This project uses computer power to analyze satellite images; it has an environmental impact. Running models like K-means and GMM on Sentinel-2 data can use about **0.1 to 1.5 kilowatt-hours** of electricity per analysis, which equals around **0.06 to 0.9 kilograms of CO_2 emissions**, depending on how detailed the images are and what hardware is used.

I made the code efficient by using fast array operations, processing data in small chunks, and avoiding unnecessary steps. This helped keep memory use and processing time low, especially when running in Google Colab or similar platforms.

Even though the analysis creates a small carbon footprint, it can help prevent much larger environmental damage. By spotting early signs of deforestation or vegetation recovery, the results can support better land management. Protecting or restoring even a small forest area can **offset thousands of kilograms of CO_2**, far more than what the analysis produces. It can give a general picture to the area where you can focus on areas where NDVI changed significantly to avoid wasting energy.

This work could be made even more eco-friendly in the future. For example, using **low-energy processors**, running the code when **renewable energy** is more available, or tracking CO_2 use with tools like **CodeCarbon**. Also, using **lower-resolution data** (like 20m instead of 10m) can still give useful results with much less processing since the goal is only to get a general picture of the area.

This project shows that it's possible to use machine learning in a way that is careful with energy, while helping to protect the environment at the same time.