PSYCHOLOGY

Modelling diet choices

Meat is an important source of greenhouse-gas emissions, but not enough people are giving it up. A new model integrates diets, land use and climate change to explore the potential and implications of mass adoption of vegetarian diets.

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The company WeWork recently generated fierce controversy by banning meat in meals that the company pays for, in order to reduce the company's impact on climate[1]. Reducing meat consumption can reduce greenhouse-gas emissions considerably, but is WeWork's draconian policy the best way to accomplish this? Dietary choice is complex and is influenced by many interacting factors. Despite a great deal of research, we still do not know what policy measures are effective at changing diets. In this issue of *Nature Sustainability*, Eker and colleagues[2] incorporate dietary choices in a model of land use, greenhouse-gas emissions and climate change in order to shed light on what might drive a global transition away from meat-eating.

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Livestock production — especially ruminant animals, such as cattle and sheep — is responsible for around 18% of global greenhouse-gas emissions[3], so reducing consumption of meat can play an important role in addressing climate change. Workplaces such as WeWork are beginning to implement a variety of policies to accomplish this. Less coercively, the Department of Management, Society and Communication at the Copenhagen Business School makes vegetarian food the default option, but allows people to opt-out and order meat if they wish[4]. This policy was effective and popular: in its first six months, 90% of food orders were vegetarian and most people supported continuation of the policy[4].

Behaviour change can make an important contribution towards reducing greenhouse-gas emissions[5,6], but in order to achieve those reductions we need to know both what the effect would be if everyone made the change and also how many people would actually change their behaviour under a well-designed policy[6]. The potential environmental benefits of reducing meat consumption have been well documented[3], but researchers and policy makers have limited understanding about how effective different policies would be at changing dietary behaviour. This ignorance is an obstacle to designing useful policies.

Integrated assessment models (IAMs) are useful tools to explore the connections between society and the natural world. In the context of climate change, they can support the design and analysis of climate-change policies[5]. They allow a quantitative assessment of the impacts of possible policies so that policy scenarios can be compared. They also allow researchers to examine how robust those policies are to the uncertainties inherent in the processes described in the models. However, until recently, IAMs have included behaviour in simplistic economic terms, neglecting important insights from behavioural science[5,7,8].

Eker et al. present an IAM that connects diet, land use and greenhouse-gas emissions. Changes in diets are modelled on the basis of the psychological theories of Planned Behaviour and Protection Motivation. The Theory of Planned Behaviour, which has been widely used in environmental contexts, focuses on the role of social norms in shaping behaviour: growing public perception that certain individual behaviours create shared risks eventually leads to the emergence of social norms that condemn such behaviours. People care about the values that are prominent within their community and among other individuals close to them (for example, the role of peer pressure). Therefore, as social norms develop and intensify, individuals are more likely to change their behaviour. The Protection Motivation Theory, which is widely used in health contexts, focuses on individual risk: someone will be more likely to change their behaviour if they believe the change will reduce the risk or impact of a perceived threat. In both theories, people are less likely to change their behaviour if they perceive substantial obstacles to making the change (low perceived self-efficacy). Eker et al. consider two kinds of risk associated with meat eating: health risks, which follow the Protection Motivation Theory because each individual's risk is driven by their own behaviour; and climate risks, which follow the Theory of Planned Behaviour because the risk is driven by collective behaviour. Perceptions of each kind of risk are driven by public awareness of the risks: health-risk awareness is proportional to the number of deaths associated with red-meat consumption and climate-risk awareness is proportional to the frequency of extreme weather events.

To the extent possible, the researchers calibrate the model using published empirical data. Where there is uncertainty about parameter values, the authors use Monte Carlo sampling to conduct a sensitivity analysis.

The researchers model four scenarios of diet change. In all four scenarios, the greenhouse-gas emissions from food production drop as the number of vegetarians rises. However, results show that the specific type of diet that the meat-eaters follow has a greater impact than the number of vegetarians. In a scenario in which 90% of the population reduces red-meat consumption while continuing to eat poultry and fish (a flexitarian diet) and 10% follows vegan diets, greenhouse-gas emissions are far less than those in a scenario in which 50% follows a 'reference' meat-eating diet and 50% follows an ovo-lacto vegetarian diet.

Thus, reducing red-meat consumption broadly appears to have a greater environmental benefit than persuading a smaller fraction of society to become vegetarian or vegan. The same theoretical framework could also be used to study a transition from meat-intensive diets to flexitarian diets, and it may be far easier to persuade meat eaters to reduce red-meat consumption than to become vegetarians.

Results show that the most important factors driving dietary change include social norms among young people, self-efficacy among females and concern about health risks, whereas perceived climate risks do not seem to matter. This finding is consistent with previous empirical studies that found not only that health concerns were a more powerful driver of reducing meat consumption, but also that invoking environmental concerns could backfire and inhibit dietary change[9].

The model by Eker and colleagues has limitations: it is based on psychological theories and data that are drawn largely from studies of Western industrialized nations and many parameters could not be well estimated from published research. More research is needed to fill these gaps in our knowledge, and the reported sensitivity tests provide guidance for future research.

It is good news that broadly reducing red-meat consumption has greater impact than increasing vegetarianism, because in the United States — one of the largest consumers of beef in the world — per-capita beef consumption has dropped by roughly one-third since 1970 and this has produced a net reduction in per-capita food-related emissions[10,11]. Despite this trend, the average diet in the US is still far from flexitarian, but models such as the one discussed here have the potential to identify policies that could accelerate changes towards lower red-meat consumption.

Meeting climate-change commitments will require deep and rapid cuts in both energy and food-related emissions. IAMs informed by current behavioural science can play an important role in designing policies to achieve these cuts. There is much work to do, but Eker et al. have taken an important step in that direction. ❐

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