



# Summary Report of the Harvard Research Symposium on the Nexus of Food, Agriculture, Environment, Health and Society

February 27, 2015 at Harvard University  
Report by Lauren Bloomberg

## 1. Abstract

The Harvard Research Symposium on the Nexus of Food, Agriculture, Environment, Health, and Society (the “Food+ Symposium”) was held on February 27, 2015 in Harvard University’s Geology Museum Lecture Hall. The goal of the symposium was to provide attendees with a sense of the excitement and breadth of the Food+ research underway at Harvard and to foster cross-fertilization among researchers. More than twenty Harvard faculty members from eight schools and a dozen departments gave seven-minute “speed presentations” on their current Food+ research. An audience of more than 250 students, faculty, staff, and citizens from the greater Boston community attended. This summary report includes an overview of the symposium’s content, provides the contact information and self-authored abstracts of the Harvard faculty presenters, identifies and thanks those individuals and organizations that helped to make the symposium a reality, and provides links to audio and video recordings of the symposium.

## 2. Overview

### 2.1 Background

[Steven Bloomfield](#), Executive Director of the Weatherhead Center for International Affairs, opened the Food+ Symposium with Henry David Thoreau’s enduring wisdom: “I have great faith in a seed. Convince me that you have a seed there and I’m prepared to expect wonders.” The Food+ Symposium’s “seed” was planted six years ago, when [Robert Paarlberg](#), Steven Bloomfield and [William Clark](#) initiated a [Workshop on the Sustainability of the World’s Food and Farming Systems](#) at the Weatherhead Center. However, as William Clark explained in his introductory remarks, by 2014 it had become clear that the Workshop was only scratching the surface of Harvard University’s wealth of food-related research and experts. And while other fields have energetic, logical focal points around which to convene and share perspectives, no such focal point had organically emerged at Harvard for the Food+ nexus.

To better highlight Harvard’s Food+ wealth, Paarlberg and Clark conceived of the idea of a symposium featuring a cross section of the university’s current research on food-related topics. With support from Harvard Kennedy School student Jessica Newman, they assembled a university-wide Food+ Steering Committee, which in turn sought out food-area experts from throughout Harvard’s diverse faculties and professional schools. They found more research underway from a wider range of perspectives than anyone had imagined. This discovery, together with the Steering Committee’s view that a half-day symposium was most desirable, led

the organizers to focus Food+ planning on the research of *faculty*, though this meant that an even wider array of work by students, research and program staff would not be represented at the event. (For an indication of the breadth and depth of this work, see the “Acknowledgements” and “Additional Symposium Resources” sections later in this report).

The Food+ Symposium that emerged from these planning activities strove to provide attendees with a sense of the excitement and range of the Food+ research underway by Harvard faculty and to foster cross-fertilization among researchers. The symposium was conceived to complement the existing food activities of Harvard students, activists and centers, such as the [Deans’ Food System Challenge](#). In his introductory remarks to the symposium, Bloomfield expressed his hope that this Food+ event would plant seeds of curiosity in the Food+ community and advance food research at Harvard for years to come.

During the four-hour symposium, twenty-two Harvard faculty members – representing a dozen academic departments and eight professional schools – presented seven-minute “speed overviews” of their food-related work. This presentation structure was designed to share a snapshot of Harvard faculty research rather than delve into methodology or specific evidence. Over 250 members of the Harvard and Cambridge communities gathered to learn about Harvard’s research at the nexus of food, agriculture, environment, nutrition, health and society. Diverse Harvard schools and services were represented in the audience, as well as affiliates of Boston University, Tufts, MIT and other local universities. The event drew members of the wider Boston food community from the private, public and non-profit sectors.

## 2.2 Research Themes

The presentations covered broad-ranging topics, with many salient themes emerging throughout the day. In the area of **Food Economics**, David E. Bell examined crop commodities and supply chains, while Michael Kremer discussed a mobile phone service that could inexpensively improve Indian agricultural productivity. On the subject of **Food Politics**, Robert H. Bates explained the relationship between African party competition and the region’s recent agricultural/economic revival. Sheila Jasanoff compared how three different political cultures have influenced societal perceptions of food technology innovations.

The theme of **Food Regulation** was central in multiple presentations. Comparing the European and American models of livestock regulation, Robert Paarlberg explained the importance of regulatory environment as global meat and fish consumption increases. Emily M. Broad Leib examined the relationship between law and food systems through the example of expiration dates and food waste. Jacob E. Gersen focused on food labeling laws, asking how consumer perceptions and subsequent purchases are influenced by labels.

Within the realm of **Food and Society**, Joyce E. Chaplin described the evolution of historiography as historical hunger and material determinism are increasingly appreciated within the discipline. Susan Greenhalgh’s anthropological approach revealed the traumatic human costs of the “war-on-fat” and socially-acceptable “fat-shaming.” Gunnar Trumbull compared American and French culinary identities, as well as explained the social factors that drove the transformation of food innovation.

Several faculty presenters brought a **Public Health** perspective to the Food+ Symposium. Ann Forsyth introduced the factors by which urban design seeks to optimize the health of city populations and the sustainability of cities. Elsie Sunderland weighed the health risks versus nutritional benefits of fish consumption, outlining the challenges of toxicity and sustainability. P.K. Newby argued for a holistic approach to nutritional epidemiology, and emphasized that health choices extend beyond the individual.

Closely related to Public Health, David S. Ludwig and Walter C. Willett's presentations emphasized the theme of **Nutrition Science**. Ludwig stressed the importance of dietary quality over caloric balance, and how the prevalence of processed carbs in the American diet could be fueling the obesity epidemic. Willett's long-term longitudinal studies revealed the relationship between diet and disease, underscoring the role of a healthy dietary pattern in disease prevention.

In the area of **Agricultural Innovation**, Shawn Cole presented his study of a mobile-phone technology and managerial improvements that increased yields on farms in India. Daniel Schrag shared the results of a study he had chaired for the President's Council of Advisors on Science and Technology. The report analyzed agricultural research systems, issues of funding competition, and preparedness for current and future challenges to agriculture. George Church discussed genetically-modified crops as alternatives to hazardous chemical pesticides, while N. Michele (Missy) Holbrook discussed genetic adaptation of crops to incorporate water-conservation traits.

Three faculty presentations emphasized the theme of **Climate Change**. Elizabeth M. Wolkovich explored the historical evidence provided by wine grape harvesting records with a view toward mitigating the future impacts of climate change. Samuel S. Myers discussed the negative impacts of global climate change and declining wildlife populations on the nutritional quality of crops. Peter Huybers introduced models of potential crop damage due to warming trends, and explored the prospects for long-range prediction of heatwaves and improved agricultural adaptation.

The faculty presenters contributed a richness of perspective beyond the envisioned scope of the conference. The overarching and resounding theme of "Food" connected these diverse subjects and unique outlooks, highlighting the importance of food-related research and the urgency of the faculty members' work. Several invited presenters, whose perspectives would have further enriched the discourse, unfortunately could not attend: Theodore C. Bestor (FAS Anthropology), Richard Hornbeck (FAS Economics), Nathan Nunn (FAS Economics), Rema Hanna (HKS), Calestous Juma (HKS), Forest L. Reinhardt (HBS) and Aaron Bernstein (HMS).

[Ray Goldberg](#), whose breadth of perspective on the global food system is described by Clark as "unparalleled," closed the symposium. Goldberg lamented that due to time constraints, Harvard faculty are often unable to connect with other faculty beyond their immediate domain. Harvard students have made great progress overcoming the decentralized nature of the school system, and so must the food-area faculty. For this reason, Goldberg expressed hope that the Food+ Symposium becomes an annual event wherein speakers provide five-year prospectuses and share updates on their projects from the prior symposium. In conclusion, Goldberg stressed that the public, private and non-profit sectors are not enemies, as they are often mischaracterized.

Modern society does not have the luxury of assigning blame or declaring villains. Goldberg noted that we are beginning to witness innovative cross-sector collaborations to address the food-related problems discussed in the symposium. Such partnerships between sectors are, he argued, the only way forward. Harvard could play an important role in facilitating and participating in them.

### **2.3 Audience Feedback**

During the Food+ Symposium, attendees shared their reactions to presentations and discussed the thought-provoking research in real time via Twitter (#HarvardFoodPlus). After the event, participants were invited to anonymously share their feedback through an online submission portal. The request for feedback included questions about the event structure and content, as well as the future of “Food+” at Harvard and beyond. Respondents argued that certain topics – such as food as a resource (availability/competition), socioeconomic factors of food access and eating habits, and food trends (e.g. organic and localist) – were largely missing from the discourse and thus, presumably, from the research now being conducted by Harvard faculty. Overall, the most frequent response was an appreciation of the broad multidisciplinary range represented at the symposium. One participant suggested that the series of talks would provide the basis for “an amazing degree program.” On the future of Food+, feedback included multiple requests to include faculty from other local universities in the “Food+” dialog, as well as the suggestion to showcase the cutting-edge work of Harvard students. Many participants requested information and opportunities for involvement in subsequent Food+ activities, demonstrating the Harvard community’s deep and timely interest in the nexus of food, agriculture, environment, nutrition, health and society.

### **3. Presentation Summaries (*as provided by speakers*)**

#### **Robert H. Bates**

Eaton Professor of Politics, Department of Government, FAS

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#### *The Politics of Agricultural Policy in Africa*

In the decades after independence, many states in Africa became poorer; they turned authoritarian; the policies of their governments exhibited urban bias; and while peopled largely by farmers, Africa imported much of its food. Scholars, including myself, probed the roots of their economic decline and hypothesized that they lay in Africa's politics.

More recently, Africa's economies have revived, propelled in significant part by the revival of agriculture. Systematic research strongly suggests that politics again plays a major role. The return of party competition, it has been found, means that those competing for power now have to counter to the interests of farmers, who constitute the majority of the electorate. Politicians therefore have a strong incentive to endorse policies that promote the interests of those who produce rather than those who purchase agricultural crops.

Changes in political institutions in Africa thus produce a change in political incentives; the change in political incentives seems to have led to a change in public policies; and the change in policies appear to have affected the behavior of farmers.

**David E. Bell**

George M. Moffett Professor of Agriculture and Business, HBS

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*Supply Chains*

Prof. Bell discussed three trends that affect the trading of commodities in the world today. The first is a move away from crops as commodities: crops are increasingly being segregated and tracked both for food safety reasons but also because of consumer demands for different food types. The second trend is a renewed interest in self-sufficiency by nations. The international trading of food is economically optimal but not if it leaves a country exposed to disruption. Finally there is the problem of correlated risk: as communications improve, consumers and countries react to events in coordinated ways, creating large swings in supply and demand.

**Emily M. Broad Leib**

Lecturer on Law, HLS; Director, Harvard Food Law and Policy Clinic

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*The Role of Law and Policy Research in Our Food System; Case Study on Food Waste*

This presentation discussed how law and policy can contribute to efforts to improve the health and environmental impacts of our food system. It discussed key tools lawyers bring to this work and described research and practice utilizing such tools to reduce the staggering amount of unnecessary food waste.

**Joyce E. Chaplin**

James Duncan Phillips Professor of Early American History, History Department, FAS

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*Food and America's Material Origins*

The 2013 excavation of cannibalized human remains at the site of Jamestowne Fort in Virginia, where winter hunger killed many colonists during the “Starving Time” of 1609 to 1610, was a dramatic reminder that material scarcity has been an intrinsic part of the American past. The Jamestown discovery joins many other recent prompts to consider food—in its broadest definition, from subsistence cannibalism to modernist cuisine—as part of the academic historian’s remit. This is a significant shift. For a long time, historians preferred to emphasize ideas, agency, and other non-material factors. They feared, however incongruously, that to argue for the place of food in history was, on the “low” end (as with starvation), too materially

deterministic or else, on the “high” end (meaning restaurants), too frivolous. Now, however, there is an intriguing rush to examine how America had material as well as ideological origins. This trend is expressed in new work on climate, environment, and natural resources, including food. My contributions include publishing multiple pieces on these topics (most recently a forthcoming co-authored book on Thomas Robert Malthus, the original “Malthusian”), advising dissertations on food and environment, helping two new academic journals in food studies get a start, and teaching food history to undergraduates in the General Education curriculum.

### [George Church](#)

Professor of Genetics, HMS

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#### *Genetic Alternatives to Pesticides, Herbicides, Antibiotics and Antiviral Chemicals*

Alternatives are needed for expensive and hazardous doses of chemicals applied to entire ecosystems and the systems fed by water runoff to repeatedly (and temporarily) fight off numerous pests. Genetics can help by changing the types of food production, e.g. vegan/microbial sources with taste and texture equivalent to meat and dairy. A second route is via gene drives which enable intentionally permanent or reversible changes in the pest populations or disease vectors.

### [Shawn Cole](#)

Professor, HBS, and affiliate of the Poverty Action Lab and the NBER

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#### *The Value of Advice: Evidence from a Mobile-Phone Based Agricultural Advice Service in India*

Attempts to explain the astonishing differences in agricultural productivity around the world typically focus on farm size, farmer risk aversion, and credit constraints, with an emphasis on how they might serve to limit technology adoption. This paper took a different tack: can managerial practices explain this variation in productivity? A randomized evaluation of the introduction of a mobile-phone based agricultural consulting service, “Avaaj Otalo (AO)” to cotton farmers in Gujarat, India, reveals the following. Demand for agricultural advice is high, with over two thirds of treatment farmers calling into the AO line. Farmers offered the service turn less often to other farmers and input sellers for agricultural advice. Management practices change as well: farmers invest more in the most appropriate inputs, make better pesticide and fertilizer decisions. We find dramatic increases in yield for cumin (33%), and improvements in cotton yield (10%) for a sub-group which received frequent reminders to use the service.

**Ann Forsyth**

Professor of Urban Planning, GSD

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*Neighborhood Food Environments and Beyond*

My work focuses on the social aspects of physical planning, urban design, and urban development. The big issue behind this research and practice is how to make more sustainable and healthy cities and the site of most of that research has been in suburbs and smaller cities. In my professional work as a planner and urban designer, and in my research, I have come at this problem in several ways—studying places, developing tools, and reflecting on practices.

In the area of healthy places, I started with an interest in walking and physical activity, and transitioned from there to food, making most of my contributions in the area of measuring neighborhood environments. I have created a number of new tools and methods in planning—an urban design inventory, GIS protocols, health impact assessments, survey instruments, and participatory planning techniques. However, neighborhood design, while important, makes a modest contribution to healthy eating and physical activity. This has led me to be interested in many other connections between health and place—exposures to contaminants and irritants, accessibility to resources of healthy living, and environmental supports of healthy behaviors. I have worked to translate some of this research for practice, while highlighting the need to supplement these environmental characteristics interventions at other spatial scales and in programming, education, policy, and pricing.

**Jacob E. Gersen**

Professor of Law & Affiliated Professor of Government, HLS; Director, the Food Law Lab at Petrie-Flom

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*On Food Law & Food Beliefs*

What is food law and how does the law drive the food that is produced, sold, and consumed? In a case involving two producers of pomegranate blueberry juice, the Supreme Court recently held that competitors may sue food companies for labels that are fraudulent or misleading to consumers. In *Preference and Perception in the Law of Food*, we report on preliminary survey results about how consumer perceptions of food are affected by food labels. The results suggest that most survey respondents were not confused by the allegedly confusing labels at issue in *POM Wonderful v. Coca-Cola*, and that the dominant driver of purchasing decisions is not perceived quality, nutrition, or juice content, but simply perceived price.

**Susan Greenhalgh**

Professor of Anthropology, Anthropology Department, FAS

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*Fat-talk Nation: The Human Costs of America's Fight Against Fat*

For the last 15 years America has been home to a society-wide “war on fat” in which not just public health authorities, but every sector of society, and all of us as individuals are engaged in constant “fat-talk” aimed at educating, badgering, and shaming heavy people into shedding pounds. We hear a great deal about the health and economic costs of obesity to the nation, but little about the human costs the war on fat itself might be imposing. My anthropological research examines how the war on fat is playing out in society and with what effects on individuals and society. Despite enormous progress in understanding the biology of obesity, efforts to find safe, effective means to prevent and treat obesity have not yet yielded satisfactory results. But the motivation to lose weight is stronger than ever. In American culture, my research suggests, fatness is not primarily about health; it is about morality and political inclusion. While thin, fit people are celebrated as “good biocitizens,” fat people are deemed undeserving of membership in the community of valued Americans. In an analysis of 250 auto-ethnographic narratives of young Californians, I trace the emergence of our country’s first “war-on-fat generation,” a generation obsessed with their bodies and whose most fundamental sense of self comes from their size. The findings, to be published this spring in *Fat-talk Nation: The Human Costs of America’s War on Fat*, show that regardless of their weight, most feel miserable about their bodies and almost no one is able to lose weight and keep it off. This book shows that the battle against fat, designed to rescue America from obesity-induced national decline, is itself damaging the bodily and emotional health of young people and disrupting families and intimate relationships. The human trauma is disturbing -- and it is virtually unknown. Even as scientific research on obesity continues, we need a cultural revolution aimed at rethinking fat-talk, stopping fat abuse, and dethroning weight as a central measure of human value.

**N. Michele (Missy) Holbrook**

Charles Bullard Professor of Forestry, Department of Organismic & Evolutionary Biology, FAS

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*Breeding Water-Conserving Crops: Why Understanding the Physiological Basis of Water Conservation Traits is Helpful*

Soybean lines that appear less sensitive to drought (delayed wilting phenotype) have around for several decades, but the incorporation of this trait into superior yielding germplasm has been slow due to inconsistent yield performance of progeny lines. Here I reported studies begun in my lab in which we found that the slow-wilting phenotype (in PI416937) is the result of limited hydraulic conductivity within the leaf that causes stomatal closure during high atmospheric vapor pressure (VPD). Identification of the hydraulic basis for delayed wilting behavior has allowed the development of screens for the phenotypic expression of this trait in breeding material and thus the commercialization of this "water conservation" trait.

## [Peter Huybers](#)

Professor, Department of Earth and Planetary Science, FAS and SEAS  
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### *Crops and Temperature Extremes: Damage, Prediction, and Adaptation*

High temperatures damage crops, and the warming expected in coming decades raises concerns regarding future yields. This talk briefly reviewed several lines of work to model crop damage from high temperatures, quantify potential adaptation to hotter conditions, and improve prediction of changes in extreme temperatures.

Sensitivity of US maize yield to high temperature varies by an order-of-magnitude across climate zones. Using this extant adaptation across space as a proxy for adaptability to future warming suggests that production losses in the Southern US from a moderate warming of mean temperature would be counterbalanced by increased Northern production. Changes in other moments of the temperature distribution are also possible, of course, and we identify significant trends in variance and skew to accompany mean warming. Curiously, the hottest growing season temperatures in the US Midwest are found to be trending cooler. Only a small fraction of Midwest cropland is irrigated, and the wider cooling effect appears to be that agricultural intensification is associated with greater capacity for transpiration. Crops increasingly cool ambient air temperature through evaporation, though this moderating effect is lost during drought conditions, whereupon temperatures revert back to historic highs. Finally, in exploring long-range prediction of heat waves, we identify a mode of ocean-atmosphere variability in the mid-latitude Pacific that permits for skillful predictions more than 40 days in advance. If this predictive horizon can be further extended, perhaps through improved ocean forecasting, heat-wave probabilities could be factored into planting decisions.

## [Sheila Jasanoff](#)

Pforzheimer Professor of Science and Technology Studies, HKS  
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### *Between Two Worlds: Technological Controversy and the Future of Food*

Professor Sheila Jasanoff discussed the factors underlying radically different interpretations of innovation in food technology. What is at stake here? Some claim that GMO technology will improve upon nature - making it more orderly and manageable - thus increasing yield and the capacity to feed the growing global population more efficiently. Others (often dismissed as “neo-luddites”) protest against GMO technology, with undertones of socioeconomic conflict and divergent views about the meaning of nature and the natural. Jasanoff’s research looks cross-nationally and comparatively at the kinds of politics that people have constructed around agricultural technologies. For example, in America, a form of “denialism” has sprung up around GMOs, with experts explaining each episode of accidental release as a fault of disparate social actors rather than of the technology itself. She has found that expectations about how public knowledge should be generated and what constitutes legitimate expertise differ across America, Britain, and Germany. Three salient differences can be identified across these three political cultures: expectations about the relations between politics and expertise; the production of trust

around technical claims; and decisions about what kinds of products are appropriate to consume. “What kinds of food do we want?” thus translates into “What kinds of politics and ethics do we want?”

### **Michael Kremer**

Gates Professor of Developing Societies, Department of Economics, FAS

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#### *The Potential for Mobile Agriculture Extension*

Public agricultural extension services in many developing countries suffer from management and accountability problems, and provide coarse messages that are not tailored to farmer circumstances. Private agricultural extension services are subject to market failures: a service may charge for advice, but that advice can easily be shared, and if a service is supported by commissions its credibility is difficult to assess. A mobile phone based approach could provide information at low marginal cost. Existing research suggests this could potentially increase smallholder farmers’ productivity; facilitate adaptation to changing climate and extreme weather; reduce use of unnecessary pesticides and fertilizer, and improve the operations of contract farming organizations. Information could be tailored to local agro-climatic conditions (soil chemistry, weather forecasts, pest outbreaks), market conditions (input and output availability and prices), and individual farmer characteristics (acres under operation, labor supply, time of planting, education, previous experience). Such a system could allow for a two-way flow of information with farmers on results and experiences. Using machine learning and continuous experimentation, the platform could continuously improve its ability to deliver tailored messages on best practices. Access could potentially be made free to farmers by partnering with large-scale contract farming organizations, governments, and donors. There may also be potential for financing via advertising, technology firms, and telcos.

### **David S. Ludwig**

Director, New Balance Foundation Obesity Prevention Center, Boston Children's Hospital;  
Professor, Pediatrics, HMS; Professor, Nutrition, HSPH

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#### *Which Comes First, Overeating or Obesity?*

The conventional approach to weight loss, based on the First Law of Thermodynamics, considers obesity a simple problem of calorie imbalance: too many consumed, not enough expended. Because fat has twice the calorie content of the other major nutrients, the mainstay of obesity treatment for the last half century has been the low fat diet. Unfortunately, this approach has shown exceptionally poor long-term effectiveness in practice.

This conventional approach disregards decades of research into the biological control of body weight. Feeding studies show that simple calorie reduction elicits physiological adaptations – increasing hunger and decreasing metabolic rate – that antagonize weight loss over the long term. According to an alternative hypothesis, the anabolic state of fat cells plays a dominant role

in the control of body weight. When fat cells become excessively anabolic, they take in and store excessive calories. Consequently, the concentration of metabolic fuels in the blood stream declines, triggering the starvation response.

Numerous factors in the environment affect the anabolic state of fat cells, but chief among them is consumption of processed carbohydrate, including refined grains, potato products and concentrated sugar. These high glycemic load foods stimulate, calorie for calorie, more insulin secretion than unprocessed carbohydrates, protein or fat. Thus, the increasing amount and processing of dietary carbohydrate may have elicited adverse biological changes in the US population and driven the obesity epidemic. If this hypothesis is true, than a focus on dietary quality, rather than calorie balance, would produce better results in the long-term treatment of obesity.

### [Samuel S. Myers](#)

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Clinical Instructor, HMS

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### *Impacts of Global Environmental Change on Human Nutrition*

The research I do with the greatest relevance to the Food Plus Symposium is a series of investigations into the nutritional and health implications of large-scale, anthropogenic environmental change. My group has evaluated the impact of rising concentrations of atmospheric CO<sub>2</sub> on the nutritional value of important food crops by building a large dataset of 41 cultivars of six important food crops grown in 7 locations on 3 continents over 10 years at both ambient and elevated (roughly 550 ppm) CO<sub>2</sub>. We found significant reductions in iron, zinc, and protein in these crops in response to concentrations of CO<sub>2</sub> that the world will experience within the next 40-50 years. We have also been studying the impacts of pollinator declines on human nutrition and health outcomes in a global analysis which calculates burden of disease for each of 160 countries in response to different pollinator decline scenarios. Finally, we have been studying how declines in both terrestrial and marine wildlife populations would impact nutrient intake and health outcomes. We are doing this at a fine scale in Madagascar where we are collecting data on dietary intake, wildlife population dynamics, and biological samples (blood, breast milk, blood spot, malaria and parasitology testing, and fecal samples) from 750 individuals over time. We are also conducting a global analysis of the ways in which fisheries management and fisheries declines would impact nutrient intakes and health outcomes for populations around the world.

## [P.K. Newby](#)

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### *Researching & Communicating Nutrition in the 21<sup>st</sup> Century*

From the earliest discoveries of vitamins and minerals, nutrition science has traditionally relied upon reductionism to answer significant questions of diet and health. Still today reductionist thinking pervades the discipline, as embodied in the “single nutrient paradigm” that dominates nutritional epidemiologic research. Dependence upon reductionist thinking has limited our ability to uncover dietary truths and effectively communicate life-saving research results. In essence, reductionism does not account for the complexity of food itself, which includes myriad elements that work in concert to impact health—nor does it reflect how people actually eat. The notion of examining diet as a whole rather than as individual nutrients or foods is based on the theory that the entire diet is the principal determinant of health, particularly in matters of chronic disease prevention. Novel methods to study “dietary patterns” emerged in the 1980s and exploded in the past decade, expanding greatly the ways in which nutrition studies are conducted. This growing body of literature has revealed that a plant-based diet is related to a decreased risk of chronic diseases like obesity, heart disease, and type 2 diabetes. As a result, dietary guidelines and recommendations are increasingly focused on the complete diet rather than single nutrients and are thus more comprehensible to the public. The next big challenge for nutrition is going beyond the individual in the study of why what we eat matters and communicating the science in a way that stimulates food choices that create a healthier planet, as well as healthier people.

## [Robert Paarlberg](#)

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### *Regulating Tomorrow’s World of Meat and Fish*

Meat consumption in the developing world will double between now and 2050, and fish consumption will increase rapidly as well (in China fish consumption has been doubling every decade since 1990). These future food needs will be satisfied not through an expansion of traditional barnyard, grazing, and wild catch systems, but from a steady introduction of more highly capitalized and specialized industrial systems, including “factory farm” concentrated animal feeding operations (CAFOs) and farmed fish aquaculture systems.

As these industrial systems expand in the developing world, the regulatory environment will be important. CAFO and aquaculture systems are well regulated for food safety in the United States, but much less so for environmental protection and scarcely at all for antibiotic use (a human health risk) or animal welfare. In Europe, stronger environmental protections are in place, antibiotic use to promote animal weight gain has been banned, and animal welfare standards in some countries (e.g., Germany) are extremely high. For these and other reasons, livestock systems in Europe are high-cost compared to American systems.

My new research project asks if tomorrow's livestock systems (and aquaculture systems) in the developing countries will follow the American or the European model. Also, will this choice be driven by a global extension of corporate best practices, or by public sector measures? Will the rapid expansion of industrial meat and fish production systems in developing countries produce a regulatory race to the bottom, the top, or the middle?

**Daniel Schrag**

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*Report to the President on Agricultural Preparedness and the Agricultural Research Enterprise*

**Elsie Sunderland**

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*Health Impacts of Methylmercury in Fish and Marine Mammals*

Seafood is an important source of protein and micronutrients, particularly for coastal communities in the north and developing countries. Neurocognitive deficits in children associated with methylmercury exposures are well established. Guidance on seafood consumption is less clear because of the countervailing risks associated with reduced intake of omega-3 fatty acids and other less nutritious food choices. Further, global capture fisheries are presently being harvested close to their maximum capacity. Health risks associated with global contaminants such as methylmercury extend beyond individual seafood consumption choices to the health and sustainability of fisheries. Increasingly, contaminant burdens in the tissues of marine mammals and wild fish globally are exceeding toxicological thresholds that may impact the reproductive success of these species. Fluctuations in fisheries stock abundance are generally attributed to climate change and harvesting activities rather than the direct impacts of contaminants on the health of fisheries themselves. Collapse of global fish stocks due to extreme contaminant levels such as in the coastal basins of contaminated rivers in East Asia poses a serious threat to the health of vulnerable coastal communities that depend on fishing resources.

**Gunnar Trumbull**

Philip Caldwell Professor of Business Administration, HBS  
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*Good Food, Bad Food: the Origins of Culinary Cultures in France and America*

[Walter C. Willett](#)

Professor and Chair, Department of Nutrition, HSPH

*Development of Empirical Evidence on Diet and Health*

Strong beliefs have long existed about many aspects of diet and health, but until recently little empirical evidence existed. Beginning in 1980, our group at the School of Public Health and Brigham and Women's Hospital has developed a series of longterm longitudinal studies, now tracking the diets of approximately 300,000 men and women and relating them to incidence of most major causes of morbidity and mortality in the U.S. These studies have also incorporated biomarkers of diet, and more recently have added genomics and metabolomics to understand mechanistic pathways.

Many findings, both hypothesized and unexpected, have emerged from these efforts; these include the relation between *trans* fat intake and risk of coronary heart disease, the benefits of unsaturated fat intake in prevention of heart disease, the importance of carbohydrate quality in relation to risks of diabetes and cardiovascular disease, and the lack of relation between dietary fat and risk of breast cancer. We have shown that a healthy dietary pattern, together regular physical activity and not smoking, can prevent the large majority of heart disease, diabetes, and some cancers. Recent analyses of major protein sources implicate high consumption of red meat in cardiovascular disease, diabetes, and cancer; thus minimizing consumption of red meat represents an important convergence of human and planetary health.

[Elizabeth M. Wolkovich](#)

Assistant Professor of Organismic & Evolutionary Biology at the Arnold Arboretum

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*From Pinot to Cabernet: The Future of Good Wine with Climate Change*

Winegrapes (*Vitis vinifera* ssp. *vinifera*) are one of the world's most lucrative and important crops, and also one of the most responsive to climate, with some researchers suggesting terroir equates to climate. A major way this climate sensitivity is exhibited is through phenology---especially the timing of flowering, veraison and harvest---with winegrape harvest dates serving as temperature proxies they are often so tightly related. Elizabeth Wolkovich gave an overview of work in her lab discussing (1) exploiting the phenological hyperdiversity of winegrapes to better understand what other plant traits may covary with phenological responses to climate, and (2) efforts using long-term harvest records from across France with reconstructions of temperature and drought to examine the drivers of early harvest over the previous centuries and more recently. She showed how suggest climate change may have fundamentally altered the drivers of early winegrape harvests across France, but also highlighted how differences in how varieties respond to climate may provide some buffering from dramatic changes in winegrape regions, given proper advanced management.

## 4. Acknowledgements

### Steering Committee:

Aaron Bernstein (HMS), Steven B. Bloomfield (WCFIA), William Clark (HKS), N. Michele (Missy) Holbrook (FAS), Peter Huybers (FAS), Emily Broad Leib (HLS), Jessica Newman (HKS), Robert Paarlberg (HKS), Forest Reinhardt (HBS), Daniel Schrag (FAS), and Walter Willett (HSPH).

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### Organizing Committee:

Jessica Newman (HKS), Lisa Matthews (HUCE), Megan Margulies (WCFIA), Colin Durrant (OFS), Heather Conrad (WCFIA), Kristin Caulfield (WCFIA), Lauren Bloomberg (HKS).

## 5. Additional Symposium Resources

- Food+ Symposium websites: <http://foodbetter.squarespace.com/research/>;  
<http://wcfia.harvard.edu/conferences/15-Harvard-Food-Plus-Research>
- Food+ Symposium agenda: <http://tinyurl.com/FoodPlusAgenda>
- Video: <https://www.youtube.com/playlist?list=PL2SOU6wwxB0spjJ-8duNZXlmTIY7HG1J8>
- Audio only: <https://soundcloud.com/wcfia/sets/harvardfoodplusresearch>
- Harvard Gazette coverage: <http://news.harvard.edu/gazette/story/2015/03/focus-on-food/>
- Twitter: #HarvardFoodPlus