Biodiversity Analyst Practical Exercise

Instructions:

Thank you for applying for the Washington DC-based IUCN Biodiversity Analyst position in the Science Team. This exercise is designed to assess your ability to program and perform the types of analyses that will be necessary for the Biodiversity Analyst Role.
This is a two part exercise, one quite specific, and another more general. Each part uses its own data:

- Part 1 is about spatial analysis using the STAR metric.
- Part 2 is about manipulating and working with remote-sensing data.

Please do not spend more than 2-3h on this exercise.
Please document any assumptions that you make.
Please do not vibe code the exercise, as fully understanding these types of analyses is an essential part of effectively performing the role.

To be considered, completed exercises must be returned via email to nicholas.macfarlane@iucn.org by **11:59pm Washington DC time (EDT) on Thursday July 31st, 2025.**

PART 1: STAR Analysis
Introduction

What is STAR?

The **Species Threat Abatement and Restoration (STAR) metric** is a spatially explicit indicator developed by the IUCN to estimate the **potential reduction in species extinction risk** that could be achieved through conservation actions at specific locations. These actions may include threat abatement (e.g., controlling invasive species, reducing pollution, stopping deforestation) or habitat restoration.

Each species contributes a score to a given location based on two components:

1. Its extinction risk category (e.g., CR, EN, VU), which is translated into a numerical weight.

2. The proportion of the species' suitable habitat (AOH) that overlaps with that location.

The STAR score at a site represents the amount of global extinction risk that could potentially be reduced if conservation actions were implemented there for the species present. A higher STAR score indicates a greater opportunity for contributing to global biodiversity outcomes at that location.

Note: *In this exercise, we will* ***not disaggregate the scores by specific threats*** *(e.g., agriculture, logging). The focus is only on calculating total STAR scores per species based on extinction risk and AOH coverage within the site.*

How is STAR Score Calculated for a Species?

The STAR score for a species at a given location (e.g., a national park) is calculated as:

$$STAR\ score_{i,site} = P_{i,site} * W_i$$

Where:

- $P_{i,site}$ is the **proportion of the species' total AOH** that is found **within the site** (Braulio Carrillo National Park in this case).

- W_i is the **weight based on extinction risk** of species i_i:

    - CR (Critically Endangered) = 400
    - EN (Endangered) = 300
    - VU (Vulnerable) = 200
    - NT (Near Threatened) = 100

Information about the STAR metric: https://www.iucnredlist.org/assessment/star

Objective

Determine species-specific STAR scores for a given site of interest (**Braulio Carrillo National Park**) using spatial data and programming tools such as **R or Python**. This includes integrating species AOH data and extinction risk metadata to produce spatially explicit conservation metric.

Instructions

You are provided with the following files:

- A set of **AOH rasters** (Area of Habitat) for four amphibian species. Each raster pixel represents the **proportion of the species' global suitable habitat (AOH)** that is located within that specific cell.
- A polygon shapefile or spatial layer for **Braulio Carrillo National Park**.
- A **metadata table** with extinction risk categories for each species (e.g., CR, EN, VU, NT).

Tasks

1. **Calculate species habitat proportion within the park:**
    - For each species, calculate the **proportion of its total AOH** that falls **within Braulio Carrillo National Park**.

2. **Calculate STAR score within the park:**
    - Using the extinction risk category from the metadata, compute the **STAR score** for each species **within the national park**, using the formula and weights described above.

3. **Deliverables:**
    - A reproducible and well-documented **R or Python script** (.R, .Rmd, or .ipynb) explaining each step of the procedure.

    - An **Excel file (.xlsx)** containing the following for **each species**:

        - Species name
        - Extinction risk category
        - Proportion of AOH within the park
        - STAR score within the park

Evaluation Criteria

- **Clear, well-structured code** using appropriate tools for spatial analysis and data management:
    - In **R**: e.g., terra, sf, and the tidyverse suite (e.g., dplyr, readr, tibble)
    - In **Python**: e.g., rasterio, geopandas, and pandas for data handling and processing
- Reproducibility: script runs successfully with provided files.
- Accurate and clearly presented summary of results in Excel format.

PART 2: Remote Sensing Analysis

Objective

Using whatever type of programming language you would like and the sample data provided and the field boundary, determine the average tree cover and total biomass of the field.

Instructions

You are provided with the following files:

- A geotiff file of above_ground_biomass_density (tons/ha)
- A geotiff file for tree cover (unit %)
- A geojson file for a field boundary

Tasks

1. **Calculate the average tree cover of the field**

2. **Calculate the total biomass of the field**

3. **Deliverables:**
    - A reproducible and well-documented piece of code explaining each step of the procedure.

    - A short text document with your answer to each question, and an explanation of any assumptions you might have made and their implications.

Evaluation Criteria

- **Clear, well-structured code** using appropriate tools for spatial analysis
- **Reproducibility**: code runs successfully with provided files.
- Accurate answers, reasonable assumptions, and clear documentation.