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Compiling Food Balance Sheet (FBS) using FAO Supply Utilization Accounting (SUA) data to improve food system modeling

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We compiled a new SUA dataset of 530 agricultural commodities and developed a consistent aggregation method.

1. Compiling and balancing global agricultural supply utilization accounting data

The Food and Agriculture Organization (FAO) serves as a primary source of data in research related to global agriculture development, land use, trade, food security, nutrient, and dietary health.

- recently released a detailed Supply Utilization Accounting (SUA) dataset, which includes details for processed commodities.
- Possible inconsistencies/discrepancies across FAO datasets: production (QCL), trade (TCL; TM), food balance sheets (FBSH; FBS), non-food balance (CB).
- We recompile and balanced the data for all available agricultural commodities.
- Important to maintain data balance across different dimensions!

Balance across space

- $\sum_{reg} Import_{reg} = \sum_{r} Export_{reg}$
- $\sum_{reg} Net trade_{reg}$

Balance across time

- Opening $stock_t = Closing stock_{t-1}$
- Opening $stock_t + Stock \ variation_t = Closing \ stock_t$

Balance across Supply - Utilization (market clearing)

• Opening $stock_{reg,t} + Production_{reg,t} + Import_{reg,t} = Closing\ stock_{reg,t} + Consumption_{reg,t} + Export_{Reg,t}$

Balance along supply chain

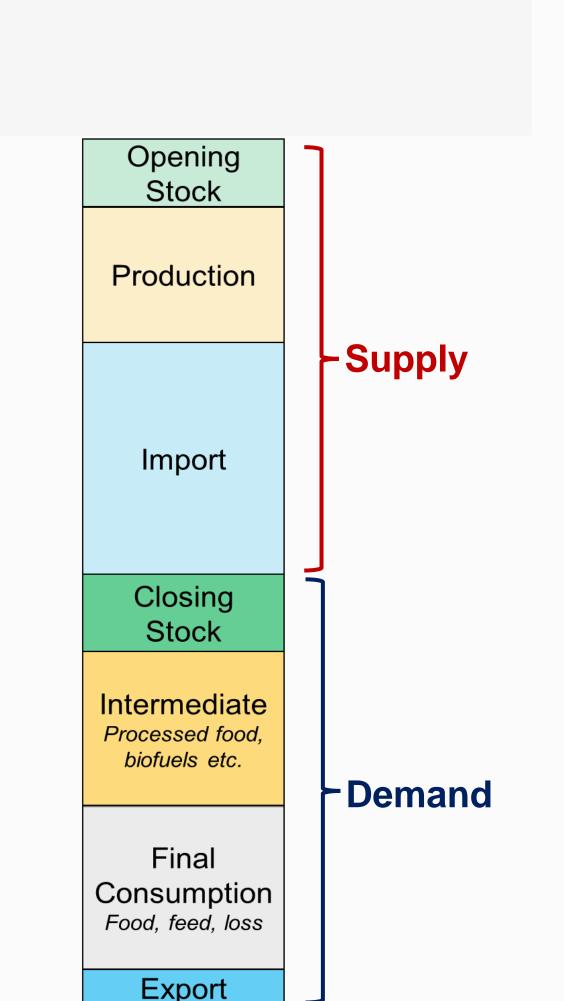
• $extraction\ rate = \frac{senondary\ production}{r}$ primary processed used

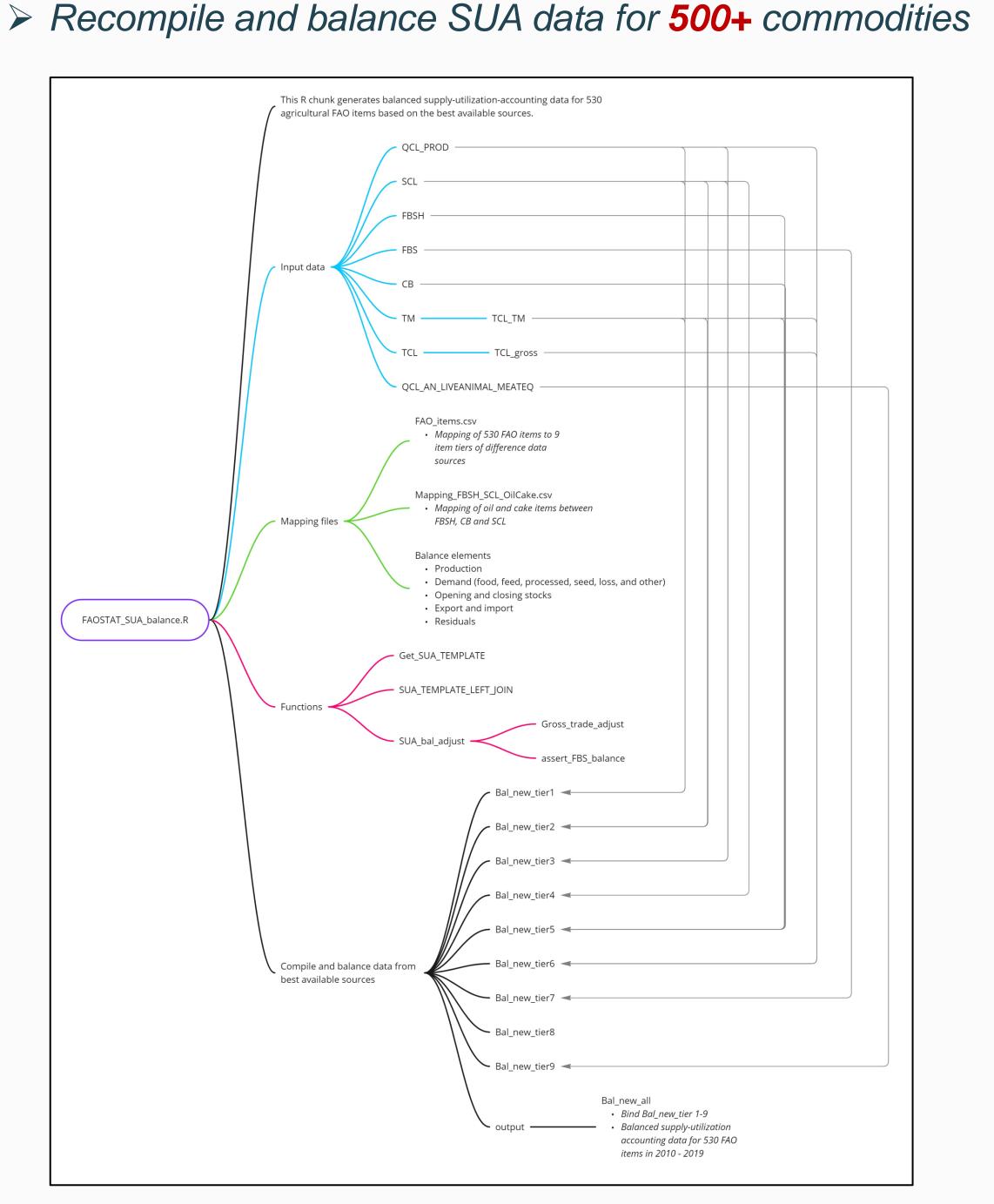
Balance in primary production input to output

- $Crop\ yield = \frac{primary\ output}{harvested\ area}$
- Feed conversion rate = $f^{eed input}$

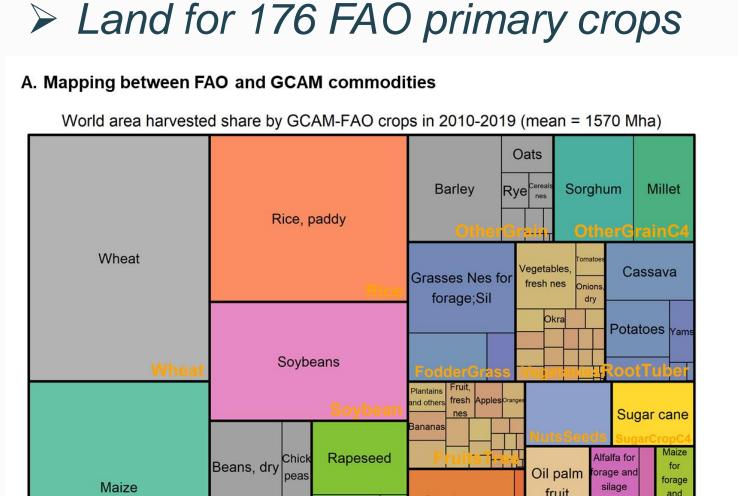
Balance in food availability and macronutrients

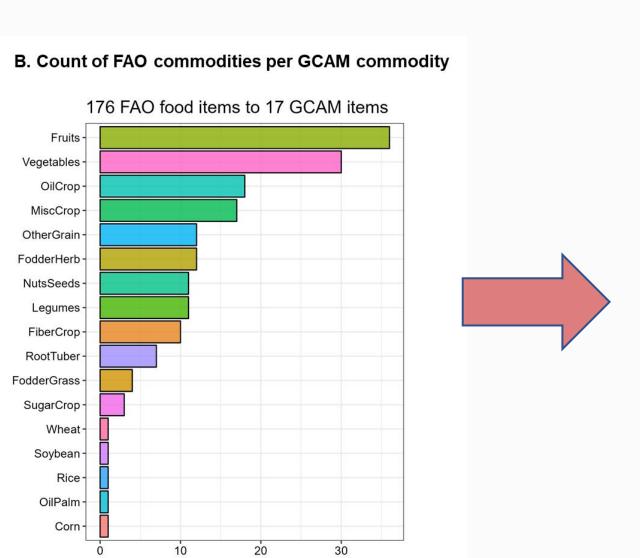
• Tracing for calories, protein, and fat in food tonnes



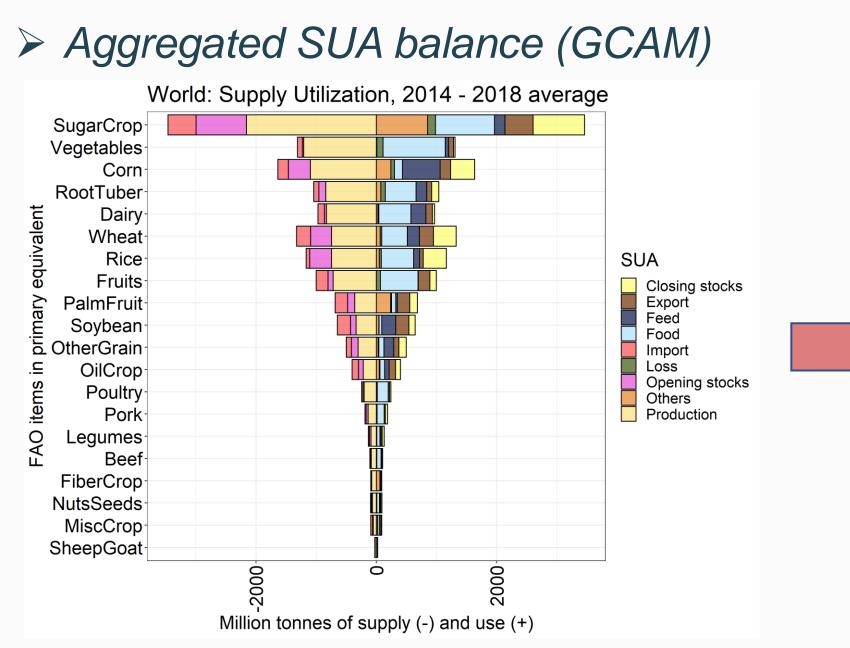


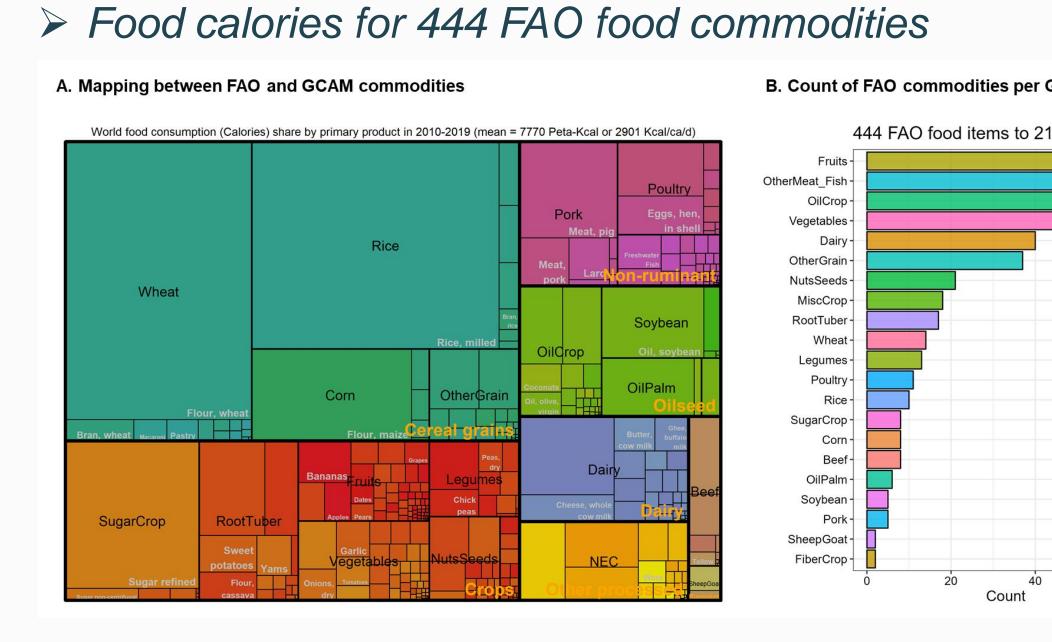
2. Connecting land hectares to food nutrients for global agroeconomic modeling (GCAM)

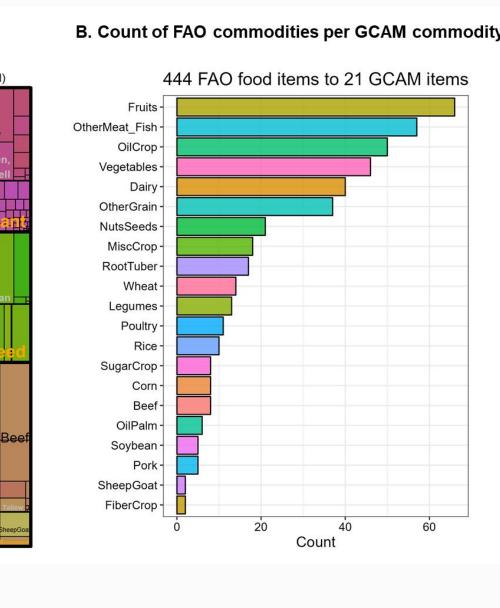




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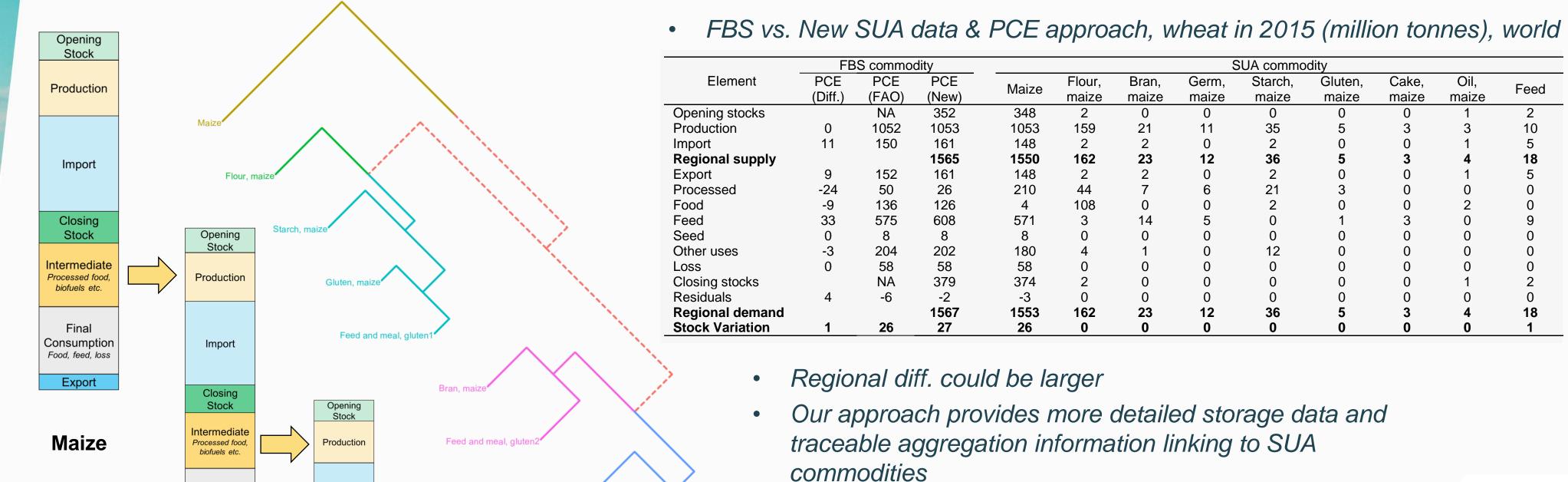


4. Summary

> Illustration of the Primary Commodity Equivalent (PCE) approach for aggregating agricultural commodities (wheat example in left panel)

3. Aggregation to primary commodity equivalent (PCE)

> Comparison between FAO FBS and the new method (wheat example in the table on the right)



- We compiled a SUA dataset of 530 agricultural and food commodities and constructed a nested commodity mapping to understand the relationship across all the commodities.
- We developed a robust PCE approach that allow aggregating agricultural and food commodities along the supply chain.
- The approach is transparent, reproducible, consistent, and more flexible and results are more explainable.
- A R repo will be made publicly available, but it would benefit from the continued efforts of a broader community to scrutinize, improve, update, and maintain the data processing.
- Historical data, especially data in the model base year, is extremely important for global economic equilibrium modeling. Thus, carefully bridging the gap between the datasets and balancing assumption enhances scientific robustness in economic modeling.

Livestock PCE Aggregation Mapping

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Gluten



Crops

Aggregation

Mapping

PCE