

# Impact of Temperature Change on Agricultural Productivity in European Countries

## 1. Introduction

In Europe, rising temperatures are expected to impact agricultural productivity, influencing food production. This report aims to assess whether temperature change is affecting agricultural productivity in European countries. Specifically, we investigated the relationship between temperature changes and food production values over the past few decades, seeking to understand whether rising temperatures affect agricultural output.

## 2. Used Data

The analysis utilizes two primary datasets extracted from two data sources and stored in an SQLite database.

### Temperature Change Data from FAOSTAT:

- This dataset contains annual temperature change values for various European countries from 1961 to 2022.
- The data includes columns for the country name, year, and temperature change value.
- The temperature change is measured in degrees Celsius (°C).

### Food Production Data from Kaggle dataset "Global Food and Agriculture Statistics"

- This dataset includes annual food production values for the same set of countries over a similar period.
- The data contains columns for the country name, year, and food production value.
- Food production values are given in terms of production volume or value, depending on the source data.

The data was processed and cleaned to ensure consistency and accuracy. Irrelevant columns were removed, and the data was filtered to include only European countries. The final datasets used for analysis contained relevant information on temperature changes and food production for each year and country.

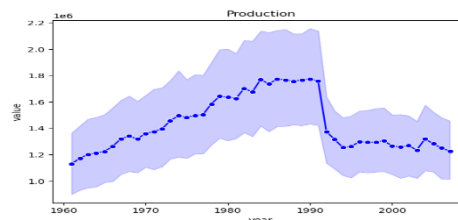
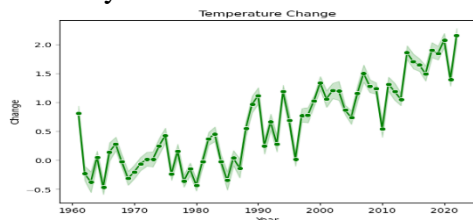


Table: temperature_data			
	Area	Year	Change
	Filter	Filter	Filter
1	Albania	1961	0.186
2	Albania	1961	-0.611
3	Albania	1961	1.0
4	Albania	1961	2.419
5	Albania	1961	-0.515
6	Albania	1961	0.173
7	Albania	1961	-0.339
8	Albania	1961	-0.161
9	Albania	1961	0.568
10	Albania	1961	1.064
11	Albania	1961	1.471
12	Albania	1961	-0.319
13	Albania	1961	0.649
14	Albania	1961	0.968
15	Albania	1961	-0.109
16	Albania	1961	1.034
17	Albania	1961	0.635
18	Andorra	1961	-0.53
19	Andorra	1961	3.396
20	Andorra	1961	1.559
21	Andorra	1961	2.499
22	Andorra	1961	0.557
23	Andorra	1961	0.933

Table: food_data			
	Area	year	value
	Filter	Filter	Filter
1	Albania	2007.0	824818.0
2	Albania	2006.0	858366.0
3	Albania	2005.0	813707.0
4	Albania	2004.0	819870.0
5	Albania	2003.0	789269.0
6	Albania	2002.0	755188.0
7	Albania	2001.0	747971.0
8	Albania	2000.0	733849.0
9	Albania	1999.0	700072.0
10	Albania	1998.0	706612.0
11	Albania	1997.0	682452.0
12	Albania	1996.0	717104.0
13	Albania	1995.0	720032.0
14	Albania	1994.0	656860.0
15	Albania	1993.0	615519.0
16	Albania	1992.0	539687.0
17	Albania	1991.0	485462.0
18	Albania	1990.0	602837.0
19	Albania	1989.0	629160.0
20	Albania	1988.0	557620.0
21	Albania	1987.0	599481.0
22	Albania	1986.0	583574.0
23	Albania	1985.0	576715.0

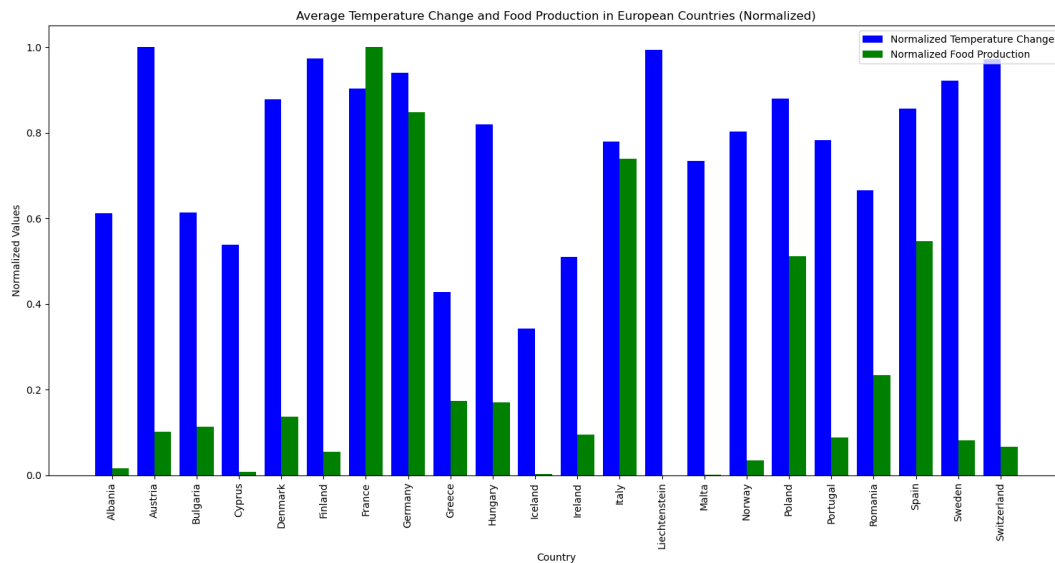
### 3. Analysis:

#### Methods:

To analysis the data I used Grouped bar chart, Scatter Plot Matrix and Heatmap.

#### I. Grouped bar chart:

The grouped bar chart was used to compare the normalized average temperature change and food production across different European countries. The data for temperature change and food production was normalized to allow for a direct comparison within the same scale.

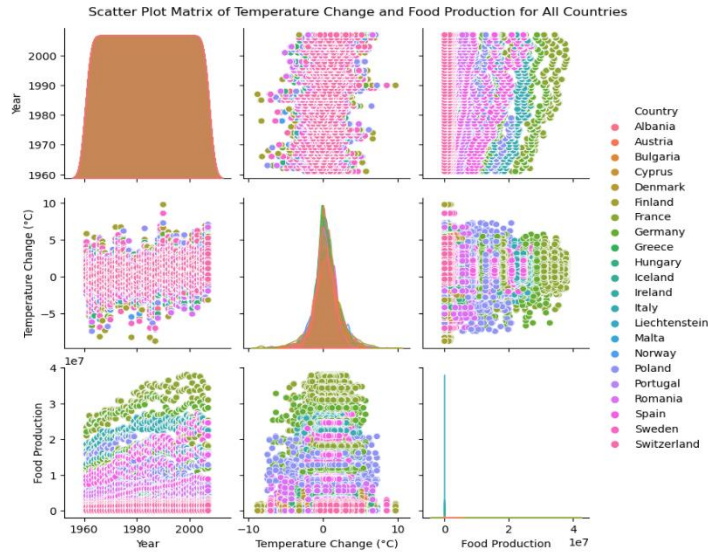


#### Interpretation:

- Countries like France, Germany, and Italy show high normalized values for both temperature change and food production, indicating a significant impact of temperature change on food production.
- Some countries, such as Denmark and Switzerland, show high temperature changes but relatively lower food production values, suggesting that other factors might be influencing food production besides temperature change.

#### II. Scatter Plot Matrix:

A scatter plot matrix was created to visualize the relationships between year, temperature change, and food production for all European countries. Each scatter plot in the matrix shows the relationship between two variables, and the diagonal plots show the distribution of each variable.

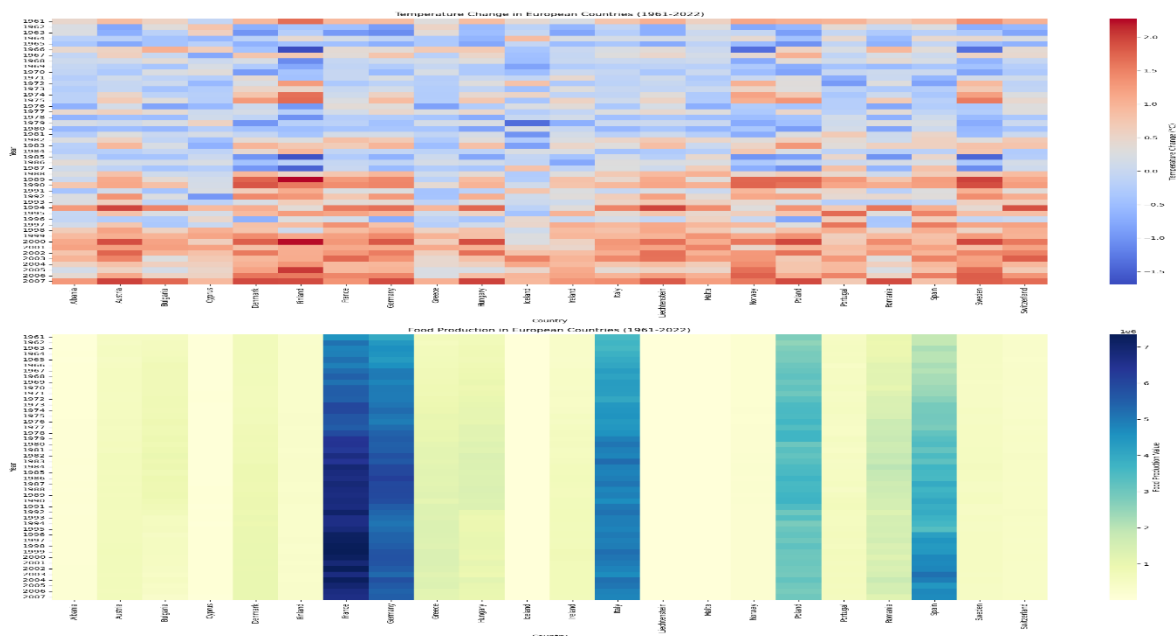


### Interpretation:

- The lack of a clear pattern in the temperature change vs. food production scatter plots indicates that while temperature change may influence food production, it is not the sole factor. Other environmental, economic, and agricultural practices likely play a significant role.
- The distribution plots suggest that temperature changes have been relatively consistent over time, while food production shows more variability.

### III. Heatmap:

Two heatmaps were created to visualize temperature changes and food production across European countries over the years. The intensity of the color in the heatmap represents the magnitude of the values.



### Interpretation:

- The temperature change heatmap reveals that countries like France, Germany, and Italy have experienced significant temperature increases over the decades.
- The food production heatmap indicates that countries such as France and Germany have consistently high food production values.
- Comparing both heatmaps, it is observed that some countries with high temperature changes also show high food production, but this is not a universal pattern, indicating the presence of other influencing factors.

## 3. Conclusion:

### Is temperature change affecting agricultural production in European countries?

The analysis indicates that while there is some correlation between temperature changes and food production, it is not a straightforward relationship. Some countries with significant temperature changes also show high food production, but this is not consistent across all countries.

The question of whether temperature change affects food production cannot be answered definitively with the available data. **The analysis shows that temperature change is one of the factors, but not the sole determinant of food production output.**

### Uncertainties and Limitations:

The data did not capture all variables affecting food production, such as soil quality, irrigation practices, agricultural policies, and economic conditions.

**In conclusion**, the relationship between temperature change and agricultural production is complex and affected by many factors. While this analysis offers some insights, we need a broad approach to fully understand and address how climate change impacts food production. To gain a better understanding, future research should include more factors, use advanced statistical methods, and conduct detailed case studies.