Meat or not? - A model-based analysis of the global diet change dynamics

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Keywords: Human behavior, meat consumption, climate change, integrated assessment models

Extended Abstract

This study extends an existing integrated assessment model, namely the Felix Model (Rydzak *et al.*, 2013; Walsh *et al.*, 2017), to capture the social and behavioral mechanisms behind diet change. This extension is based on global diffusion of vegetarianism in response to climate events and social norms.

As illustrated in Figure 1, the threat of extreme weather events affects the attitude towards diet change. This attitude change, however, forms a negative feedback loop of *Willingness to change* as the behavior, i.e. lower meat consumption, lessens the climate change impacts, hence the perceived threat. The social diffusion of behavior forms the positive feedback loop of *Social transmission*, as the higher number of vegetarians shift the social norm (a term associated with the percentage of a behavior in population) towards low meat consumption, which further stimulates the diet change behavior. The model also accounts for the increasing meat consumption in developing countries as the income levels rise, indicated by the Gross World Product. Furthermore, the model includes the effects of population heterogeneity in terms of age, gender and education level on social transmission behavior, self-efficacy and climate risk perception, respectively.

The model is quantified according to (i) the estimate of vegetarian population as 1.5 billion (21.5 in 2010 (Leahy, Lyons, and Tol, 2010); (ii) a reference behavior with an increasing vegetarian population due to the increasing awareness in the western world, and (iii) empirical studies that show the relative values of the psychological parameters (e.g. self-efficacy of women and men). Figure 2 shows the reference simulation results and the uncertainty ranges resulting from a multivariate sensitivity analysis with 500 simulations and ±50% parameter ranges. In the reference simulation, the vegetarian population increases until 2100, yet not at a rate sufficient to mitigate the adverse environmental impacts of agriculture. Still, due to the lack of data on global diet change dynamics and various other uncertainties, this model is used rather as a heuristic to explore various scenarios. In particular, a statistical screening method (Ford and Flynn, 2005) is employed to identify the uncertainties that are most influential on diet change dynamics. The findings show that the factors that relate the climate events to the attitude of people towards diet change, for instance the number of events that trigger change (*x0 risk attitude*) or *time to forget* the past events, are most influential on the long-term dynamics of the vegetarian population.

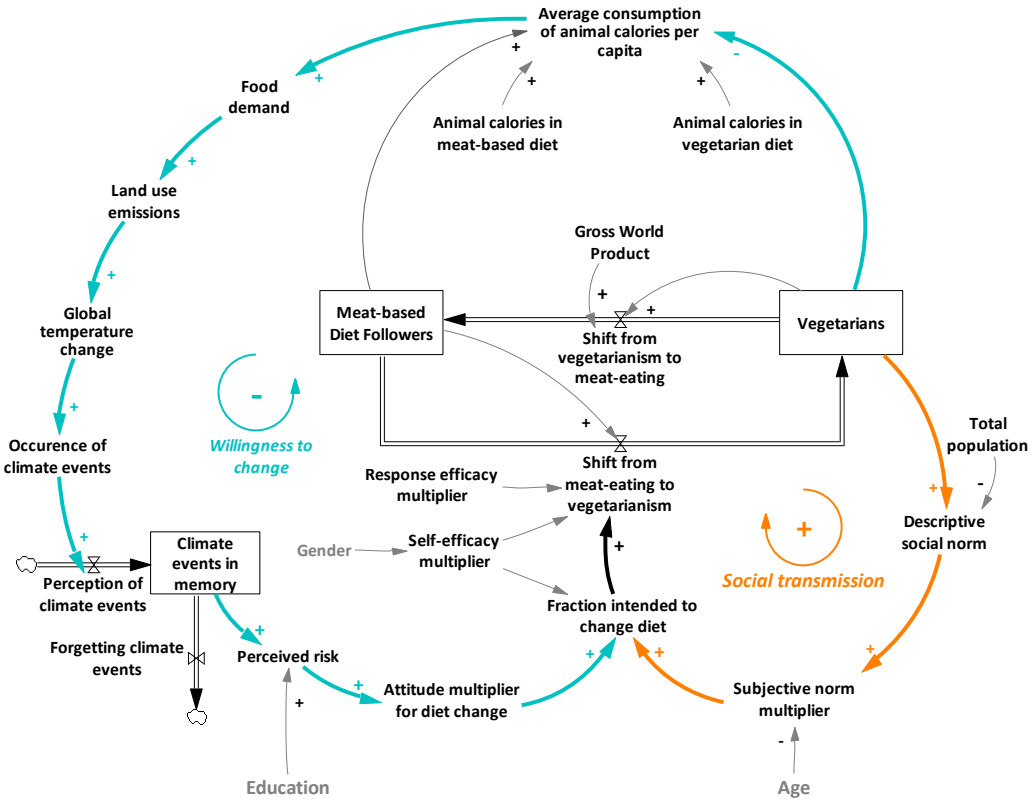

Figure 1: An overview of the model structure of the diet change mechanism

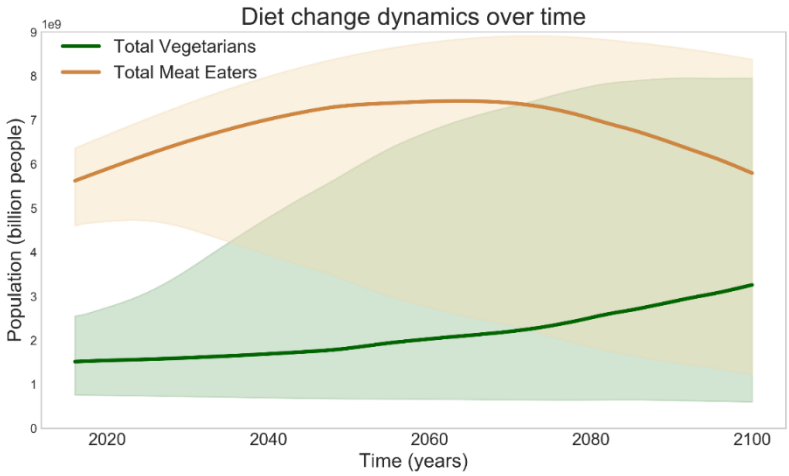

Figure 2: Dynamics of Meat-based Diet Followers *and* Vegetarians *in the reference simulation*

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