



Dover Poly

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Jovian

BuildingBlocs Hackathon

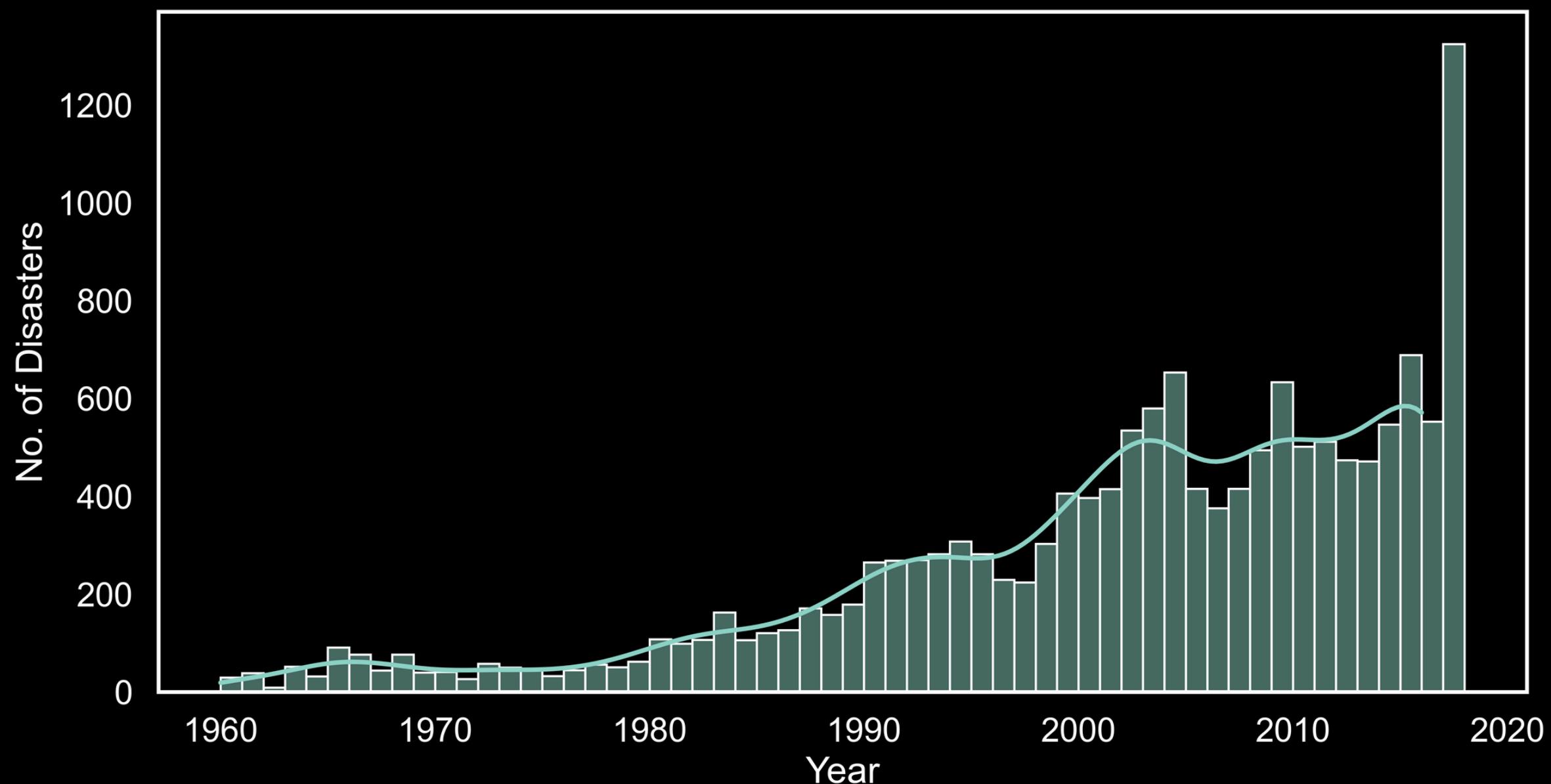
STRATEGIES TO PROTECT ENDANGERED SPECIES AGAINST NATURAL DISASTERS

Get Started

INCREASING NUMBER OF NATURAL DISASTERS

From the graph, we can observe that the number of natural disasters per year has significantly increased across the years from 1960 to 2018.

As disasters become more frequent, they pose a threat to endangered species therefore, it is important that we enhance our strategies to protect these endangered species.

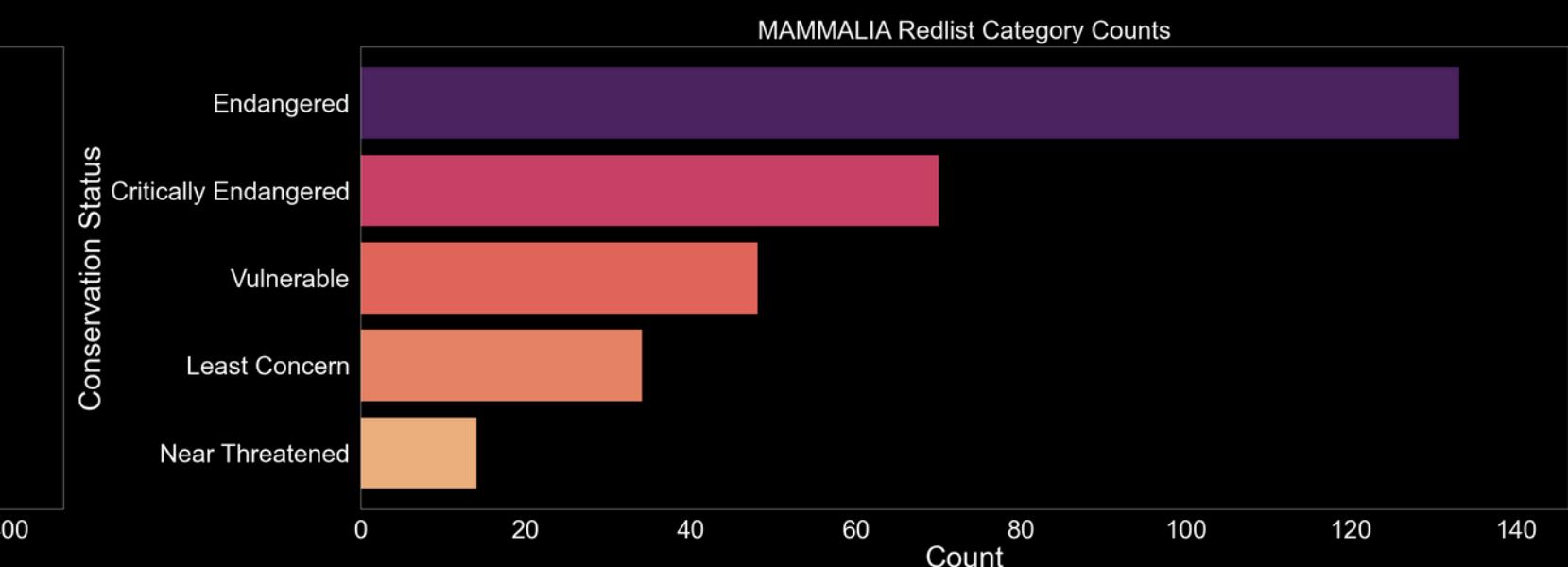
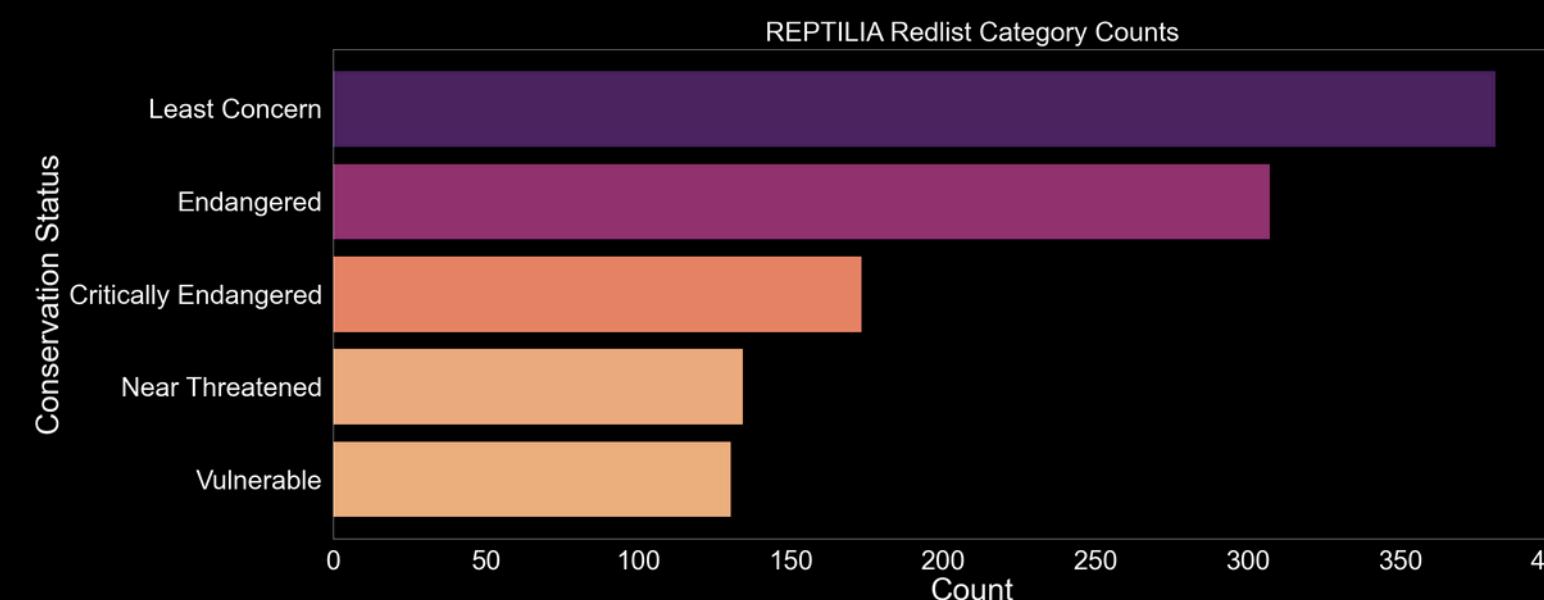
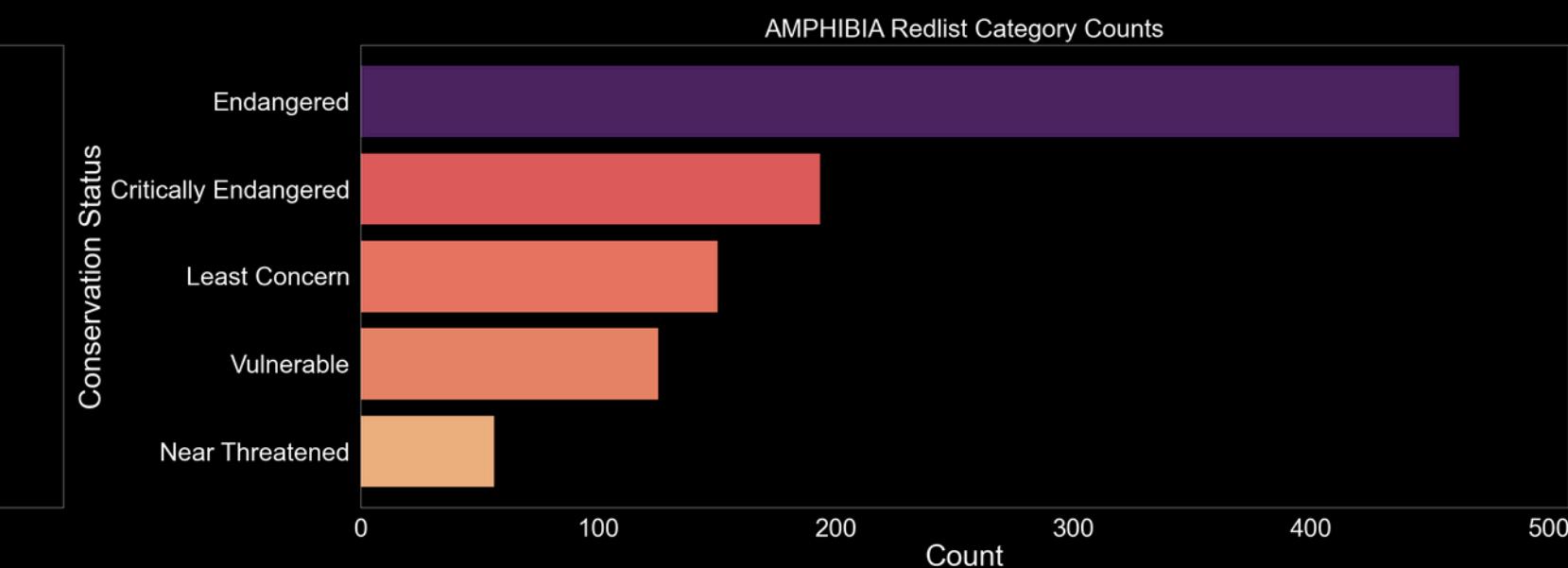
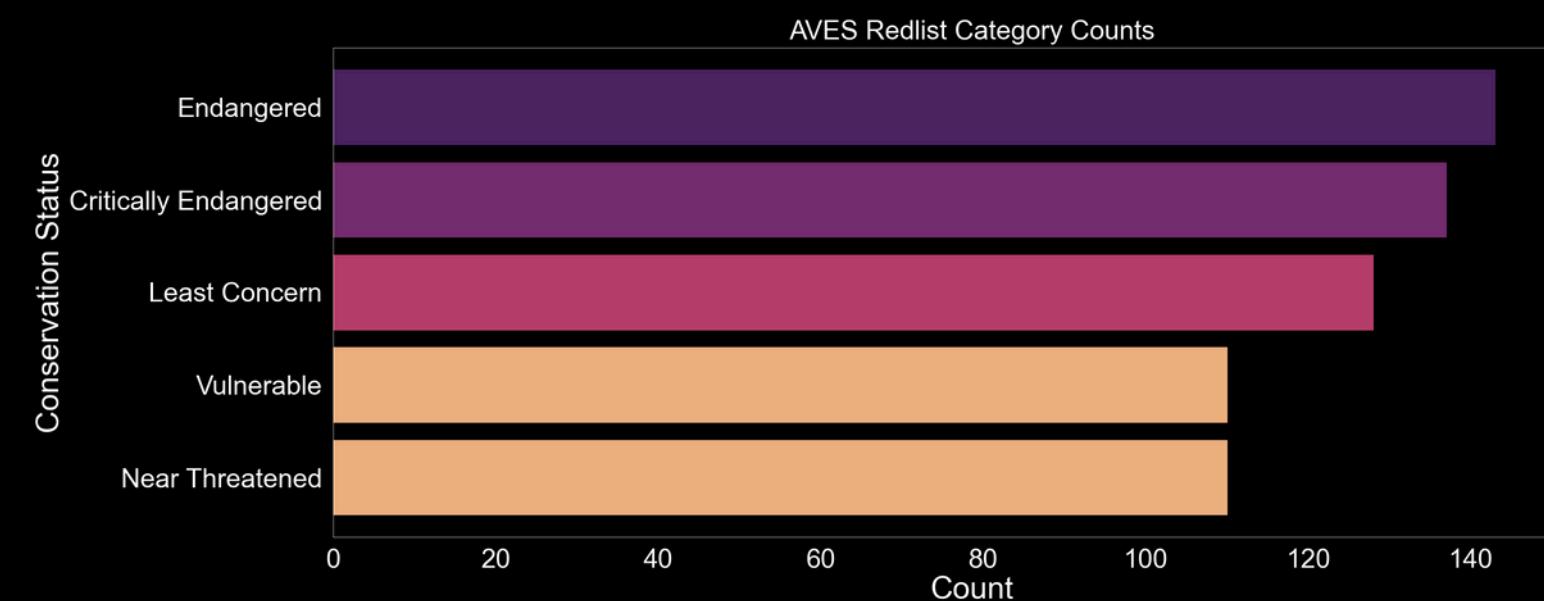


WHICH SPECIES ARE AT MOST RISK?

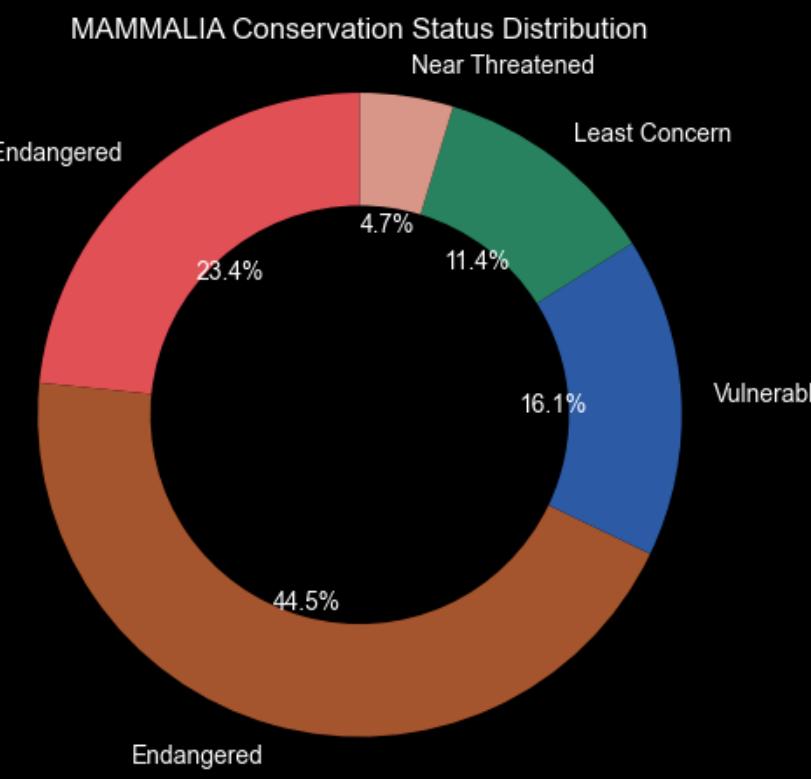
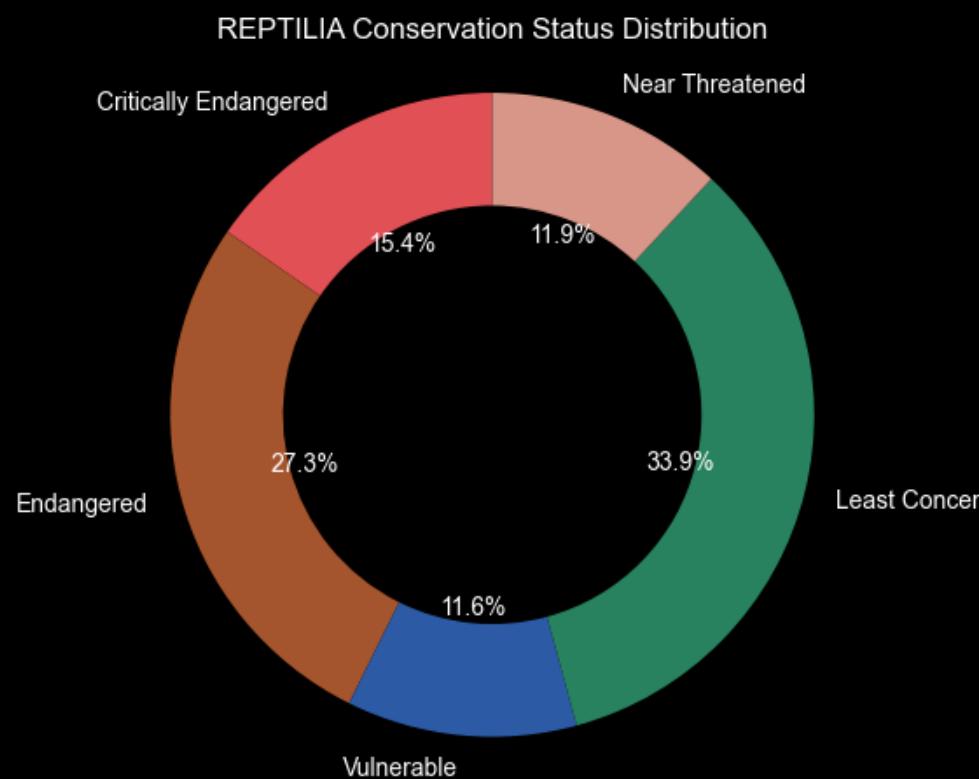
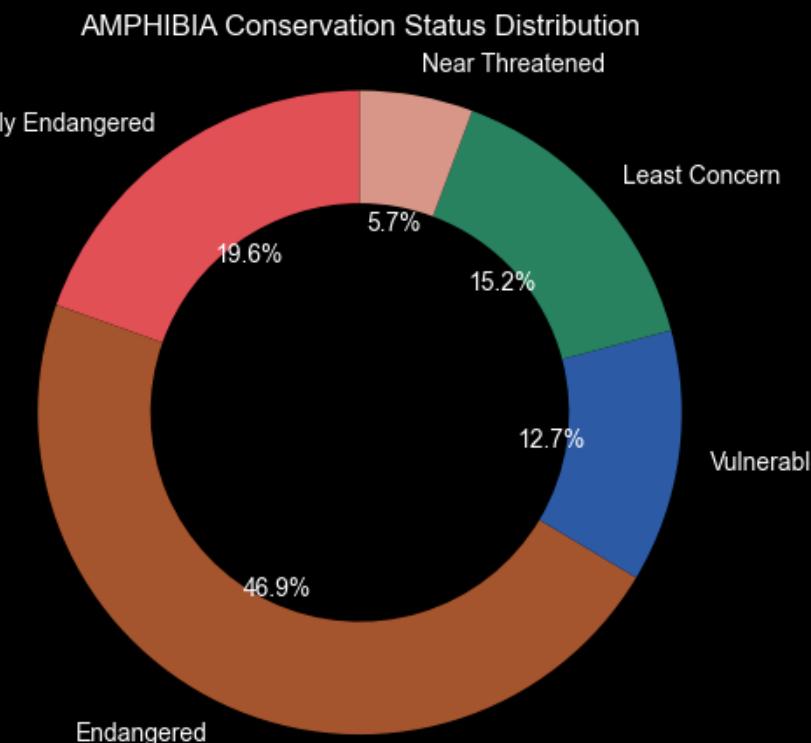
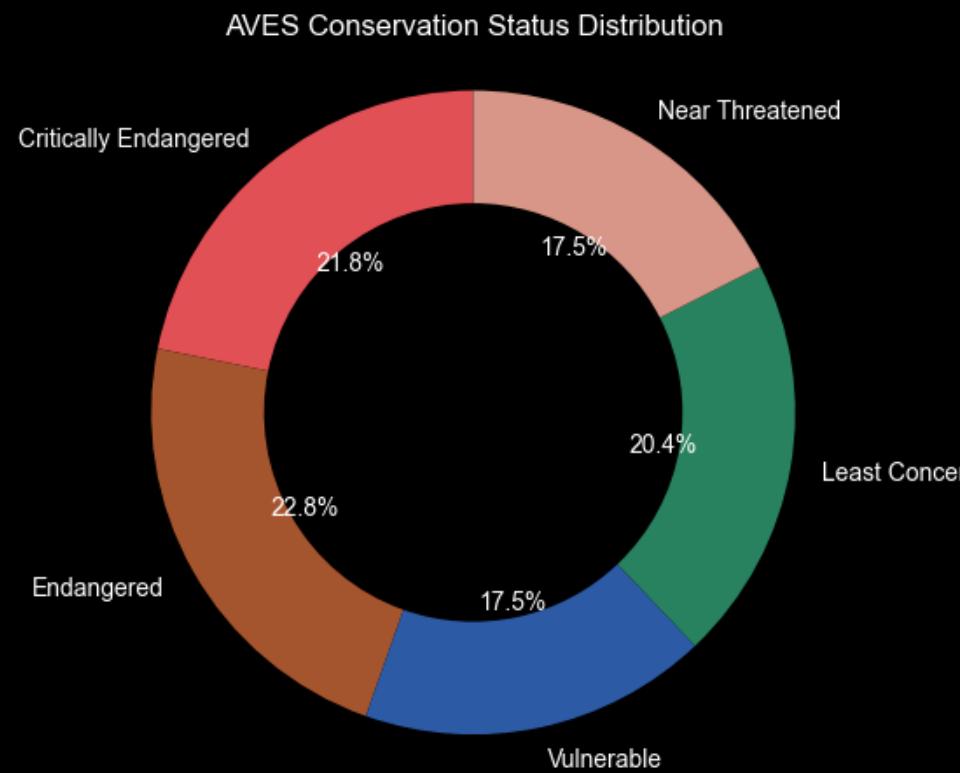
Amphibias have the highest counts of endangered and critically endangered species followed by reptiles.

Aves also show significant number of threatened species even though not as many as amphibia and reptiles.

Overall, amphibias face greatest conservation challenges as many of the species fall under threatened or critically threatened.



WHICH SPECIES ARE AT MOST RISK?



From the percentage viewpoint, we can observe that Amphibians and Mammals have the largest percentage of Endangered and Critically Endangered.

This means that they need more attention from conservation efforts.

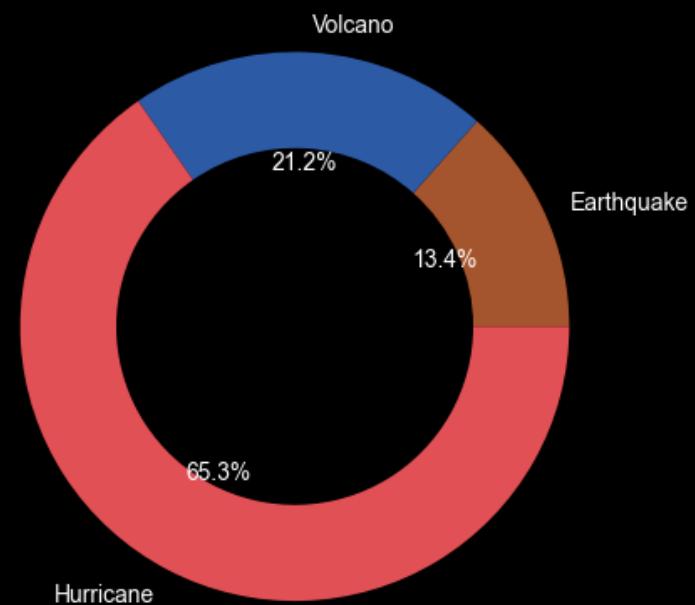
FREQUENCY OF DISASTERS

Hurricanes impact the most often out of all the natural disasters with more than 60% of the disaster occurrences across all species.

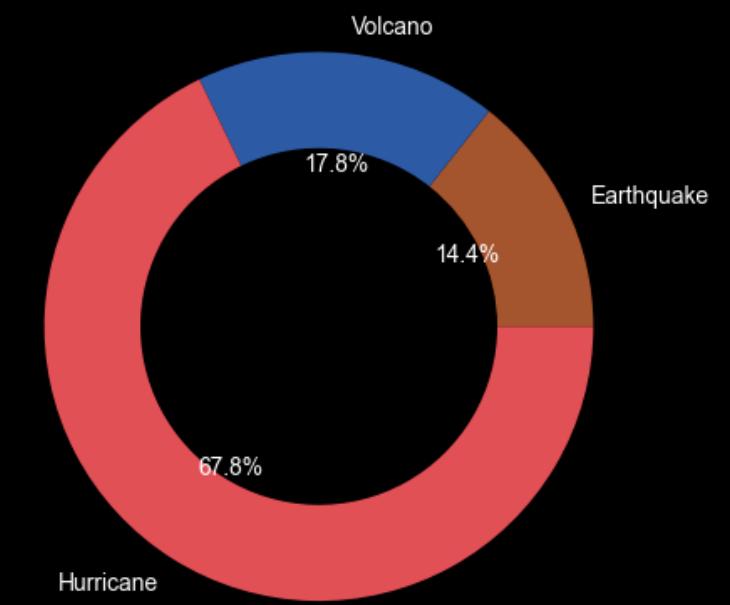
Birds are affected by volcanoes and earthquakes less frequently with 2.7% and 3.1% frequency respectively.

The remaining species tend to get affected more often by volcanoes (Average of 14.9%) compared to earthquakes (Average of 11.2%)

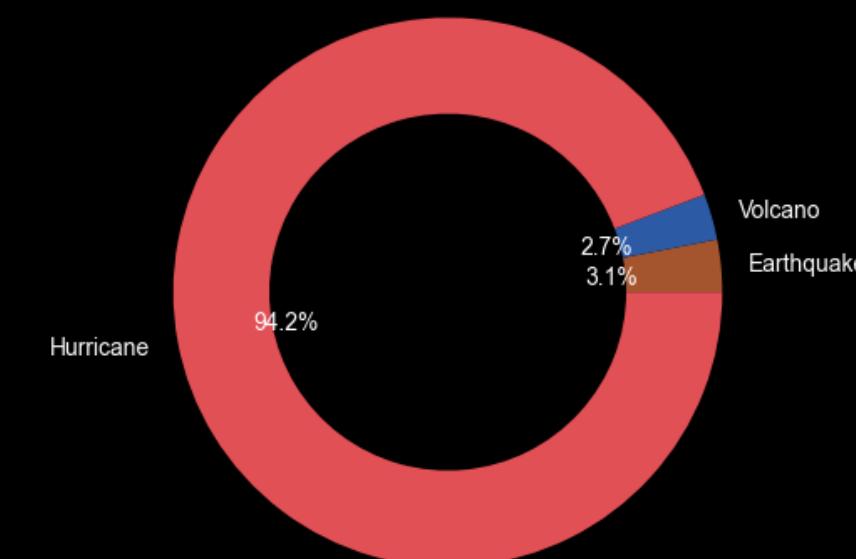
Frequency of disasters impacting Reptiles



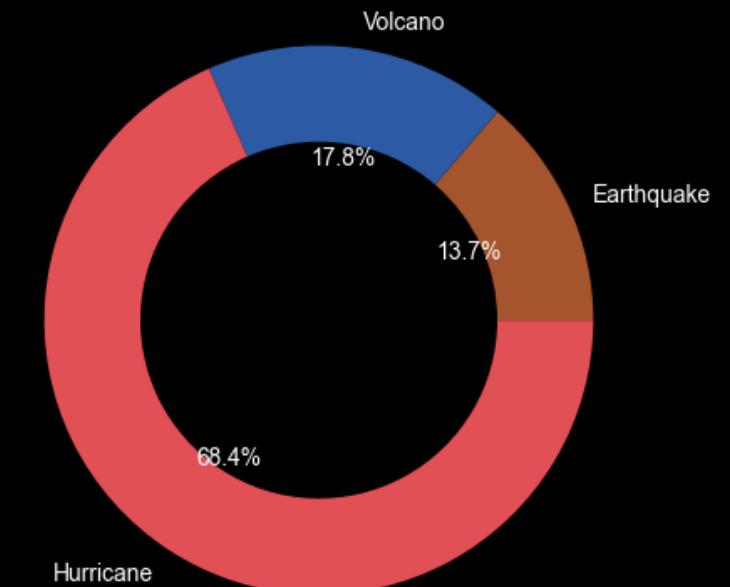
Frequency of disasters impacting Amphibians



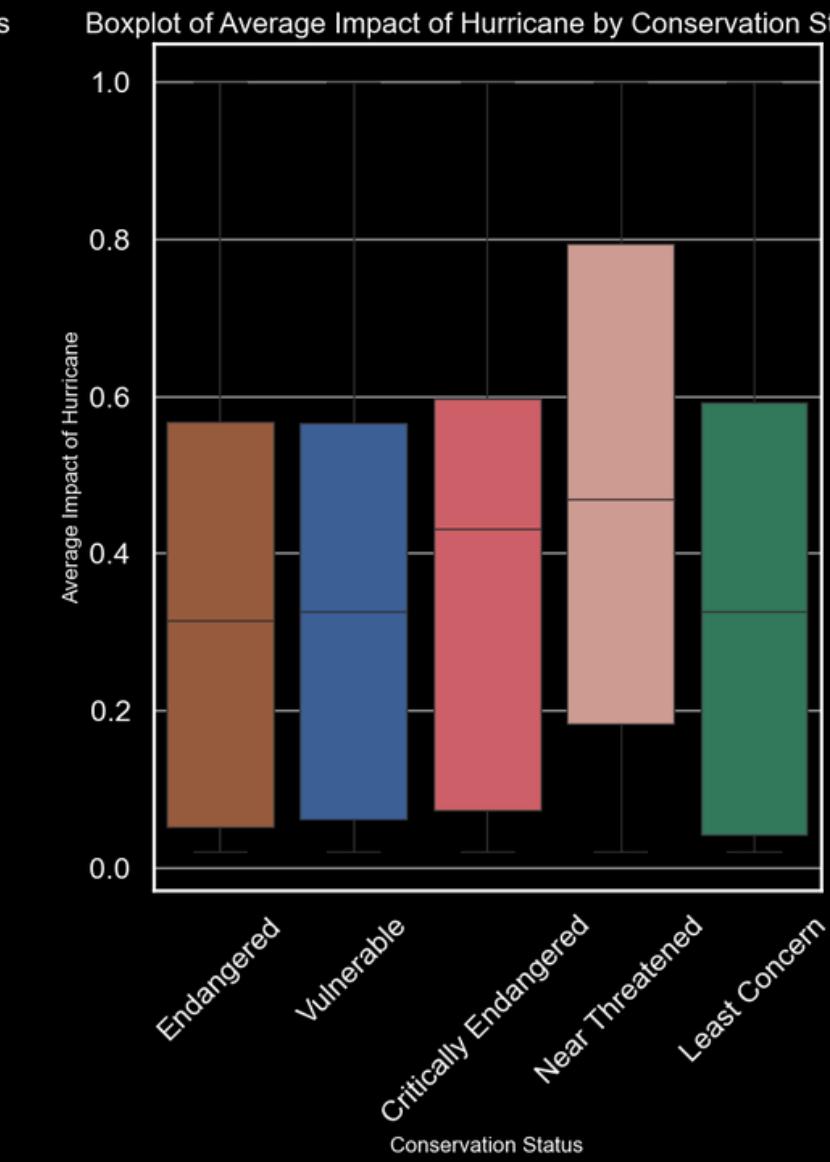
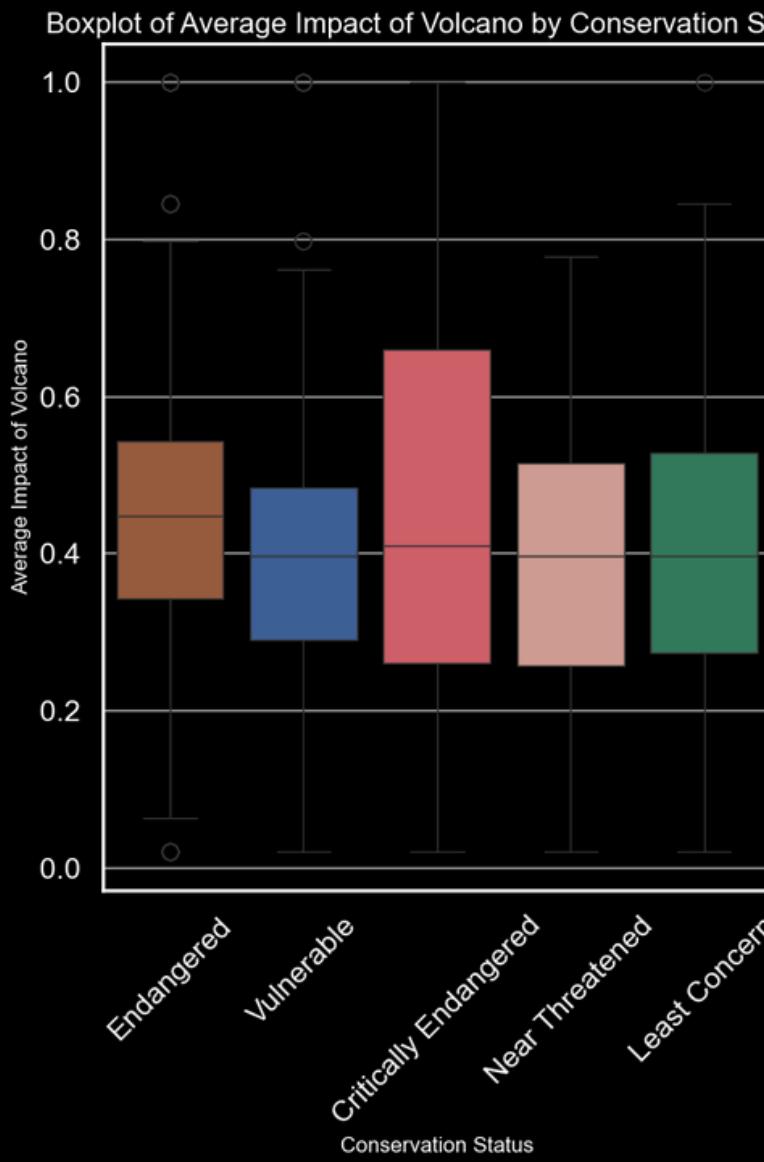
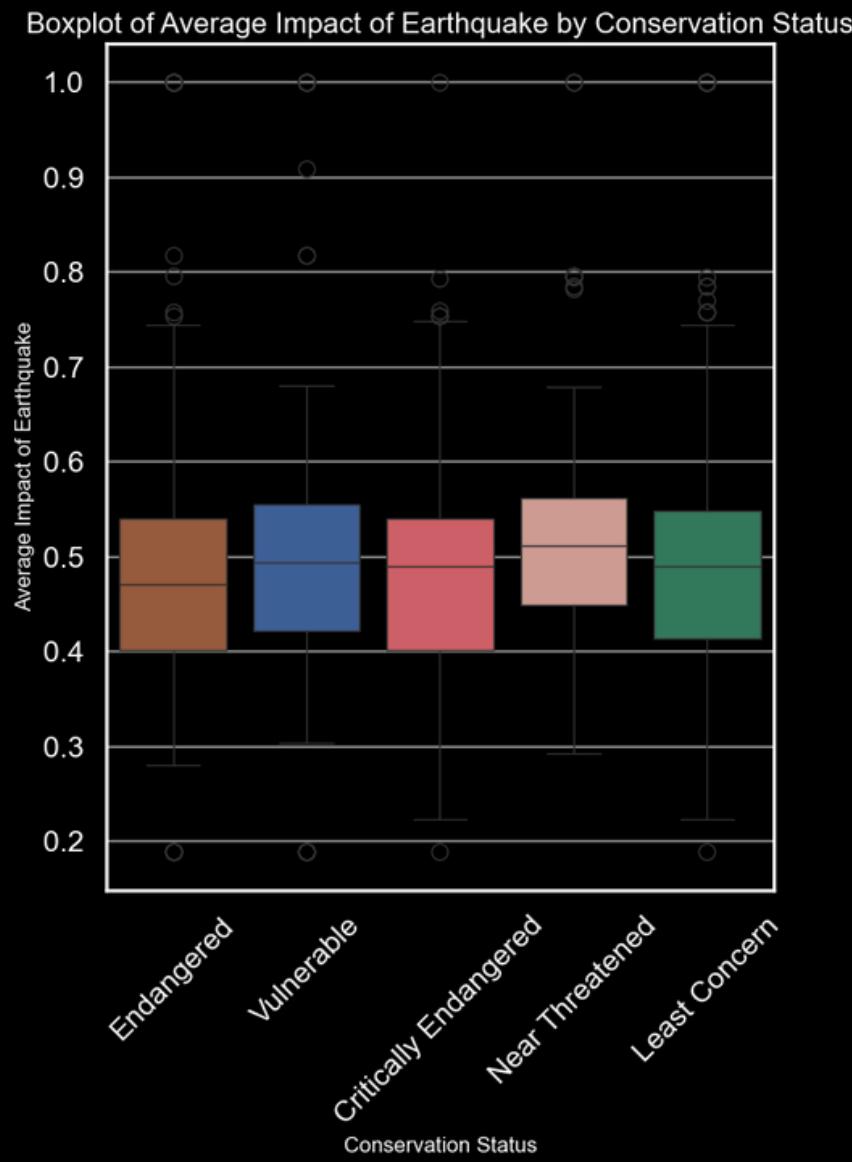
Frequency of disasters impacting Birds



Frequency of disasters impacting Mammals



IMPACT OF DISASTERS



Earthquake has the highest mean of the average impact compact and shortest range and interquartile range compared to other disaster.

On the other hand, volcano has lower mean and wider range.

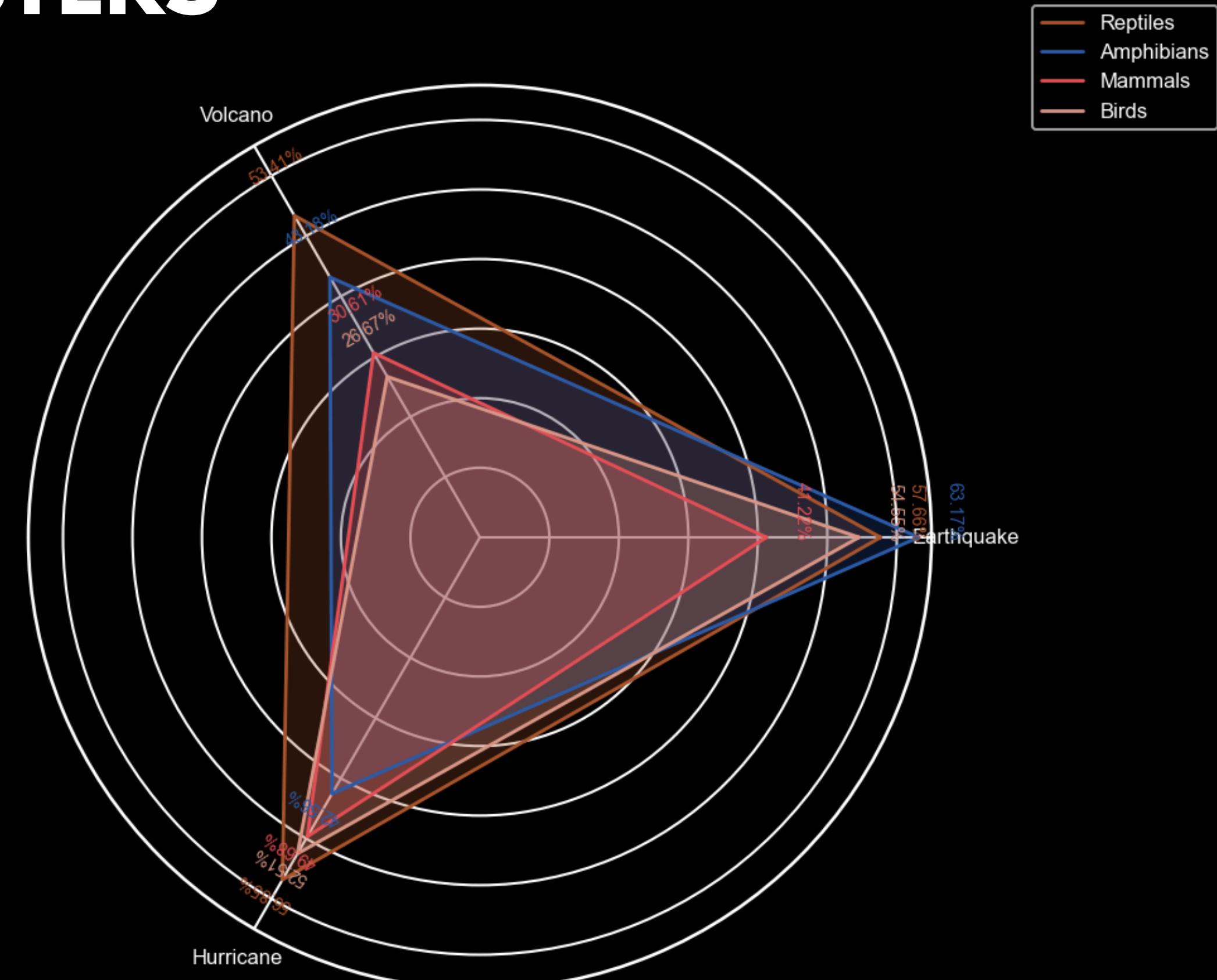
Lastly, the mean impact of hurricanes are the least and it has the largest range.

RISK LEVEL OF DISASTERS

We observed that reptiles, amphibians and birds are the most affected by earthquakes while mammals are the most affected by hurricanes.

Reptiles are the most prone while mammals are the least affected across all 3 disaster types at 55.87% and 40.50% respectively.

Looking at the average of high-risk caused by each natural disaster, we can observe that Earthquakes pose the most risk at an average of 54.15%, followed by Hurricanes at 50.40% and finally Volcanoes at 38.39%.



SPECIES HABITATS

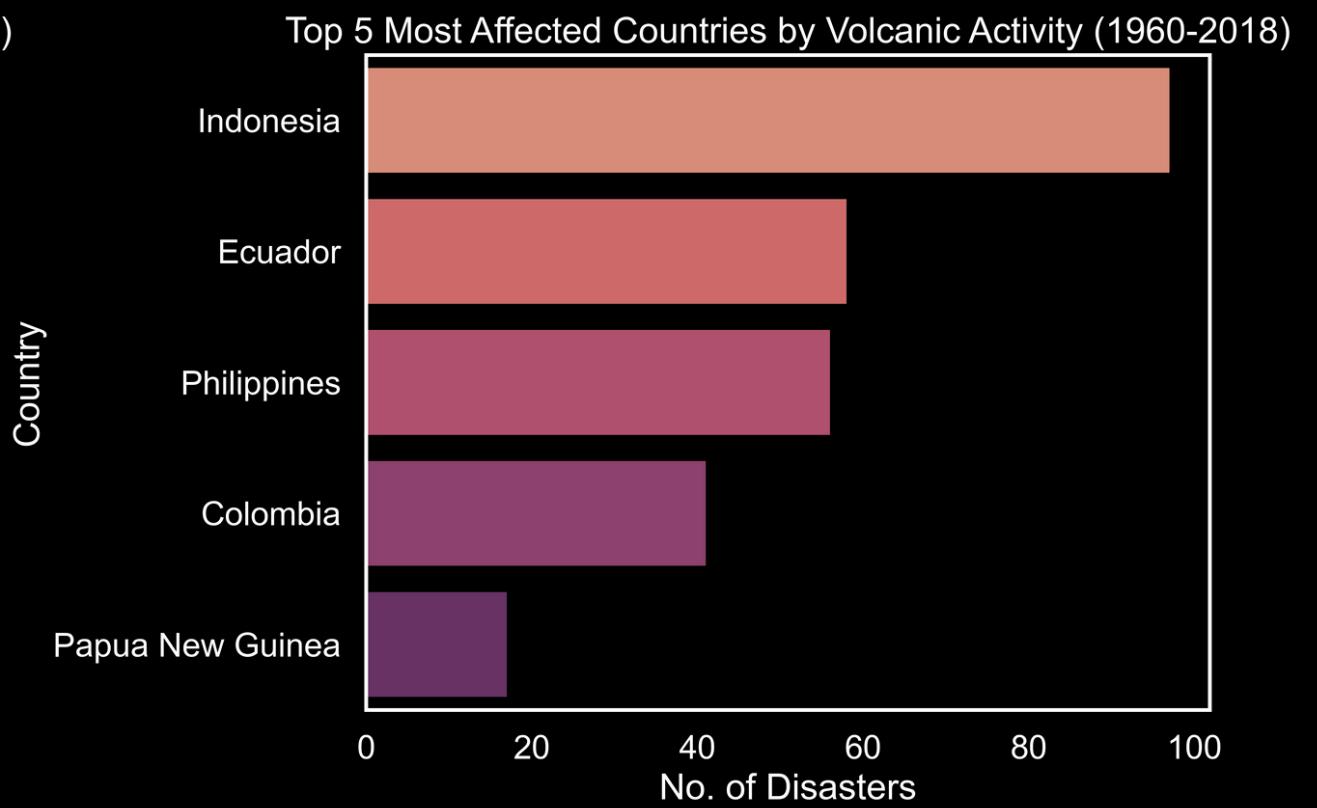
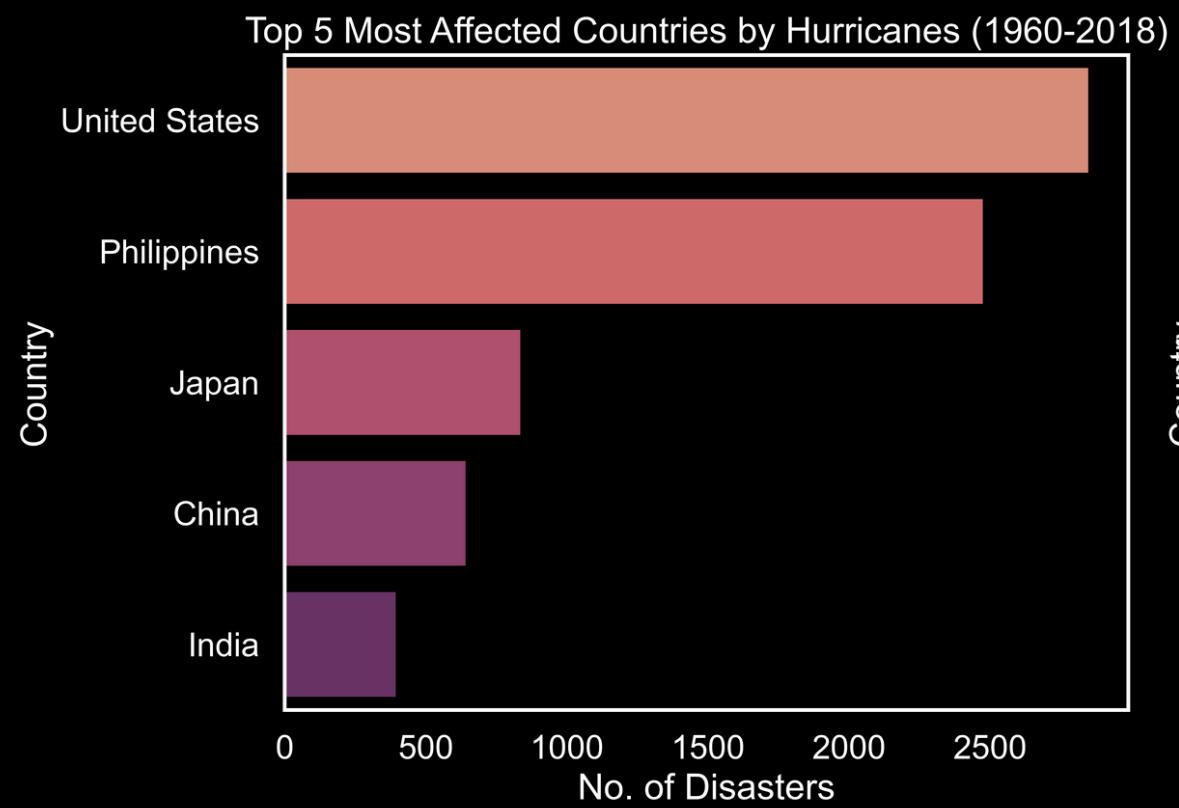
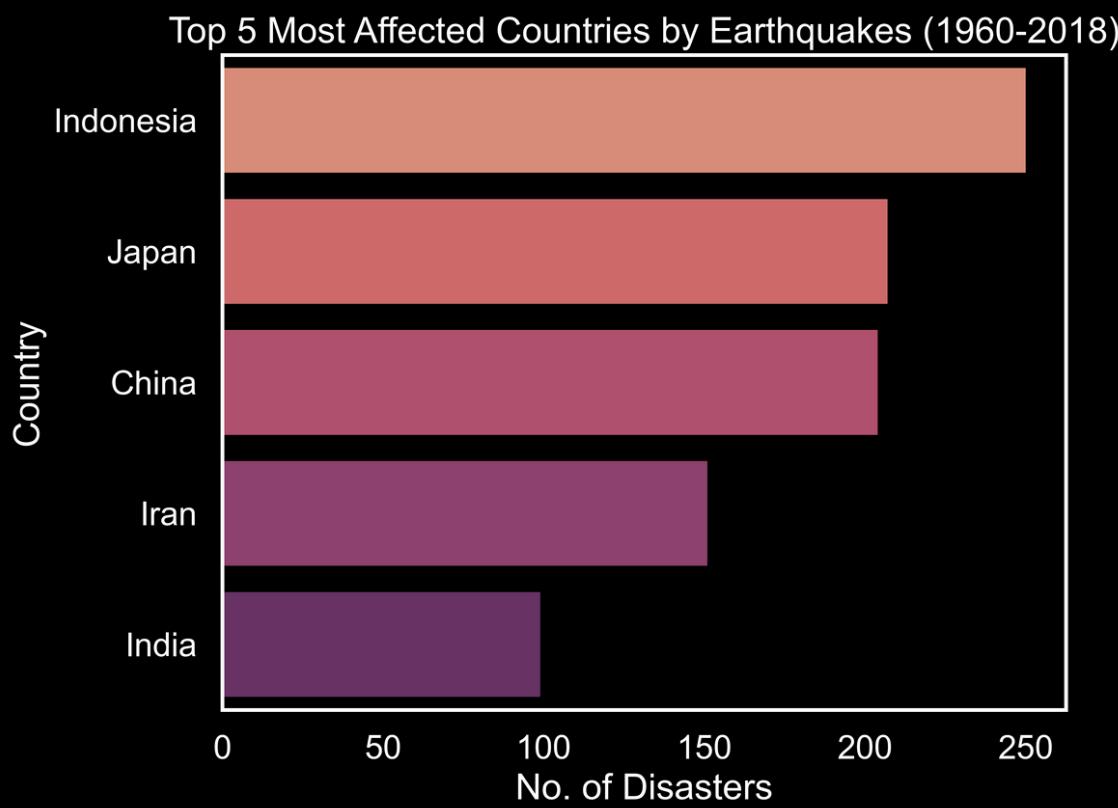
Neotropical has an abundance of amphibians (539) and reptiles (519).

Birds are more commonly found in the Oceanian realm. While Mammals on the other hand, are more commonly found in the Indomalayan and Afrotropical realms.

Reptiles are more widely distributed compared to amphibians as shown from their count in other realms such as Indomalayan, Afrotropical and Australasian.



LOCATIONS OF DISASTERS



Countries affected by earthquakes are Indonesia, Japan, China , India which are located in Indomalayan realm.

On the other hand, US which is located in nearctic realm is the most affected by hurricanes followed by philippines, japan, china, and india that are located in indomalayan realm.

Lastly, Indonesia that is located in indomalayan realm is the most affected by volcano followed ecuador located in neotropical realm.

AI SIMULATION PIPELINE OVERVIEW

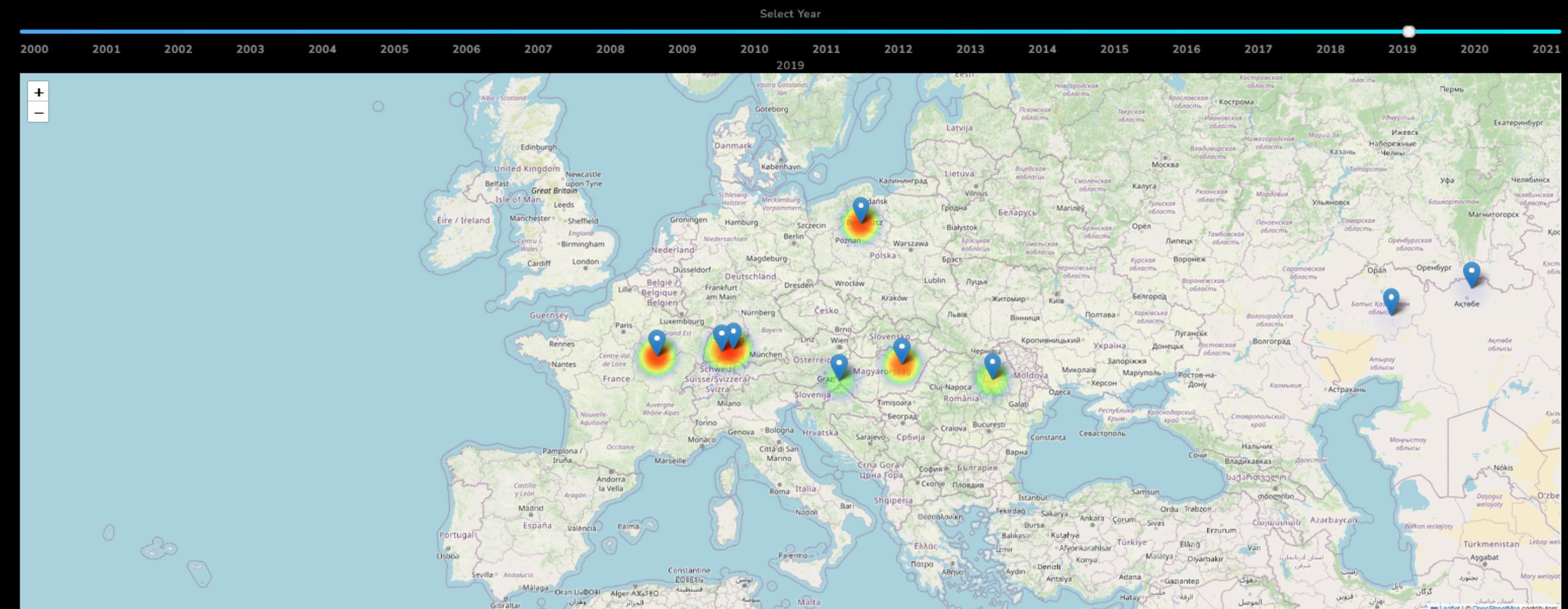
The goal of our AI simulation is to forecast disasters a few years into the future. For each disaster, it predicts the location, the disaster type and subtype as well as the casualty rate depending on whether there is proper disaster relief efforts.

Our AI simulation pipeline consists of three machine learning models, a time-series model and two regression models.

These three models are used sequentially, meaning the first model's output feeds into the second model, and the second model's output feeds into the third model.

Using the results from the pipeline, we can output them onto a 2D geospatial map made using folium and rasterio, helping us to better visualize and prepare for future disasters.

Disaster Data by Year



AI SIMULATION PIPELINE IN DETAIL

The three models used are ARIMA time-series model, Gaussian Process Regression model and Gradient Boosting Regression.

The ARIMA time-series model is used to predict the number of different disasters that would occur yearly. We focus on three different disaster types, earthquakes, storms and volcanic activity.

The Gaussian Process Regressor would then predict where these disasters would take place. Gaussian Process Regression allows for the output of multiple variables, which we need in this case as we are predicting the longitude and latitude of each forecasted disaster.

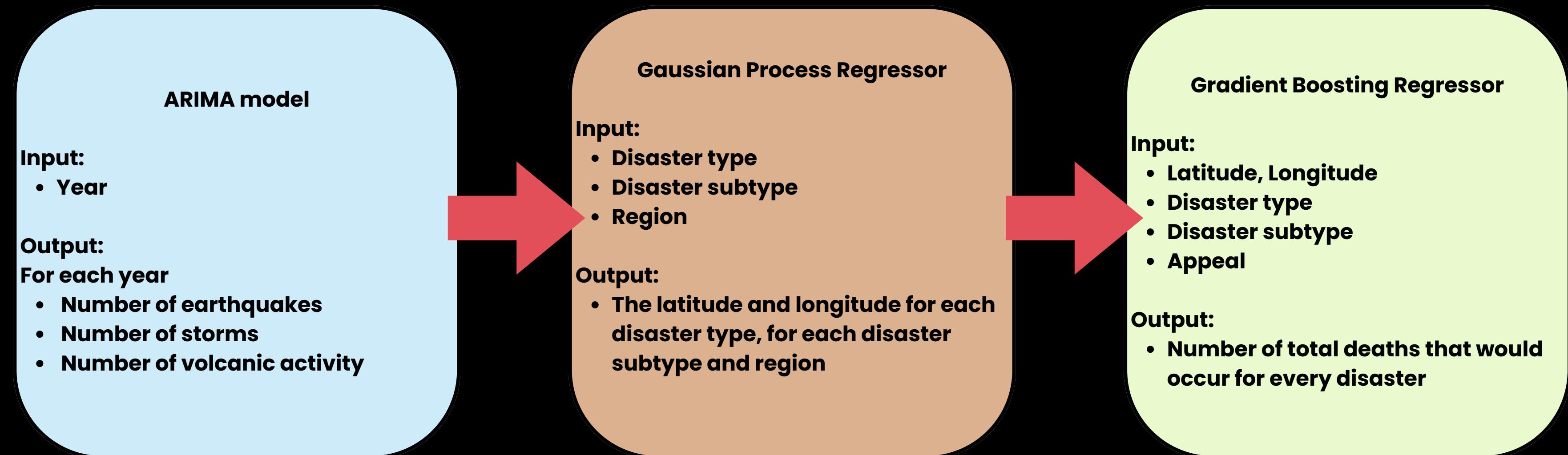
Finally, the Gradient Boosting Regressor predicts the casualty rate (or severity) of the disaster, based on the disaster type and location predicted from the two models above.

The final output would consist of predictions from all three models, and will be sent to the 2D geospatial map for visualization.

Below is an example of the output for a disaster:

```
{  
  "year": 2000,  
  "latitude": 39.64110212,  
  "longitude": 20.88226481,  
  "Total Deaths": 0.0,  
  "Disaster type": "earthquake",  
  "Disaster subtype": "Ground movement",  
  "Appeal": "No"  
}
```

AI SIMULATION PIPELINE IN DETAIL



CONCLUSION ON THE ANALYSIS

From our analysis, we can conclude that the Indomalayan realm requires the most attention as it has a high concentration of all the species which are endangered and is highly vulnerable to all 3 natural disasters types (Earthquakes, Hurricanes and Volcanoes).

More conservation efforts need to be focused on mammals and amphibians as shown Figure 3 as they have the highest percentage of endangered and critically endangered.

Referring to Figure 6, conservation efforts for amphibians should be focused towards volcanoes and earthquakes, for mammals and birds, it should be focused more towards earthquakes and hurricanes and for reptiles, it should be evenly focused on.

Meanwhile, in the Neotropical realm, conservation efforts should be focused on reducing the impact of volcanoes, particularly for reptiles and amphibians.