

Quantifying Regional and Temporal Heterogeneity in Greenhouse Gas Emissions from Indian Diets



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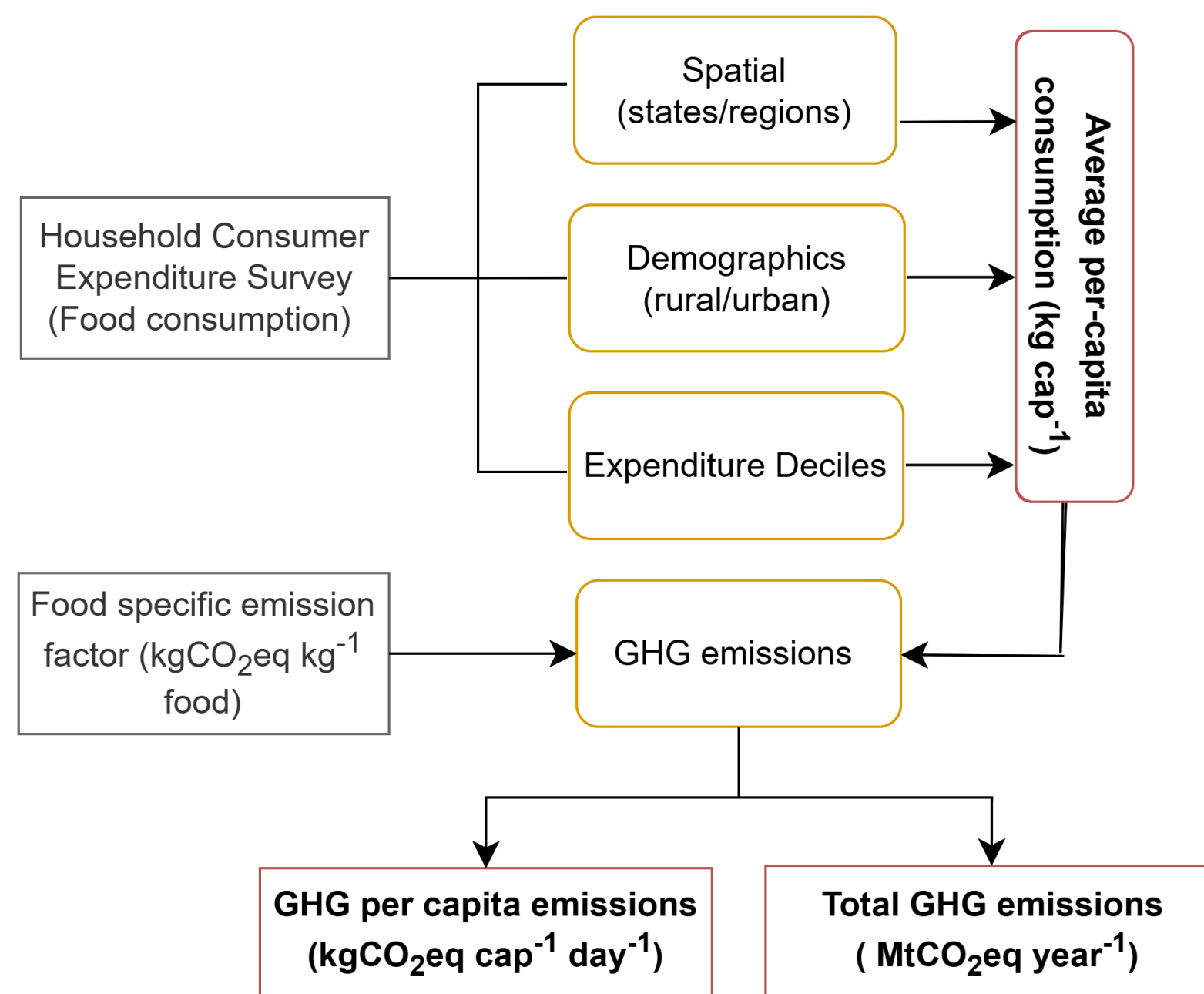
1) Introduction

- Ensuring adequate and nutritious food supply while reducing environmental impacts remains a significant challenge for India's food system.
- Shifts in Indian dietary patterns likely impeding progress towards India's net-zero target by 2070.
- Yet, the characterization of climate footprints of Indian diets and prevalent associated heterogeneity due to food choices, regions and socio-economics remains limitedly quantified.

2) Methodology

Dietary greenhouse gas (GHG) emissions are quantified by combining dietary data for 1999-00, 2011-12 & 2022-23 years and GHG emissions (CO₂, CH₄, N₂O) across the life cycle of food products. Food specific emission factors are derived from published literature (Green et al., 2018).

Figure 1: Estimating GHG emissions from Indian diets across regions, demographics and economic factors



3) Findings

Figure 2: Food consumption patterns have evolved over the years, with an increase in animal-based food from 1990 to 2022, along with continued high reliance on wholegrains in India

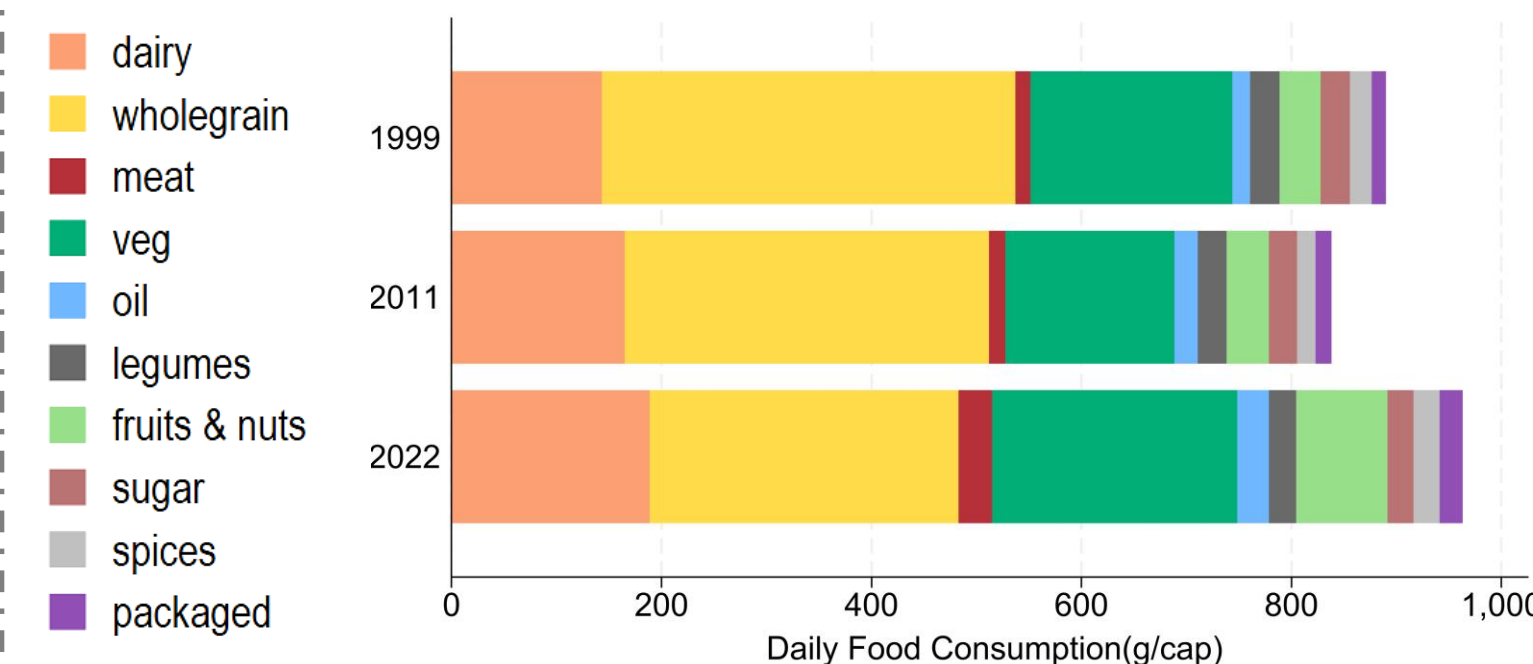


Figure 3: Increase in total GHG emissions (MtCO₂eq year⁻¹) from 1999 to 2022, highlighting the shift from wholegrain-dominated to dairy-dominated emissions

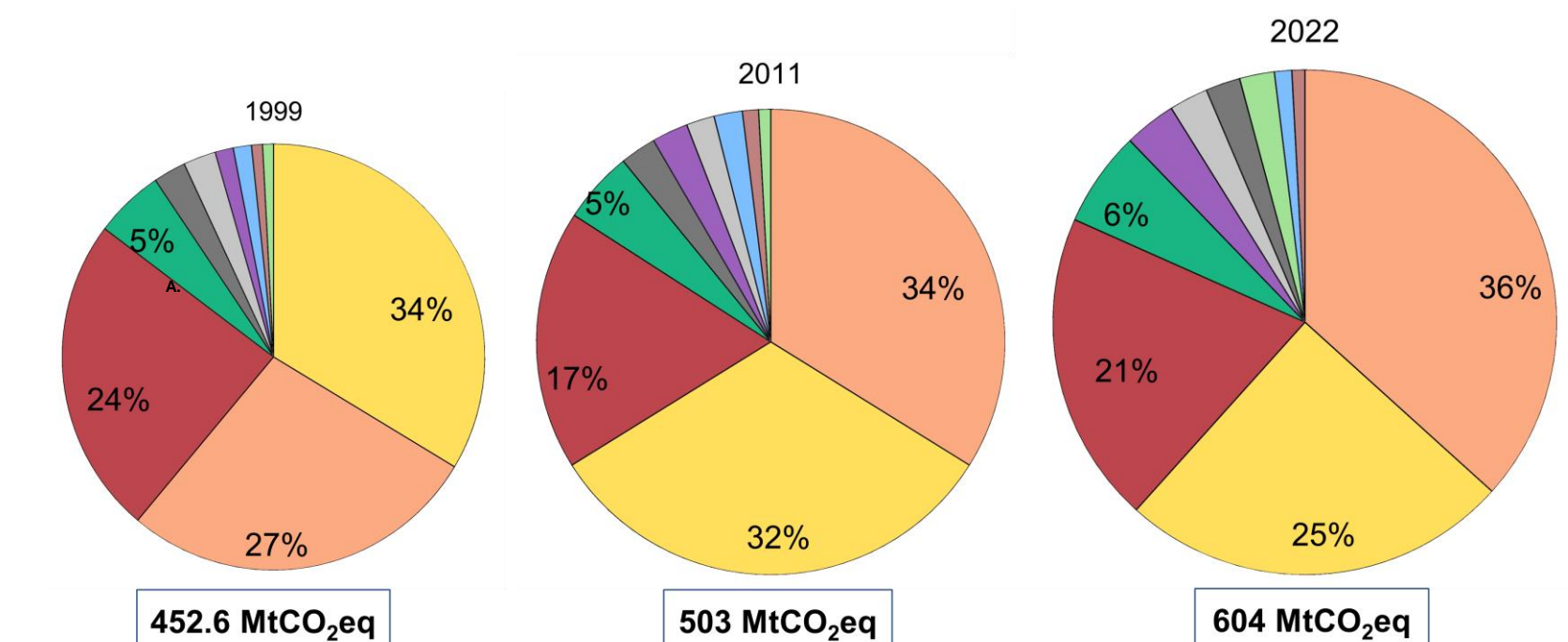


Figure 4: Total GHG emissions and per capita dietary emissions at the state level for the 2022 year reveal spatial heterogeneity driven by regional factors

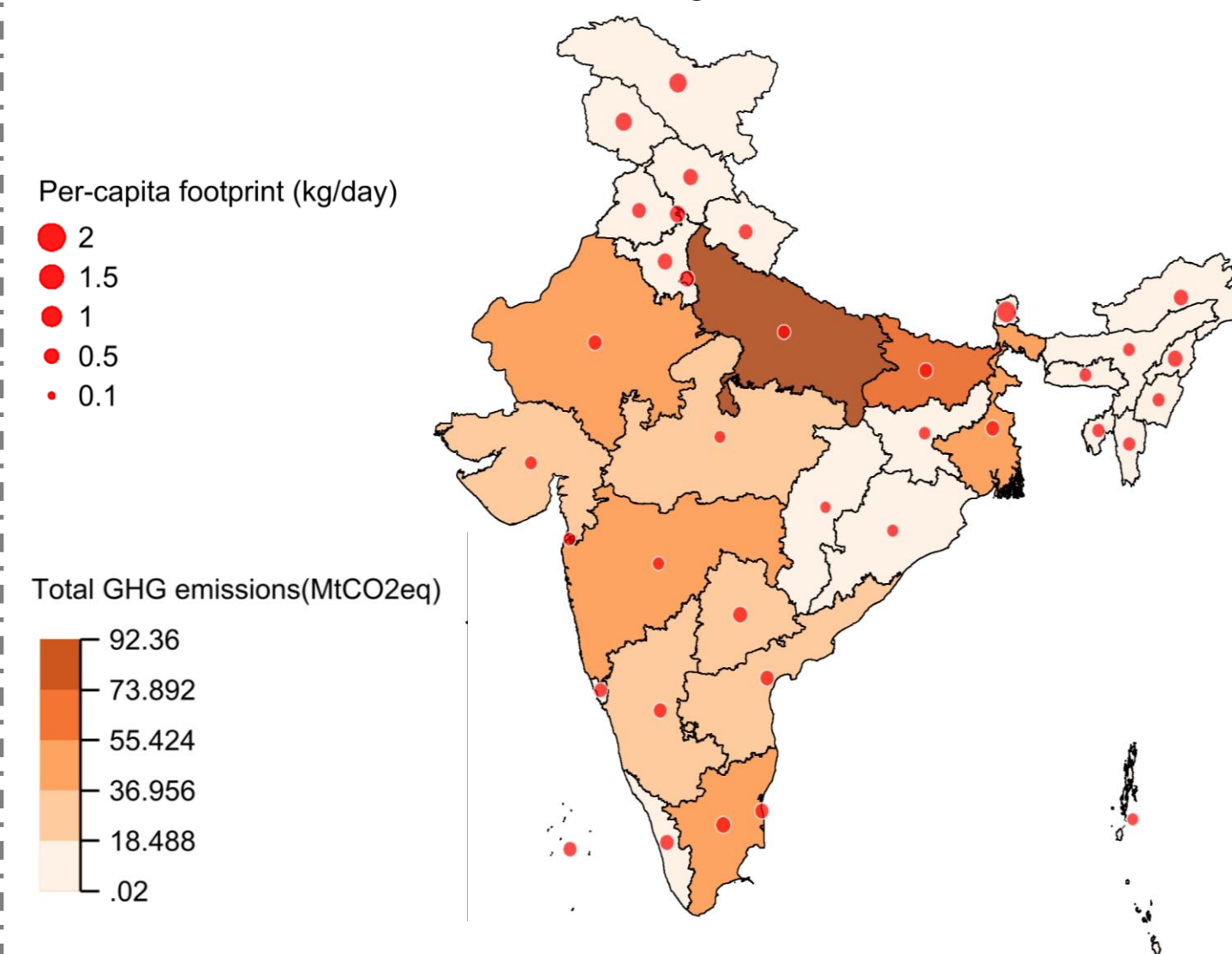
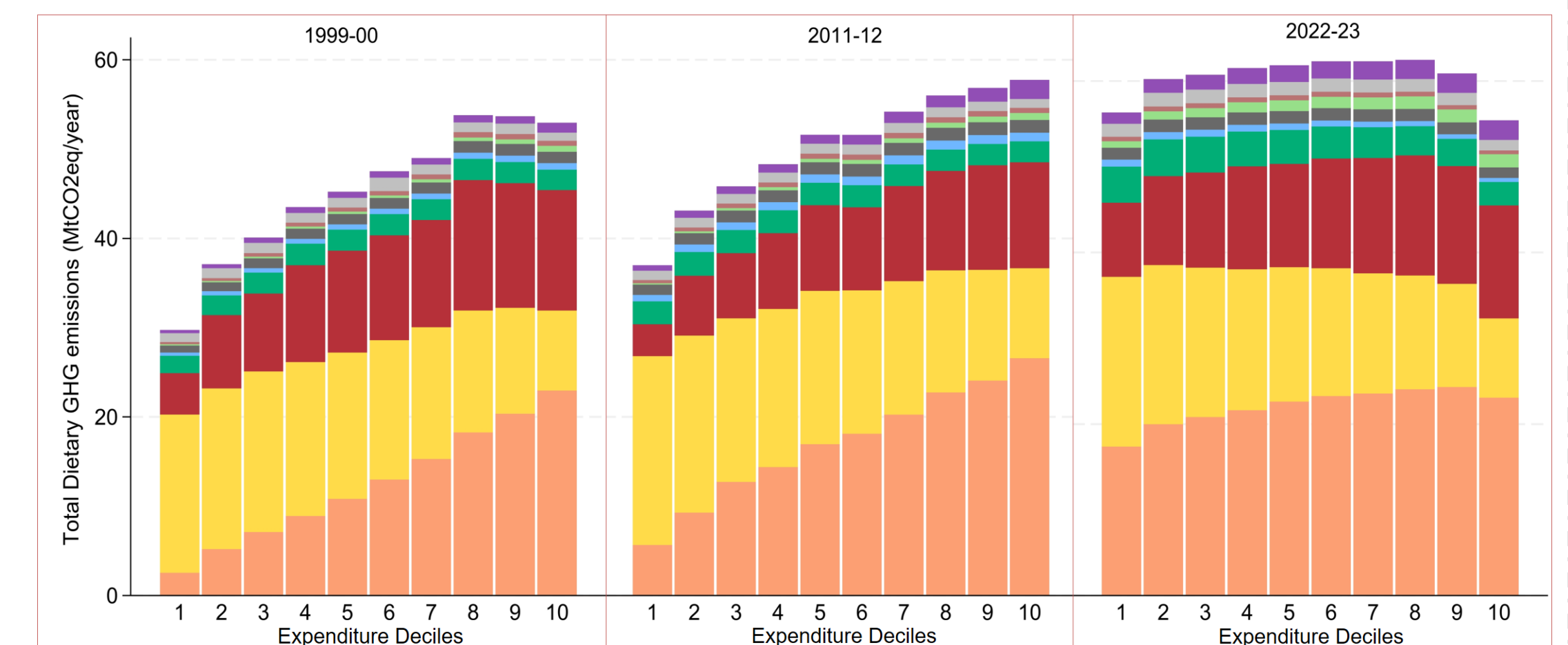


Figure 5: Total greenhouse gas (GHG) emissions (MtCO₂eq year⁻¹) by expenditure deciles for 1999, 2011, and 2022 show that total emissions increase with affluence, with a shift towards increased animal-based foods and a decline in whole grains (decile 1 = poorest, decile 10 = richest)



4) Key Takeaways

- From 1999-2022, total GHG have increased by 21% (151.26 MtCO₂eq), primarily driven by dairy, which contributed 64% (96.16 MtCO₂eq) of the total increase.
- Contribution of animal-based food in total GHG emissions remains dominant, with a 57% (341 MtCO₂eq year⁻¹) share in 2022, representing an increase of 5% since 1999.
- Large heterogeneity between states in per-capita emissions (1- 2.8 kgCO₂ day⁻¹) and total GHG emissions, with nearly 50% of total emissions contributed by only five states.
- Reducing emissions from animal-based food and wholegrain production while encouraging nutritious diets is crucial for meeting net-zero targets.

5) References

- Green et al., 2018. <https://doi.org/10.1016/j.scitotenv.2018.06.258>
- Household Consumer Expenditure, 55th Round, Schedule 1, National Sample Survey, 1999-2000.
- Household Consumer Expenditure Survey, 68th Round, Type 1, National Sample Survey, 2011-2012.
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