

# Healthy Diets and Sustainable Food Production for the Health of Our Population and Planet

*Una alimentación saludable y una producción sustentable para la salud de nuestra población y de nuestro planeta*

*Men are mistaken in thinking themselves free; their opinion is made up of consciousness of their own actions, and ignorance of the causes by which they are determined. Their idea of freedom, therefore, is simply their ignorance of any cause for their actions.*

BARUCH SPINOZA (Ethics, Demonstrated in Geometrical Order)

## INTRODUCTION

Only a few decades ago, the danger of the planet's destruction were the intercontinental atomic rockets of both superpowers. Nowadays, the planetary catastrophe is the climate crisis due to the greenhouse effect created by the use of fossil fuels and the destruction of forests and jungles in order to produce suitable food for our unhealthy diet, which shortens our quality and life potential.

Sir David Attenborough recently warned the CNN audience of the imminent collapse of civilization, (1) and, in late 2018, the Health Alliance on Climate Change sent a letter to the UK Prime Minister saying that for the preservation of both planetary and human health, the UK must become net zero carbon before 2030.

The Alliance's letter to the Prime Minister states that tackling climate breakdown is now a key part of the duties and responsibilities of all health professionals. This challenge has also become the most urgent responsibility of all politicians, whose actions will be ruthlessly judged by future generations. The point that should be clearly understood is that what is good for health is good for the planet and vice versa, what is good for the planet is also good for health. (2)

As the Dutch philosopher of the 17th century, Spinoza, states in the epigraph, we humans believe we are free to adopt the diet we want or produce the foods we like, simply because we ignore and do not know the causes that determine our actions.

These statements are likely to fall on deaf ears because of vested interests that prevent real actions. But fortunately the young people stood up: "in more than a thousand cities around the world an incalculable number of students put on their shoulders the struggle to stop climate change", (3) led by 16-year-old Swedish student Greta Thunberg, who at 14 years of age started alone, skipping school every Friday as a protest against the lack of political decisions on climate change. Now she has called for the solidarity of around 20,000 scientists worldwide who "joined the

'Fridays for Future' movement, which brings together secondary students from more than 100 countries, whose first major milestone was reached on March 15th. Young people are right was the title of the accession document". (3)

The media launched an attack to ridicule Greta's figure, and even the well-known newspaper Le Figaro attacked Greta, who has Asperger's syndrome, saying that "it was a shame to see so many young people being led by a zombie". But she stood up before the European Parliament and said "I know you don't like me being here. I don't like you being here either, because you haven't done your homework, but we have. We have read the scientific reports. What we are asking you to do is listen to science, because when we become adults it will be too late". (3)

Greta and her teammates are now new global players, contributing the drive of new generations for essential tasks.

As Francisco Branca et al. declare (4): It is necessary to transform the food system to tackle noncommunicable diseases (NCDs), and also to avoid the collapse of the planet as our young people propose.

They state that: "Global food production, responsible for up to a third of greenhouse gas emissions, is a major source of soil, air, and water pollution, while accounting for more than 70% of freshwater use and 40% of land use, and contributing to biodiversity loss. These effects could rise by 50-90% by 2050 unless food systems are transformed. The type of food produced is also important—the impact of ruminant meat production is around 100 times those of plant based foods." (4)

Food in the Anthropocene, from the Commission driven by the Lancet, starts by stating: "Food systems have the potential to nurture human health and support environmental sustainability; however, they are currently threatening both. Providing a growing global population with healthy diets from sustainable food systems is an immediate challenge". (5)

Although global food production of calories has kept pace with population growth, more than 820 million people have insufficient food and many more consume low-quality diets that cause micronutrient deficiencies and contribute to a substantial rise in the incidence of diet-related obesity and diet-related NCD, including coronary heart disease, stroke, and diabetes. Unhealthy diets pose a greater morbidity and mortality than unsafe sex, alcohol, drug, and tobacco use combined. Because much of the world's population is

inadequately nourished and many environmental systems and processes are pushed beyond safe boundaries by food production, a global transformation of the food system is urgently needed.

The absence of scientific targets for achieving healthy diets from sustainable food systems has been hindering large-scale and coordinated efforts to transform the global food system.

Food production is essentially associated with the maintenance of the Earth system. Strong evidence indicates that food production is among the largest drivers of global environmental change by contributing to climate change, biodiversity loss, freshwater use, interference with the global nitrogen and phosphorus cycles, and the Earth system changes.

The Commission concludes that these systems and processes can provide a set of globally systemic indicators of sustainable food production and might constitute universal and scalable quantitative planetary boundaries for the food system. However, the uncertainty range for these food boundaries remains high because of the inherent complexity in the Earth system dynamics.

#### FOOD AND HEALTH OF THE PLANET AND PEOPLE

In the past 50 years, increasing crop yields have contributed to reduce hunger, improve life expectancy, reduce infant and child mortality rates, and decrease global poverty. "However, these health benefits are being offset by global shifts to unhealthy diets that are high in calories and heavily-processed and with animal source foods. These trends are driven partly by rapid urbanization, increasing incomes, and inadequate accessibility of nutritious foods. Transitions to unhealthy diets are not only increasing the burden of obesity and diet-related NCD, but are also contributing to environmental degradation. Food in the Anthropocene represents one of the greatest health and environmental challenges of the 21st century", (5)

Globally, more than 820 million people remain undernourished, 151 million children are stunted, 51 million have clinical syndrome of emaciation, and more than 2 billion people have micronutrient deficiency. Concurrently, the prevalence of diseases associated with high-calorie, unhealthy diets is increasing, with 2,100 million adults with overweight or obesity and the global prevalence of diabetes almost doubling in the past 30 years. Undoubtedly, unhealthy diets are the largest risk burden of morbidity and mortality. This current food situation means that the world's diets urgently need to be transformed.

Agriculture is the largest cause of global environmental change and occupies about 40% of the global land. Food production is responsible for up to 30% of global greenhouse-gas emissions and 70% of freshwater use.

Conversion of natural ecosystems to croplands and pastures is the largest factor causing species to be threatened with extinction.

Environmental burden from food production also includes marine systems. About 60% of the world's

fish stocks have already been depleted, and global marine fishing has been declining since 1996. Therefore, aquaculture rapidly expanded, which can negatively affect coastal habitats, freshwater, and terrestrial systems. That is why we are now facing the challenge of feeding a population that is expected to increase from 7,600 million people to 9,800 in 2050 a healthy and sustainable diet which, with the production of the current type of foods, is impossible to achieve within the boundaries of safety on the systems and social and environmental processes. Therefore, methods of food production need to be urgently reviewed.

#### Reference healthy diet

The characteristics of a reference healthy diet, which could include a strict vegetarian diet and consumption of modest amounts of animal source foods, have well-established traditions in several regions. The best studied example is the Mediterranean diet, similar to the diet of Crete in the mid-20th century (low in red meat, 35 g/day, and largely plant-based, with about 40% of energy consumed mainly as olive oil). With this diet, the Greeks had the highest life expectancy at that time.

Some cultures with traditional diets, such as those in Indonesia, Mexico, India, China, and West Africa, also include little red meat. High consumption of nuts is traditional in some West African populations (e.g. Niger) and large amounts of soy foods are consumed in many Asian populations (e.g. Taiwan).

There are many cultures which provide many opportunities to learn new ways of preparing foods that are healthy and enjoyable. Fruits and vegetables are an essential source of many micronutrients, including provitamin A for prevention of night blindness; the benefit is achieved by consuming about five servings per day (300 g/day of vegetables and 200 g/day of fruits). There is no clear upper limit of fat consumption, but 50 g/day of total added fat is recommended, emphasizing predominately unsaturated plant oils. For sugar, a limit of 31 g/person per day of all sweeteners is recommended, or less than 5% of energy.

#### EARTH SYSTEM PERSPECTIVE ON SUSTAINABLE FOOD PRODUCTION

Sustainable food production has complex systems of interactions from local to global scales that should be considered. Global boundaries should be identified within which global food production needs to remain as safeguard of biophysical processes that support the biosphere and a stable Earth system.

Sustainable food production should consider greenhouse-gas emissions, land and water use, nitrogen and phosphorus application, biodiversity loss, and chemical pollution from herbicides and pesticides.

#### Climate change

Climate changes due to the greenhouse effect lead to sea-level rise and increasing frequency of extreme weather events.

Eliminating all greenhouse-gas emissions is not feasible. Global carbon dioxide emissions from fossil fuel burning and industrial processes should peak no later than 2020 and reach about 5 Gt of carbon dioxide equivalent per year by 2050. Emissions from land-use changes for agriculture and forestry will transition by 2050 from a global net source (about 5 Gt of carbon dioxide equivalent per year) to a net carbon sink (-10 Gt of carbon dioxide equivalent per year) by 2100 (Table 1).

#### Freshwater use

Agriculture share of global water consumption is 75–84%; 84% of cropped land uses freshwater from rain, and the remaining 16% uses irrigation (e.g. rivers and aquifers). Also, 70% of bathroom water is used for irrigation, varying from 21% in Europe to 82% in Africa. Water consumption for food production has more than doubled between 1961 and 2000.

The original planetary boundary for water use is quite uncertain, the commission adopted 2800 km<sup>3</sup>/year, with an uncertainty range of 1000–4000 km<sup>3</sup>/year.

#### Needs of nitrogen and phosphorus

Nitrogen and phosphorus are crucial for plant growth. Their use as land fertilizers is essential for maximizing crop yields and will continue to be necessary for feeding a growing global population.

Excessive application of nitrogen and phosphorus in food production has substantial consequences: runoff produces eutrophication of freshwater and marine ecosystems and subsequent development of hypoxic conditions causing fish death and other environmental damages.

Other effects are reduced biodiversity and ammonia (nitrous oxide) emissions, which is a potent greenhouse gas. In addition, phosphorus fertilizer is a non-renewable resource and its projected existence at its rate of exploitation would run out within 50 to 100 years.

Estimates of human needs show that feeding about 10,000 million people by 2050 on existing cropland will require higher annual global applications of nitrogen and phosphorus fertilizers that exceed the planetary boundaries for nitrogen (62–82 Tg per year) and phosphorus (6–2–11.2 Tg per year). Humanity can

only be fed if more food is produced per unit of nitrogen or phosphorus input, loss of nutrients is reduced to a minimum, and nutrients are recycled (Table 1).

#### Biodiversity loss

The functional value of biodiversity is poorly understood and is thus undervalued. Biodiversity enhances ecosystem services necessary for human wellbeing, “including food production, pollination, pest control, heat regulation, carbon sinks, and grassland feedback by rainfall. Nutritional quality, protective attributes, and flavors of most plant foods is a function of evolutionary interactions between species”. (5)

We have entered the sixth mass species extinction on Earth; for example, insect biomass has been reduced by 75% in 30 years and farmland birds by 30% in 15 years.

Faced with uncertainty, the Commission suggests 1–80 extinctions per million species per year.

#### Land-system changes

Food production is the largest driver of land use and land-use change, mainly through clearing of forests and burning of biomass. Between 2000 and 2014, Brazil lost on average 2.7 million ha/year of forest, the Democratic Republic of Congo 0.57 million ha/year with a 2.5 factor increase since 2011, and Indonesia 1.3 million ha/year. About 51% of the global land surface can be classified as intact ecosystems.

The Commission proposes zero land system change into farmland, protecting the remaining 50% of the land as intact biodiversity (Half Earth strategy).

#### SUSTAINABLE FOOD SYSTEMS TO ACHIEVE HEALTHY DIETS

Different environmental indicators demonstrate that plant-based foods cause fewer adverse environmental effects per unit weight, per serving, per unit of energy, or per protein weight than animal source foods.

Therefore, vegan and vegetarian diets are associated with the greatest reductions in greenhouse-gas emissions, land use and water use. Diets that replace ruminants with other alternatives, such as fish, poultry, and pork, also show reduced environmental effects, but to a smaller extent.

Plant-based diets could reduce greenhouse-gas emissions in 2050 by up to 80%.

**Table 1.** Scientific targets for six key Earth system processes and the control variables used to quantify the boundaries (6)

	Control variable	Boundary (uncertainty range)
Climate change	Greenhouse-gas emissions	5 Gt of carbon dioxide equivalent per year (4.7–5.4)
Nitrogen cycle	Nitrogen application	90 Tg of nitrogen per year (65–90;* 90–130)
Phosphorus cycle	Phosphorus application	9 Tg of phosphorus per year (6–12;* 8–16)#
Freshwater use	Water consumption	2500 km <sup>3</sup> per year (1000–4000)
Biodiversity loss	Extinction rate	10 extinctions per million species-years (1–80)
Land-system change	Cropland use	13 million km <sup>2</sup> (11–15)

\*Lower boundary range if production practices improve and redistribution is not adopted.

#Upper boundary range if improved production practices and redistribution are adopted and 50% of applied phosphorus is recycled.

The current production of maize, rice and soybeans could not be increased if two-thirds of them are still used to feed the animals.

Improved production practices could reduce water use by about 30%.

It is estimated that increased efficiency in the use and application of fertilizers could reduce nitrogen use by about 26% and phosphorus use up to 40%. Reducing caloric intake from 2500 kcal/day to 2100 kcal/day assumes that BMI is reduced to 22 kg/m<sup>2</sup> globally, which complies with WHO recommendations on healthy bodyweight and physical activity levels and would allow reaching the boundaries for food production in 2020.

#### HOW TO ACHIEVE A GREAT FOOD TRANSFORMATION

"The Commission highlights the need for a Great Food Transformation [...]. This transformation will not happen unless there is widespread, multi-sector, multi-level action to change what food is eaten, how it is produced, and its effects on the environment and health, while providing healthy diets for the global population [...]. Data are sufficient and strong enough to warrant action, and delay will increase the likelihood of serious, even disastrous, consequences". (5)

#### Five strategies for achieving a Great Food Transformation

*Strategy one:* Seek international and national commitment to shift towards healthy diets.

*Strategy two:* Re-orient agricultural priorities from producing high quantities of food to producing healthy food.

*Strategy three:* Intensify sustainable food production to increase high-quality output.

*Strategy four:* Strong and coordinated governance of land and oceans.

*Strategy five:* At least halve food losses and waste,

in line with global sustainable development goals.

#### CONCLUSIONS

The food we eat and how we produce it will determine the health of people and the planet's viability, and major changes must be made to avoid both reduced life expectancy and continued environmental degradation.

The assumptions made by the Commission demonstrated that it is possible to feed a global population of nearly 10,000 million people a healthy diet within food production boundaries by 2050.

However, this Great Food Transformation will only be achieved through widespread, multisector, multilevel action that includes a substantial global shift towards healthy dietary patterns, large reductions in food loss and waste, and major improvements in food production practices.

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#### REFERENCES

1. Tutton M, Attenborough D. "The collapse of our civilization is on the horizon". CNN, December 4, 2018.
2. Stott R, Arulkumaran S, Gilmore I, Godlee F, Page L, on behalf of 29 signatories. Legislate for carbon net zero by 2030. Lancet online February 20, 2019.
3. Russo S, Greta. Contratapa. Página 12. 30 de marzo 2019.
4. Branca F, Lartey A, Oenema S, Aguayo V, Stordalen GA, Richardson R, et al. Transforming the food system to fight non-communicable diseases. BMJ 2019;364:I296 (Published 28 January 2019). <http://doi.org/c4mx>
5. Willet W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: The EAT – Lancet Commission on healthy diets from sustainable food systems. Lancet 2019. <http://doi.org/gft25h>
6. Adapted from Table 2 of reference 5.