Supporting Information

Behrens et al. 10.1073/pnas.1711889114

Dietary Information

Average Diets Composition. FAO FBSs were used as the basis of the average diet composition for each nation (47). Food balance sheets already have wastes other than consumer waste subtracted. Because we are interested in the impacts of diets and not waste, we also subtracted consumer wastes per region and food group using FAO data (48). A concordance table for waste data between regions, nations, and food groups is available in Dataset S1 (sheet Waste_Percentages). Fig. S1 shows the composition and size of the estimated, daily average diets by kcal, along with protein and fats as a percentage of total energy. For ease of assessment, we report the following dietary data in six aggregated food groups: meat, fish, dairy, grains, VFN, and other (e.g., sugars; for aggregation scheme, see Dataset S1, sheet Diet_Classifications). Cultural and social variations in food intake are clearly visible across nations, for example, the high protein intake in Japan and the low number of calories from fats in middle-income nations. A table of kcal and weight intake for all 88 distinct food subgroups and all nations is available in Dataset S1 (sheets g_per_capita_per_day and kcal_per_capita_per_day).

Nationally Recommended Diets. Nationally recommended diets were built in two steps: first, the sourcing from the primary information provided by health and nutrition bodies, and second, the construction of NRD-compliant diets using previously obtained FAO data where needed. Sources for national recommended guidelines are given in Table S1; internet links for these diets are available in Dataset S1, sheet NRD_overview. Nation-specific guidelines were found for 37 of the 44 nations available in the MRIO database. Given that further nation-specific guidelines were unavailable, the use of EXIOBASE rather than alternative MRIO datasets with more nations is appropriate. Concordances between guidelines and raw NRD data can be found in Dataset S1, sheet Diet_Classifications. Portions were used from the NRDs themselves where available; in the few cases where portion data were unavailable, default values were used (52). Individual tables for the composition of diets of each nation along with further information are available in Dataset S1 (sheets 1_Austria to 44_South Africa). When guidelines suggest a choice between two food groups, with one total weight (i.e., 400 g fruit or vegetables), the two groups were split along currently consumed proportions from FBSs. Fig. S2 shows the composition of the raw suggestions in the NRDs.

As Fig. S2 shows, not all guidelines include all food groups, with Hungary and India omitting meat and fish, respectively, and Latvia and Norway along with Indonesia omitting dairy. To develop a representative diet compliant with recommendations, we took the assumption that if no recommendations were available for a food group, then the average consumption (less consumer waste) would be consumed.

Comparison Between Average and Nationally Recommended Diets. To investigate the influence of dietary volume on the differences between diets, an isocaloric and nonisocaloric comparison was made. To build this comparison, the average diet was isocalorically scaled to the nationally recommended diet but with the assumption that empty calories would account for no more than 350 calories a day (on the general basis of guidance across all recommendations). Calorie data for each food group were derived from the FBS. Fig. S3 shows the isocaloric difference between diets, and Fig. S4 shows the nonisocaloric difference between diets.

Environmental Impacts

Concordance Between Food Categorizations. Consumption-based environmental impacts were calculated using the EXIOBASE MRIO database. EXIOBASE itself was built with food sector categories from statistical information from the FAO giving a straightforward concordance between the two categorization schemes, where the 88 food subgroups in FAOSTAT were aggregated to the 17 food groups in EXIOBASE (see Dataset S1 for concordances, sheet Diet_Classifications and full list of FAOSTAT subgroups for each EXIOBASE food group in sheet EXIOBASE_Food_Categories).

Environmental Impact Indicators. The three forms of environmental impact were chosen on the basis of the planetary boundary frameworks (19). The three indicators are GWP100 (88), PO_4^{3-} eq (54), and ha for greenhouse gases, eutrophication potential, and land, respectively. To show that NO_x eq as defined by ref. 89 has similar impacts to PO_4^{3-} eq we plot the correlation between the two in Fig. S10. These impacts were chosen because they are three of the four highest-risk impacts for which robust data are available. Absolute impacts for average diets are available in Fig. 1*A*. For completeness, Fig. S5 shows the absolute impacts of nationally recommended diets.

Mapped Relative Changes. Fig. S6 shows the mapped variations associated between nationally recommended and average diets for all three environmental impacts. Relative changes between the dietary choices are plotted, with a scaled region for Europe.

Country Information

Income Categories. Country information and income categories were sourced from the World Bank (20). Table S2 shows the classifications for the countries included. Concordances are available in Dataset S1, sheet Country_Classifications.

Import Dependences. Alterations in import patterns calculated with EXIOBASE are shown in Figs. S7–S9 as a percentage of total food-related environmental impacts per capita per day (or continuous land use for the year 2011 in the case of land). No assumption of changes in production structure is made. We focus on composition changes rather than volume changes in imports and so use isocaloric values. The largest global food producers show the lowest imports of embodied GHGs, for example, the United States, Brazil, Europe, and Australia. Japan, Russia, and Canada show large imports of embodied GHGs. Diets associated with NRDs increase import dependence in Australia and Canada while reducing import dependence significantly in Japan, and less so in Brazil, South Africa, India, and Russia.

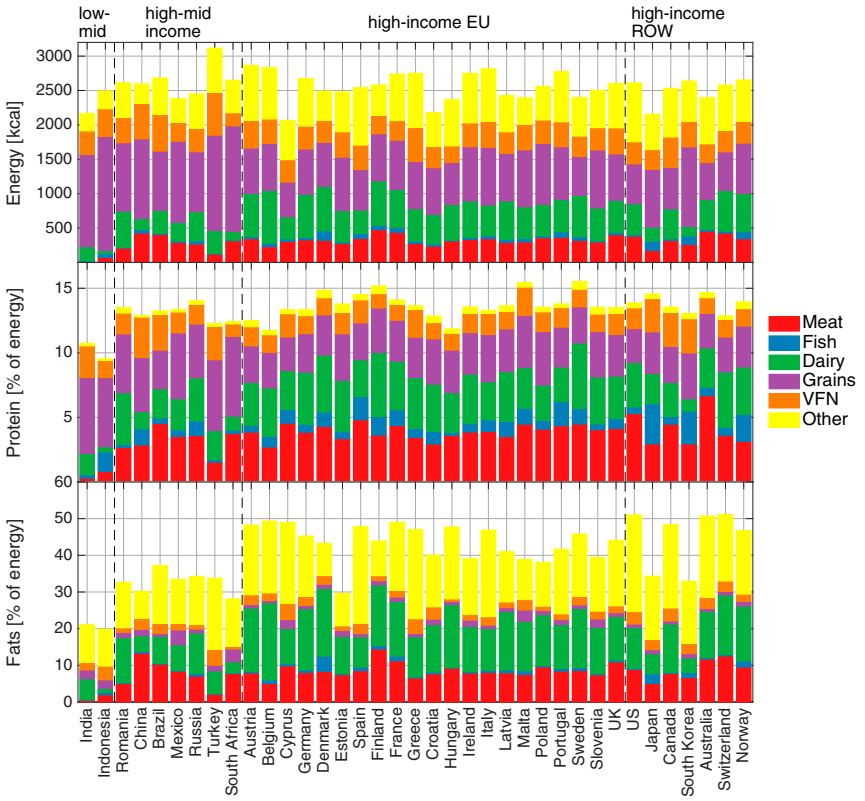

Fig. S1. Average dietary intake in energy along with protein and fats as a percentage of energy intake. Food types and countries are grouped together.

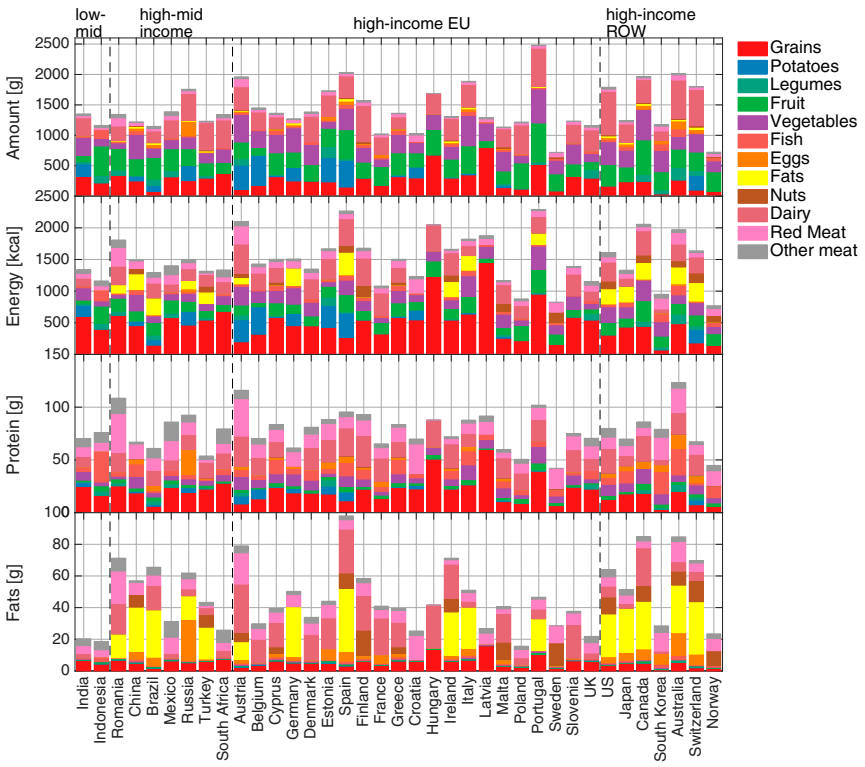

Fig. S2. Composition of food group-based, nationally recommended diets in weight, energy, protein, and fats. Not all recommendations include all food groups or empty calories; therefore, NRDs generally have fewer calories than needed. Food types are presented in the format in the NRDs.

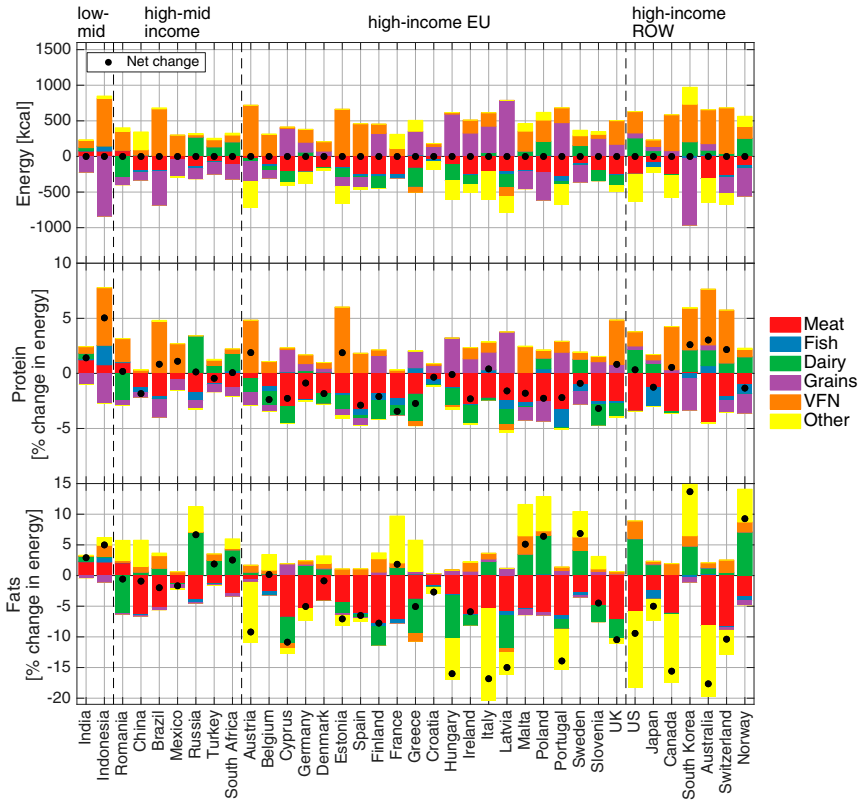

Fig. S3. Isocaloric difference between average and nationally recommended diets. *Top* gives caloric changes per food group, with no change in net energy intake. *Middle* gives the change in the percentage of energy made up of proteins by food group. *Bottom* gives the change in the percentage of energy made up of fats by food group.

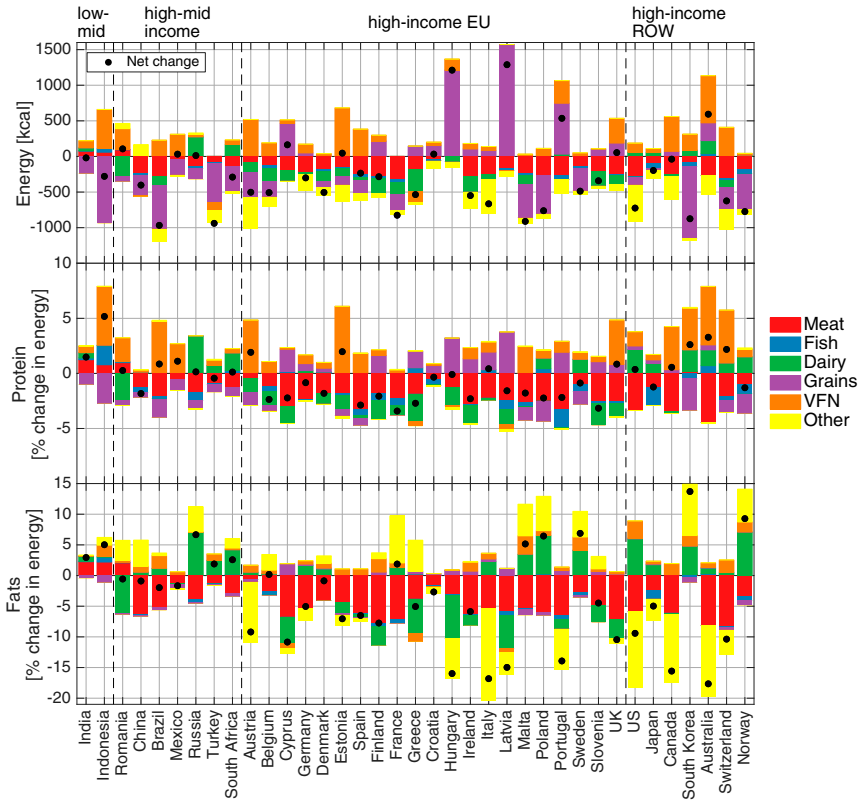

Fig. S4. Nonisocaloric difference between average and nationally recommended diets. *Top* gives caloric changes per food group, with no change in net energy intake. *Middle* gives the change in the percentage of energy made up of proteins by food group. *Bottom* gives the change in the percentage of energy made up of fats by food group.

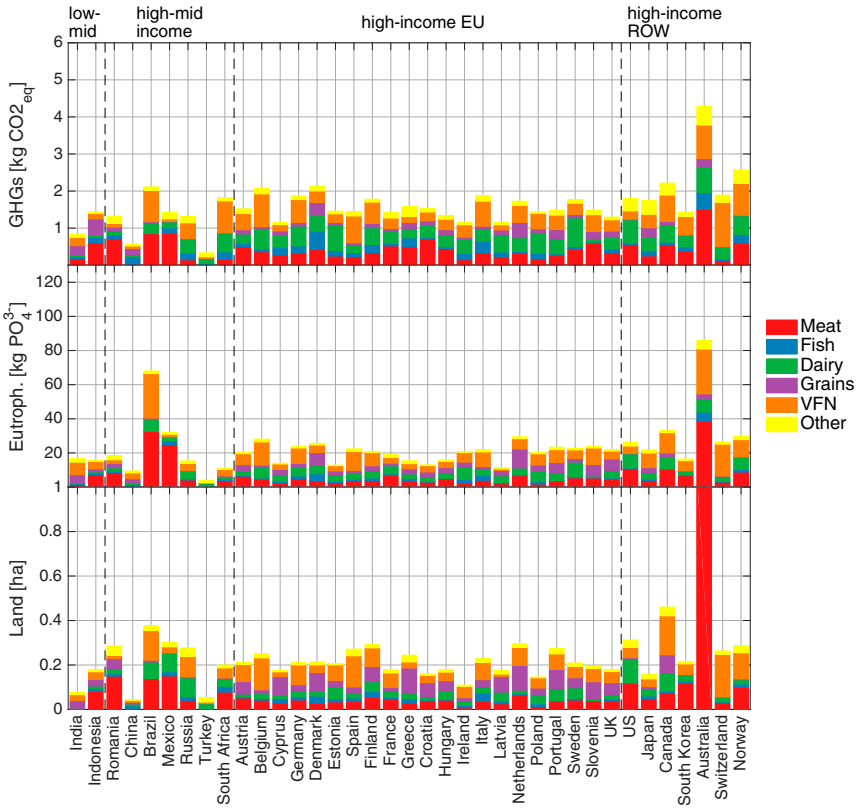

Fig. S5. Absolute environmental impacts for recommendation-compliant diets. Figure has been truncated in the case of Australia because land use extends to 2.26 ha·a^{-1}.

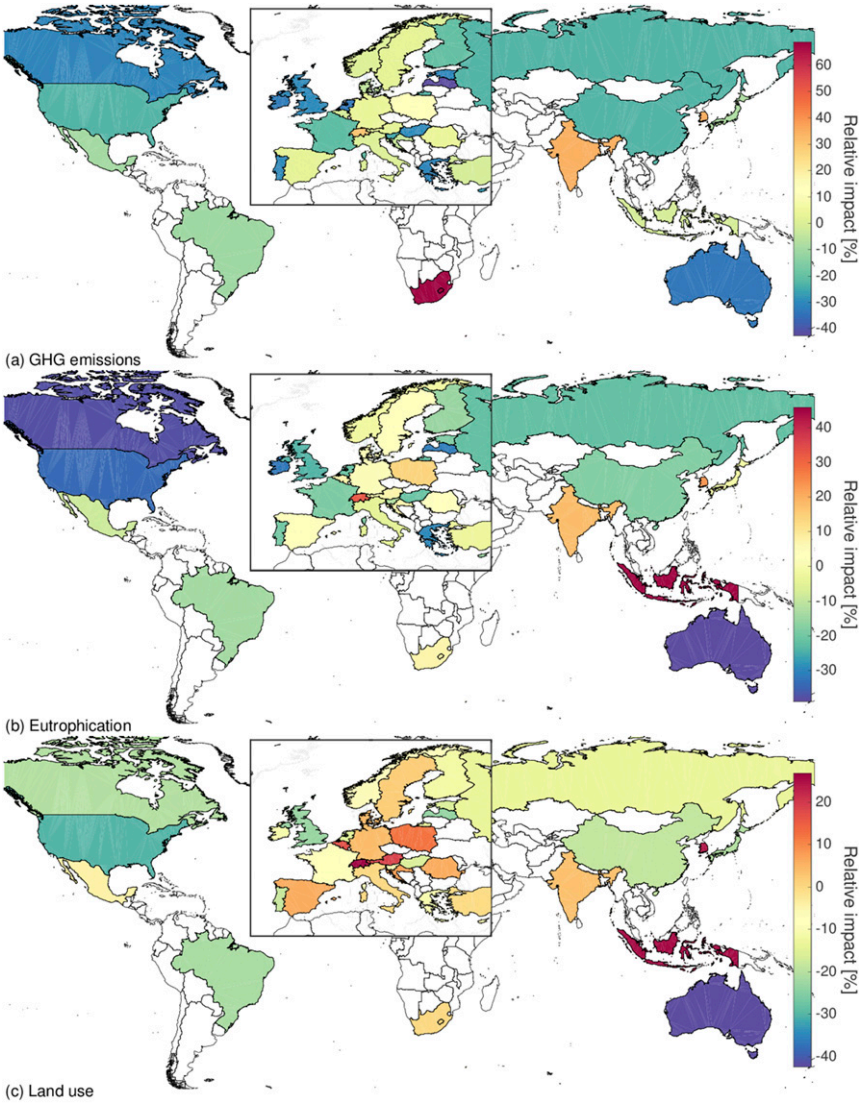

Fig. S6. Relative changes in (*A*) emissions, (*B*) eutrophication, and (*C*) land use associated with NRDs compared with average diets and mapped to nations included in the study.

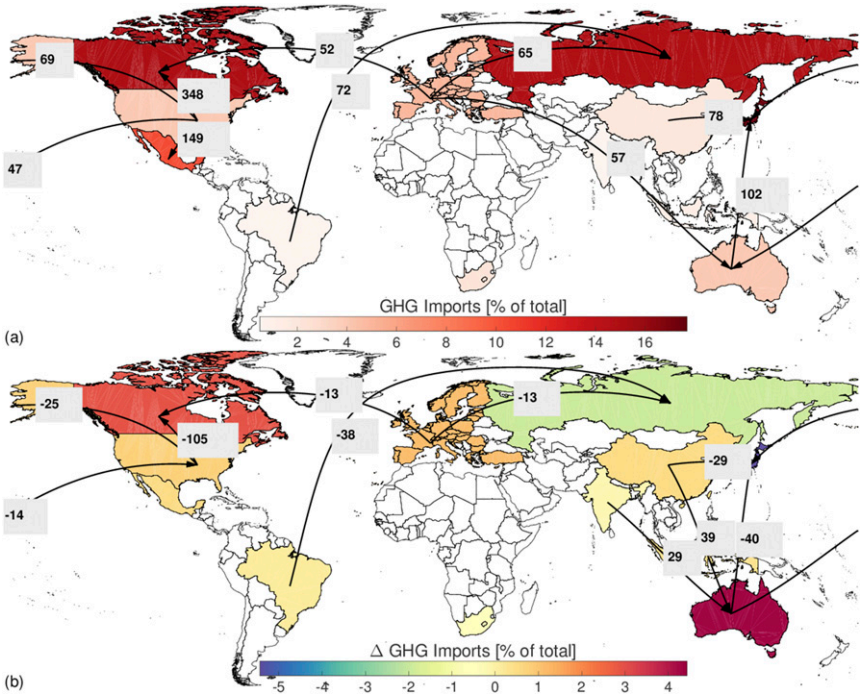

Fig. S7. Flows of GHGs embodied in the food system worldwide. Amounts represent per person, per day with Europe aggregated together. (*A*) GHG imports embodied in food as a percentage of the total available, with arrows indicating the 10 largest flows of embodied GHGs. (*B*) The change associated with NRDs.

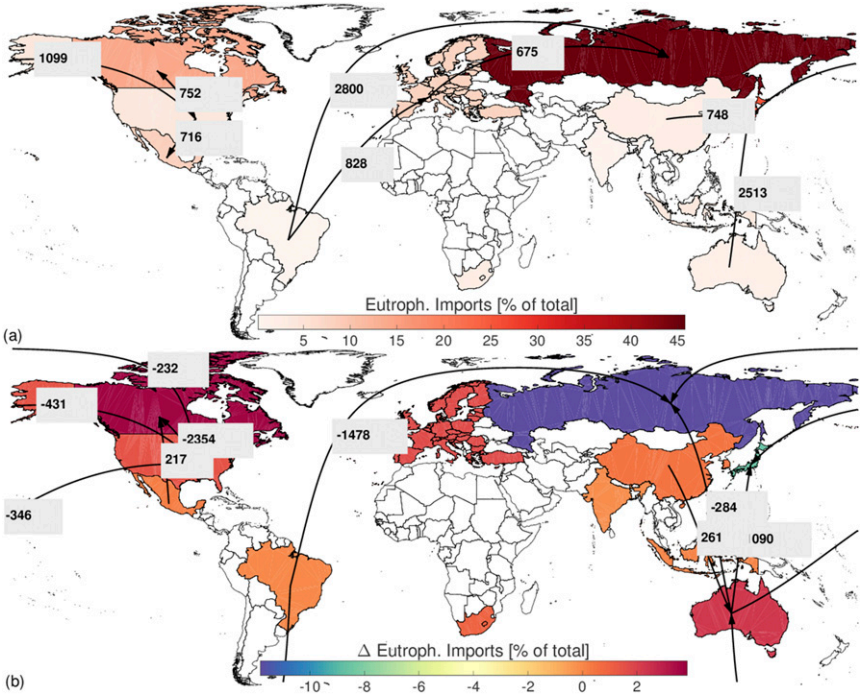

Fig. S8. Eutrophication embodied in the food system worldwide. Amounts represent per person, per day with Europe aggregated together. (*A*) Eutrophication imports embodied in food as a percentage of the total available, with arrows indicating the 10 largest flows of embodied eutrophication. (*B*) The change associated with NRDs.

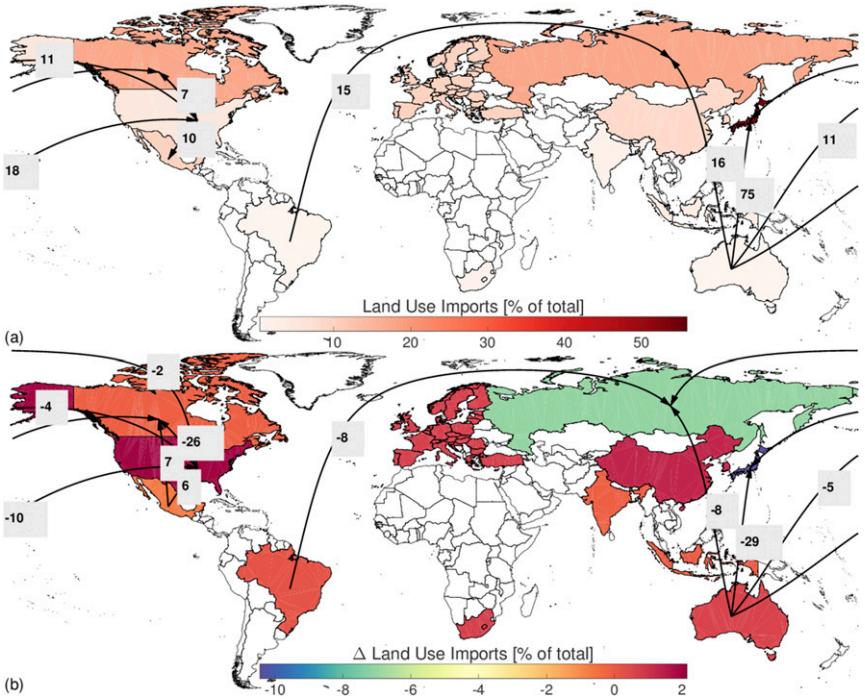

Fig. S9. Flows of land use embodied in the food system worldwide. Amounts represent per person, per day with Europe aggregated together. (*A*) Land use imports embodied in food as a percentage of the total available, with arrows indicating the 10 largest flows of embodied land use. (*B*) The change associated with NRDs.

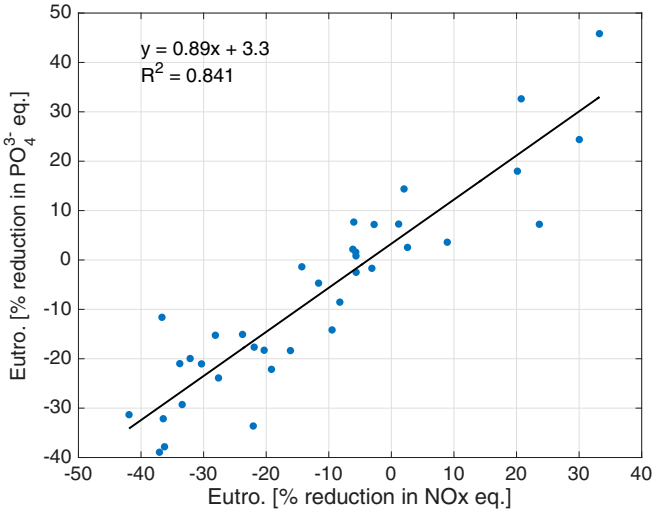

Fig. S10. Correlation between percentage of reductions from average to recommended diet adoption in NO_x eutrophication equivalents and PO_4^{3-} eutrophication equivalents.

Table S1. Sources for recommended diets by nation

Country	Source
Australia	National Health and Medical Research Council (56)
Brazil	Ministry of Health of Brazil (59)
China	Chinese Nutrition Society (61)
Finland	Valtion ravitsemusneuvottelukunta (64)
Greece	Ministry of Health (67)
Ireland	Food Safety Authority of Ireland (69)
Japan	Ministry of Health, Labour and Welfare and Ministry of Agriculture, Forestry and Fisheries (70)
The Netherlands	Brink et al. (73)
Portugal	Direção-Geral da Salude (75)
South Korea	Park et al. (78)
Switzerland	Schweizerische Gesellschaft für Ernärung (81)
United Kingdom	Public Health England in association with the Welsh Government, Food Standards Scotland and the Food Standards Agency in Northern Ireland (84)
United States	US Department of Health and Human Services and US Department of Agriculture (22)
Austria	Ministerium Faruen Gesundheit (57)
Croatia	Degac et al. (24)
Denmark	Ministeriet for Fødevarer, Landbrug og Fiskeri (62)
France	Programme National Nutrition Santé (65)
Hungary	Imre et al. (23)
Indonesia	Usfar and Fahmida (51)
Latvia	Veselibas ministrija (71)
Malta	Health Promotion & Disease Prevention Directorate (74)
Norway	Helsedirektoratet (76)
Romania	Graur et al. (79)
Slovenia	Ribic (82)
Spain	Mari et al. (85)
Turkey	Ministry of Health (87)
Belgium	Minister van Sociale Zaken en Volksgezondheid (58)
Canada	Health Canada (60)
Cyprus	Ministry of Health (63)
Estonia	National Institute for Health Development (66)
Germany	German Nutrition Society (68)
India	National Institute of Nutrition (21)
Italy	Ministero delle Politche Agricole e Forestali (72)
Mexico	Arenas et al. (17)
Poland	Chabros et al. (77)
Russia	Rosminzdrav (80)
South Africa	Vorster et al. (83)
Sweden	Brugård Konde et al. (86)

Table S2. Country income classifications

Classification	Nations
Low–middle income	India and Indonesia
High–middle income	Romania, China, Brazil, Mexico, Russia, Turkey, and South Africa
High-income EU	Austria, Belgium, Cyprus, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Latvia, The Netherlands, Poland, Portugal, Sweden, Slovenia, and United Kingdom
High-income ROW	United States, Japan, Canada, South Korea, Australia, Switzerland, and Norway

Other Supporting Information Files

Dataset S1 (XLSX)