UCI SUSTAINABLE SYSTEMS ANALYSIS

UCI Solutions that Scale

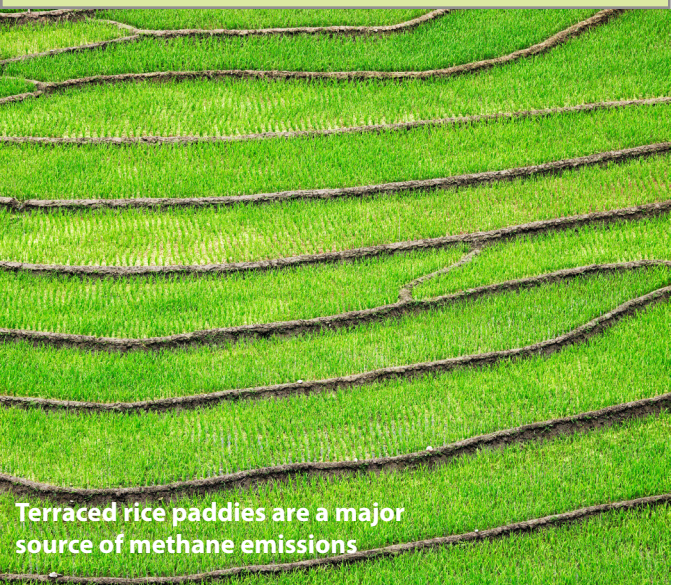
RESEARCH BRIEF

KEY POINTS FOR DECISIONMAKERS

- **Analyzing sources and drivers of land-use emissions highlights key mitigation opportunities.** Certain countries, processes, and products account for disproportionately large shares of land-use emissions. E.g., although red meats supply just 1% of calories produced worldwide, they account for 25% of land-use emissions. The countries with the highest emissions intensity of agricultural production include a mix of tropical and land-intensive systems which are uniformly poor and prone to agricultural expansion.

- **Even in affluent countries, land-use emissions are not convincingly decreasing.** Although our results may help to prioritize mitigation efforts, they also suggest that big reductions in land-use emissions will require similarly drastic changes in agricultural production and/or agricultural practices.

- **Land-use emissions are a major threat to international climate goals.** Even if global land-use emissions per capita reach the current level in Europe (<1 ton $CO_{2\text{-eq}}$ per person per year), global land-use emissions would be 5-13 Gt $CO_{2\text{-eq}}$ per year in 2100—a quantity difficult to reconcile with ambitious international climate goals.



Terraced rice paddies are a major source of methane emissions

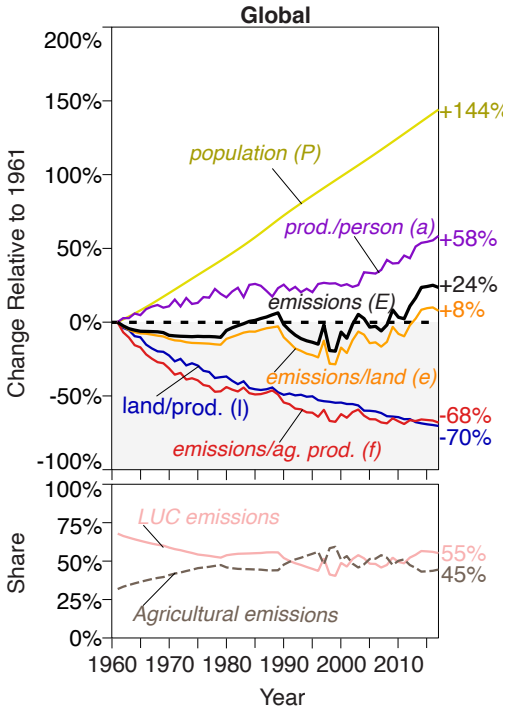
Detailed accounting of land-use emissions reveals mitigation opportunities and challenges

Agriculture and land-use change together represent roughly a quarter of human GHG emissions each year. We need to track them more carefully and better understand trends and their drivers.

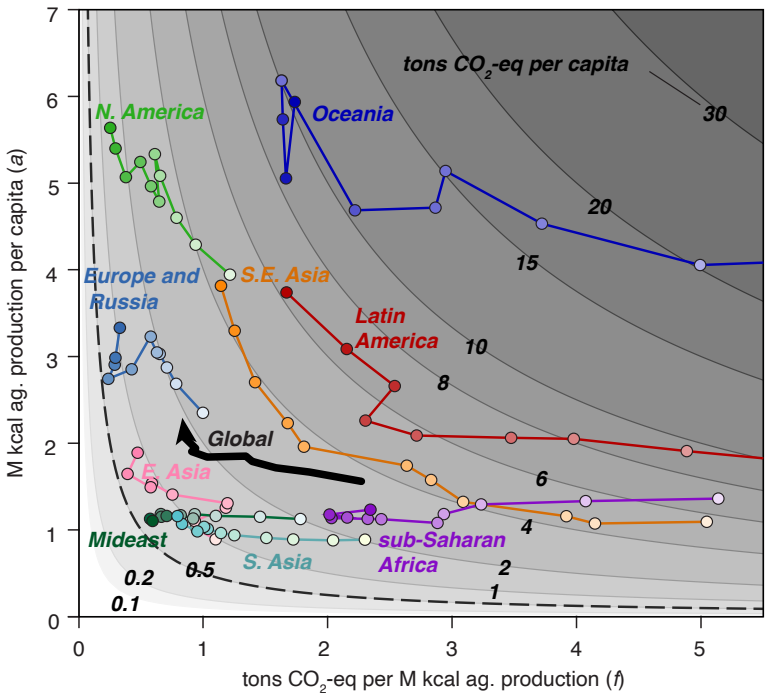
In contrast to fossil fuel CO_2 emissions, trends and drivers of land-use GHG emissions (from both agriculture and land-use change) have not been comprehensively and systematically assessed.

We analyze country-, process-, GHG- and product-specific land-use emissions from 1961 to 2017, including demographic, economic and technical drivers of emissions and related uncertainties.

Since 2001, rising emissions per land area used have caused emissions to increased by 2.4 Gt $CO_{2\text{-eq}}$/decade to 14.6 Gt $CO_{2\text{-eq}}$ in 2017. Land-use change in low-income regions (Latin America, Southeast Asia, and sub-Saharan Africa) account for most of the growth in emissions, but aggregate emissions are not convincingly decreasing in any region and are nowhere <0.5 tons $CO_{2\text{-eq}}$ per person.



Drivers of land-use emissions. Upper panel shows changes in emissions (black) and "Pale" factors such as agricultural production per person (purple), emissions per land area (orange), land area per calorie produced (blue) and emissions per calorie (red). Lower plot shows relative shares of land-use change and agricultural emissions.



Trends in per capita land-use emissions. Lines show regional trends in calories produced per person and the emissions intensity of that production 1961-2017 (from light to dark points). Contours show tons of $CO_{2\text{-eq}}$ emissions per person. Even in the most affluent regions, where land-use change emissions are small, per capita emissions have not decreased below 0.5 tons $CO_{2\text{-eq}}$ per person (dashed black contour line).

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Beef cattle

FOR MORE INFORMATION

Explore and download the Comprehensive Accounting of Land-Use Emissions (CALUE) database at

sustsys.ess.uci.edu/CALUE/

CALUE