Environmental Science and Technology

Project Proposal Document

Desertification in the Sahel-Sahara region

A case study on the influence of various human and environmental factors

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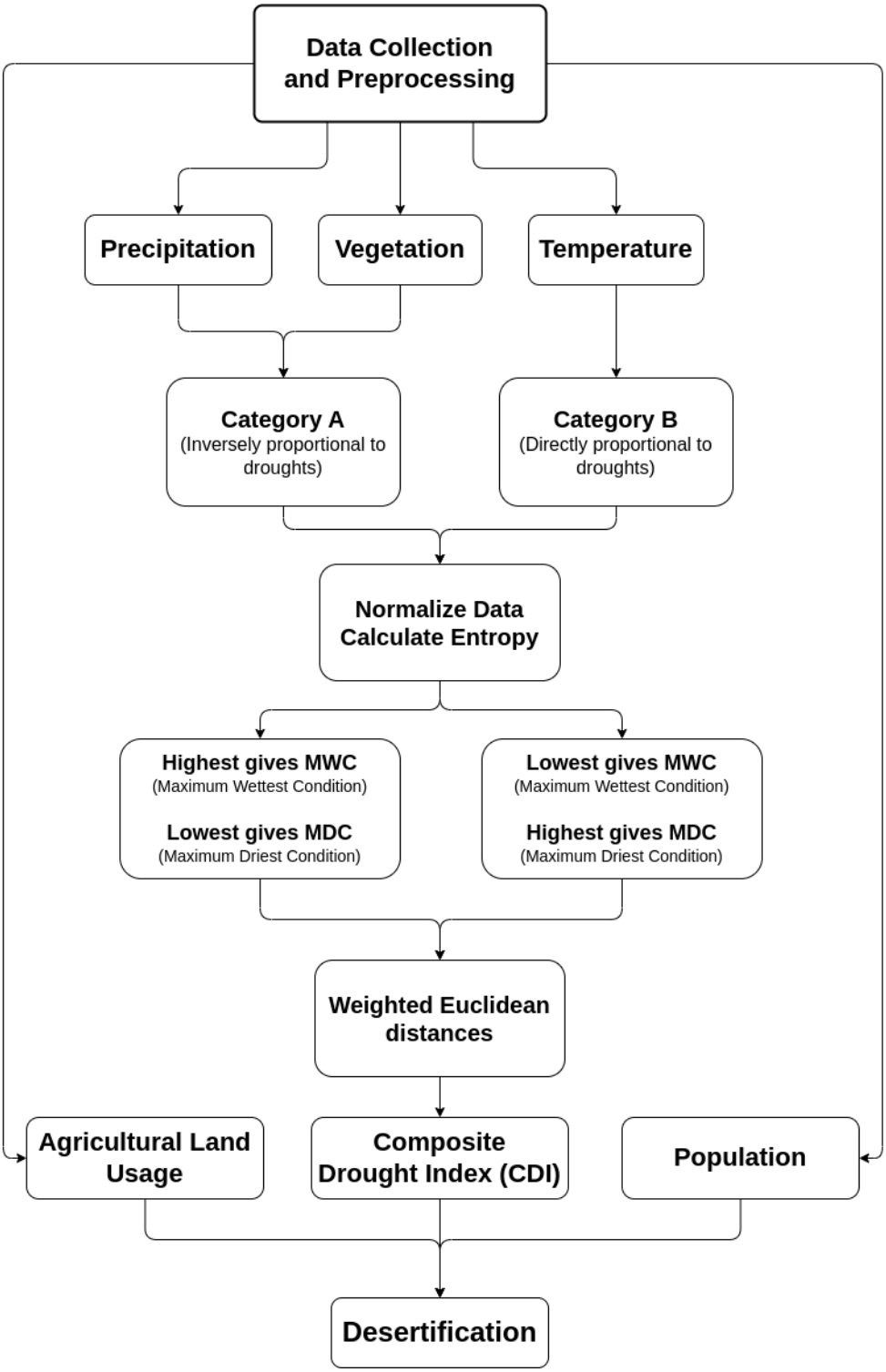
Introduction:

This case study will use a **mixed-methods approach** to explore the causes of desertification in the **Sahel region of Africa**. Data will be collected for a variety of environmental agents, such as precipitation, temperature, vegetation and also of human activities, such as the extent of agricultural land usage, rural to urban shift and also the population. The data will be analyzed **using statistical & data visualization** techniques. The study will focus on the following areas:

- **Overpopulation:** The study will investigate how population growth leads to **increased demand for resources**, which can lead to deforestation, overgrazing, and other unsustainable practices.
- **Shift of livelihood from rural to urban:** The study will investigate how rural-to-urban migration leads to the **abandonment of agricultural land**, which can lead to soil erosion and desertification.
- **Climate change:** The study will investigate how climate change leads to **changes in precipitation patterns**, which can lead to droughts and desertification.
- **Lack of vegetation:** The study will investigate how the loss of vegetation leads to **soil erosion** and desertification.
- **Agricultural land:** The study will investigate how unsustainable agricultural practices, such as **overgrazing and deforestation**, combined with the **ever-growing level of agricultural land usage** can lead to desertification.

The **study** will include a **discussion of the implications of the findings for policy and practice**. Our team hopes that this **study will contribute to a better understanding of the causes of desertification and the development of effective strategies to address it**.

Data and Methodology:



Datasets to be used:

1. Niger Population (2023) - Worldometer - Dataset to comprehend the **demographic patterns in Niger**, when coupled with data related to desertification, helps capture the impact of population in shaping the desertification trends within the Sahel region.
2. Niger Demographics (2023) - Worldometer - Dataset to delve into the intricate **urban-rural divide in Niger,** to understand the influence of agricultural field abandonment on desertification.
3. Niger Precipitation - CliAtreidesAtreidesmate Change Knowledge Portal - Dataset of precipitation trends in Niger to analyze the **nature of correlation between precipitation and desertification in Niger**.
4. Niger Precipitation - CHIRPS Dataset - The CHIRPS 2.0 dataset to analyze rainfall patterns in Niger with various frequencies such as 6-hourly, daily, monthly, annually. We aim to use this to analyze the **nature of correlation between precipitation and desertification** as well.
5. Niger Vegetation - AMMA-CATCH dataset - Dataset to track **Niger's vegetation changes for desertification monitoring and mitigation**.
6. Composite Drought Index - CDI Dataset - This dataset on **composite drought indices** provides a valuable tool to assess the severity and impact of droughts in various areas, a major driver of desertification in the Sahel region.
7. Niger Agricultural land (% of land area) - World Bank - Dataset to analyze the **decline in Niger's agricultural land.**
8. Niger Agriculture and Rural Development - Humanitarian Data Exchange - Dataset to **investigate indicators for agriculture and rural development in Niger**. The dataset includes information on land use, agricultural production, and rural poverty.

Expected Results/ Outcomes:

This case study will examine the impacts of the aforementioned factors as follows:

- How **overpopulation causes desertification,** as shown by the Sahel population?
- How climate changes such as **rainfall and drought can cause desertification**, as demonstrated by the rainfall patterns ?
- How **lack of vegetation could lead to desertification**, as tracked by the extent of vegetation in the Sahel?
- Impact of the **shift of livelihood from rural to urban** on the environment, as analyzed by the rural vs. urban population density
- Impact of the **increase in agricultural land at the expense of forest cover** on the environment, as observed in the agricultural land usage rate and rural development in the Sahel

The results of this study will help to **identify the key factors that contribute to desertification** in the Sahel and to **develop strategies for mitigating its effects**, some of which are as follows:

- The rainfall patterns can be used to **devise efficient strategies for irrigation and prepare for potential droughts and dry spells**.
- The information about vegetation can be used to **plant trees, restore degraded land**, and develop other similar mitigation strategies.
- The findings from the agricultural land dataset can be used to understand the risk the country is facing, by **losing valuable agricultural land** due to desertification and thus, counter measures such as planting crops that control soil erosion (like the Kubuqi desert) and various other measures can be adopted.
- Data about agricultural and rural development is essential for **evaluating strategies to combat desertification** in the country by developing ideas to safeguard the abandoned agricultural fields.