Diet Optimization to Reduce Carbon Emission

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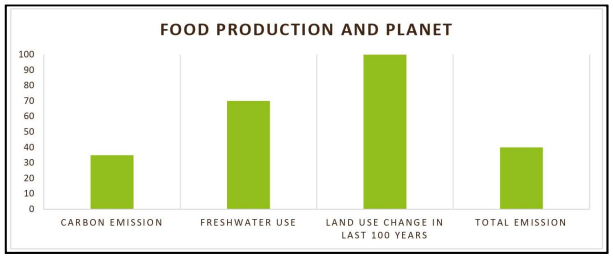
Introduction

Producing enough food for growing population in the whole world is a major worldwide concern. Not only producing food is concern, but also the impact of production on environment is a big issue. Food production contribute significantly to climate change, and it is crucial to be able to precisely monitor the greenhouse emissions from the food factor.

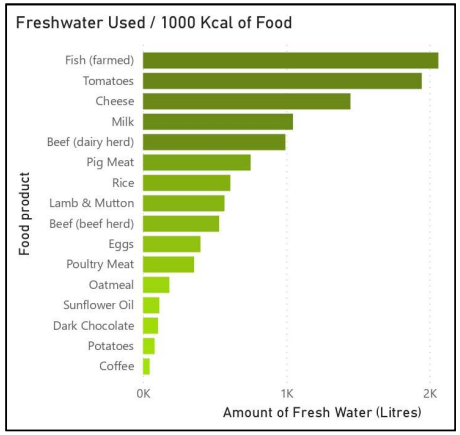
- Food production generates around **35%** of total man-made greenhouse gas emission.
- Over **70%** of the freshwater is used globally for agriculture.
- Land use change over past **100** years has been doubled from 3 Billion Hectare **to 6.5 Billion** Hectare.
- The carbon emission from food per capita in the U.S. is around 10kg/day.

Therefore, to mitigate this problem in the future, we come up with some diet plans to help reduce the gas emission.



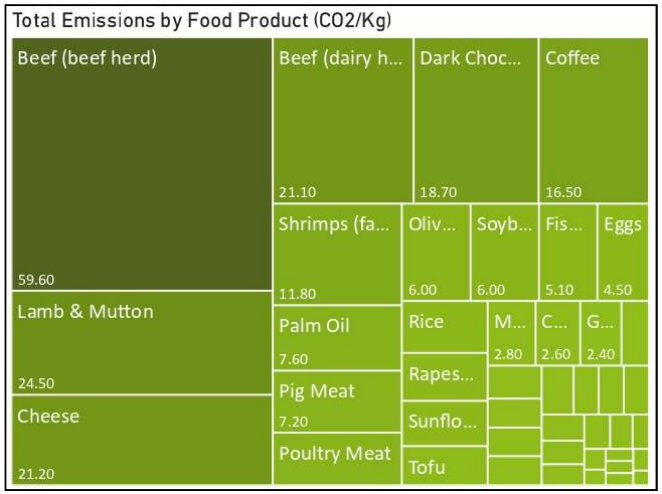
Objective

- The research aims to find out the food having the high negative impact on environment.
- To identify the product having high carbon emissions/calorie.
- To determine and encourage consuming nutritious diet in a sustainable way.



Data Description

- Data Source: The dataset was released by Our World in Data.
- The features include the values of different emissions and other interlinked factors of different food products.
- The features includes various comparisons of emissions with different components.



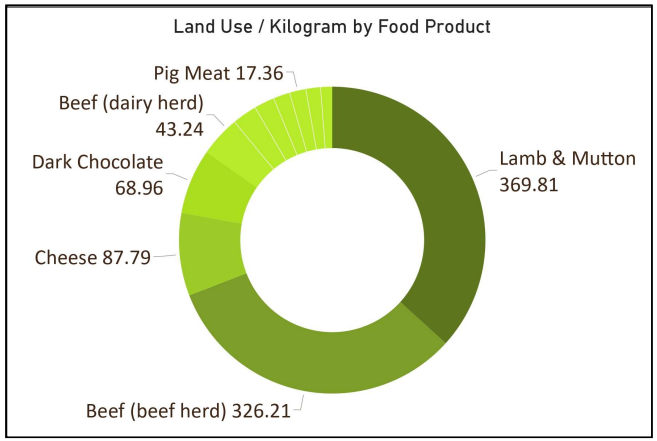
Methodology

- Descriptive analytics, aiming to explore the relationship among types of food and the carbon-dioxide emissions they generate.
- Perform **Linear Programming** to precisely recommend daily food intake.
- $\mathbf{P(F) = A_1x_1 + A_2x_2 + B_3x_3 + \text{---------} + A_ix_i}$

F: Carbon Emission (Target Variable)

X_i = Food Products (Decision Variable)

A_i = Coefficients of Decision Variable



Results

- The suggestions are based on the WHO's food pyramid having a intake for young adult to be **2500Kcal / day**.

Sustainable Daily Diet Plan			
Foods	Option 1 (20% Less carbon emission)	Option 2 (50% Less carbon emission)	Option 3 (75% Less carbon emission)
Pork	0 -100 g	0 -80 g	0 g
Fish	0 -120 g	0 -100 g	0 - 120 g
Shrimp	0 -180 g	0 -100 g	0 - 20 g
Beef	0 -50 g	0 -20 g	0 g
Lamb	0 -50 g	0 -50 g	0 g
Poultry	0 -50 g	0 -50 g	0 g
Total Meat	**300 g**	**230 g**	**100 g**
Milk	250 - 300 g	200 - 250 g	200 - 250 g
Cheese	25 - 35 g	25 - 35 g	25 - 35 g
Vegetables	500 - 750 g	500 - 750 g	500 - 750 g
Oil	25 - 50 g	25 - 50 g	25 - 50 g
Nuts	25 - 30 g	25 - 30 g	25 - 30 g
Sugar	0 - 25 g	0 - 25 g	0 - 25 g
Fruit	300 - 600 g	300 - 600 g	300 - 600 g
Eggs	50 - 100 g	50 - 100 g	50 - 100 g
Starchy	300 - 500 g	300 - 500 g	300 - 500 g

- Most reduction in carbon emission was observed when reducing meat intake, having up to **75%** when consuming just **100gm /day**.
- When a person switches from one level to next level, the meat choice becomes more stricter.
- Unlike meat, other vegetable and plant/dairy based foods do not severely account for the carbon emission.

Conclusion

- Transforming red meat to white meat would largely decrease the emission.
- If they want to control their carbon emission, reducing the total meat intake would also be beneficial.

Future Work

- In future, the project can consider the freshwater and land use to come up with more sustainable diet.
- We could expand the target group of people and geographic location for further research.

References

1. https://ourworldindata.org/co2-emissions
2. https://www.who.int/news-room/fact-sheets/detail/healthy-diet

Kevin Pham | Tinglei Ruan | Vikas Jangra