ESG #2

PREDICTING AGRICULTURE/ FARM BASED EMISSIONS

MEET THE TEAM

ABHINAV SONONE

Abhinav, is currently pursuing his studies in BS Data Science and Applications at IIT Madras, India. He also holds a prior degree in Mechanical Engineering from the University of Pune, India.
With a diverse range of interests spanning multiple fields, Abhinav is passionate about solving real world problems using DS.

KARTIK SHARMA

Kartik is pursuing Btech in computer science from BIT MESRA
He is a passionate techie who is keen to work with new technologies and exploring new fields of computer science.
He is a full stack developer and learning Data Science. He loves to sing, paint and trek.

AGENDA

- Problem Statement and Solution [Introduction]
- Approach and Methodology
- Data Collection and Preparation*
- Some Insights and discussion
- Solution Demonstration
- Tech Stack
- Result and Impact
- References
- Q&A

PROBLEM STATEMENT AND SOLUTION

Problem Statement

- The agricultural sector contributes significantly to greenhouse gas emissions, impacting climate change.
- Current challenges include a lack of data and standard methodologies to calculate overall emissions from farming activities.
- This absence hinders the identification of emission reduction strategies and sustainable farming practices.

Significance of Addressing the Problem

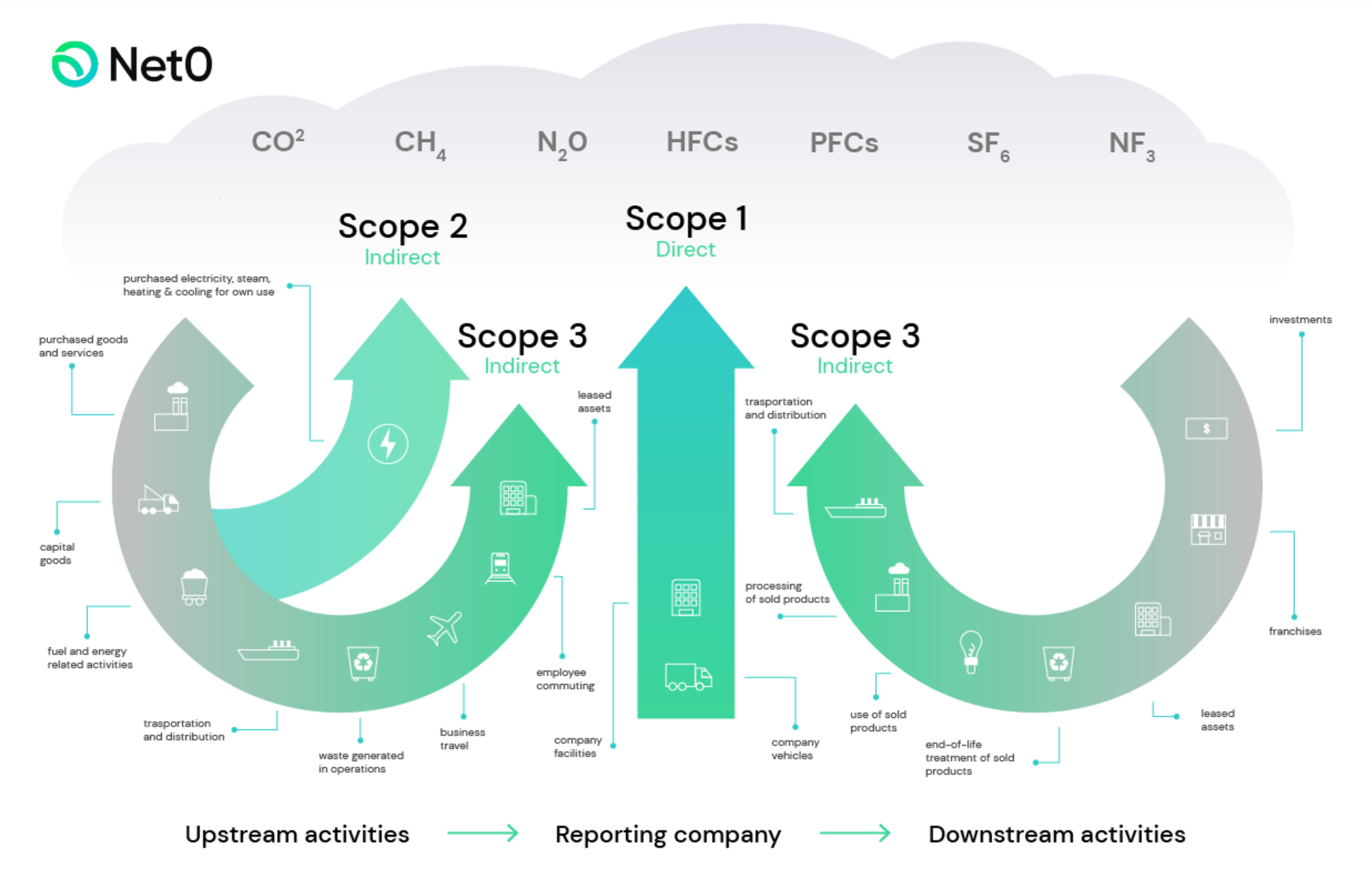
- Addressing agricultural emissions is crucial for mitigating climate change and achieving environmental sustainability.
- Reducing emissions from farming activities can contribute to global efforts to combat climate change and promote sustainable development.
- It can lead to improved air and water quality, soil health, and the conservation of natural resources.

Our Solution: Emission Estimation & recommendation

- Introducing our innovative solution that aims to estimate emissions from agricultural farms and provide actionable recommendations.
- Our objective is to enable farmers to make informed decisions, adopt sustainable practices, and reduce their environmental footprint.
- By leveraging data-driven approaches, machine learning algorithms, and domain knowledge, our solution empowers farmers to contribute to a greener future.

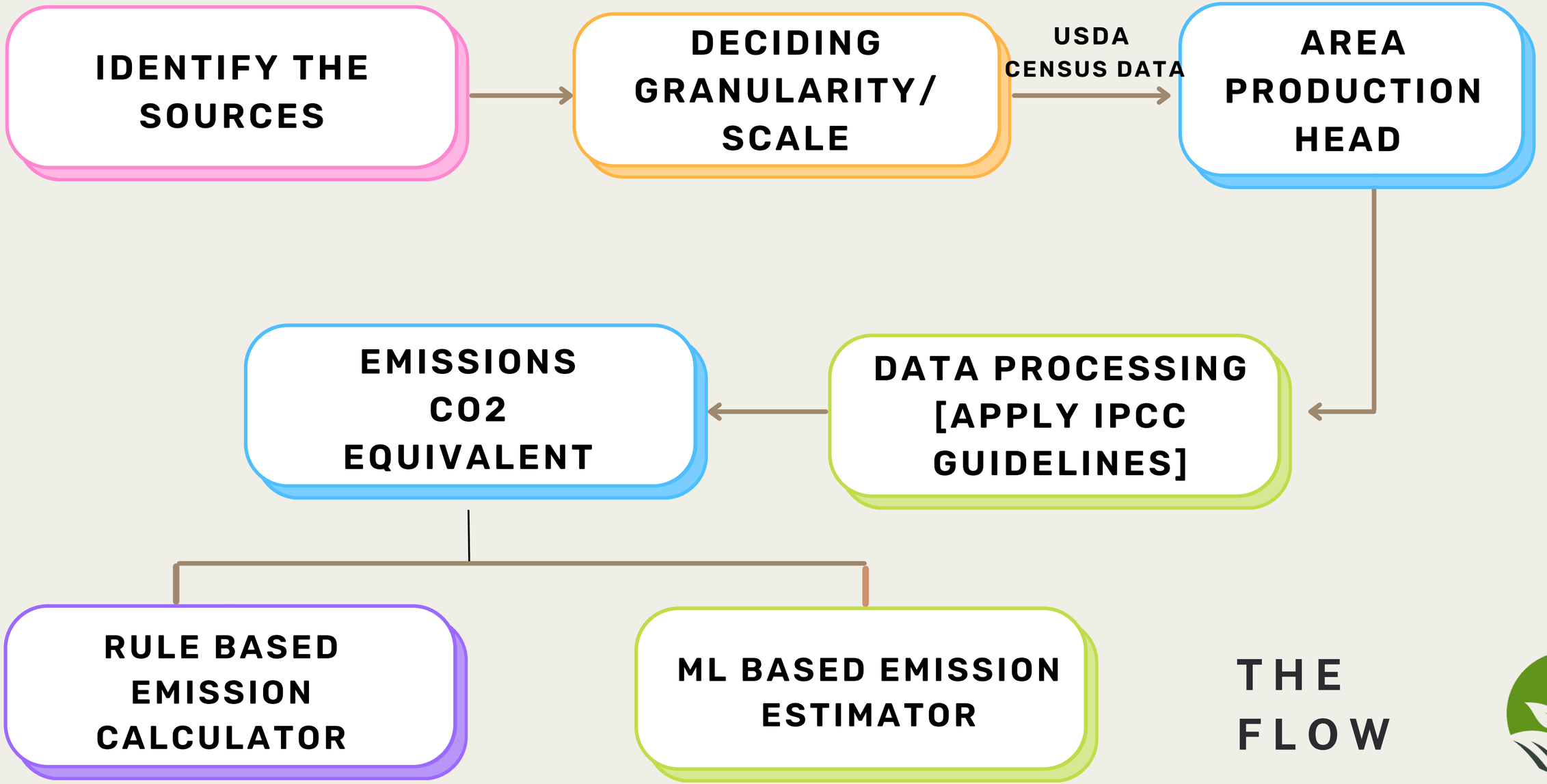
APPROACH AND METHODOLOGY

SCOPE



Source: Google Images

APPROACH AND METHODOLOGY



THE FLOW

DATA SOURCES

USDA Ag Data Commons
U.S. DEPARTMENT OF AGRICULTURE

EPA United States Environmental Protection Agency

nature communications

kaggle

IPCC Data

Source: Google Images

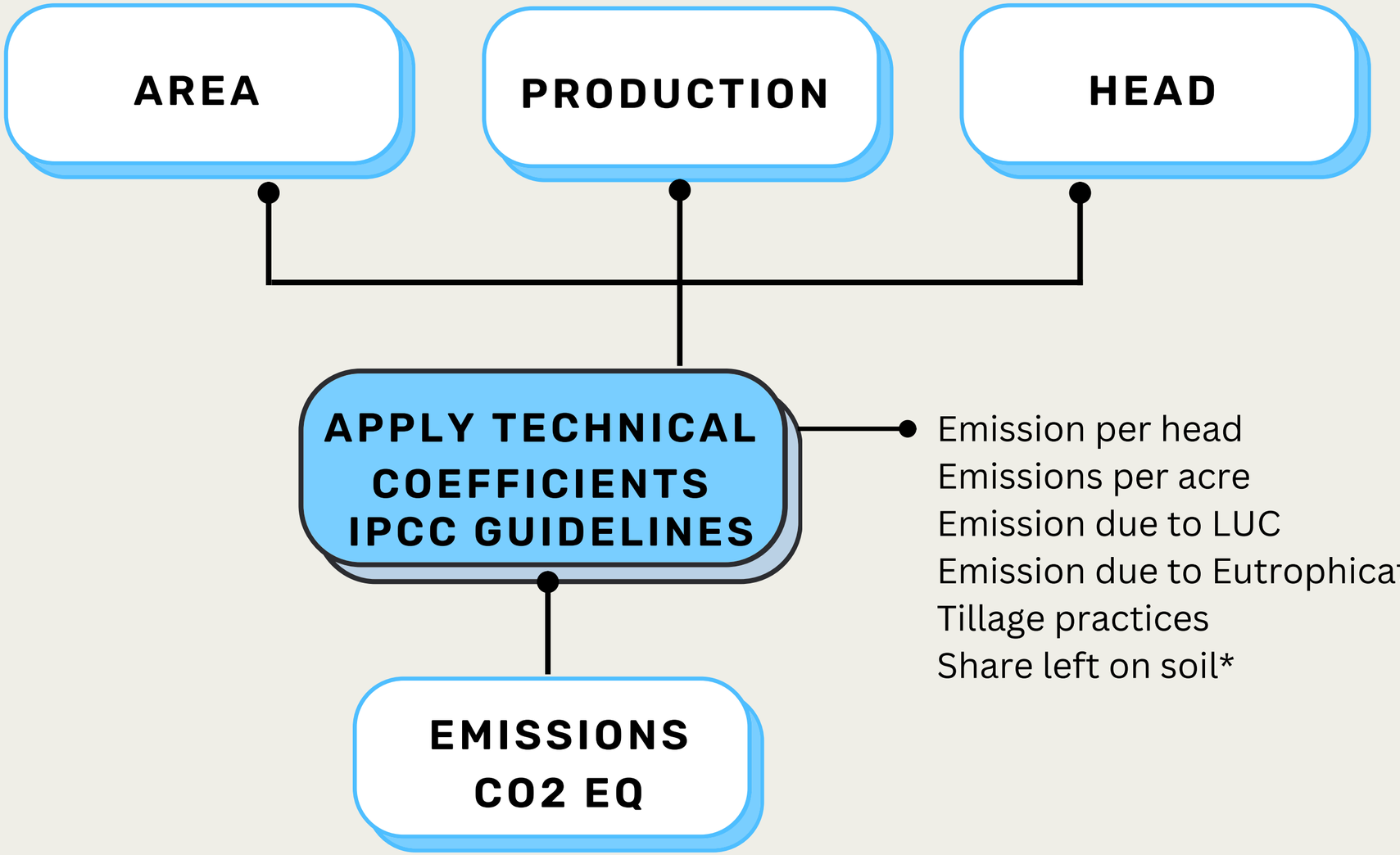
DATA COLLECTION AND PREPARATION

	Program	Year	Period	Geo Level	State	State ANSI	Ag District	Ag District Code	County	County ANSI	CORN-AREA-ACRES	CORN-production in BU	CORN Production in Kg	BARLEY-AREA-ACRES	I
0	CENSUS	2017	YEAR	COUNTY	ALABAMA	1	BLACK BELT	40	AUTAUGA	1.0	645.0	86350.0	3.042894e+06	0	
1	CENSUS	2017	YEAR	COUNTY	ALABAMA	1	BLACK BELT	40	BULLOCK	11.0	1292.0	109325.0	3.852511e+06	NaN	
2	CENSUS	2017	YEAR	COUNTY	ALABAMA	1	BLACK BELT	40	DALLAS	47.0	13876.0	1933303.0	6.812780e+07	NaN	
3	CENSUS	2017	YEAR	COUNTY	ALABAMA	1	BLACK BELT	40	ELMORE	51.0	2487.0	414272.0	1.459856e+07	NaN	
4	CENSUS	2017	YEAR	COUNTY	ALABAMA	1	BLACK BELT	40	GREENE	63.0	34.0	615.0	2.167203e+04	NaN	

DATA COLLECTION AND PREPARATION

BARLEY-AREA-ACRES	BARLEY PRODUCTION IN BU	BARLEY PRODUCTION IN Kg	RICE-AREA-ACRES	RICE - PRODUCTION, MEASURED IN CWT	Rice Production in Kg	SUGARCANE-AREA-ACRES	SUGARCANE, SUGAR - PRODUCTION, MEASURED IN TONS	SUGAR PRODUCTION in KG	WHEAT-AREA-ACRES	WHEAT - PRODUCTION, MEASURED IN BU	Wheat Production measured in Kg
0	0	0.0	NaN	NaN	NaN	NaN	NaN	NaN	334.0	20485.0	721872.3571
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.0	0.0	0.0000
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.0	0.0	0.0000
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

DATA COLLECTION AND PREPARATION



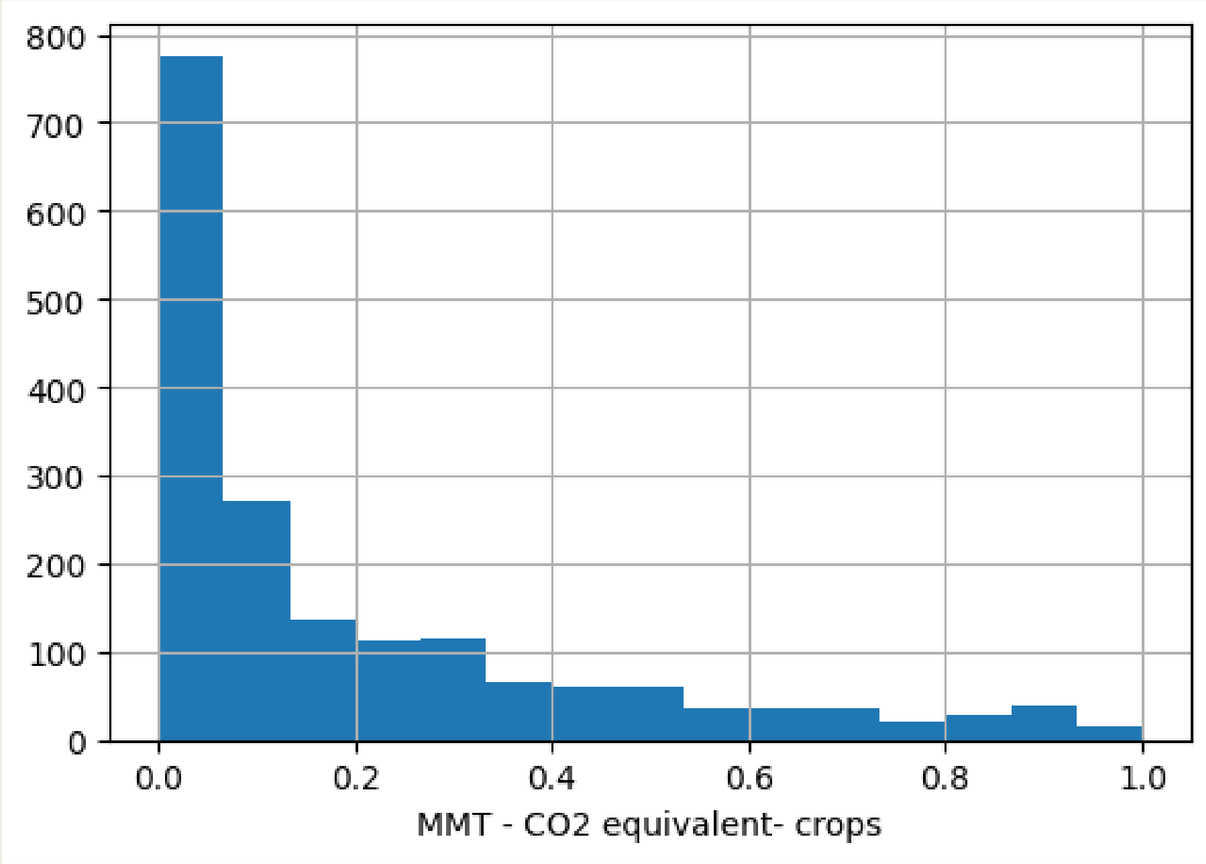
- Emission per head
- Emissions per acre
- Emission due to LUC
- Emission due to Eutrophication
- Tillage practices
- Share left on soil*

Crop-Scope1-MMT
0
0
0.05
0.01
0
0
0
0
0.01
0
0.03
0
0.03
0.01

INSIGHTS #1

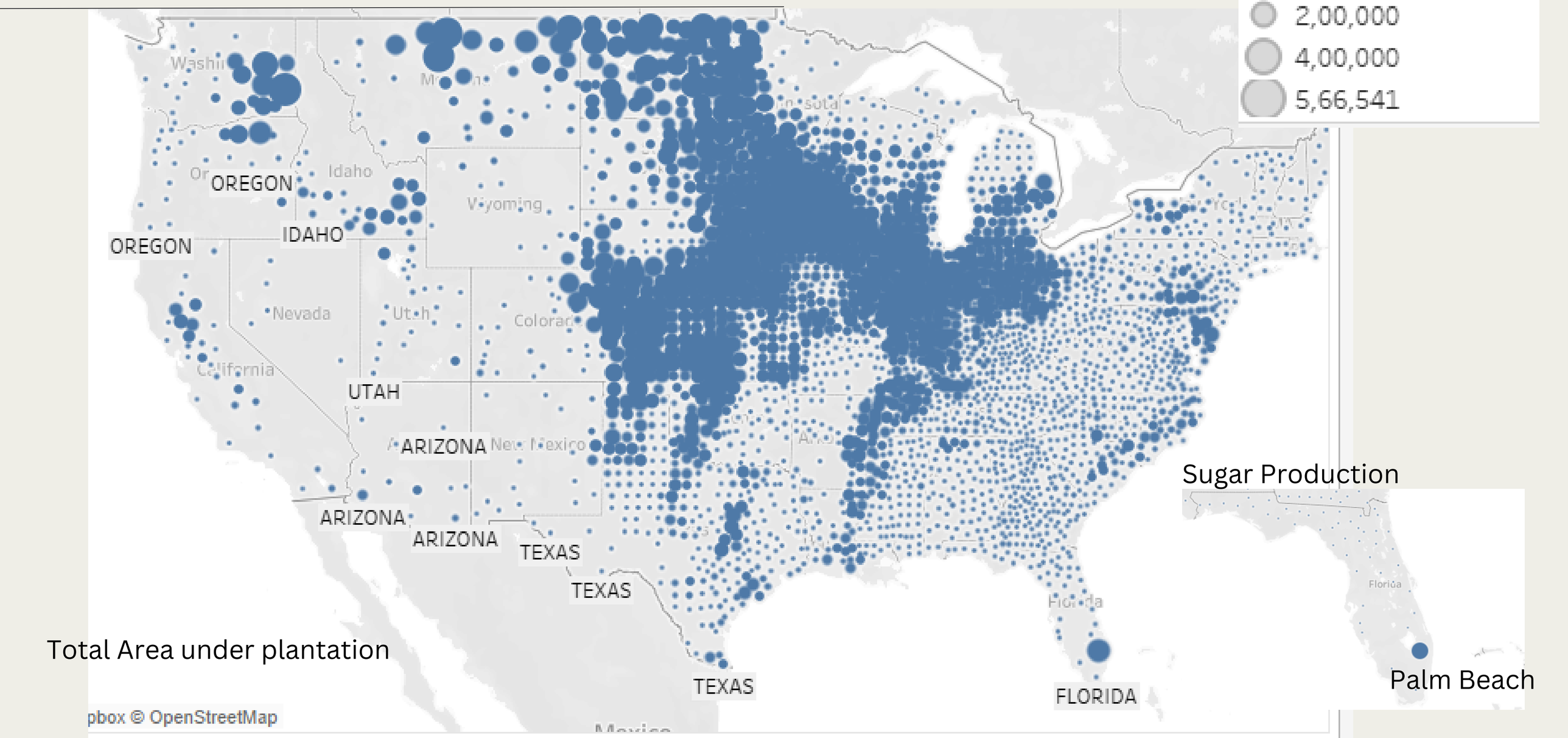
- Since the data is at county level: Majority of counties emissions are in range of 0.0-1.0 MMT CO2 equivalent

- As we move towards rights: Majority counties from Iowa, Illinois, Florida: Agricultural States of USA



Histogram of CO2 GHG emissions

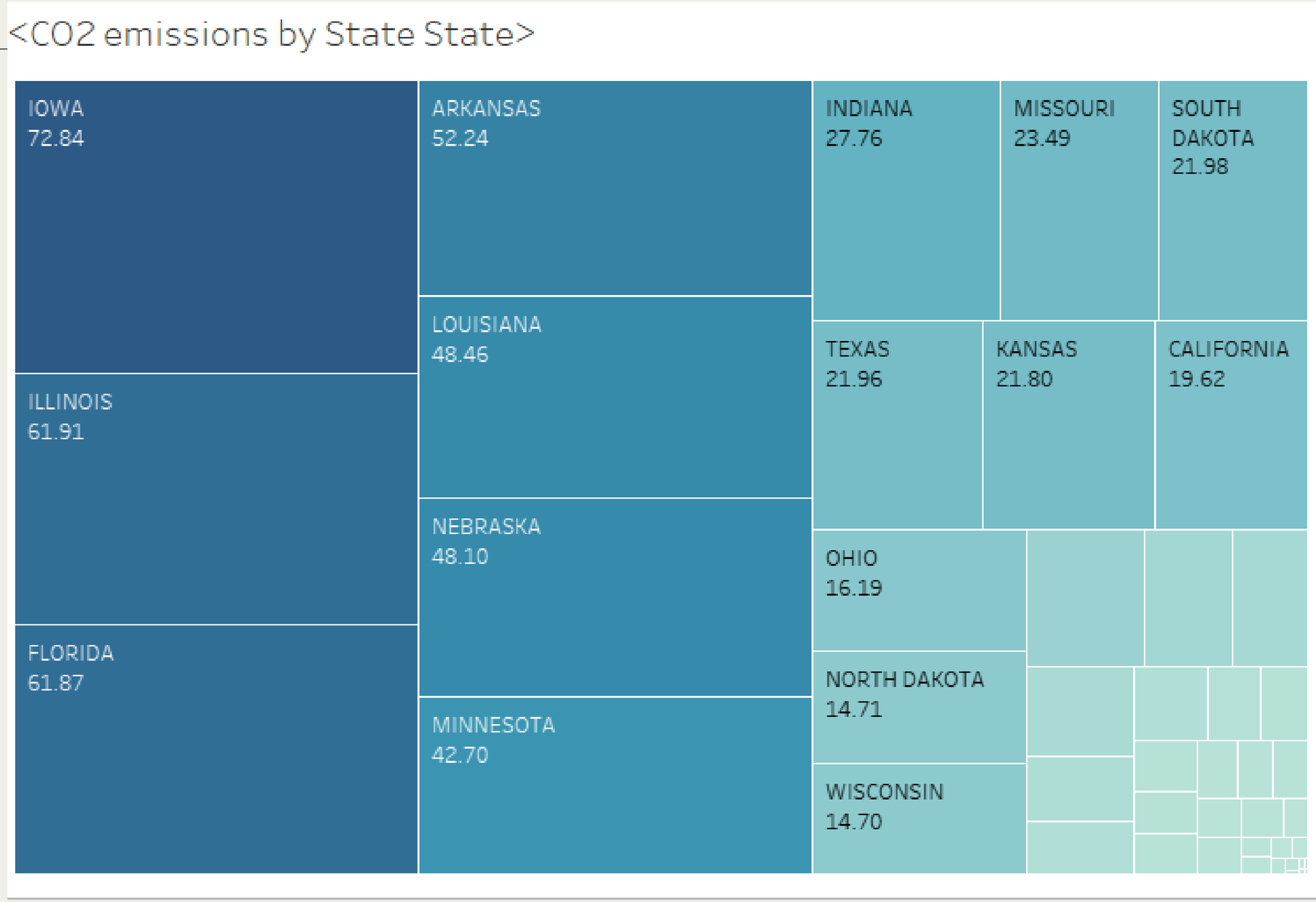
INSIGHTS #2


SUM(total area under p...
0
2,00,000
4,00,000
5,66,541
OREGON
IDAHO
OREGON
UTAH
ARIZONA
ARIZONA
ARIZONA
TEXAS
TEXAS
TEXAS
FLORIDA
Sugar Production
Palm Beach
Total Area under plantation
pbox © OpenStreetMap

INSIGHTS #3

- Iowa and Illinois are major producers of corn
- Corn and rice cultivation, in particular, can be associated with higher CO2 emissions
- Eutrophication-Rice
- Florida- outlier: Sugar

CO2 emissions by State

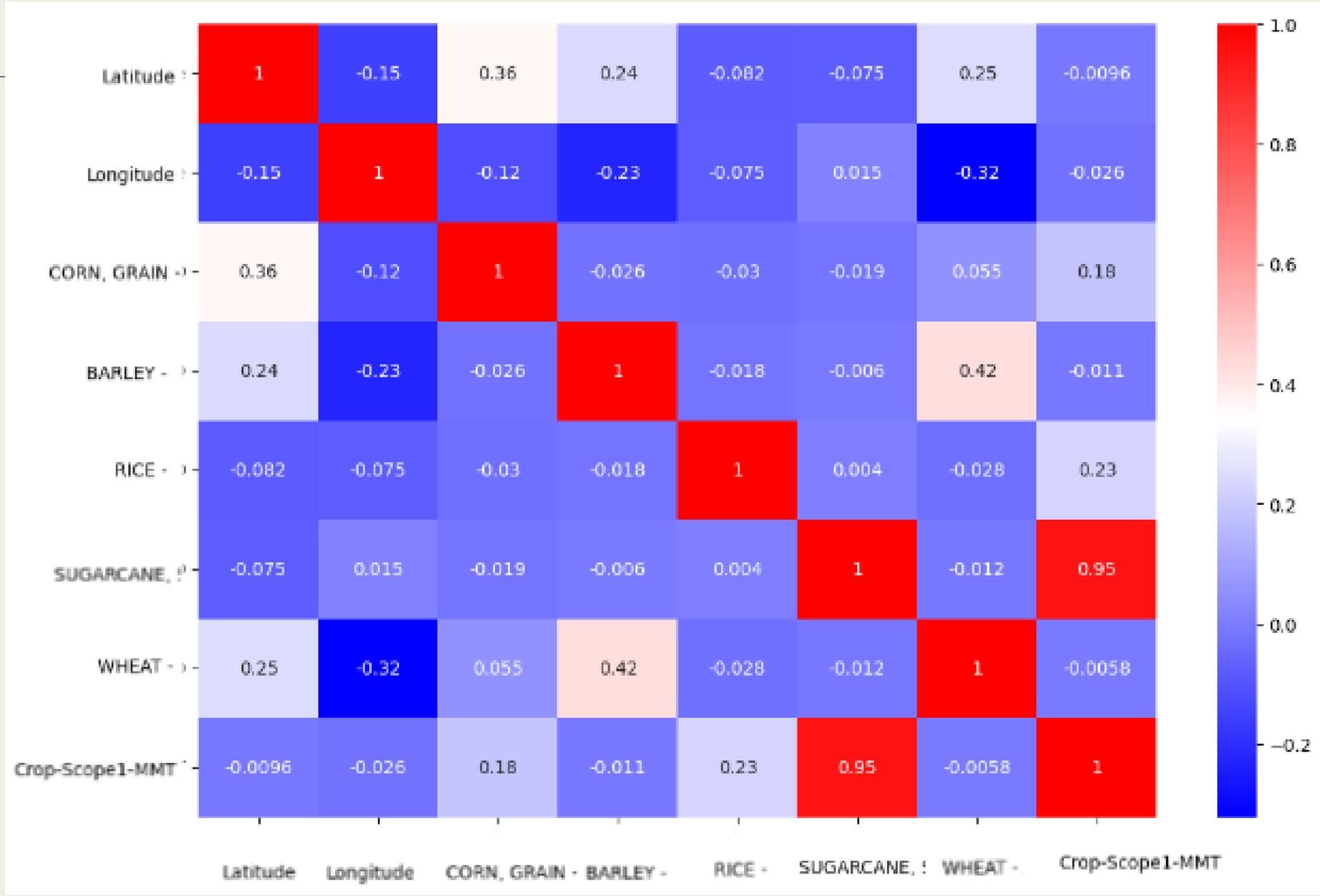


INSIGHTS #4

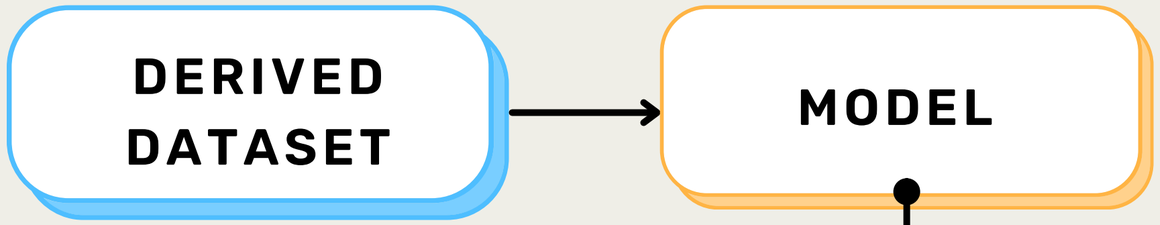
- Barley is often part of crop rotation systems. Crop rotation practices help improve soil health and fertility -> increased carbon storage in the soil.

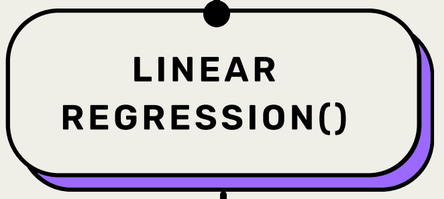
- Barley is typically grown with fewer synthetic fertilizers and pesticides compared to some other crops

CORRELATION MATRIX



MODEL BUILDING





FunctionTransformer(Lat,Long)
Spherical Co-ordinates -->
Cartesian co-ordinate system

```
model.score(X_test, y_test)
```

```
0.8615725694111582
```

```
model2.score(X_test, y_test)
```

```
0.9689571953684224
```

PRODUCT

GreenAg

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A New Way To Reduce Emissions

Join us on this journey as we strive to revolutionize emissions estimation and support sustainable practices in the agricultural industry. Together, we can make a significant difference in reducing crop-generated emissions and preserving our planet for future generation. Further, as the world's population increases, farming will play an increasingly important role in sustaining global societies.

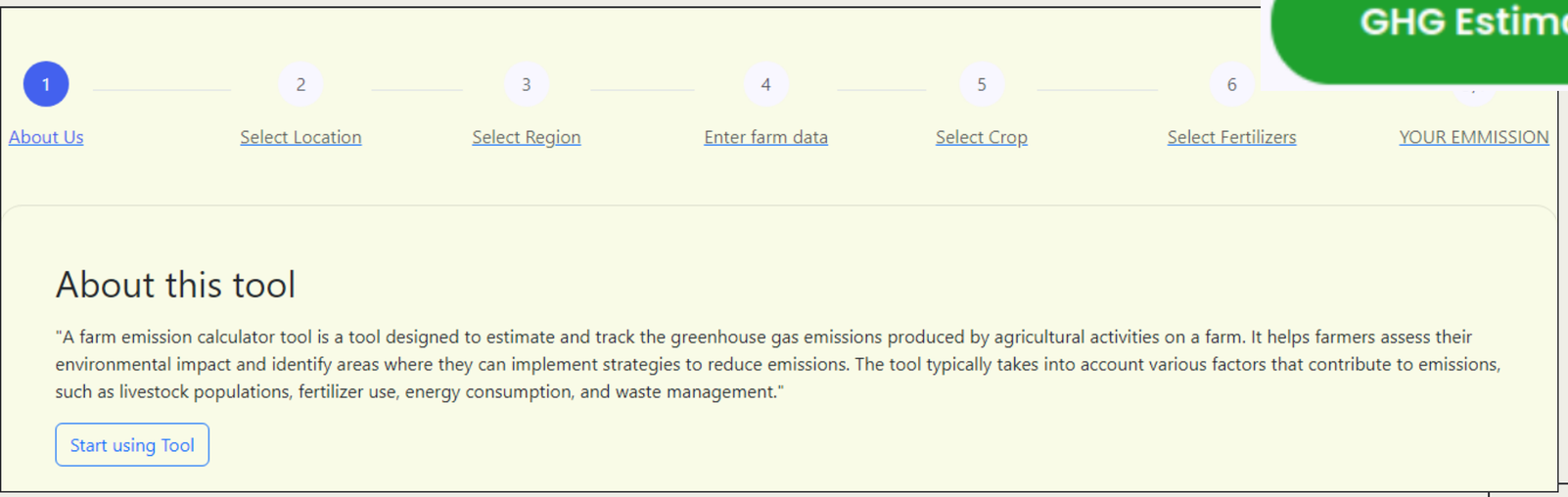
GHG Estimator ML- GHG Estimator

OUR OFFERINGS

GHG Estimator

Farm Specific Estimator
Rule Based Model
Inputs:

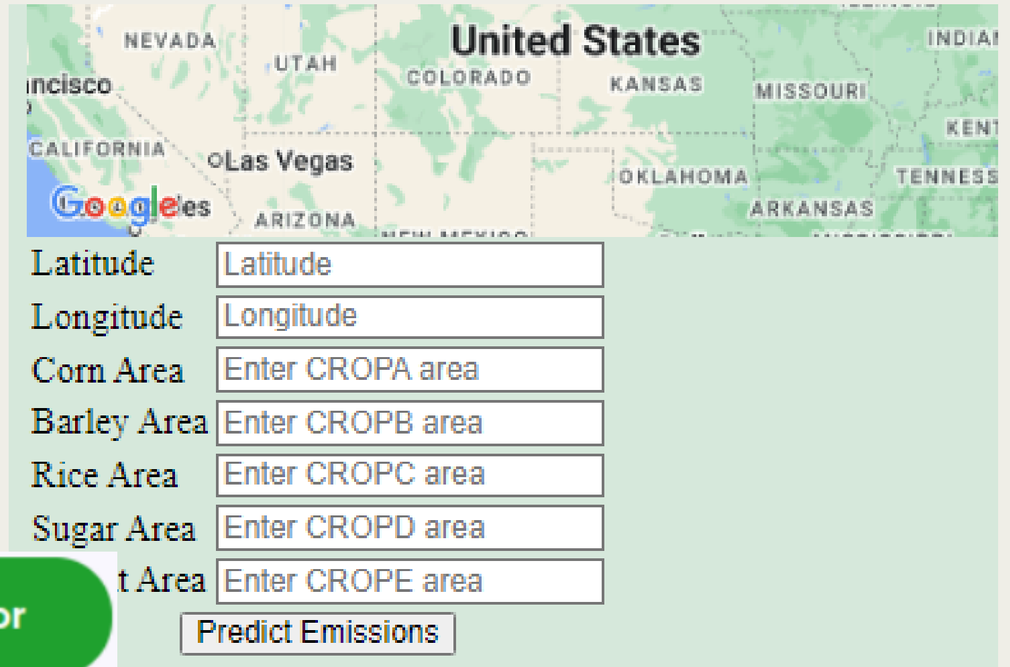
- Crops
- Area
- Fertilizer
- Lime
- Tillage etc



ML based estimator
Inputs:

- Spatial Data:
  - Latitude
  - Longitude
- Crops
- Area

ML- GHG Estimator



TECH STACK
















Source: Google Images

IMPACT

Empowering Farmers with Data-Driven Insights on GHG emission

Reduction in Emissions and Improved Sustainability

Policy development and regulation

Promote Sustainable agricultural practices

REFERENCES

- Team board : https://aps06.notion.site/11211d1d028f4f338f04f20ffafdaed9?v=1767f93a00014193a6c173bf003907b1&pvs=4
- https://quickstats.nass.usda.gov/#E6928B44-9AE0-3902-9760-8FCDFD3CFD3C
- https://cfpub.epa.gov/ghgdata/inventoryexplorer/#agriculture/entiresector/allgas/category/all
- https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

Thank you!

ACKNOWLEDGEMENT:

WE WOULD LIKE TO EXPRESS OUR SINCERE GRATITUDE TO OUR COACH, ANAND SIR, FOR THEIR INVALUABLE GUIDANCE AND SUPPORT THROUGHOUT THIS PROJECT.

Q&A

TEAM09