

# Wild Guard

Process book

COM 480 – Data Visualization 2024  
Group ERA

---

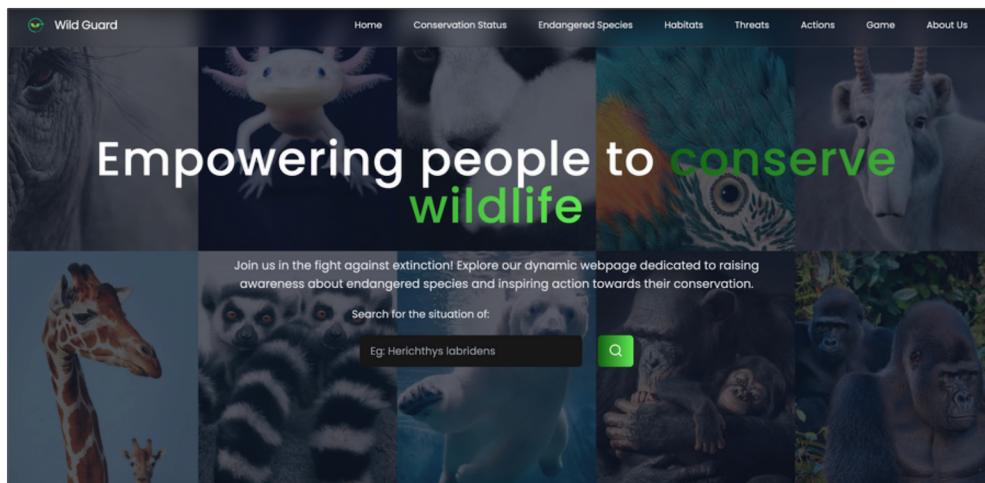
**Authors:**

Adriana Orellana  
Jianan Xu  
Angel Zenteno

**EPFL**

## 1. Introduction

The websites of endangered animal conservation usually display information about numerous endangered animals, such as the [IUCN Red List](#), [WWF](#), and [ESI](#). However, it is time-consuming to check each animal's information page to get an overview of the situation of endangered animals all over the world. Therefore, in addition to displaying the information of each endangered animal individually, we conduct statistics and analysis based on the IUCN database, so that people can have a general understanding of the current status of endangered animals around the world in a short time. We aim to raise awareness about the protection of endangered species among people (mainly students) through some interactive components of our website.



## 2. Datasets

- The introductory video comes from [National Geographic UK](#).
- Our primary data set for interactive data visualizations is from the [IUCN Red List](#). After preprocessing, the data set utilized for visualizations includes 1,799 endangered animals, with 39 attributes for each.
- The quiz set in our game has 13 questions in total, all selected from a website named [Textbook](#).
- Our icons are from [Flaticon](#).

### 3. Design and Development Process

In this section, we describe the path we took to achieve the final result. We reuse sketches and plans from previous milestones, expanding and explaining the modifications made along the development process.

Figure 1 shows the overall design of our site. Our implementation closely follows this sketch. When users visit our site, we initially display a short introductory video calling on people to protect wildlife. We aim to raise awareness among users about protecting endangered animals through the video. Users have the freedom to skip the video at any time by clicking the "LET'S GO" button. Subsequently, the user is directed to the main page, i.e., the data visualization pages. We present five interactive visualizations from five perspectives on endangered animals: conservation status, global distribution, habitat, threat, and conservation action. Users can quickly gain an overview of the current state of the world's endangered animals by exploring these visualizations.



Fig. 1: Sketch of the entire site.

To further increase the interactivity of our website, we provide a search bar and a game. By using the search bar, users can search for detailed information about a particular animal, such as its taxonomic classification, its conservation status, and threats. Additionally, on the animal information pages, we visualize a line chart of the endangered animal's conservation status over time.

Users can start the game via the game entrance button. In the game, users need to answer three quizzes about the conservation of endangered animals. If all answers are correct, users will receive a certificate issued by us. Otherwise, we will display a pie chart showing the percentage of correct and incorrect answers to help users try again. The game not only enhances interactivity but also fulfills the educational purpose of our website in a fun atmosphere.

We will elaborate on the search bar, five interactive visualizations, and the game in the following sections. Additionally, our website has an About section for introducing our team and auxiliary components like a navigation bar, footer, and back-to-top button.

## 3.1 Components

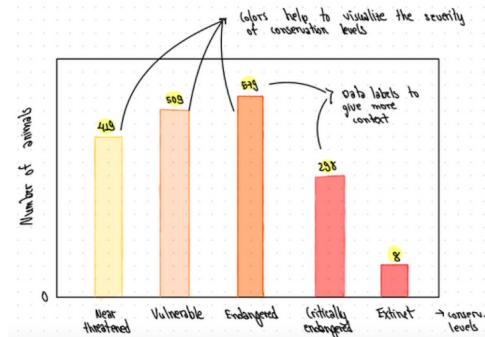
To build our webpage, we used React, a tool that helps us create user-friendly interfaces. We paired it with Vite to quickly visualize changes in the browser. Additionally, we utilized Tailwind for CSS and Python to preprocess our data. For data visualization, we employed 'Recharts' for charts, 'react-globe' for a 3D globe, 'Leaflet' for a 2D world map, and 'D3.js' for packed circles. We also used ChatGPT to classify and quantify the conservation action data. The path we took to obtain the final result for each component is generally the same: (1) drawing sketches; (2) implementing the most basic features or functions; and (3) improving details and aesthetics.

- **Search Bar and Animal Information Page**

The first section users see on the landing page contains a search bar where they can type an animal's name to learn more about it. As they type, the search bar suggests possible matches. Once they have finished typing and clicked the search button, a page with the animal's information appears. It includes details like its taxonomic classification, conservation status, geographic range, habitat information, and threats it faces. The animal information page also provides additional details such as its population trend and a line chart showing the animal's historical conservation status. We found images for some animals, but for those we could not, a placeholder image is displayed instead.

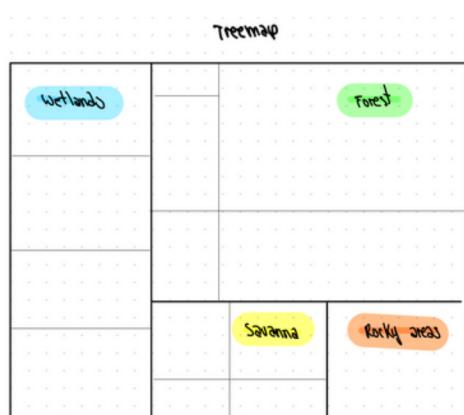
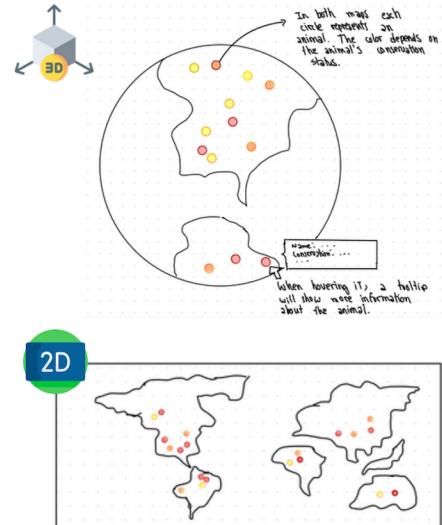
## • Conservation Status Section

This section introduces the conservation status categories and the number of species that fall within each category. The color scheme is designed to convey a level of urgency, with colors closer to red indicating a more critical situation. When users hover over a bar, they will see the exact number of species in that category, accompanied by a brief description of the category itself.



## • Global Distribution Section

The section illustrates the worldwide distribution of endangered species. Each point on the map represents the location of a species, with the color of the points reflecting their conservation status — the darker the red, the more endangered the species. Users can interact with the globe by rotating it, zooming in and out, and hovering over individual dots to see detailed information about each species. Additionally, we have implemented a toggle that enables users to switch between a 3D globe and a 2D world map by clicking.

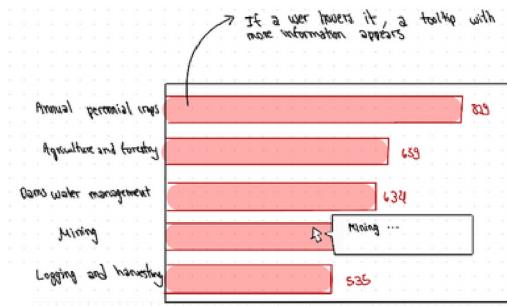


## • Habitat Section

The Habitat section utilizes a treemap to visualize the distribution of species across various habitats. Related habitat sub-types are grouped together and represented by the same color, highlighting their shared general habitat category. When users hover over a specific habitat, a tooltip will appear, revealing the exact number of species that inhabit it, as well as the habitat's full name.

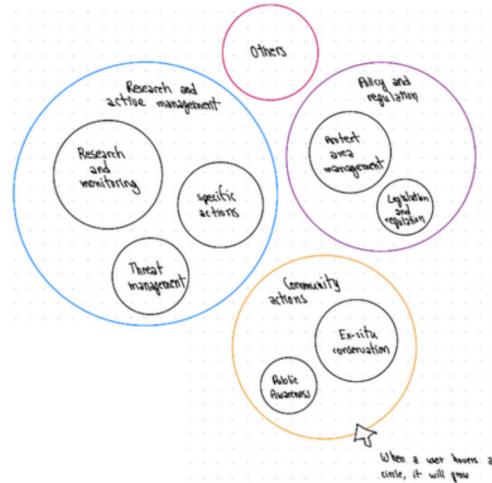
## • Threat Section

This section highlights the top 5 most significant threats impacting the largest number of animal species in our data set. These threats are ranked in order of severity, with the most critical threats appearing first. When a user hovers over a threat, a tooltip will appear, providing additional information on the number of species affected by that threat, along with a brief description of the threat itself.



## • Conservation Action Section

This section represents hierarchical conservation actions for endangered species using packed circles, where each circle indicates a category of action. While our initial plan was to enable zooming by hovering over these circles, we ultimately decided to implement a click-to-zoom feature to reveal subcategories. The size of each circle reflects the number of animals that benefit from these actions. The larger the circle, the wider the impact of this action on endangered species.



## • Game Entrance and Game Page

For educational purposes, we designed our game as a limited-time quiz challenge and implemented it in the following steps. Initially, we searched for and assembled a set of quiz questions. Secondly, during each session, three random questions are selected from the quiz set and presented to players, each equipped with a hint button to toggle hints on and off. Thirdly, we assess responses: if all answers are correct, a certificate is displayed; otherwise, a failure image appears. Fourthly, a three-minute time limit is enforced, which is complemented by a dynamic progress bar. If the time expires, the quiz is automatically submitted. Finally, upon game failure, a pie chart is displayed showing the percentages of correct and incorrect answers, with details of correct Q&A pairs revealed upon hovering.



## 3.2 Challenges

In this section, we explain the challenges that we faced and the design decisions that we took.

One of the primary challenges in our project was the absence and incompleteness of data. As we focus on endangered wildlife, which exists in small numbers in the wild, it is inherently difficult for wildlife scientists to locate and study them. This scarcity of studies significantly limits the amount of data collected by the IUCN. Consequently, when we visualized the IUCN data, the missing and incomplete data posed several challenges. We have also implemented several strategies to address these issues.

For example, profile images and population data for some animals are missing from the database. Additionally, even when population data for recent years are available, they often lack specific population numbers and only include conservation statuses spanning recent decades. Therefore, for animals with available conservation status information, we visualized this data using a line chart overtime on the animal information display page.

For the threat section, we initially intended to create a dynamic bar chart displaying the top five threats to endangered animals over the years. However, due to the lack of year-specific threat information, we could only visualize the top five current threats to endangered animals.

Another major challenge was that some data were textual descriptions extracted from studies, rather than specific numerical values. These textual descriptions are challenging to quantify and consequently difficult to visualize effectively. For example, In our original dataset, conservation actions for each species were described textually, making it difficult to determine their categories and importance. Therefore, we used a large language model (LLM) to classify and quantify the conservation actions, enabling us to present a clear visualization.



## 4. Peer assessment

Throughout the project, each member of the group made fair contributions. Everyone was actively involved in brainstorming the initial website topic, collecting data sets, and writing reports. During the development phase, although each team member was primarily responsible for certain components, all members actively participated in the design, development, testing, and optimization of every part. Below, we have listed the contributions and components for which each person was primarily responsible.



### Adriana Orellana

- Cleaned the scraped data to remove missing information and save the most important animal features after doing the exploratory data analysis.
- Implemented search bar and animal information page which includes a line chart visualization that displays the historical conservation status of an animal.
- Improved the styles and content of tooltips on bar charts to provide more descriptive information when users hover over these visualizations.
- Designed the layout of the webpage, and defined the styles for it.
- Implemented additional components, including a navbar, footer, and back-to-top button.



### Jianan Xu

- Found the introductory video and implemented the introductory video page.
- Implemented a 3D globe and 2D world map to display the global distribution of endangered animals, including a toggle for switching between them.
- Used Python and LLM to classify and quantify textual conservation action data and implemented packed circles to visualize the processed data.
- Searched for and assembled the quiz set and implemented the game.
- Designed our certificate and implemented a pie chart to show the percentages of correct and incorrect answers.



### Angel Zenteno

- Developed a script to scrap data from The IUCN Red List to build our dataset.
- Implemented a conservation status chart to display conservation categories.
- Preprocessed habitat data to match treemap requirements.
- Implemented the tree map of the habitat section with custom styling and interactive hover effects.
- Deployed our web page to GitHub Pages for public access.
- Implemented a threats chart to highlight key dangers to species.