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Future Diet Scenarios and Their Effect on Regional and Global Biofuel Potential

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Food production has been one of the most significant ways in which humans have changed the surface of the Earth. It is projected that further intensification of agriculture will be necessary to meet a growing population and the increased demand for calories from animal products. This would require substantially more land and resources devoted to animal production. However, globally, the proportion of per capita caloric intake from animal to total caloric intake has remained relatively constant for the last 50 years at slightly above 15%. Nevertheless, there are large discrepancies across regions and through time. For example, northern European countries derive over 30% of calories from animal products, while India is under 10%; between 1961 and 2007, China's per capita consumption of animal calories has increased by over a factor of ten, while in the US, animal calorie consumption has remained constant. In general, per capita consumption of animal products is lower in developing countries than in developed countries, and it is commonly assumed that future animal product consumption will increase as developing countries become wealthier. On the other hand, wealthier countries are remaining constant or even decreasing their proportional consumption of animal calories, and this could be a different way that future diets may evolve. We create different future scenarios for calorie demand from vegetal products, beef, sheep and goat, pork, poultry, and dairy based on historical national trends and estimated income elasticities for these various food products. The extreme scenarios are one in which the world evolves to a highly vegetal calorie diet and, on the other extreme, one in which the world evolves to diets with high meat consumption. Intermediate scenarios include projections of current trends and one in which the world moves to a healthy balanced diet given current recommendations. Using DTU-GCAM, and global integrated assessment model with an included land use module, we explore the effect of these different global and regional diet scenarios on land use and biofuel potential up to the year 2095. The model economically optimizes food production for 14 different regions of the world based on their current and historical land use and land cover, using free market and free trade assumptions.