



Research

Nestlé's *Nourishing the World* symposium – to learn to share

AUTHORS

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In 2016, Nestlé celebrated its 150th anniversary. The company used the occasion to reflect on past achievements and, more importantly, to anticipate the challenges that lie ahead. Undoubtedly the biggest challenge with respect to food will be to address the many factors that threaten the security of nutrition. The topic requires an interdisciplinary understanding of the issues, as well as action by numerous stakeholders, including the food industry.

With food security in mind, *Nourishing the World* was the theme of the 13th Nestlé International Nutrition Symposium, held in October 2016 in Lausanne, Switzerland. Leading experts from both the private and public sectors came together to outline scenarios for the 21st century.

The United Nations' first three global sustainable development goals (SDGs) are (i) eradicating poverty, (ii) zero hunger and (iii) good health and well-being, which are enabled by improving food and nutrition security. The well-known double burden of diseases has evolved into a triple burden: some 2 billion people are deficient in micronutrients, 2.1 billion people overweight or obese and almost 800 million people are food insecure^{1,2}. Malnutrition, which is a consequence of an inadequate diet, is generally regarded as a leading cause of hampered cognitive or physical development and ultimately poor health. Failure to deliver on climate action (SDG 13), one of the greatest challenges of our time, will make global food security impossible.

With its *Nourishing the World* symposium and through its many global initiatives, Nestlé is committed to understanding food and nutrition security in a sustainable manner.

Food safety at Nestlé

Food safety is fundamentally important for food and nutrition security and must continue

to be a high priority. Nestlé's long-term success has been underpinned by the strong conviction that food safety is non-negotiable. The company's commitment to food safety began in 1867, when Henri Nestlé decided that his infant cereal would be sold in packaged units only. This was an innovation in an era when most foodstuffs were sold loose and were exposed to contamination.

Today, Nestlé's food safety standards meet or exceed those described by Codex Alimentarius, which was established in 1963 by the Food and Agriculture Organization of the United Nations and the World Health Organization (WHO) to define science-based safety and quality standards for food. Food has never been safer, and yet every year there are still thousands of people getting sick or even dying from food poisoning. Food safety was the theme of the WHO's World Health Day in 2015, which helped to increase global awareness of the importance of having food that is safe to eat.

It is clear that preventing contamination is key. Familiar pathogens such as *Salmonella* still threaten food safety, but there are more recent threats as pathogens evolve, which include drug-resistant strains of *Salmonella*, *Clostridium* or the Shiga toxin-producing *Escherichia coli* that caused the outbreak of food poisoning in Germany in 2011. Consequently, Nestlé is developing capabilities to identify origins of outbreaks by whole-genome sequencing to eradicate the source. In doing so, Nestlé will stay one step ahead in the fight against life-threatening contamination by making sure that pathogens, as well as organisms that cause food spoilage (for example yeasts, moulds and bacteria), do not get into our foods. Controlling the supply chain ensures safe sourcing of raw materials such as milk, meat, fish, cereals, nuts, seeds, flours, fruit, vegetables and salads. It also means assessing manufacturing processes to confirm that pathogens are destroyed so

that they cannot find their way into finished products. Needless to say, whatever process is used to destroy pathogens it should not also destroy the nutritional value of foods.

Addressing the safety of raw materials can bring benefits to local agricultural communities. For example, one of Nestlé's priorities is to reduce high levels of mycotoxins in cereals from central and West Africa. The underlying, fungus-based contamination is enabled by insufficient hygiene during handling, a humid environment and poor drying and storage conditions. Mycotoxins are considered to be carcinogenic, they can cause immune suppression, impaired development in children and liver damage in both humans and animals. Reductions of mycotoxin contaminations are being achieved through training, capacity building and raising awareness of the health implications of contaminated grains. An estimated 150 million people in Côte D'Ivoire, Ghana and Nigeria will have healthier diets as a result of the Nestlé Grains Quality Improvement project.

Sustainable nutrition

Global food systems are at risk of being undermined by current trends in global population growth, urbanization, poverty, water stress and food waste. Anthropogenic climate change is exacerbating these stressors. In particular, global warming and subsequent worldwide changes in the water cycle increase the risks to ecosystem services, specifically the production of food on land³. Moreover, warming and acidification of the ocean is

impacting marine ecosystems⁴. There is also the compounding problem of inequality in food and nutrition security, with ongoing problems of under- and over-nutrition and their consequences for health. Therefore, as well as ensuring a safe food supply, making nutrition affordable and sustainable is a prerequisite for improving human health in the future.

To continue being successful in the long term, food companies need to go beyond food safety and address nutrition sustainability and affordability. Sustainable nutrition is a collective responsibility that involves industry, governments and individuals.

Specific examples of Nestlé's contribution to ensuring that diets are sustainable include making fortified foods more accessible as well as finding alternative sources of protein, especially to replace those derived from animals.

Fortification

Fortification is a longstanding practice to address micronutrient deficiencies. Regular and frequent consumption of fortified food ensures an optimized health outcome for deficient sub-populations. A systematic review of multi-micronutrient fortified milk and cereal products showed that fortification can be an effective option to reduce anaemia in children up to three years of age in developing countries⁵. However, such interventions are needed on a larger scale. For example, national nutrition surveys conducted in India indicate that micronutrient deficiencies remain prevalent

among children. In 2015, up to 50% of children age 6–23 months and 40% of children age 24–59 months had iron-deficiency anaemia. At the same time, it has been demonstrated that the local economic impact of reversing micronutrient deficiency is substantial⁶.

Nestlé's Popularly Positioned Products strategy provides accessible and affordable nutrition to populations with low incomes. In 2015, Nestlé created nearly 5,000 of these products, of which 79% were fortified with at least one of the principle shortfall micronutrients, namely zinc, iron, vitamin A and iodine.

Since 2013, Nestlé has been working with agricultural research institutes in several countries to develop and establish supply chains for biofortified crops that naturally contain high levels of vitamins and minerals. Local agricultural production of the new crop varieties was still very small until 2015. However, the intermediary trading companies, together with the farmers with whom they work, were able to substantially increase the harvest of biofortified maize in 2016. Much of this crop is used directly by local communities where there is a need for fortified foods. In addition, Nestlé has committed to buy significant quantities of this harvest to stimulate the creation of a reliable supply chain⁷.

Alternative sources of protein

It has been estimated that the demand for livestock products will increase by 70% between 2005 and 2050⁸. The livestock industry

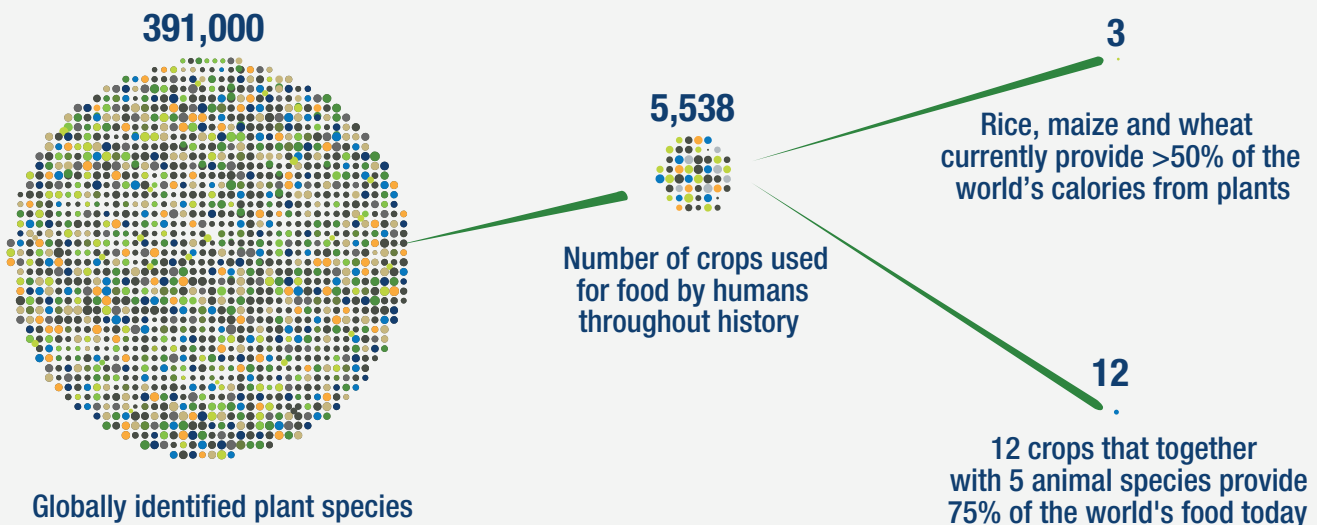


Figure 1. Diversity in the world's food systems is deteriorating significantly (Modified from ref. 11–13). With permission from BIOVERSITY INTERNATIONAL.

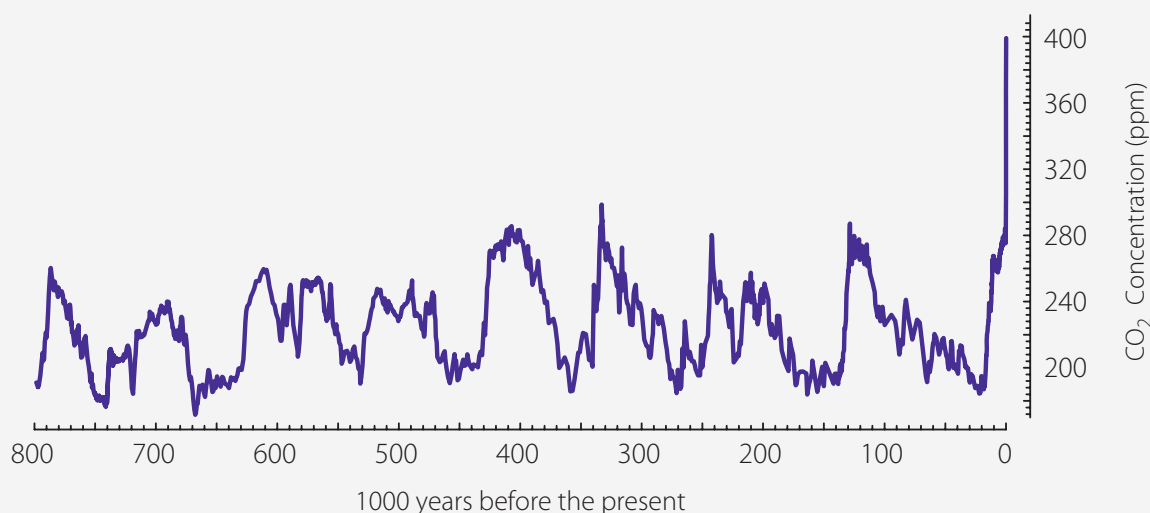


Figure 2. Reconstruction of atmospheric CO₂ concentration over the past 800,000 years based on measurements of air trapped in an ice core from Antarctica¹⁴ and direct atmospheric measurements since 1958. Natural CO₂ variations are evident during the past eight ice age cycles. The increase of CO₂ since industrialization has led to levels 30% higher than at any time in the past 800,000 years. Figure modified with permission from T. Stocker¹⁴.

has a major impact on the environment through greenhouse gas emissions as well as the use of water, pesticides and fertilizers required for the production of animal feed. Therefore, the consumption of meat merits specific consideration.

Population growth coupled with an increase in standards of living indicates that meat production will need to double to satisfy the hypothetical demand in 2050 – an assumption that is based on current dietary patterns⁹. The water requirement per kilogram of beef is 15,000 litres. Added to this, estimates suggest that the livestock sector contributes almost one-sixth of greenhouse gas emissions related to human activity, with 41% coming from beef production. In addition to its environmental impact, it has been known for some time that there is a positive association between the risk of colorectal cancer and high consumption of red and processed meat¹⁰.

Most of the protein in Nestlé's products is of dairy origin, but the company also makes use of alternative (non-meat) sources of protein such as cereals, grains, leguminous seeds (pulses), soy and almond milk. A number of factors require consideration when using alternative proteins to replace meat, including nutritional quality, technical factors, consumer acceptance, price and supply issues. Nestlé is already applying commercially available alternative proteins in some of its products, and is actively exploring new ones. New sources of alternative proteins may include

microorganisms as well as agricultural and industrial byproducts.

Dietary diversity

Lack of diversity in diets is correlated to stunted growth and increased risk of diet-related non-communicable diseases. Over the past decades, diversity in the world's food systems deteriorated significantly. More than 390,000 plant species have been identified across the globe, and nearly 5,600 crops have been used for food throughout human history (Fig. 1). Yet, today just three crops provide over 50% of the world's calories from plants. Twelve crops and five animal species cover 75% of the world's food demand today¹¹⁻¹³.

Shifting diets to include more food varieties has the potential to improve nutrition and it is also good for the environment. It is estimated that each person will contribute 400kg CO₂-C_{eq} per year for an average animal product-based diet in 2050. Simply changing to a diverse Mediterranean diet would reduce CO₂ emissions by 25% for that individual. Consequently, increasing agricultural biodiversity is a promising approach to address the challenge of improving sustainable nutrition.

Nestlé conducts extensive research into plant science (for example into coffee and cocoa) to help farmers produce crops in a way that ensures their long-term economic future while preserving the environment. Nestlé scientists work through a network of research

and development (R&D) centres, together with more than 1,000 Nestlé agronomists and in close coordination with national agricultural institutes, private partners, local governments and smallholder farmers. The company's activities are focused on:

- Conventional plant selection and breeding to offer a better choice of plant varieties to farmers.
- *In vitro* research to preserve natural genetic diversity and deliver better plants to farmers.
- Consumer-centric understanding of the quality of raw materials and how they impact product delivery.
- Education of farmers to improve productivity, crop quality and environmental protection.

Environment

The Paris Agreement sets out a global agenda for putting the world on track to avoid or at least reduce climate change by limiting global warming to well below 2°C. The agreement also recognizes the importance of food security in the international response to climate change, as reflected by many countries focusing prominently on the agriculture sector in their planned contributions to adaptation and mitigation.

The increase in CO₂ emissions caused by burning fossil fuels, deforestation and land-use change is unprecedented in the past 800,000 years¹⁴ (Fig. 2). Continued emission of

greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts on people and ecosystems, as affirmed in the Summary for Policymakers of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), that was approved by all governments of the world³. Any of these scenarios is linked with an impact on crop production, emphasizing again the food security and food supply concerns.

Nestlé is currently setting targets and commitments to reduce CO₂ emissions and to establish net zero emissions throughout its operations. Nestlé has endorsed a number of multi-stakeholder initiatives, including the Paris Pledge for Action, welcoming the adoption of a new, universal climate agreement at the 2015 United Nations Climate Change Conference (COP 21) in Paris, Caring for Climate, and the American Business Act on Climate pledge.

Assessment of overall environmental impact

Nestlé uses eco-design tools to assess the overall environmental performance of products and packaging throughout their life cycle. The company looks holistically at the environmental impact of any new product when it is still in development phase. This holistic view includes greenhouse gas emissions, water use and land use.

The company's global corporate commitments are best illustrated by actions of specific markets. For example, in 2015 Nestlé Brazil increased production volume by 8.8% compared with 2014 levels, yet the water consumption dropped by 19.2% and energy use has been reduced by 6.4%. During the same period, direct greenhouse gas emissions were reduced by 17.6% and waste for disposal was cut by 78%. The Zero Waste for Disposal guideline helps all Nestlé sites to prevent, reuse and recover by-products and waste.

Modelling food systems in a multifactorial world

The complexity of global or local food systems can be modelled in a meaningful way. For example, modelling can answer questions about different scenarios, such as the implications of healthy eating in different countries or regions. Modelling can also assess the impact of diet patterns on mortality through non-communicable diseases and on environmental metrics.

Such models already indicate co-benefits between a healthy diet and related greenhouse gas emissions¹⁵.

Another parameter for modelling sustainable nutrition and health is global poverty. Defining poverty is complex. A working paper by the Department of Economics at the University of Oxford describes a novel feature of linear programming for defining an international poverty line based on a diet that has minimum cost, but ensures survival. For poorer countries, this amounts to \$1.88 per day, which is consistent with the World Bank's figure of \$1.90¹⁶.

To model the global food system towards greater understanding of its connectivity and complexity Nestlé has contributed as a partner/stakeholder in various transdisciplinary groups such as:

- Center for Integrated Modelling of Sustainable Agriculture and Nutrition Security (CIMSANS), which had the goal to (i) lead new partnerships on novel methods for food system modelling, (ii) improve knowledge of agricultural adaptation to the increasing impacts of climate change, and (iii) predict resource scarcity on sustainable nutrition security.
- The European Union-funded Transmango project, which aims to obtain a comprehensive picture of European and global food demand and on raw material production.
- The European Sustainable Food and Nutrition Security project (SUSFANS), which is building a conceptual framework of food systems, evidence-based data and analytical tools for assessing EU-wide food policies and their impact on consumer behaviour and public health.

The way forward

Public-private partnerships are important for food security and institutions such as the University of Cambridge are well positioned to take on the challenge through their strategic Cambridge Global Food Security research initiative¹⁷.

To successfully pursue sustainable nutrition, it may be necessary to re-introduce and strengthen the food and agricultural curriculum, notably in higher education, a topic that was removed from many institutions in the 1980s, due to low student enrollment.

Nestlé and systems health

The complexity and interconnectedness of food and human biology systems has led to the research domain of systems health to

address health issues of today and tomorrow. The systems approach towards food has been under investigation for some time, with increasing participation and activity by global and European-led multidisciplinary groups.

The example of obesity in the United Kingdom illustrates key aspects of the health systems' complexity. The UK spends more on its National Health Service to treat obesity and diabetes than on the police, fire and judicial systems combined. The causes of weight gain are complex, with a combination of biological, environmental, social and behavioural aspects. A systems approach to analysing and then addressing these factors is essential at the local, country and global levels.

Nestlé is ideally positioned within the food and nutrition domain, having a clear view upstream to the agricultural supply of ingredients and raw materials but also downstream to consumers, including waste management. This unique perspective of the value chain is increasingly shaping the company's ways of working. For example, Nestlé's direct connection to consumers through products and brands can contribute to a systems solution in combination with government action, community-level changes and individual initiatives guided by evidence-based data.

Personalised nutrition

Health advice, especially in the area of nutrition, has been dependent on data derived from a reductionist strategy, that is, seeking to describe the role of specific nutrients or genes on biological processes¹⁸. Moving to a complex systems-level way to study interactions between genes, nutrition and other environmental factors will open up new research areas and lead to novel applications for improving health and nutrition for groups, families and individuals.

While the term eHealth is broadly used, the basis for eHealth is data. The idea of dense, dynamic, personal data clouds represents a paradigm shift, which will play an important role in boosting the capabilities of personalised nutrition and will transform healthcare. These data clouds will encompass personal information on genome, microbiome and the self-tracking of lifestyle (diet and activity) – all measured in the context of an individual's local, physical, social, and family environments.

Aggregating data from many individuals will eventually provide a better understanding of optimal health and a transformation of systems biology, for example, towards the

novel concept of P4 medicine: predictive, preventive, personalised and participatory. Detecting disease transitions earlier through diagnostics, using patient stratification for drug trials, and understanding individual responses to nutrition or medical treatments are just a few of the changes and insights that are emerging from systems analysis. The goal is to enable individuals to take control of their health with actionable, evidence-based diets, behaviours and medicines for promoting scientific wellness, rather than the current model of treating diseases¹⁹.

These advances are providing Nestlé with new opportunities to deliver personalised nutrition solutions to consumers. For example, in July 2016, Nestlé and Samsung announced a research collaboration aiming to advance nutrition, health and wellness through personalised and connected mobile technologies.

A sustainable future

Global Nestlé R&D projects aim to improve the nutritional balance of products, meals and diets in a sustainable and affordable way²⁰. This includes studying the environmental impact of products and diets using dedicated modelling tools to understand nutrition and environmental impact simultaneously. Various approaches analyse data from physiological and metabolic measures together with dietary intake data and food access data alongside the long-term goal to drive personalised nutrition. This approach is instrumental in finding targeted solutions for people, with the ultimate aim of enhancing people's quality of life across the socio-economic spectrum in all countries.

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