DS2500 Final Project

Biodiversity Decline and Species Extinction

Samara Shankar,
Maygala Selvisudhakar,
and Sydney Howard

Table of contents

01

Background

Biodiversity is the measure of all life on earth. This includes the total number of global species, genetic variation, ecosystem interactions, and regional population changes encompassing all living organisms

Why Do We Care?

Genetic and species diversity is necessary for maintaining healthy ecosystems that provide critical services for human survival, including clean air and water, food sources, pollination, and climate regulation, ultimately contributing to human well-being and a stable environment

02

Exploring the Data

Datasets Explored

Red List Index

Shows trends in overall extinction risk for groups of species.

Living Planet Index

Comprised of the average change in population sizes for extensive vertebrate animal populations

Share of Terrestrial KBA that are protected

Illustrates the proportion of terrestrial Key Biodiversity Areas (KBAs) that are covered by designated protected areas.

Living Planet Index

Measures the abundance change in 34,836 populations across 5,495 native species relative to the first year of collection (1970 is 100%) until 2020.

Scope of Data:

- Includes only vertebrates (mammals, birds, fish, reptiles, amphibians).
- Limits representativeness of global biodiversity by omitting non-vertebrate

Ethical Considerations:

- Compiles its data from published scientific articles, online databases, and government reports
- Few privacy or ethical concerns as data is publicly available and published.

Geographical Bias:

- Underrepresentation of tropical regions with higher species richness.
- Data from well-studied regions (e.g., temperate zones) dominates.

Data Sensitivity:

- Dataset sensitive to outliers, potentially skewing results.

Despite limitations, the Living Planet Index (LPI) is the most comprehensive measurement for biodiversity loss!

Red List Index

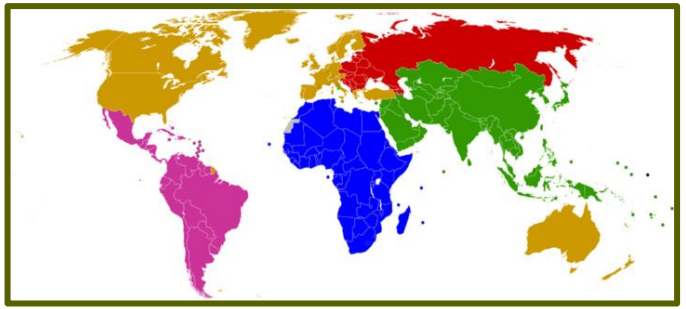
Measures extinction risk trends for species groups from 1993 to 2024. Values range from 0 (all species extinct) to 1 (no extinction risk).

- **Scope**: Includes mammals, birds, cycads, amphibians, and corals, differing from LPI's vertebrate focus.
- **Data Sensitivity:** Regional/national indices are weighted by species distribution fractions.
- **Focus**: Compare extinction rates to regions with high/low biodiversity loss.

Share of Terrestrial KBA

Measures the proportion of terrestrial KBAs covered by protected areas from 2000 to 2023. A higher percentage indicates greater biodiversity protection.

- **KBA**: A "Key Biodiversity Area" is a critical sites contributing to long-term biodiversity persistence across various environments.



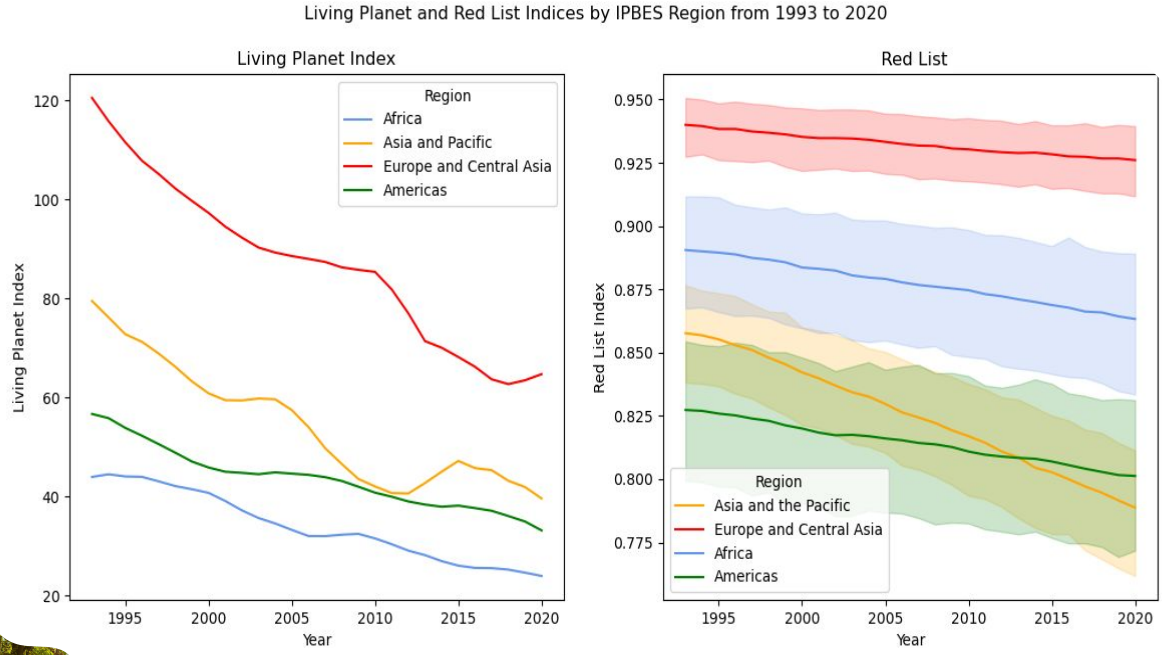
IPBES regions

An area, especially part of a country or the world that has definable characteristics, as identified by the Intergovernmental Platform for Biodiversity and Ecosystem Services **(IPBES)**

03

Data Science Approache

Comparing The Yearly Changes in Red List and Living Planet Indices



- Red list is aggregation of all countries within region specified by **IPBES**
- Visualization allows us to easily compare these datasets and analyze environmental trends regionally

Comparing The Yearly Changes in Red List and Living Planet Indices

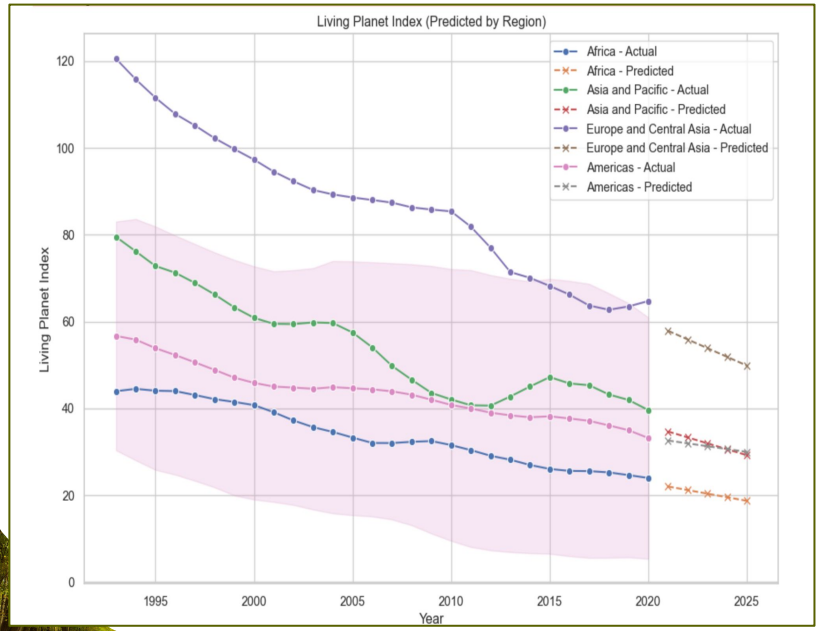
Takeaways:

- Europe and Central Asia is the highest in both indices, indicating the best performance in terms of biodiversity
- Between 2010 and 2015, the **Red List Index** of Asia and the Pacific fell below that of the Americas, and **Living Planet Index** almost fell below, but was able to rise in the following years, indicating a change in behavior or effort from governments in that region

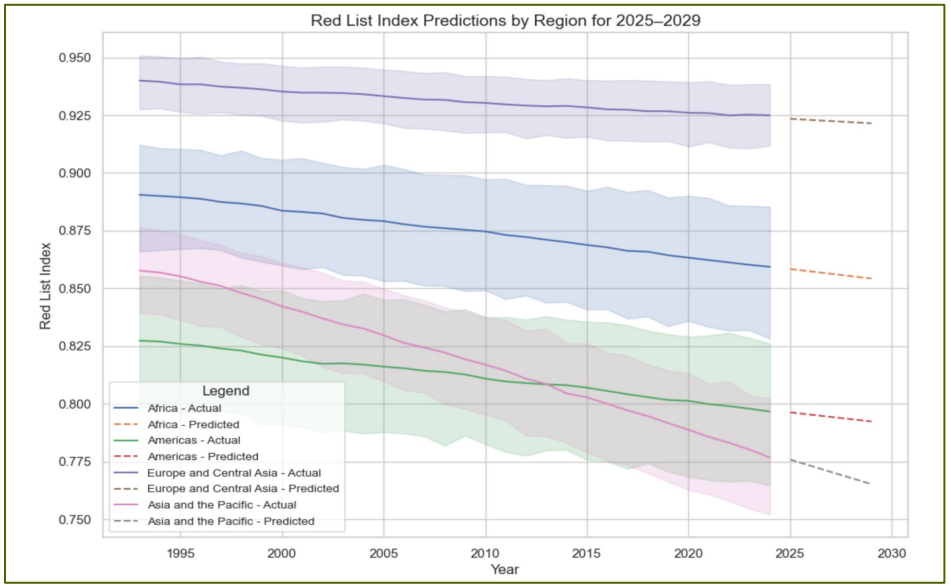
Living Planet Index Average Percent Change From 1970-2020	
Region/Group	Relative Change % (1970 = 100%)
Africa	-71%
Asia and Pacific	-57%
Europe and Central Asia	-33%
North America	-37%
World	-73%

Linear Regression Model LPI & RLI

Living Planet Index only provided data up to 2020 so the linear regression model was used to predict what the LPI would be for each country from 2021 to 2025.

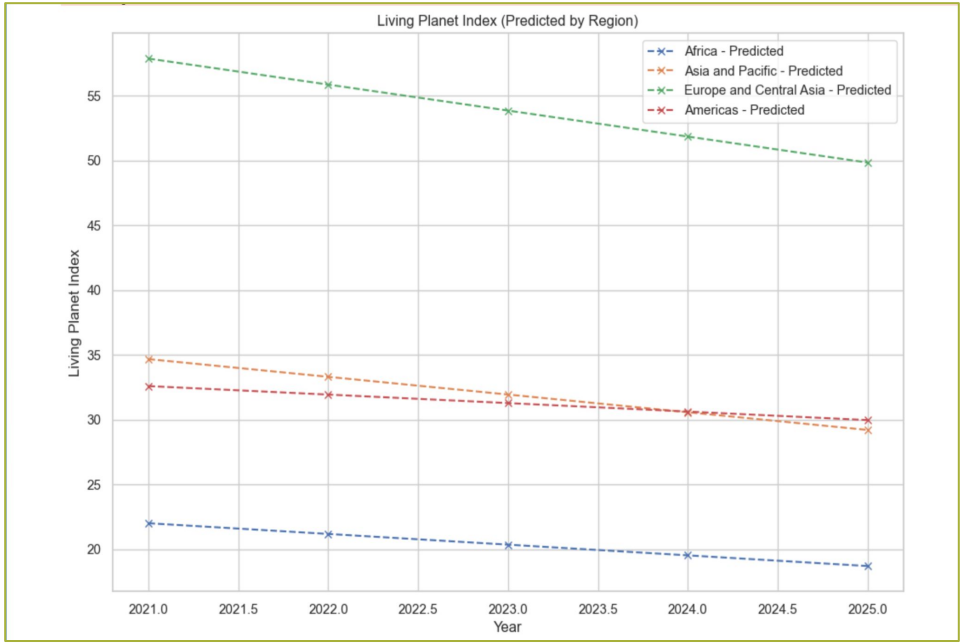


Red List Index provided data up to 2024 so the linear regression model was used to predict what the RLI would be for each country from 2025 to 2029



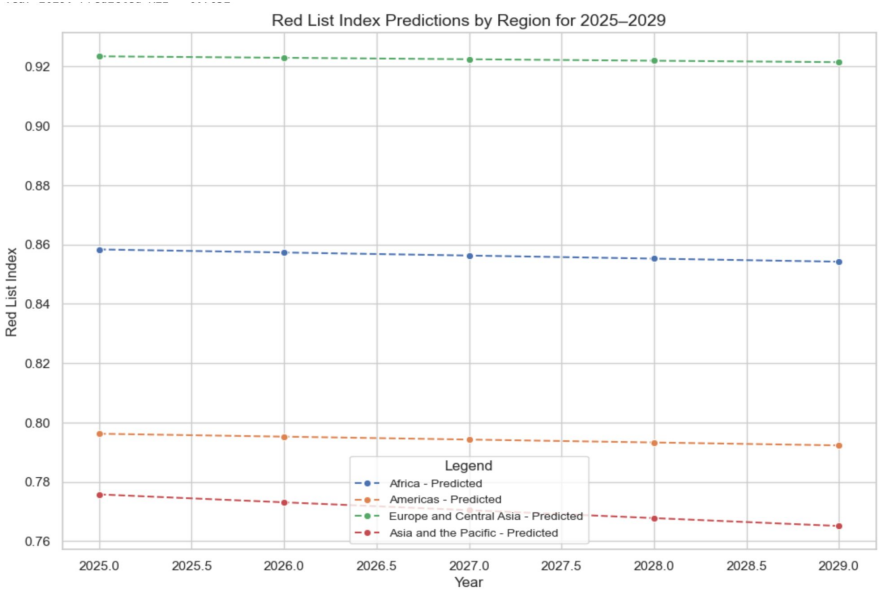
Living Planet Index Predictions

Region	Predicted LPI 2021	Predicted LPI 2022	Predicted LPI 2023	Predicted LPI 2024	Predicted LPI 2025
Africa	22.010	21.185	20.359	19.533	18.707
Americas	32.595	31.939	31.283	30.627	29.971
Europe & Central Asia	57.868	55.863	53.857	51.852	49.846
Asia & Pacific	34.676	33.309	31.943	30.577	29.211

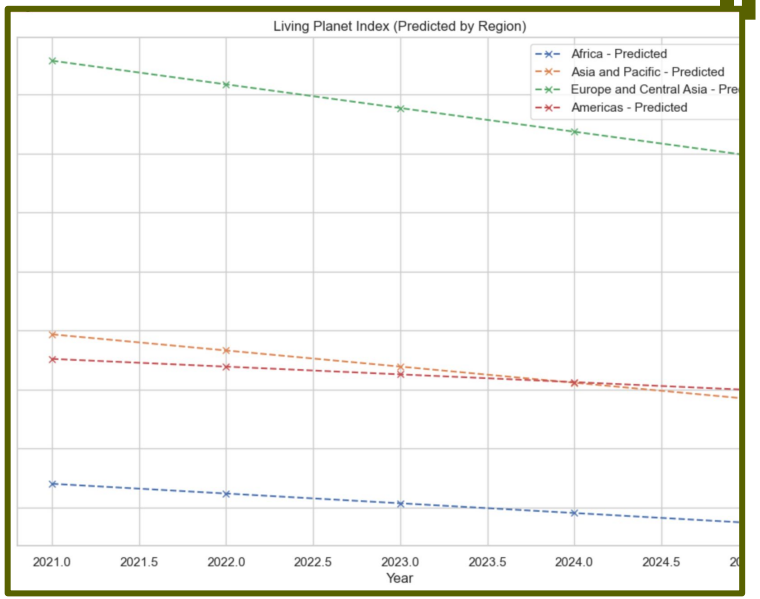


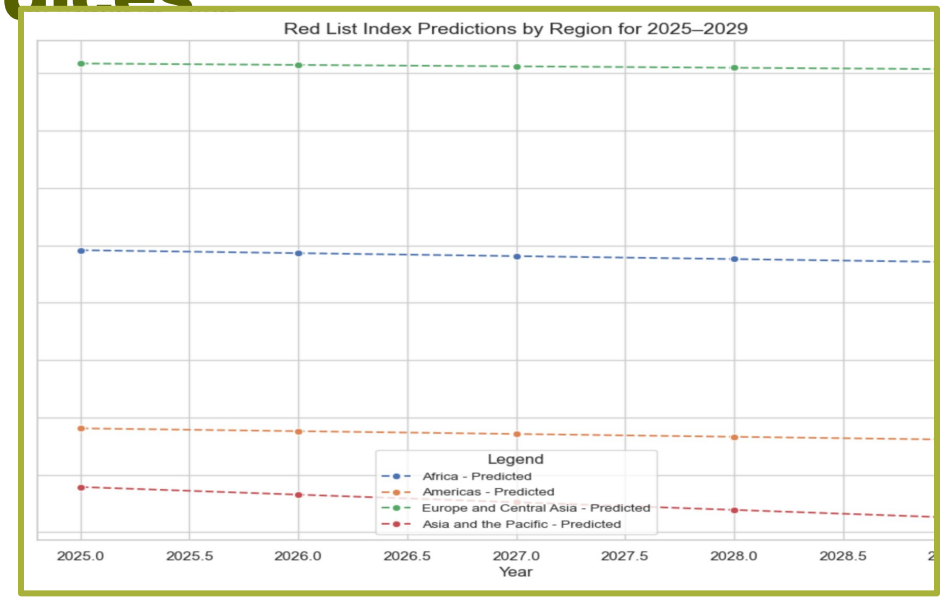
Red List Index Predictions

Region	Predicted Red List Index 2025	Predicted red list index 2026	Predicted red list index 2027	Predicted red list index 2028	Predicted red list index 2029
Africa	0.8584	0.8573	0.8563	0.8553	0.8542
Americas	0.7962	0.7953	0.7943	0.7933	0.7923
Europe & Central Asia	0.9234	0.9230	0.9225	0.9220	0.9215
Asia & Pacific	0.7758	0.7731	0.7705	0.7678	0.7652

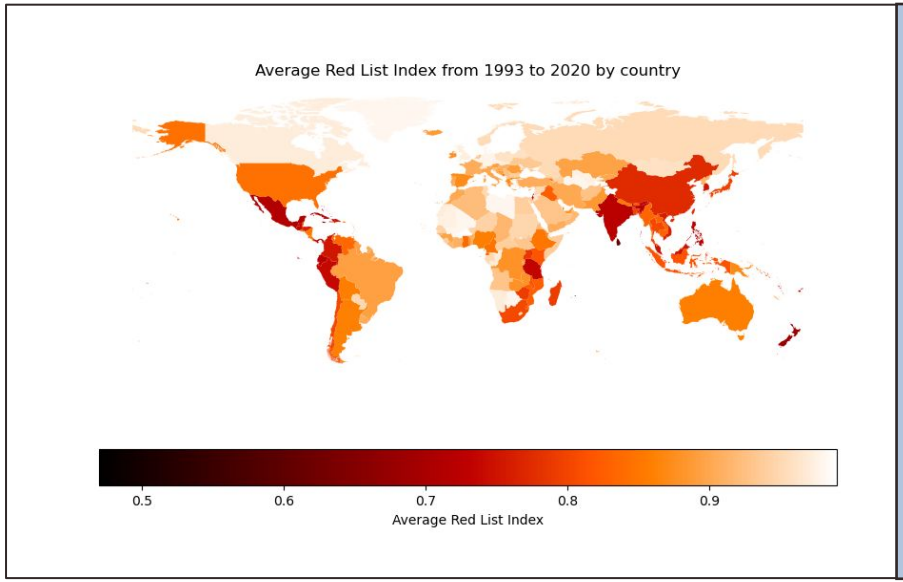


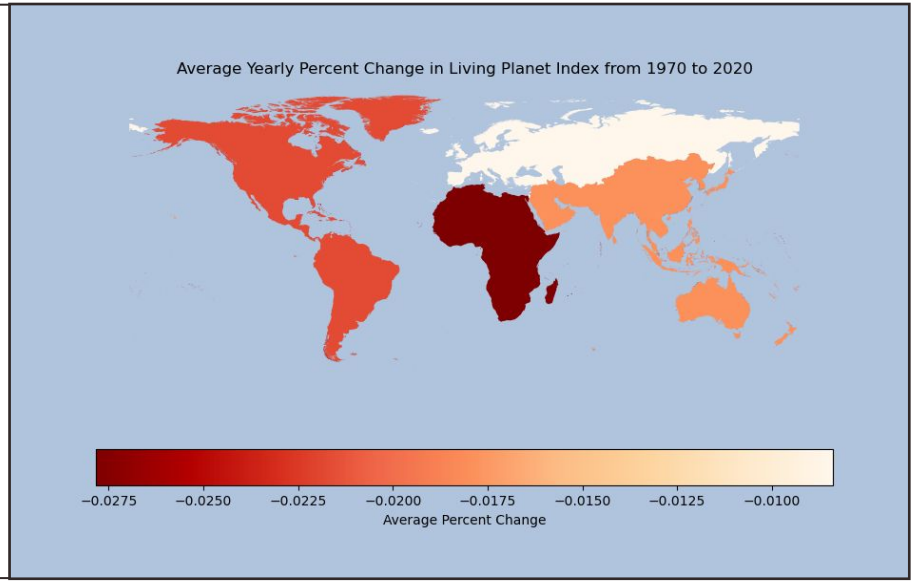
Comparing the yearly changes in predicted Red List and Living Planet Indices





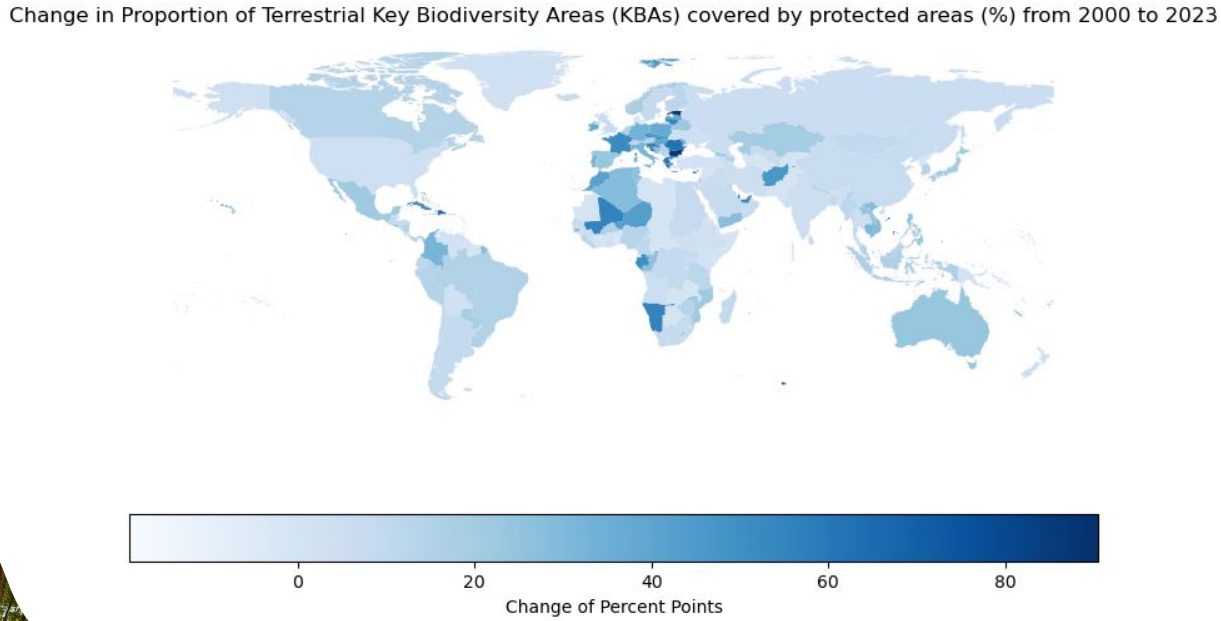
Comparison continued





Africa appears to have a terrible average yearly change in **Living Planet Index** from 1970-2020. Despite this, it does not seem like one of the worst regions in terms of **Red List Index**. This visualization, with **Red List** no longer being aggregated, allows us to better visualizes which countries have the highest extinction risk, and which may be determinate of the regional values for **living planet index**

Visualizing Development



This aggregation allows us to see, over the past few years, which countries are working to improve conditions, thus have committed to environmental development. **European countries** seem to have the most frequent pattern of increasing protection of KBAs.

Africa and the **Americas** have the two worst Red List Indices and Living Planet Indices over the past few decades, but **Africa** has shown much more increase in KBAs protected than that of the **Americas**

04

Future Work

Future Work

1 Identify Risks and Causes of Loss

- Focus on regions and species at highest risk of biodiversity loss.
- Investigate root causes like habitat destruction, deforestation, and fossil fuel emissions.
- Develop prediction models integrating climate projections and land-use changes.

2 Evaluate Conservation and Sustainability

- Assess current conservation programs to identify successes and areas for improvement
- Study sustainable practices and communities to prevent biodiversity losses
- Analyze socioeconomic and ecosystem impacts of biodiversity loss

3 Utilize Data for Policy Insights

- Explore successful policies to guide future conservation strategies.
- Inform data-driven decisions to protect wildlife and ecosystems.

Sources

Our World in Data. (2024). *Data page: Share of terrestrial Key Biodiversity Areas that are protected*. Data adapted from BirdLife International, IUCN, and UNEP-WCMC. Retrieved November 27, 2024, from https://ourworldindata.org/grapher/protected-terrestrial-biodiversity-sites

Our World in Data. (2024). *World region map definitions*. Retrieved November 27, 2024, from https://ourworldindata.org/world-region-map-definitions

Ritchie, H., & Roser, M. (2024). *Biodiversity*. Our World in Data. Retrieved November 27, 2024, from https://ourworldindata.org/biodiversity

Ritchie, H., & Roser, M. (2024). *Red List Index*. Our World in Data. Retrieved November 27, 2024, from https://ourworldindata.org/grapher/red-list-index?tab=table

IPBES Regions and Sub-Regions. (2021). *Zenodo (CERN European Organization for Nuclear Research)*. Retrieved November 27, 2024, from https://doi.org/10.5281/zenodo.5719431

World Administrative Boundaries - Countries and Territories. (2019). Retrieved December 3, 2024, from Opendatasoft.com website: https://public.opendatasoft.com/explore/dataset/world-administrative-boundaries/export/?flg=en-us