



United States Department of Agriculture

Global Economics and Food Demand

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Kansas City, Missouri, USA

The 25th Asia-Pacific Integrated Modeling (AIM) International Workshop
National Institute for Environmental Studies

18-19 November 2019

Tsukuba, Japan

The findings and conclusions in this presentation are those of the author and should not be construed to represent any official USDA or U.S. Government determination or policy. This research was supported in part by the U.S. Department of Agriculture, Economic Research Service.

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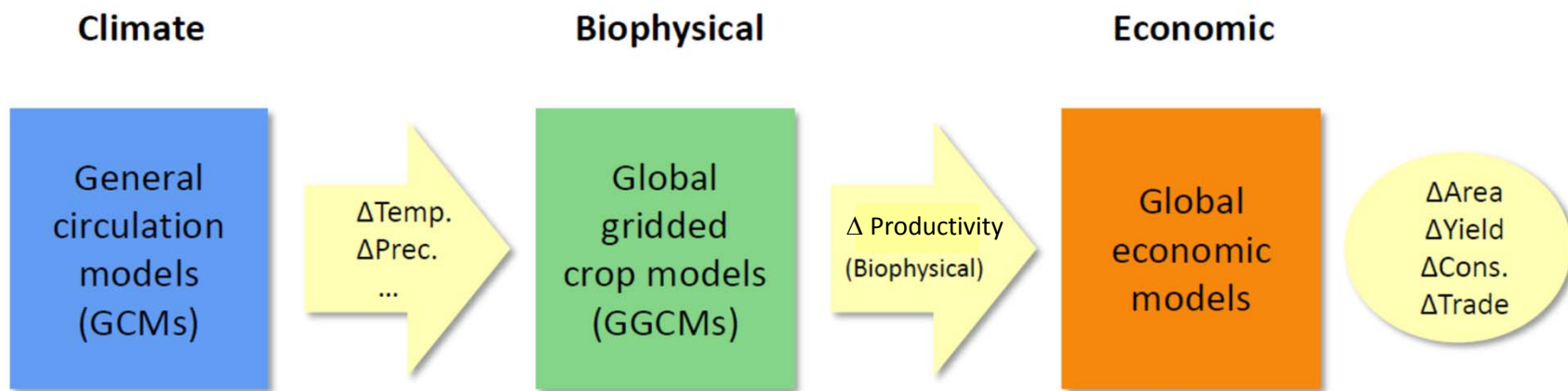


Outline

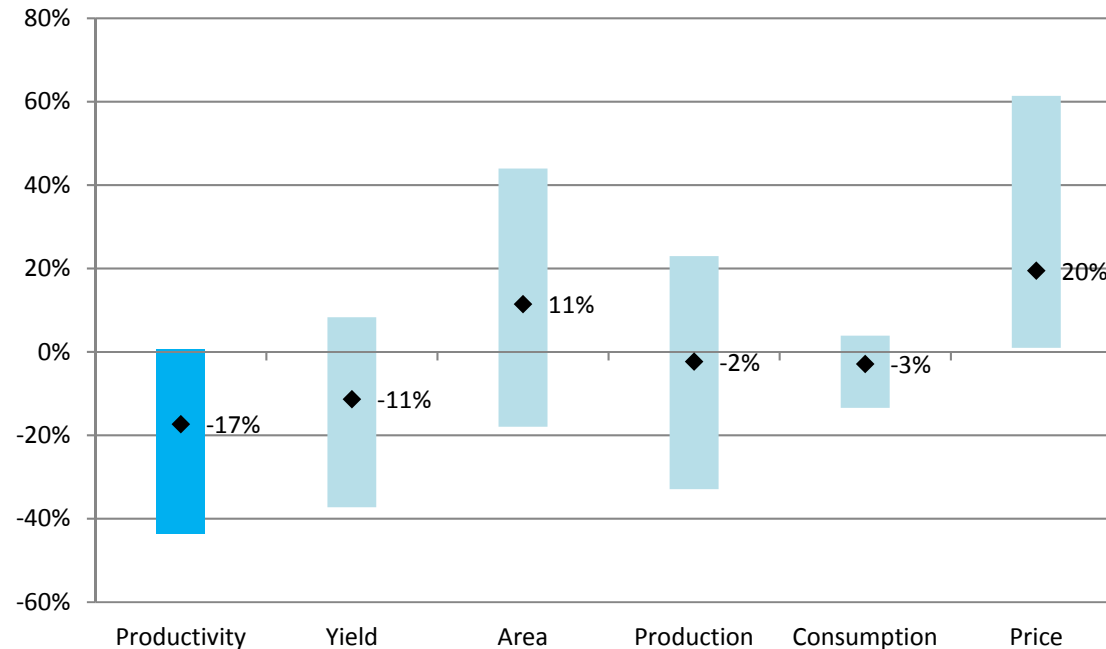
- Review of climate impact and adaption study by the Agricultural Model Intercomparison and Improvement Project (AgMIP)
- Historical food consumption by major food group in large countries
- Model projections of world food demand to 2050
 - Per capita calories available for consumption
 - Crop calories needed to meet food demand
 - Variation across Shared Socio-economic Pathways
- Implications for land use



The climate modeling chain: From biophysical to socioeconomic



Economic Responses to a Decline in Agricultural Productivity Due to Climate Change in 2050



Change in **Productivity** is the exogenous shock. All other changes are endogenous responses relative to baseline. The black diamond is the average (mean) percent change with climate change compared to no climate change in year 2050; the height of a column is the range across climate models, crop models, and economic models. Results are a world average across major field crops: wheat, rice, coarse grains, and oil seeds.

Source: Nelson et al. (2014) *Proceedings of the National Academy of Sciences*, Vol. 111(9): 3274-3279.

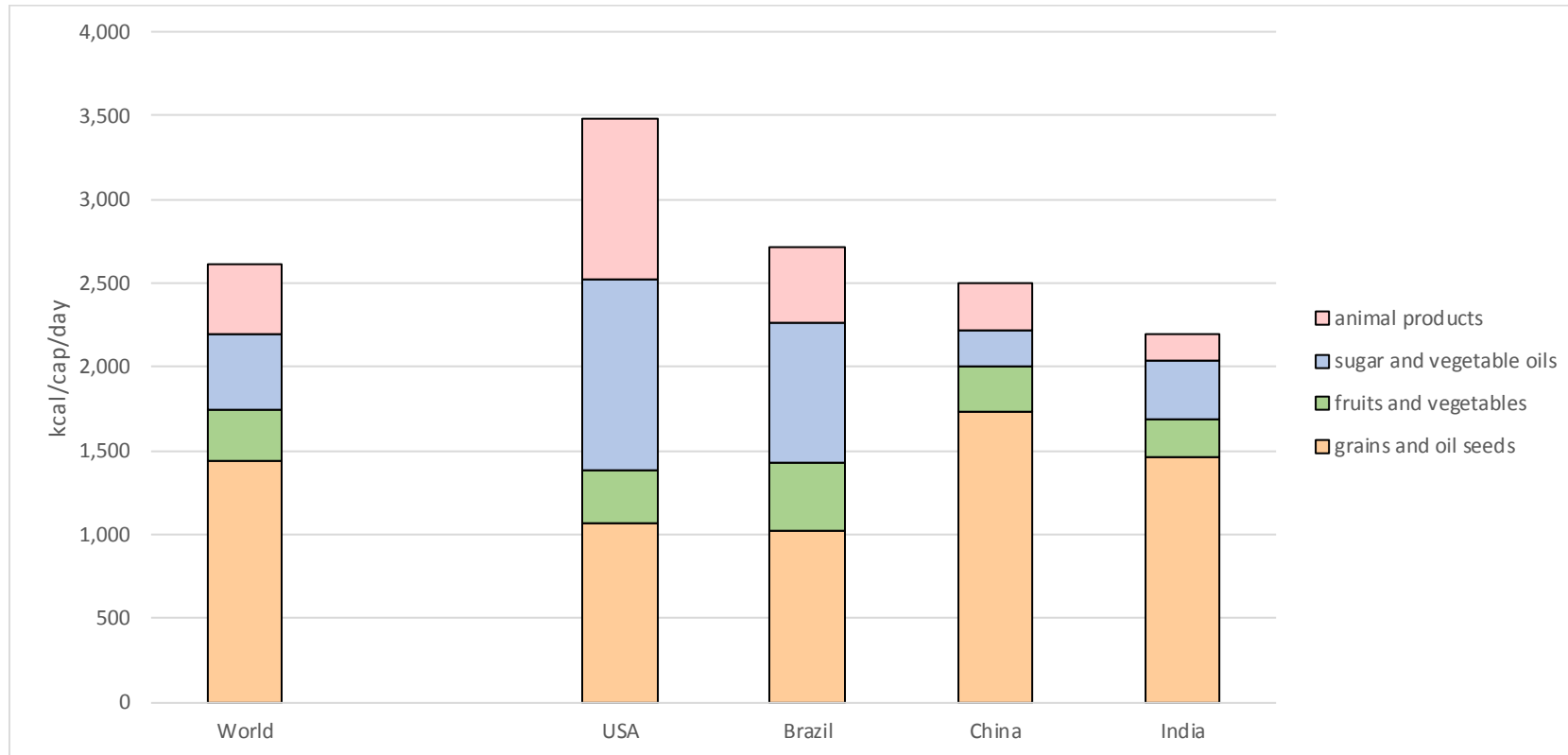


Future demand for food

- World demand for food calories
 - Food and Agriculture Organization (FAO) of the United Nations provides historical data to 2013
 - Food available for consumption (includes waste at home and in restaurants)
 - Calories as unit of aggregation
 - Model-based projections to 2050
 - Shared Socioeconomic Pathways (SSPs) provide a range of scenarios, including variation in global diets, population, and per-capita income
 - Global demand for food calories increases in all scenarios from 2010 to 2050
- World demand for calories from crops
 - Model-based projections from 2010 to 2050
 - Demand for crop calories increases by 52 percent from 2010 to 2050 in “middle of the road” scenario, or about 1.1 percent per year



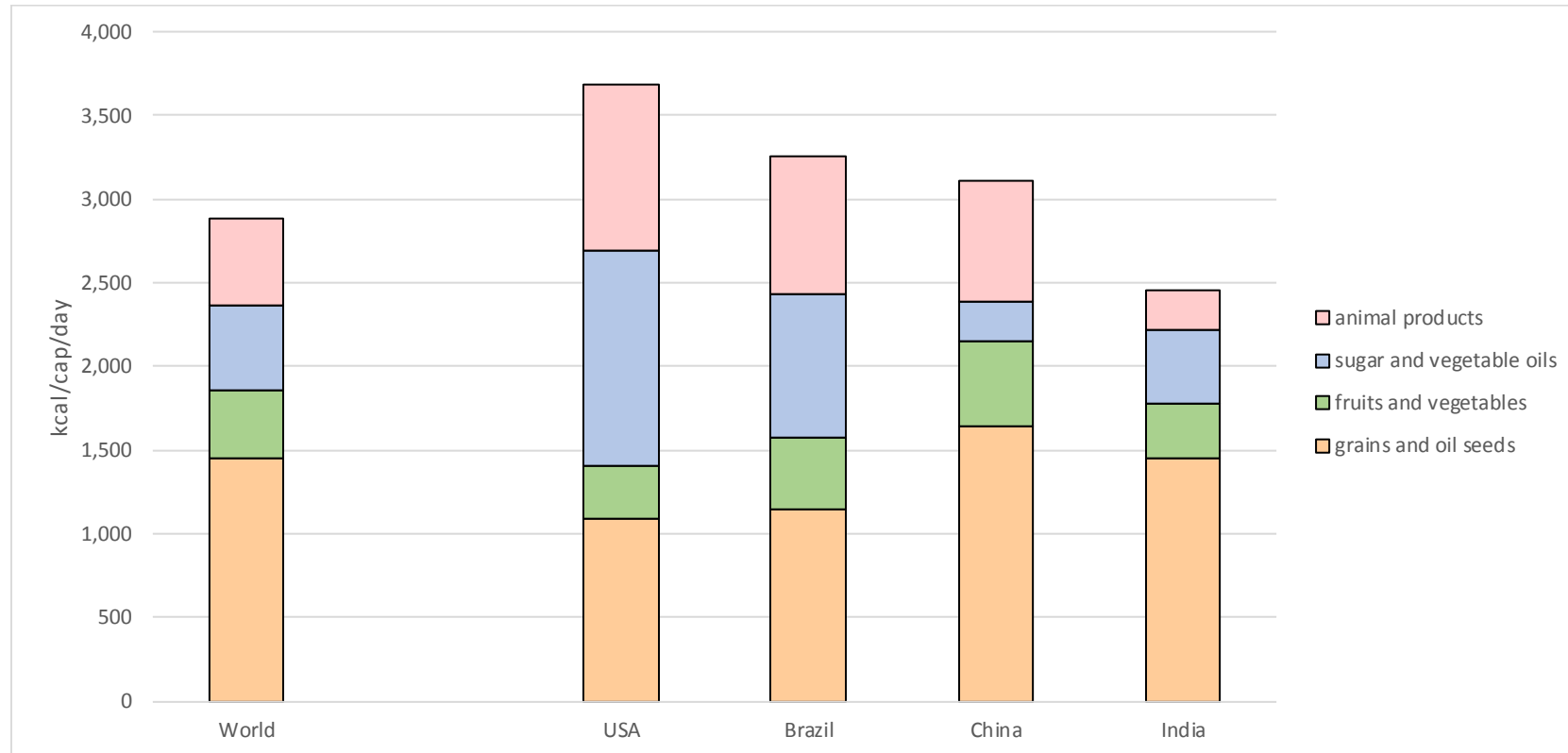
1990 per-capita calories available for consumption



Source: Food balances from the Food and Agriculture Organization (FAO) of the United Nations



2013 per-capita calories available for consumption



Source: Food balances from the Food and Agriculture Organization (FAO) of the United Nations

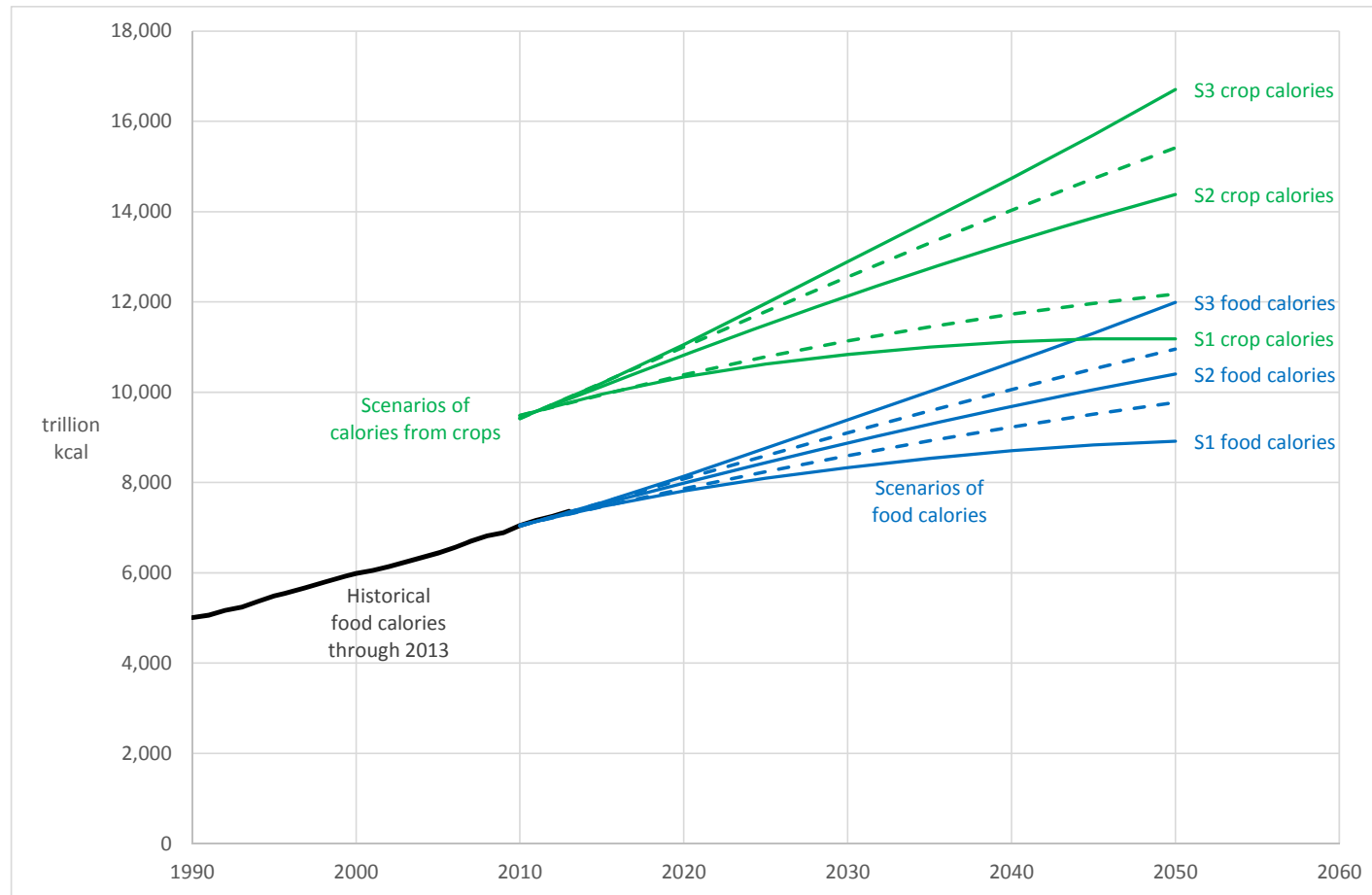


Shared Socio-economic Pathways: summary of key characteristics

Attributes	SSP1	SSP2	SSP3
Population	U.N. low growth	U.N. medium growth	U.N. high growth
Income	High growth	Medium growth	Low growth
Agricultural productivity	High improvements in agricultural productivity; rapid diffusion of best practices	Medium pace of technological change	Low technology development
Food consumption	Low-meat diets in transition and developed countries	Small increase in all food products over time, except grains, in developing and transition countries	Greater increase in meat consumption in developing and transition countries

Note that the behavior of food consumption across scenarios is not consistent with income growth. The SSPs have animal product consumption growing fastest in the low-income-growth SSP3 scenario. This is opposite the pattern of observed behavior, where consumption of animal products grows with income.

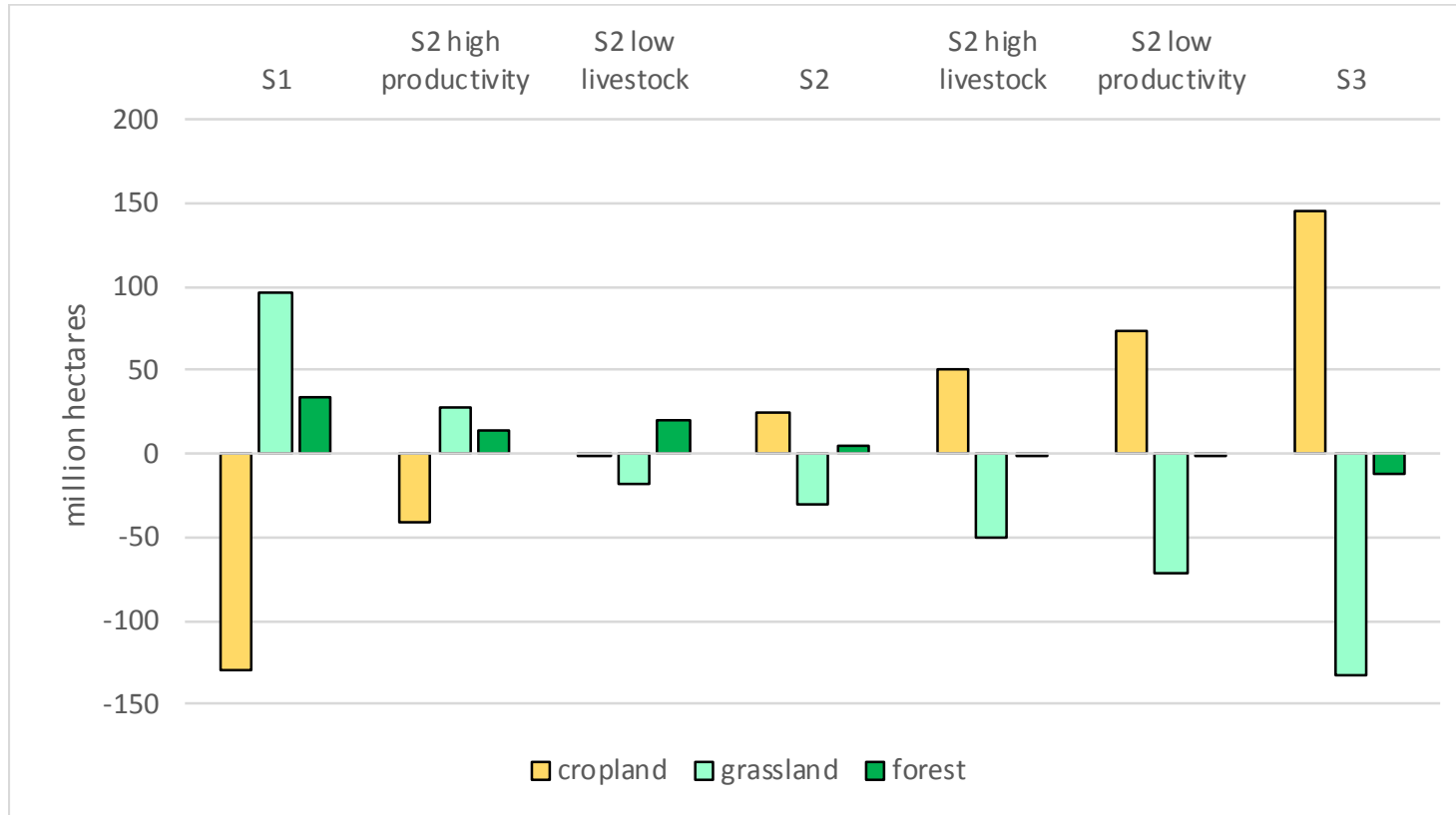
World demand for food calories and crop calories



Note: The dashed lines show the variation due only to changes in diets, from scenario “S2 low livestock” to scenario “S2 high livestock.” The change in food calories due to dietary preference, the difference between the dashed blue lines, is much smaller than the difference between the dashed green lines (crop calories). This magnifying effect is due to the quantity of feed calories required per calorie of animal product.



Land use change from 2010 to 2050 across selected scenarios



Note: Total world cropland in 2010 was approximately 1.5 billion hectares.



Summary

- World demand for calories from crops
 - Model-based projections from 2010 to 2050
 - Demand for crop calories increases by 52 percent from 2010 to 2050 in “middle of the road” scenario, or about 1.1 percent per year
- Drivers of food demand and land use
 - Shared Socio-economic Pathways
 - Population
 - Income growth per capita
 - Dietary preference
 - Agricultural productivity
 - Climate change impacts and adaptation
 - Limiting CO₂ emissions through bioenergy

