

# Eat less meat, save the planet? Livestock nears sustainability limit

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The Intergovernmental Panel on Climate Change estimates that agriculture accounts for 10-12 percent of anthropogenic greenhouse gas emissions. This figure does not include land conversion effects; taking those into account, the number jumps to almost thirty percent, and livestock production accounts for the bulk of these emissions. Rearing livestock also uses a great deal of nitrogen-based fertilizer, which goes into the animals' feedstock.

A new analysis of the carbon and nitrogen cycles suggests that livestock production is on a path to unsustainability, and that it will push us beyond Earth's safe operating limits by the middle of the century.

## A nitrogen fixation

Global food systems intensely disrupt the nitrogen cycle. Nitrogen is a key element in amino acids, the building blocks of proteins; as such, nitrogen is essential for all life on earth. Although it is the most abundant element in our atmosphere, atmospheric nitrogen cannot be used until it is "fixed" into a reactive form. Nitrogen fixation was traditionally accomplished by bacteria, but, since the Industrial Revolution, human activities now fix more nitrogen than natural sources. Astonishingly, half of the synthetic nitrogen fertilizer ever used in the history of Earth has been applied in the last 20 years; perhaps not as astonishingly, fixed nitrogen levels have more than doubled in that time.

Disrupting the nitrogen cycle increases radiative forcing, which warms the Earth, with potential dangerous impacts on ecosystems and humanity. Changing the nitrogen cycle also increases photochemical smog and acid deposition.

Similar things are happening with the carbon cycle. Humans use 24 percent of the planet's net primary productivity, the production of organic compounds from carbon dioxide, principally through the process of photosynthesis. Half of that 24 percent is consumed by food production.

Environmental economists have suggested setting boundary conditions for human activities in a number of areas, including greenhouse gas emissions, reactive nitrogen mobilization, and appropriation of net primary productivity. Researchers here and in Canada have used computer models to try to determine whether livestock production will push us up against these boundary conditions by 2050.

They evaluated four different production patterns, based on four different consumption patterns: continuing to eat the way we do, substituting the more resource-efficient poultry for beef, and the extremes of satisfying all of our protein requirements with either livestock or ~~Soylent Green~~ soybeans.

As of the year 2000, the livestock sector—meat, egg, and milk production—is estimated to have contributed 18 percent of anthropogenic greenhouse gas emissions and 63 percent of reactive nitrogen mobilization, and to have consumed 58 percent of net primary productivity. We are already coming dangerously close to the safe operating space in all three areas. If we continue eating animals at the same rate we do now, this model predicts that these figures will rise by 39, 21, and 36 percent, respectively, until the livestock sector uses most of, or exceeds, our safe operating spaces.

## There ought to be a law?

Based on their results, the authors suggest that "reining in growth of this sector should be a policy priority." They suggest a number of ways to accomplish this. One is to make livestock production more resource-efficient, which is feasible at the level of feed crop production and more cycling of animal manure in lieu of synthetic fertilizers. Another is to encourage people to eat more poultry and fish rather than beef to meet their dietary protein requirements.

Unfortunately, consumption of meat is currently at twice USDA-recommended levels. Americans have not yet cut down, even though we know it's better for our bodies and better for our wallets; it seems doubtful that we would

therefore cut down just because it is better for the Earth.

There are many complicating factors in this analysis. The published estimates of sustainability boundary conditions are just that, estimates. There are a wide range of resource and emissions intensities between different livestock products and technologies, both those used in the past and those being put into practice now, for one thing, and a degree of uncertainty is inherent in computer modeling.

Perhaps one of the most important variables is the increased consumption of meat, and the concomitant increase in livestock production, which is projected to occur in developing countries. The same questions may apply to livestock as to technological innovations like cars and factories: is it fair to ask the developing world to hold back, when we have already had our turn?

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