Food, Health & the Environment: A Global Grand Challenge & Some Solutions

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Abstract: The dual burden of obesity and undernutrition is a significant public health challenge worldwide, especially in the context of a changing climate. This essay presents the most recent nutritional evidence for the optimal diet for long-term health, and offers some commentary on how production of these foods affects the environment. Current dietary research supports a diet rich in fruits and vegetables; nuts, legumes, fish, and some poultry as protein sources; unsaturated fats replacing saturated fats; whole grains replacing refined grain products; dairy foods in low to modest amounts; and minimal amounts of red meat and added sugar. This healthy dietary pattern also supports sustainable agriculture and environmental preservation.

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Public health efforts worldwide have traditionally focused on alleviating undernutrition – inadequate calories and protein for optimal growth and development – but obesity has simultaneously risen as a major contributor to morbidity and mortality worldwide. Urbanization and globalization have enabled the widespread availability of foods of low nutritional quality and, compounded by declining physical activity, these result in positive energy balance and weight gain. For example, in Mexico, the prevalence of obesity has been steadily rising since the 1980s, and about 70 percent of the Mexican population is now overweight or obese.[1] Concurrently, undernutrition remains a significant challenge in many low- and middle-income countries, where the double burden of overnutrition and undernutrition is particularly severe among low-socioeconomic strata in rural areas. Total caloric intake is often adequate, but the diet quality is declining: consumption of saturated and trans fats, sugar, and refined wheat or other grains have increased, while people are eating fewer legumes and whole-grain cereals. Despite the dramatic increase in knowledge regarding the impact of diet on human health over the past several decades, the prevalence of diabetes and other noncommunicable diseases is increasing worldwide, in-

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dicating serious metabolic imbalance. In this essay, we discuss the major macronutrients (protein, fat, and carbohydrates), provide brief comments on micronutrients (vitamins), and offer some tentative conclusions on the optimal diet for long-term health and the environment.

Average protein consumption in the United States substantially exceeds bodily requirements, and adequate intake can be maintained on a wide range of diets.[2] The specific sources of dietary protein are more important for health than the total protein intake.

In affluent countries, red meat (beef, pork, and lamb) and especially processed red meat consumption is strongly associated with an increased risk of diabetes, total mortality, cancer mortality, and cardiovascular disease mortality.[3] A recent meta-analysis that included 719,361 individuals found a 29 percent increased risk of all-cause mortality associated with total red meat consumption.[4]

Accumulating evidence suggests that eating red and processed meat is significantly associated with incident stroke and stroke mortality,[5] as well as with an increased risk of type 2 diabetes.[6] We found that increasing red meat by more than one-half serving per day was associated with a 48 percent elevated risk of diabetes in the subsequent four-year period, whereas reductions in red meat intake by more than one-half serving per day was associated with a 14 percent lower risk of diabetes over the same period.[7] Reducing red meat intake will likely decrease the incidence of cardiovascular disease, stroke, diabetes, colon cancer, and possibly premenopausal breast cancer. Components other than fat, such as heat-induced carcinogens or iron, may be responsible for some of the adverse effects of red meat consumption.

Notably, these analyses on red meat intake were conducted in Western populations, but meat consumption varies substantially across the globe. By contrast, in a pooled analysis of Asian cohort studies, red meat consumption did not appear to increase the risk of all-cause or cancer mortality.[8] This discrepancy may be explained in part by the fact that Asian populations eat much less meat. In 2007, average meat consumption in the United States was 122.8 kilograms per year (kg/y), whereas consumption in China, Japan, and South Korea ranged from 46.1 to 55.9 kg/y. As noted by the authors of that analysis, the discrepancy could be attributed to meat recently being more readily available to East Asians of higher socioeconomic status, who also have better overall health, and thus, the current levels of red meat intake do not reflect long-term intakes.

Even though eating red meat has been shown to adversely affect long-term health, meat can be useful for nutrient deficient populations in which diets otherwise consist mainly of starchy staples because it is rich in protein, iron, zinc, vitamin B12, and other nutrients. Growing children especially require a positive protein balance, and animal proteins can help fill important nutritional gaps; but red meat is not the best choice. As meat consumption rises around the world, it will become increasingly important to understand the relationship between red meat consumption and mortality and chronic disease rates, which are also rising rapidly in most of these populations.

In the United States, a key distinction is between unprocessed and processed red meat. Processed meats – such as cold cuts, sausages, and bacon – contain four-fold higher levels of sodium and 50 percent higher nonsalt preservatives, including nitrate, nitrites, and nitrosamines, which are important to the biologic mechanisms of coronary heart disease (CHD), stroke, and diabetes. Processed meats simply have no place in a healthy diet.

While low consumption of red meat appears to be desirable for long-term health, poultry fat is relatively unsaturated compared to red meat. Eggs are an efficiently produced protein source and contain many vitamins. Despite public statements to the contrary, recent research has shown that moderate egg consumption does not increase the risk of heart disease, except in diabetics.

Fish is another healthful protein source and is linked with lower risk of cardiovascular disease (CVD) mortality, stroke, and total mortality. One comprehensive analysis estimated that eating about two grams per week of omega-3 fatty acids in fish, equal to about one or two servings of fatty fish per week, reduces the chances of dying from heart disease by more than one-third. Conversely, excess mercury exposure in fish can be dangerous, especially for pregnant women because of the risk of fetal developmental impairments. King mackerel, shark, swordfish, and tilefish are reported to have the highest levels of mercury and should be avoided by pregnant and lactating women. However, eating more than two servings of fish per week or taking fish oil supplements during pregnancy is beneficial for child cognitive performance.[9]

Nuts are nutrient-dense and contain unsaturated fatty acids, fiber, vitamins, minerals, antioxidants, and phytosterols. Observational and intervention studies have demonstrated beneficial effects of nut consumption on biologic mediators of chronic disease such as oxidative stress, inflammation, visceral adiposity, hyperglycemia, and insulin resistance. The PREDIMED trial of the Mediterranean dietary pattern has also demonstrated significantly reduced mortality among those randomly assigned to eat three or more servings of nuts per week.[10] Nuts reduce the risk of CHD and type 2 diabetes, likely because they are high in unsaturated fatty acids, though perhaps due to other nutritional components as well. In our prospective cohorts, we found that those who eat nuts frequently had a 20 percent lower death rate compared with those who did not eat nuts.[11] These findings are supported by similar results from several other studies. Moreover, despite being a calorie-dense food, nut consumption strongly induces satiety and is associated with reduced weight gain, waist circumference, and lower risk of obesity in observational studies and clinical trials.

Legumes are high in bioactive compounds such as soluble-fiber, vitamin E, folic acid, selenium, and phytoestrogens, though their effect on chronic disease is relatively understudied. In controlled feeding studies, legumes have been shown to lower low-density lipoprotein (LDL) cholesterol concentrations and blood pressure.[12] In a large cross-sectional study, eating legumes more than four times per week was associated with a 22 percent lower risk of CHD.[13] Legumes may also be linked to a lower risk of colon cancer, perhaps by substituting for red meat, and may help prevent diabetes and metabolic syndrome by improving glycemic control. Phytoestrogens in soy foods have a similar function to endogenous estrogens, and may protect against hormone-related cancers. In the Shanghai Women's Health Study, soy food consumption during childhood was strongly inversely associated with the risk of premenopausal breast cancer.[14]

A high intake of dairy products, at least three servings per day, has been widely touted for bone health and fracture prevention,[15] but the optimal calcium intake remains uncertain. However, U.S. recommendations of 1,200 milligrams per day are derived from balance studies lasting less than two weeks,[16] which likely reflect transient movements of calcium in and out of bone rather than long-term requirements. Global guidelines are lower: around 500 – 700 milligrams daily. Large prospective studies show that high consumption of

calcium or milk is not associated with lower overall fracture incidence. The small randomized trials of calcium without vitamin D found no significant reduction in fracture risk, and there is scant evidence that it prevents cardiovascular disease.[17] High intake of calcium may even increase risk of advanced prostate cancer.[18] Overall, recommendations for high dairy intake are not supported by the evidence. Although low-fat dairy may be preferable for health, nearly all the dairy fat stripped to produce low-fat milk goes into the human food supply, often as butter or ice cream.

For individuals who are in caloric balance, any change in a macronutrient intake must be balanced by an offsetting change in intake of another macronutrient. Hence, for macronutrients, it is most useful to think in terms of substitution, rather than simply increases or decreases. A recent substitution analysis showed that replacing one serving per day of total red meat with fish, poultry, nuts, legumes, low-fat diary, or whole grains was associated with a lower risk of diabetes and total mortality.[19] Thus, the replacement of red meat with a combination of nuts, fish, poultry, and legumes as protein sources seems optimal for overall long-term health (see Figure 1).

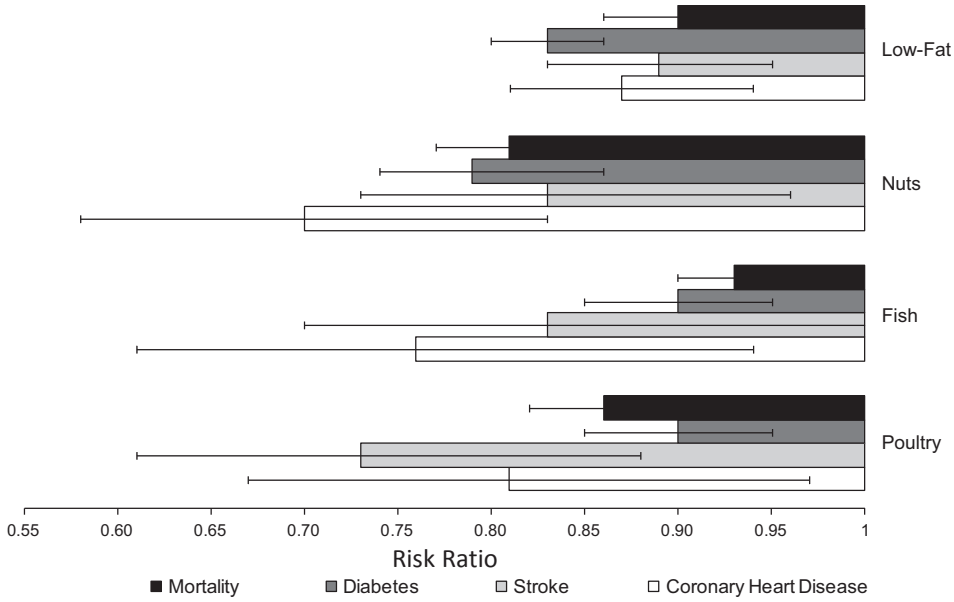
Until recently, dietary recommendations suggested reducing total fat intake to decrease coronary disease and cancer. Recommendations were based on the observation that total serum cholesterol, increased by saturated fat, predicted coronary disease risk. However, high-density lipoprotein (HDL) cholesterol is strongly protective against CHD, and the ratio of total cholesterol to HDL is a far better predictor of CHD risk than total cholesterol.[20] Indeed, substitution of carbohydrate for saturated fat, the basis of most dietary recommendations until recently, reduces beneficial HDL. In contrast, a diet that substitutes unsaturated fat for saturated fat is more beneficial because it reduces atherosclerotic LDL without affecting HDL (see Figure 2).[21] Furthermore, contrary to popular belief, data from many large prospective studies, a pooled analysis, and two large randomized trials indicate that total fat intake consumed by middle-aged women does not increase breast cancer risk.[22]

Polyunsaturated fat consumption is recommended by the American Heart Association for up to 10 percent of daily energy intake, compared with U.S. averages of approximately 3 percent in the 1950s and 6 percent at present. Omega-3 fatty acids appear to have a crucial role in the prevention of fatal arrhythmias that can complicate coronary disease. Alpha-linolenic acid is an N-3 fatty acid (mainly from plant sources) that also appears to reduce coronary disease risk and may be particularly important when fish intake is low. Furthermore, in dietary intervention trials, incidence of CHD is reduced when dietary polyunsaturated fat replaces saturated fat, but not when saturated fat is replaced with carbohydrate.

By weight, *trans*-fatty acids have the most adverse health effects of all fats. Small amounts of trans fats come from the ruminant animal products, but most trans-fatty acids in the U.S. diet are formed by the partial hydrogenation of liquid vegetable oils for margarine and vegetable shortening. In India, Dalda – a type of "vegetable ghee" – has a trans-fat level of approximately 50 percent and is a major source of domestic culinary oils. Trans fat increases LDL and decreases HDL, and is much more strongly linked to coronary disease risk than saturated fat.[23] The United States is in the process of eliminating partially hydrogenated oils from the food supply by classifying them as not "generally recognized as safe." Use of industrially produced trans fats has been banned in many jurisdictions around the world.

Palm and soybean oils are the most widely consumed oils globally. Palm oil is low

Figure 1
Replacing Red Meat with Low-Fat Dairy, Nuts, Fish, or Poultry Reduces Risk of Health Outcomes

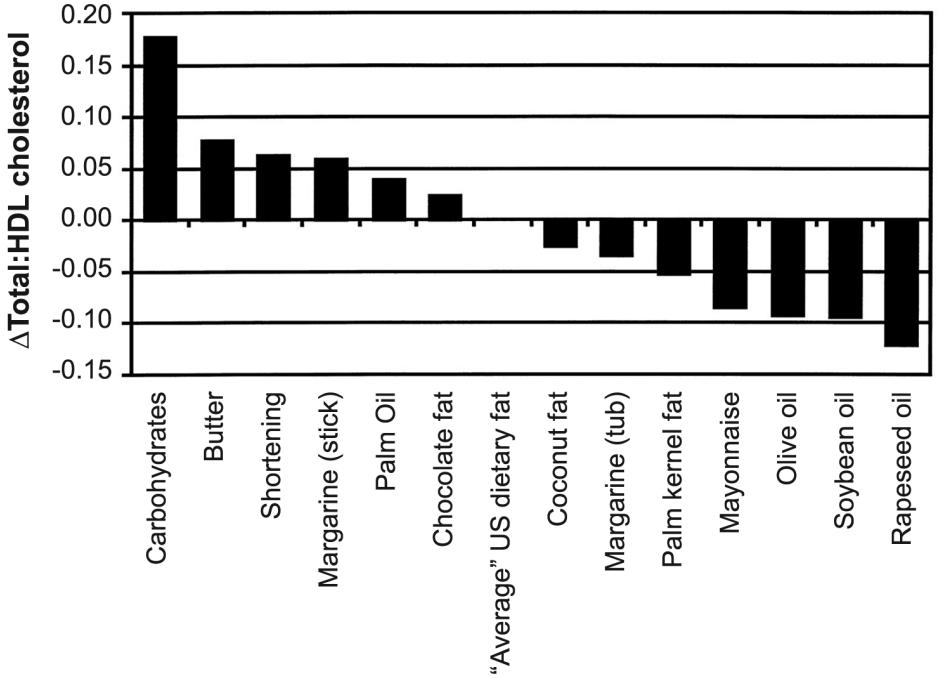


A risk ratio of less than one indicates a decreased risk. Source: An Pan, Qi Sun, Adam M. Bernstein, Matthias B. Schulze, JoAnn E. Manson, Meir J. Stampfer, Walter C. Willett, and Frank B. Hu, "Red Meat Consumption and Mortality: Results from 2 Prospective Cohort Studies," *Archives of Internal Medicine* 172 (7) (2012): 555 – 563, doi:10.1001/archinternmed.2011.2287; Adam M. Bernstein, Qi Sun, Frank B. Hu, Meir J. Stampfer, JoAnn E. Manson, and Walter C. Willett, "Major Dietary Protein Sources and Risk of Coronary Heart Disease in Women," *Circulation* 122 (9) (2010): 876 – 883; Adam M. Bernstein, An Pan, Kathryn M. Rexrode, Meir Stampfer, Frank B. Hu, Dariush Mozaffarian, and Walter C. Willett, "Dietary Protein Sources and the Risk of Stroke in Men and Women," *Stroke: A Journal of Cerebral Circulation* 43 (3) (2012): 637 – 644, doi:10.1161/STROKEAHA.111.633404; and An Pan, Qi Sun, Adam M. Bernstein, Matthias B. Schulze, JoAnn E. Manson, Walter C. Willett, and Frank B. Hu, "Red Meat Consumption and Risk of Type 2 Diabetes: 3 Cohorts of U.S. Adults and an Updated Meta-Analysis," *The American Journal of Clinical Nutrition* 94 (4) (2011): 1088 – 1096, doi:10.3945/ajcn.111.018978.

in polyunsaturated and high in saturated fat, and is consumed mostly in developing countries. Studies in humans and animals have demonstrated elevations in blood LDL cholesterol levels associated with palm oil, and in a study in Costa Rica, palm oil consumption was significantly associated with myocardial infarction compared to other oils.[24] Soybean oil, on the other hand, is rich in polyunsaturated fatty acids. The monounsaturated fatty acids and antioxidant effects of olive oil are very likely to be beneficial for CHD prevention. The PREDIMED trial found that compared with a low-fat diet, a diet high in olive oil reduced incidence of cardiovascular events[25] and was associated with better long-term cognitive performance.[26]

Because it raises triglycerides and reduces HDL cholesterol, especially in those with insulin resistance, a high-carbohydrate diet can have adverse metabolic consequences.[27] Insulin resistance is largely caused by overweight, and overweight persons are less able to tolerate a high-carbohydrate diet compared to those who are lean and active. Most Asian populations

Figure 2
Substituting Unsaturated Fats for Saturated Fats Improves the Total-to-HDL Cholesterol Ratio



Δ: predicted change. Source: Ronald P. Mensink, Peter L. Zock, Arnold D.M. Kester, and Martijn B. Katan, "Effects of Dietary Fatty Acids and Carbohydrates on the Ratio of Serum Total to HDL Cholesterol and on Serum Lipids and Apolipoproteins: A Meta-Analysis of 60 Controlled Trials," *The American Journal of Clinical Nutrition* 77 (5) (2003): 1146–1155. © 2003 by American Society for Nutrition.

have a higher prevalence of insulin resistance compared with European populations, which is hypothesized to be due to genetic determinants: the "thrifty gene" maintains caloric reserves in times of food scarcity.[28] Until recently, these populations were generally highly active and lean and thus protected from the adverse effects of this genetic predisposition. However, with more sedentary lifestyles and alarming increases in overweight, these populations are experiencing a massive diabetes epidemic.

Carbohydrates have traditionally been categorized by their chemical structures as either simple or complex. However, this distinction has no basis in physiology. Some forms of complex carbohydrates, such as starch in potatoes, are very rapidly metabolized to glucose. Instead, the glycemic index, which indicates the glycemic response after carbohydrate intake, is a better basis for carbohydrate characterization. Highly refined, as opposed to less-refined, carbohydrates result in a greater glycemic response and increased plasma insulin levels, which compound other adverse metabolic changes from carbohydrate consumption.

Instead of distinguishing between simple and complex carbohydrates, dietary recommendations should emphasize wholegrain and other less-refined complex carbohydrates as opposed to the highly re-

fined products and sugar that make up such a large portion of the U.S. diet. Globally, cassava is grown for its resilience in semi-arid conditions, but when refined into flour, it has very low nutritional value and a high glycemic load. Such products are rapidly digested and absorbed, resulting in rapid swings in insulin levels; they cause further harm by displacing foods that provide fiber and micronutrients that are lost in the milling process. For example, white – but not brown – rice is associated with a higher risk of diabetes, and replacing the same amount of white rice with brown rice decreases the risk of diabetes. In general, higher intakes of refined starches and sugar, particularly with low-fiber intake, are associated with increased risk of diabetes and CHD.[29] Higher intake of fiber from grain products, in contrast, is consistently associated with lower risks of CHD and diabetes.[30] Importantly, unrefined foods can also have high glycemic loads. Potatoes, for example, are associated with increased risk of diabetes, especially among obese and sedentary people with underlying insulin resistance.

Sugar-sweetened beverages (SSBs) are particularly problematic because of their large sugar load and rapid absorption. Observational data and randomized trials have demonstrated a significant association between SSB consumption and weight gain, and when SSBs are reduced, weight loss ensues.[31] Global consumption of SSBs is rising. In Mexico, SSBs supply roughly 10 percent of total calories. In Brazil and China, per capita Coca-Cola consumption increased by 269 percent between 2000 and 2010. SSB intake in the United States declined between 2000 and 2008, but SSBs remain the largest contributor to added sugar in U.S. diets and a leading source of calories.[32] Denmark, Hungary, France, and Mexico have imposed taxes on SSBs, and though the long-term population health effects remain to be seen, one study found an inverse relationship with SSB taxation and obesity.

Substantial evidence indicates that fruit and vegetable consumption is also important for cardiovascular disease prevention.[33] High intake of vegetables reduces blood pressure; the active factors remain unclear, but potassium is a likely contributor. Higher fruit and vegetable consumption may also lower the risk of neural tube defects, the most common severe birth defect, due to higher folic acid intake.[34] Carotenoids lutein and zeaxanthin are found in green leafy vegetables and have been inversely related to the risk of cataracts and, possibly, age-related macular degeneration.[35] The flavonoids found in berries and other fruits may help prevent Parkinson disease and type 2 diabetes.[36] The benefits of fruit do not necessarily apply to juice because it contains less fiber and naturally has a high sugar content. Large quantities of juice can be consumed rapidly, which contributes to weight gain and glucose intolerance.

In contrast to its benefits in preventing other chronic diseases, overall fruit and vegetable consumption has little effect on cancer prevention after adjusting for differences in other lifestyle factors such as smoking and body mass index.[37] However, reductions in risk of renal cell and estrogen receptor-negative breast cancer have been documented,[38] and specific fruits or vegetables may be beneficial against specific cancers. For example, some evidence suggests that lycopene, mainly from tomato products, reduces risk of advanced prostate cancer.[39]

Fruits, vegetables, and other foods are often processed or preserved for availability year-round. Large amounts of salt are used in processed foods, and commercially prepared foods contribute 75 percent of the sodium in the U.S. diet. Excess consumption of salt (sodium chloride) is irrefutably linked to high blood pressure. An estimat-

ed 22 percent reduction in stroke incidence and 16 percent reduction in CHD, in addition to the prevention of fifty thousand to ninety thousand cardiovascular deaths per year in the United States, would result from reducing sodium intake by three grams per day.[40] Many studies have shown an association between the consumption of salty and pickled foods and stomach cancer. Frozen fruits and vegetables are of equal nutritional value to those that are fresh, and usually avoid the added salt of canned goods.

Any potential benefit of vitamin or mineral supplements depends on the individual's baseline levels. A full discussion of the role of vitamin supplements is beyond the scope of this essay, but briefly, some supplementation can counteract micronutrient deficiencies. In particular, a large fraction of the U.S. population and the vast majority of African Americans have insufficient vitamin D, which is a risk factor for a wide array of diseases. A daily supplement of one thousand to two thousand IU (International Units) will bring most people to an adequate level, although those with darker skin and little sun exposure likely need more. Globally, insufficient iron is also common in premenopausal women. Multivitamins can ensure adequate levels of a variety of micronutrients, but few trials of multivitamins on long-term health have been completed. The Physician's Health Study II trial showed an 8 percent reduction in total cancer incidence in a large eleven-year trial among physicians.[41] One may speculate that less-well-nourished persons could accrue greater benefits.

Whole-diet intervention studies have validated the components of a healthy diet. The landmark 4.8-year PREDIMED randomized trial in Spain demonstrated that the Mediterranean diet, supplemented with additional olive oil or nuts, substantially reduced major cardiovascular events, as compared with conventional low-fat dietary advice.[42] The Mediterranean diet includes olive oil, nuts, fruits, vegetables, moderate fish and poultry, legumes, and moderate alcohol consumption, and discourages SSBs, spreadable fats, dairy products, red and processed meats, and sweets. Our group developed the Alternative Healthy Eating Index (AHEI) based on foods and nutrients predictive of chronic disease risk, and in observational studies this pattern is associated with lower risk of cardiovascular disease, diabetes, and cancer.[43]

Obesity is a global challenge: it is a major cause of diabetes, cardiovascular disease, and some forms of cancer. In the United States, long-term weight gain is most strongly driven by consumption, often in large amounts, of foods and beverages of low nutritional quality, such as potatoes and potato chips, refined grains, SSBs, and processed and unprocessed meats, along with increased sedentary behaviors such as watching television and sitting at a computer, and declining physical activity. Obesity has a considerable environmental toll as well. Obese adults require more energy to maintain their biomass. The global additional caloric need due to overweight is the equivalent of feeding about 120 million adults. If the global population had the same age/sex BMI (body mass index) distribution as the United States, this number would rise to nearly half a billion. Obesity also increases material and transportation costs.[44]

Genetic modification (GM) of fruits, vegetables, and other foods is increasing. Supporters of GM foods laud their potential to increase food production, while others are concerned that GM foods threaten biodiversity and disrupt ecosystems. GM crops have been developed for insect and drought resistance, herbicide tolerance, and taste. Genetic modification can make plants produce beneficial nutrients and oils, as with beta-carotene rice and unsaturated fatty acids in GM soybean oil. Corn, cotton, and

soybeans make up the majority of GM crops. The USDA has reported that GM crops, with lower insecticide use, generally have higher yields due to fewer pests. Yet there is concerning evidence demonstrating the evolution of insect resistance to GM corn.[45] Some argue that use of GM crops removes incentives for hybridization solutions to improve the nutritional profile of foods or to mitigate blight and drought. There is no credible evidence to indicate any direct adverse health effects from consuming GM foods.

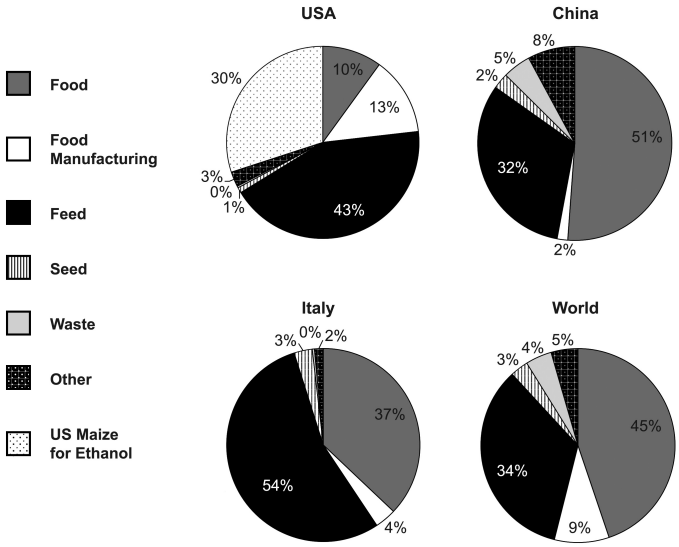
The resurgence of local food consumption has supported community economic development and helped avoid the increased carbon emissions associated with distant food transport. However, "food miles" is an imperfect metric for evaluating the carbon footprint of food transport, since the efficiency of large-scale shipping can at times offset the environmental gains of increased regional trucking. Emissions also vary by food type, with red meat having the worst impact. One study found that replacing one day per week's calories from red meat and dairy products with chicken, fish, eggs, or vegetables achieves more greenhouse gas reduction than buying all locally sourced food.[46]

In terms of environmental and public health impact, organic products may be less harmful because organic farms do not use synthetic pesticides or antibiotics. Though recent studies and EPA announcements have concluded that pesticide residue levels in conventionally produced foods are safe for consumption, the long-term health effects of many pesticides remain understudied or unknown. Even at low doses, pesticide exposure has been linked to the development of Parkinson's disease,[47] impaired child neurological development,[48] and other diseases. Growing antibiotic resistance from livestock meat and dairy production at conventional farms is another reason some consumers prefer organic foods. But rather than a simplistic dichotomy of organic/not, a more nuanced approach might be useful in determining the most effective types of fertilizers and pest-control strategies to increase production of healthful foods while minimizing adverse impacts on health and the environment. In terms of nutrient content, organic foods do not appear to be better than conventionally grown foods.[49]

Fortunately, the diets that promote human health and environmental sustainability broadly intersect. Most important, high consumption of red meat has many adverse health effects, while livestock-pasture expansion drives climate change through the release of carbon and methane into the atmosphere, depletion of water resources, and destruction of biodiversity. Further, most grain – produced with massive environmental impacts – is not used for human consumption: 34 percent of all grain globally is used as animal feed, while 30 percent of the grain produced in the United States is used for ethanol biofuels (Figure 3). Fish consumption may be an exception to the convergence of health and environmental considerations: fish has important benefits for human health, but overfishing has damaged many marine ecosystems. Thus, development and enforcement of sustainable production practices is required.

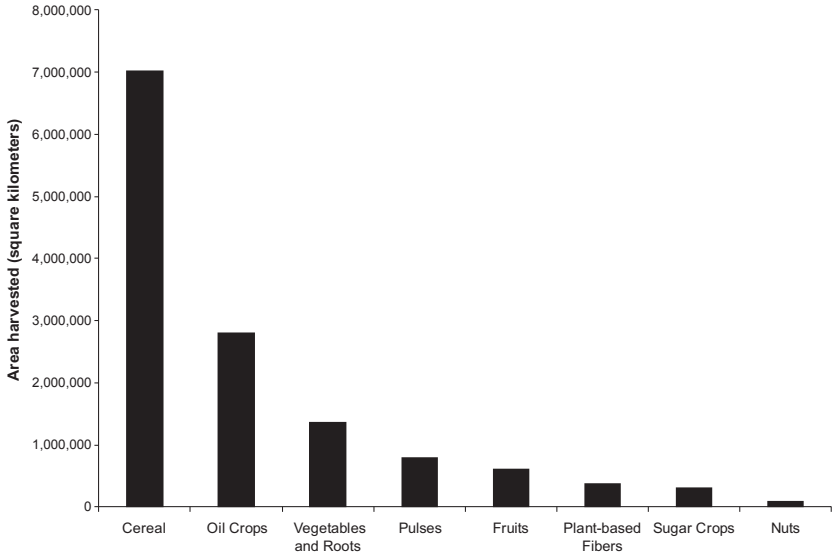
Nutritional evidence encourages major reductions in red meat and dairy intake, which would reduce the water contamination, biodiversity loss, and soil and air pollution from animal feeding operations. Livestock production uses 70 percent of the world's agricultural land and continues to expand through deforestation. The current global land-use distribution (Figure 4) favors cereals, largely used as animal feed. Multiple analyses project dramatic environmental benefits if U.S. farmland were diversified with healthy fruits and vegetables instead of the current corn- and soy-

Figure 3
Domestic Uses of Grain in the United States, China, Italy, and the World (Total)



Grains represented in data include wheat, rice, barley, maize, rye, oats, millet, sorghum, and other cereals. Data on maize used for ethanol were only available for the United States. China uses 19 percent of the total grain used in the world; the United States uses 15 percent; Italy uses 1 percent. Source: Food and Agriculture Organization of the United Nations, Statistics Division, FAOSTAT, "Food Balance: Food Balance Sheets," http://faostat3.fao.org/home/E.

Figure 4
Global Land Use in 2012 for Cereals, Oil Crops, Vegetables and Roots, Pulses, Fruits, Plant-Based Fibers, Sugar Crops, and Nuts



Source: Food and Agriculture Organization of the United Nations, Statistics Division, FAOSTAT, "Production: Crops," http://faostat3.fao.org/browse/Q/QC/E.

bean-dominated landscape. A recent report from the Union of Concerned Scientists concluded that diets high in plants and low in meat and dairy, as described in the Harvard Healthy Eating Plate, have a smaller environmental footprint than the USDA's MyPlate, which recommends red meat and high dairy intake.[50]

Current evidence for healthy eating supports elimination of trans fats from hydrogenated oils, a shift from saturated to unsaturated fats, low consumption of dairy products, and avoidance of red meat and added sugar. Nuts, legumes, fish, and some poultry should be emphasized as protein sources, grains should be in whole rather than refined form, and a variety of fruits and vegetables should be consumed daily. This healthy dietary pattern is consonant with sustainable agriculture and environmental preservation.

ENDNOTES

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