# Environmental Data Analysis

## Background

You are working with a government agency tasked with monitoring and analyzing environmental data from multiple cities. The dataset includes daily measurements of temperature, humidity, rainfall, and wind speed for the past year. The agency is particularly interested in understanding seasonal patterns, relationships between climatic variables, and anomalies in the data. Your analysis will support policy-making for climate adaptation and disaster management.

## Questions

1. Load the dataset and inspect its structure. Check for and handle missing or inconsistent data in key columns like 'Temperature' and 'Rainfall'.

2. Calculate the monthly average temperature for each city. Create line plots to compare temperature trends across cities.

3. Use a histogram to visualize the distribution of daily rainfall across all cities. Discuss trends and identify extreme values.

4. Create a scatterplot to analyze the relationship between temperature and humidity. Add a regression line to interpret the correlation.

5. Generate a heatmap to visualize average monthly rainfall for each city. Highlight regions with high rainfall levels.

6. Calculate the average wind speed for coastal versus inland cities. Use boxplots to compare distributions.

7. Perform a time-series analysis to identify trends in temperature for the most populous city. Annotate significant changes.

8. Cluster cities based on their average annual climatic conditions (temperature, humidity, and rainfall). Describe the characteristics of each cluster.

9. Analyze the impact of extreme weather events (e.g., heatwaves or heavy rainfall) on daily measurements. Create line plots to highlight patterns.

10. Compare average rainfall during the rainy season versus the dry season for each city. Use bar charts for visualization.

11. Calculate the correlation between wind speed and temperature for all cities. Visualize the relationship using scatterplots.

12. Compare the average humidity levels across seasons (e.g., Winter, Spring, Summer, Fall). Use bar charts for visualization.

13. Identify outliers in daily rainfall data for each city. Use boxplots to highlight these outliers.

14. Analyze the impact of rainfall on humidity levels using scatterplots. Discuss whether higher rainfall correlates with increased humidity.

15. Perform clustering on cities based on their climatic profiles. Use K-means clustering and interpret the results.

16. Create a heatmap to display the monthly average wind speed across all cities. Discuss patterns and implications.

17. Use time-series decomposition to analyze seasonal, trend, and residual components of temperature data for a specific city.

18. Calculate and visualize the frequency of days with extreme weather conditions (e.g., temperature > 35°C or rainfall > 15 mm).

19. Analyze the impact of urbanization on climatic factors. Compare temperature and humidity levels between urban and rural cities.

20. Develop a dashboard summarizing key climatic metrics for policymakers. Include charts for temperature, rainfall, and wind speed.

21. Explore the relationship between average monthly temperature and energy consumption (if data is available).

22. Create a bar chart comparing the number of sunny, cloudy, and rainy days for each city.

23. Perform a comparative analysis of wind speed trends for coastal versus inland cities over the past year.

24. Investigate how extreme rainfall events affect temperature variations. Use line plots to visualize these effects.

25. Develop a predictive model for daily rainfall based on temperature, humidity, and wind speed. Evaluate its accuracy.

26. Identify and map regions with the highest risk of flooding based on historical rainfall data.

27. Generate a report for policymakers summarizing the key findings and recommendations based on your analysis.

28. Analyze the impact of climate change by comparing historical data (if available) with current trends.

29. Explore the distribution of extreme wind speeds. Use histograms to visualize and interpret the findings.

30. Provide three actionable strategies to mitigate the impact of extreme weather events based on your findings.