

Comparing Past, Present, and Future Distributions of Lions (*Panthera leo*) and Cheetahs (*Acinonyx jubatus*)

Tyler Harmon, Travis Kastner, and Kalley Loveless — Department of Biology, Abilene Christian University, Abilene, Texas 79699

Introduction

Panthera leo (Lions) and *Acinonyx jubatus* (cheetahs) are two species with similar distributions across comparable geographic locations. *Panthera leo* were once widespread across areas of Africa such as the central rainforest and the Sahara desert and some parts of Southern Europe and Asia (Schaller). Lions prefer habitats like, forests, jungles, and scrub or grassland (Pocock). *Acinonyx jubatus* inhabited similar ranges, being widespread in Africa and some parts of India, inhabiting open plains, savannah, open woodland, and semi-barren zones (Rosevear). Due to human impacts on environment and habitat of these species, their home ranges have significantly decreased over the years, both being more restricted to Southern Africa. By looking at past, present, and future climate data in association with coordinates of species distribution we can construct distribution maps in order to analyze the effects of climate change on our species of interest across time periods. These maps are beneficial to clearly analyze the trends in expansion or constriction of the distributions of both *Panthera leo* and *Acinonyx jubatus*.



Fig. 1A *P. leo* (tolweb.org)



Fig. 1B *A. jubatus* (shadowsofafrica.com)

Methods

This research was conducted by using species distribution data in the form of latitude and longitude coordinates obtained from Global Biodiversity Information Facility (GBIF). These data were combined with past, present, and future climate data which were input into DIVA-GIS a geographic information software capable of comparing these locations with climate data. The 'Future' climate data represents the most extreme of 4 scenarios (The four RCPs, namely RCP2.6, RCP4.5, RCP6, and RCP8.5) in the year 2070 (average for 2061-2080) (Hijmans). In this RCP8.5 scenario emissions continue to rise throughout the 21st century rather than peaking sometime in the century. The 'Past' data represents the last glacial maximum (Hijmans). A Representative Concentration Pathway (RCP) is a greenhouse gas concentration (not emissions) trajectory adopted by the IPCC and these RCPs are consistent with a wide range of possible changes in future anthropogenic (i.e., human) greenhouse gas (GHG) emissions, and aim to represent their atmospheric concentrations (Hijmans).

Results

Figure 2A represents the present and past distributions of *Panthera leo* while figure 2B relates present to future distributions. As we can see from these figures, *Panthera leo*'s distribution expands substantially more than it declines when comparing present with past data (fig. 2A) however, it is predicted to decline more than expand when comparing present with future data (fig. 2B).

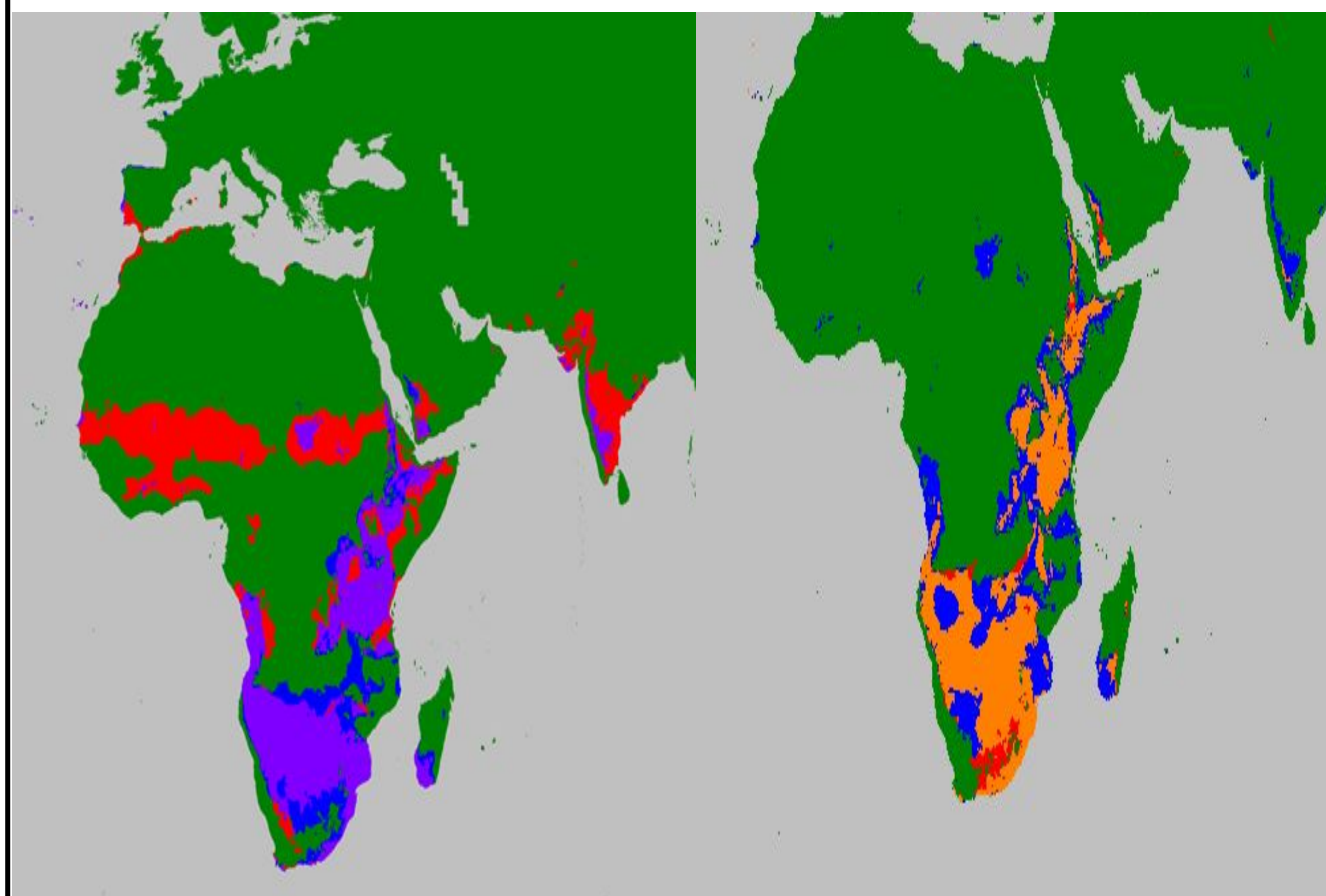


Fig. 2A *P. leo* Past

Fig. 2B *P. leo* Future

The current distribution of the species is represented by the combined blue+purple regions, past distribution is represented by the purple+red regions while the predicted future distribution is depicted by the red+orange regions.

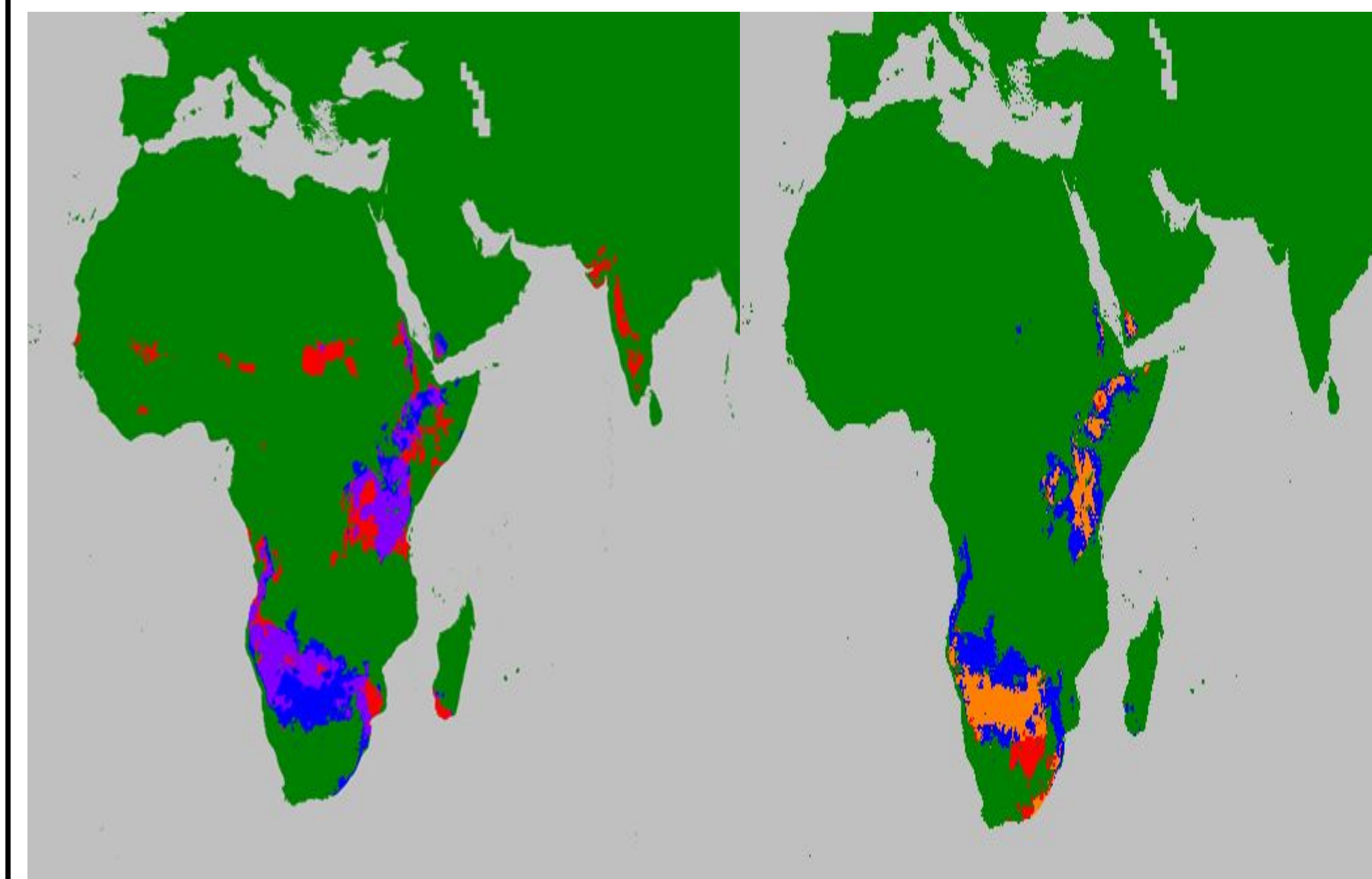


Fig. 3A *A. jubatus* Past

Fig. 3B *A. jubatus* Future

Acinonyx jubatus had more diversity in terms of expansion when comparing present with past distributions (fig. 3A). On the other hand the species is predicted to have an even more constricted distribution in the future (fig. 3B).

Discussion

The distributions of *Panthera leo* and *Acinonyx jubatus* have decreased significantly as a result of human interference in habitats and climate change which is forcing these species to find new and more concentrated areas to inhabit. These figures show the dangers of climate change on the distribution of animals, and highlight the need for human change in order to reverse our current course of climate change before there are irreversible consequences. Both of these species exhibit southward migrations, notably away from the equator. These migratory patterns are caused by Global Warming, which forces both *Panthera leo* and *Acinonyx jubatus* to move away from the equator in search of a cooler environment. As can be seen by the historic distribution depicted in figure 4, there is a slight irregularity when comparing historic distribution to the past distribution of the research experiment (Fig. 2A). This is because the past data of Fig 2A is based purely on climate data, while Fig. 4 references past historical data (human hunting/interference) in conjunction with climate data. Regardless, the data show a clear trend of a lessening range due largely to climate change, with these animals seeking out a cooler climate.

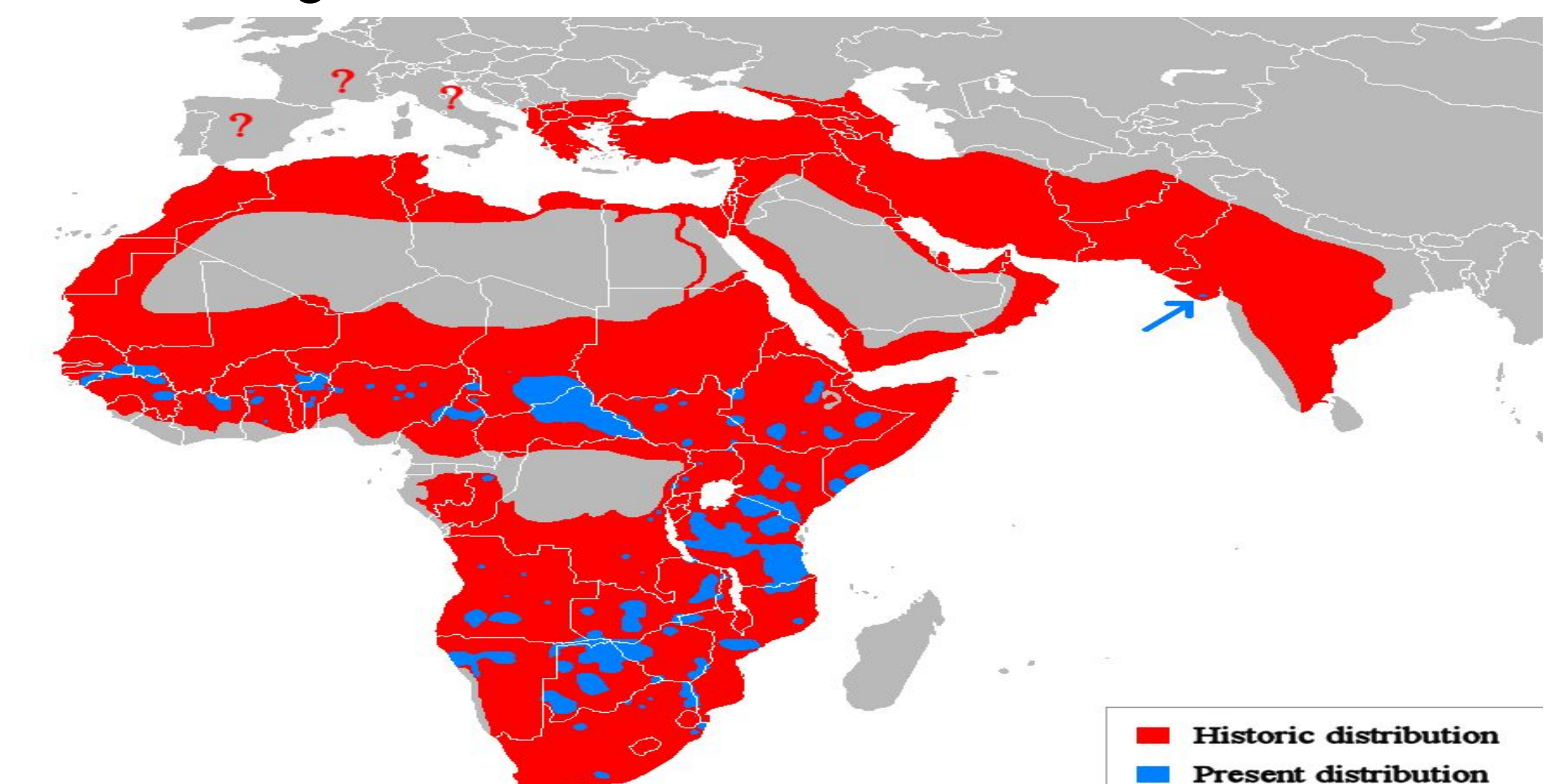


Fig. 4 *P. Leo* (wikipedia.com)

Conclusions

- The distributions of *Panthera leo* and *Acinonyx jubatus* are decreasing which runs a greater risk for possible extinction.
- *Panthera leo* and *Acinonyx jubatus* have migrated South in Africa, a course that is gradually restricting their range.
- The distribution changes of *Panthera leo* and *Acinonyx jubatus* are a result of climate change.

Works Cited

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