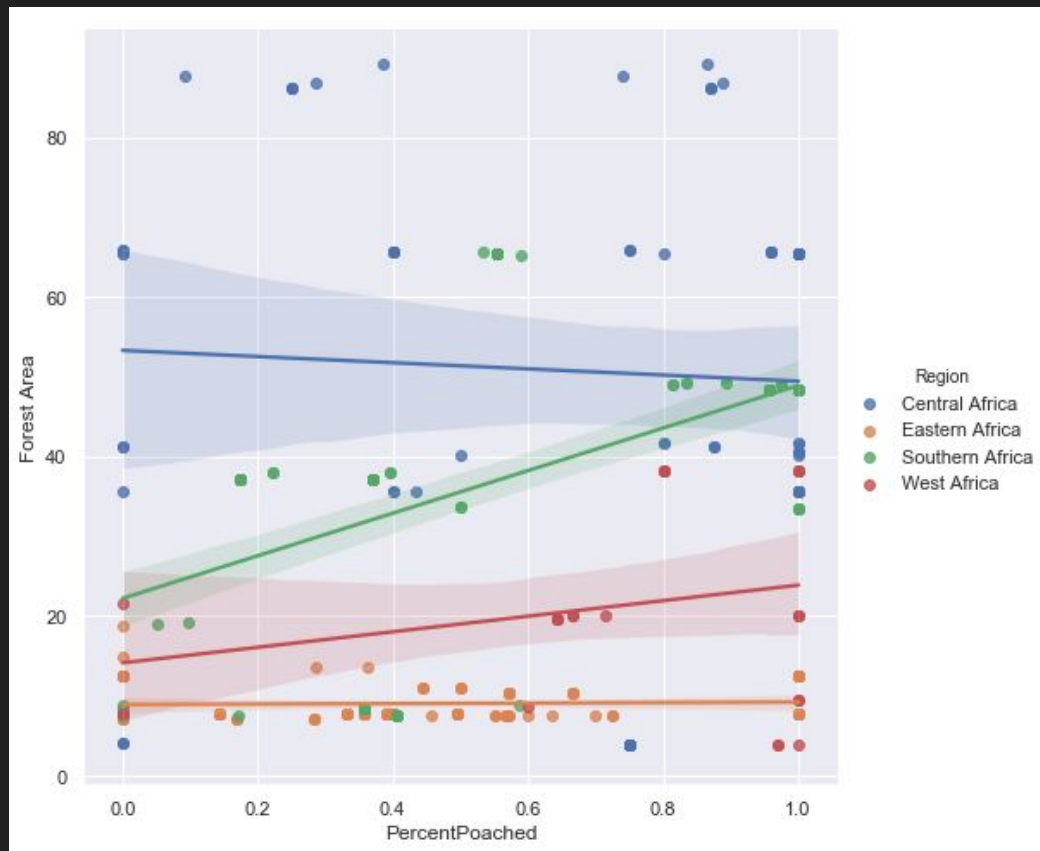
Indicators discarded:

- GCB
- Ivory Exports



Forest Area

- Percentage of total land area
- Slight positive correlation with some regions
- Regional specificity important

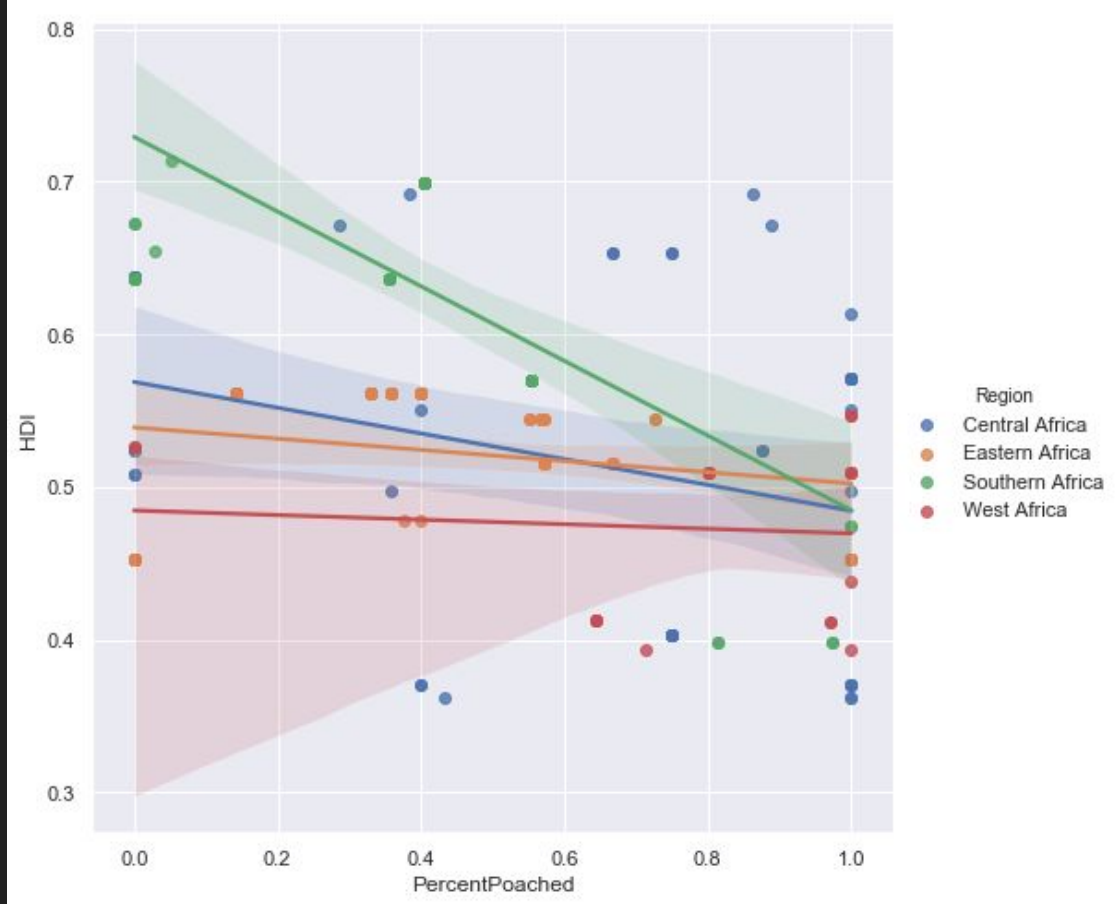


Source: World Bank Development Indicators Database

Agriculture

- Percentage of land used for agricultural purposes
- Regional differences not as apparent
- General negative correlation

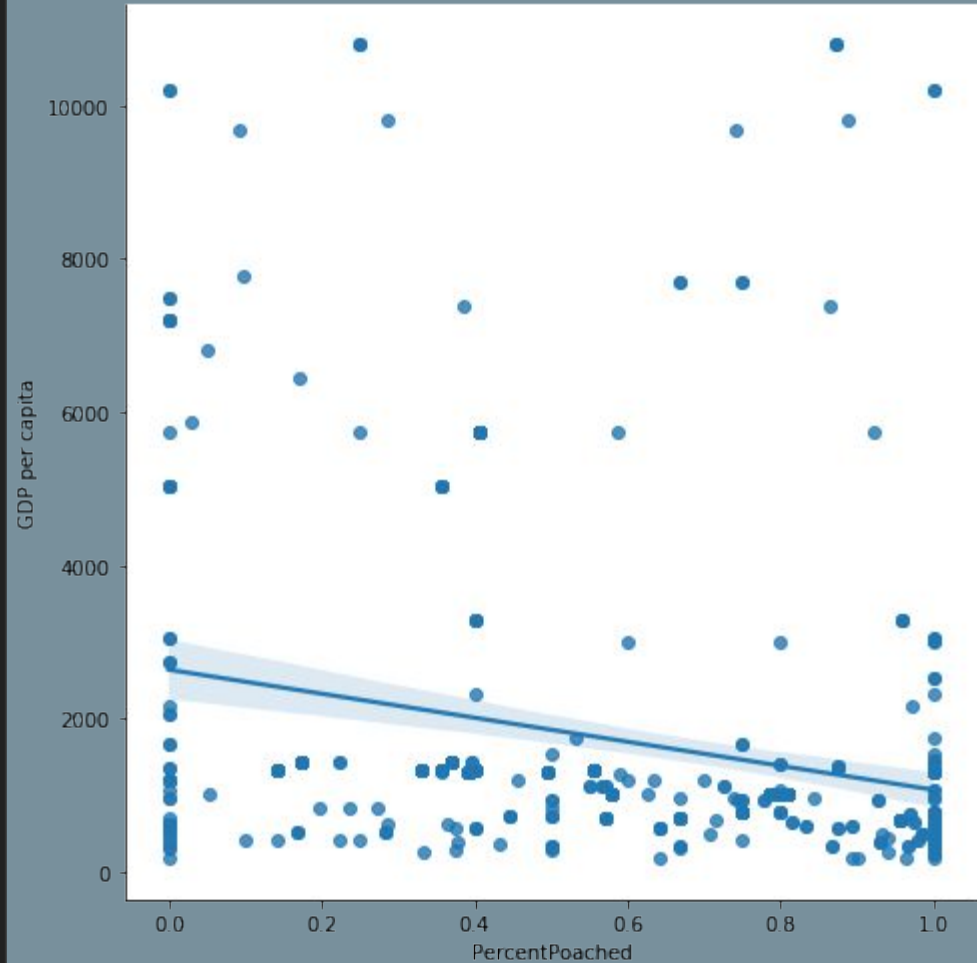
Source: World Bank Development Indicators Database



GDP

- GDP per capita
- Difficult to look at regionally, country breakdown more accurate
- General negative correlation

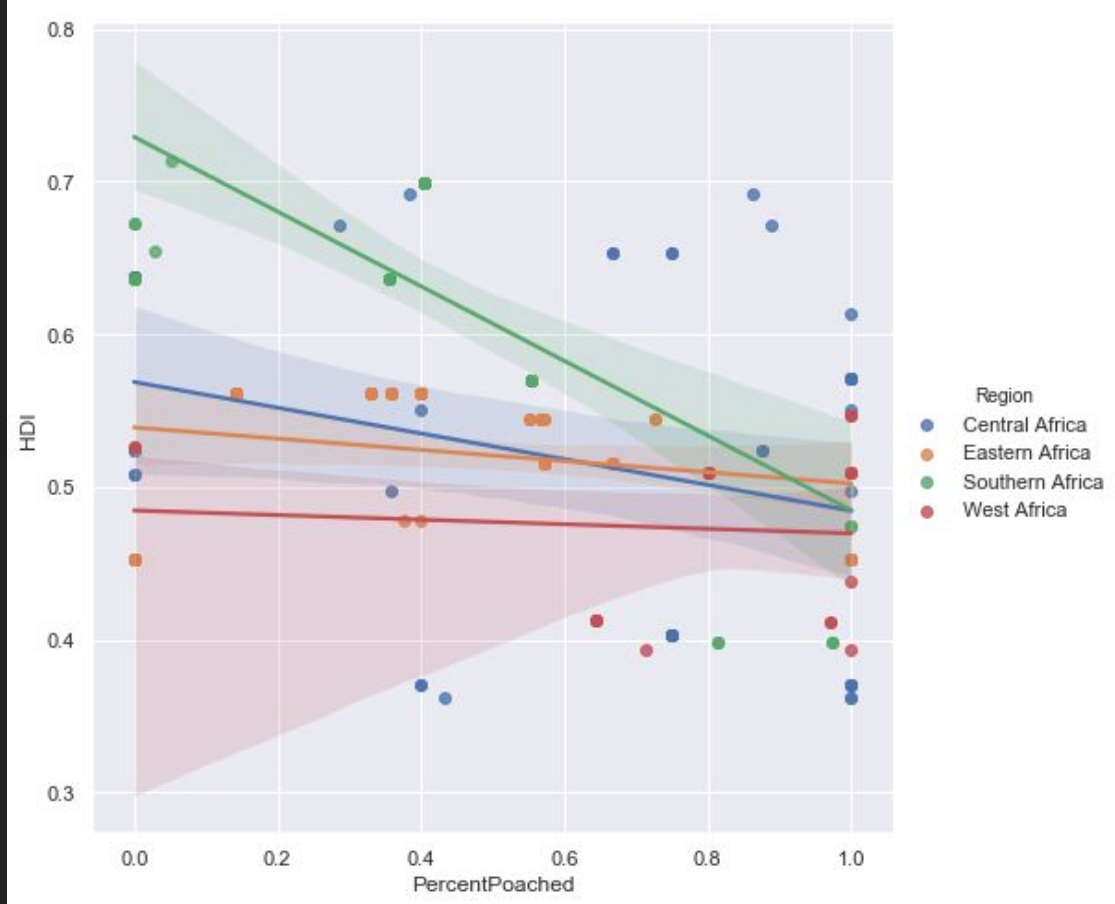
Source: World Bank Development Indicators Database



Development

- Human Development Index
 - Standard of living
 - Life expectancy
 - Education
- Regionally unique
- General negative correlation

Source: UN Development Programme



	HDI	Forest Area	Agri. Land	GDP
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Indicator combinations for
VAR models

Vector AutoRegression: Models by Region and Indicator

“Autoregression is a time series model that uses observations from previous time steps as input to a regression equation to predict the value at the next time step.”³

Measurement of model success: Root Mean Square Error (RMSE)

4 Regions = 4 Datasets

13 Combinations of Indicators

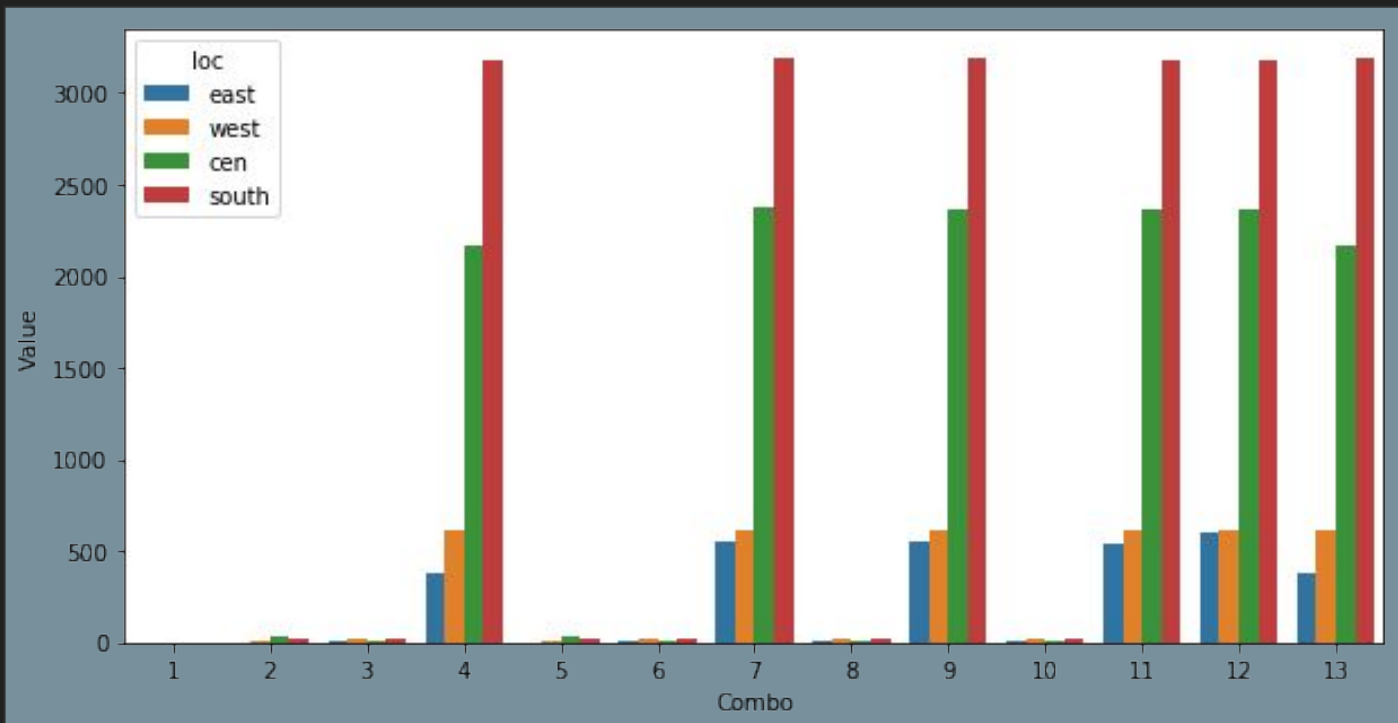
52 VAR models

³Brownlee, Jason. “Autoregression Models for Time Series Forecasting With Python.” Machine Learning Mastery, 23 Apr. 2020, machinelearningmastery.com/autoregression-models-time-series-forecasting-python/.

Poor Model Performance

	HDI	Forest Area	Agri. Land	GDP
1	Orange	Blue	Blue	Blue
2	Blue	Orange	Blue	Blue
3	Blue	Blue	Orange	Blue
4	Blue	Blue	Blue	Orange
5	Orange	Orange	Blue	Blue
6	Orange	Blue	Orange	Blue
7	Orange	Blue	Blue	Orange
8	Orange	Orange	Orange	Blue
9	Orange	Orange	Blue	Orange
10	Blue	Orange	Orange	Blue
11	Blue	Orange	Blue	Orange
12	Blue	Orange	Orange	Orange
13	Blue	Blue	Orange	Orange

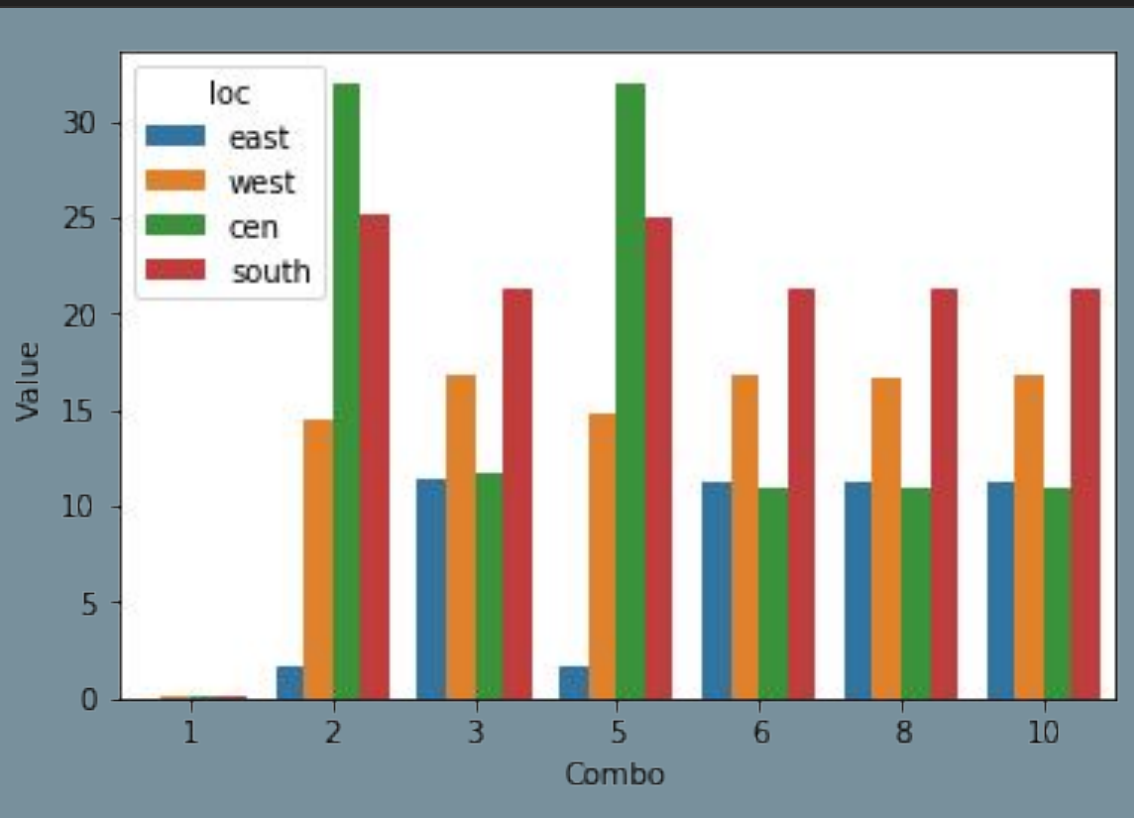
Indicator combinations for
VAR models



Good Model Performance

	HDI	Forest Area	Agri Land	GDP
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Indicator combinations for
VAR models



Dataset

Indicators

Conclusions

Limited illegally killed carcass dataset due to unreliable/inconsistent reporting inherently presents problems in overall analysis, but possibly usable due to PIKE

Human Development Index and Agricultural Land Percentage are strongest indicators of poaching used in this analysis

Human encroachment on elephant territory is a valid indicator for predicting elephant poaching across all regions

