

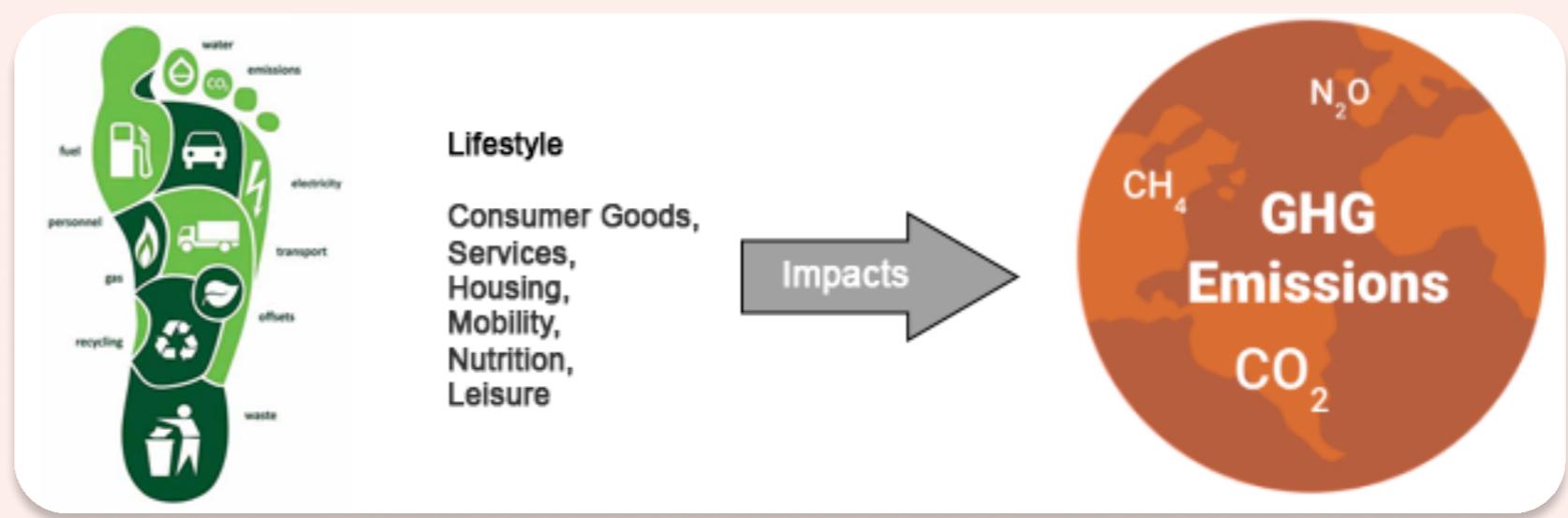
Quantitative Analysis of Lifestyle Impacts on Climate Change in US

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How sustainable living can help counter the climate crisis?

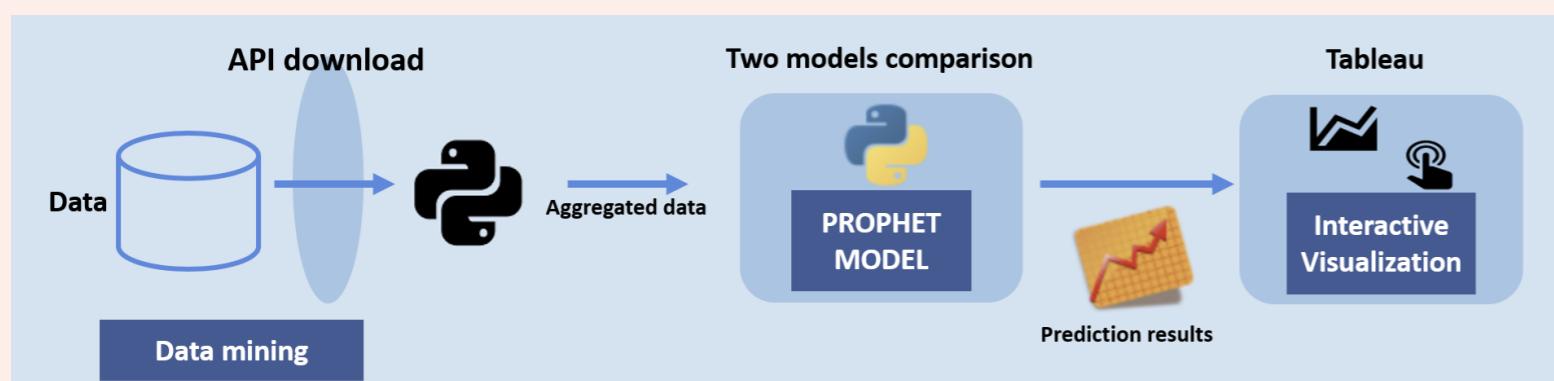
The world is now warming faster than at any point in recorded history that threaten our survival, so our impact on the natural world is an obvious concern.

Research shows that lifestyle changes could help the planet slash emissions by up to 70 per cent by 2050.



Approaches:

- Data:** Collecting national data (statistics) for each state in U.S to define the average consumption for the six consumption domains in addition to carbon dioxide (CO₂) emission.
- Model:** This historical data is put into a multi-variate time series analysis model (Prophet), which then predicts future CO₂ emission.
- Interactive visualization product:** Users can test different lifestyle change scenarios to visualize how their potential actions would affect the output if everyone did the same thing.
- Innovation:** Provide INTERACTIVE product to track climate change due to change in consumption.
- How it helps?** Active user engagement increases eco-accountability and encourages environmentally responsible lifestyles.



Experiments and results:

We used two multivariate time series models to estimate the impacts of consumptions on CO₂ emission. **Vector Auto Regression (VAR) VS. Facebook Prophet**

How does it compare with each others?

Cross Validation

5 years of historical data (2017-2021) were taken out of the fitting data set, and used for predictions. Using the predictive models, we got 'predicted' values for 2017-2021, which were compared to the actual, historical data.

Error Matrix

Metric median absolute percentage error (MDAPE) to compare the performance of the two models.

Table 1. MDAPE between the CO₂ emission predictions and their corresponding actual values across all states.

Model	MDAPE
Facebook Prophet	< 0.1
VAR	0.6884

Data Characterization:

Temporal Variables

- The proxy for climate change is carbon dioxide emission (metric tons), which is the majority greenhouse gas emission of the US.
- This study classifies household resource consumption into **six domains in units of current Dollars**:
 - Nutrition
 - Consumer goods
 - Housing
 - Leisure
 - Service
 - Mobility

Data Size: Raw datasets are greater than 800K rows, after cleaning, reformatting, the aggregated datasets are around 220K rows.

Data Resources :

- U.S Bureau of Economic Analysis
- U.S Environmental Protection Agency
- U.S. Energy Information Administration

Interactive Visualization Product:

We used three different visualizations to illustrate the impact of a user's lifestyle on CO₂ emissions.

- US CO₂ emission heatmap
- CO₂ emissions prediction by user's lifestyle choice
- Linechart for consumption expenditures per year

