

# THE FOOD REVOLUTION



TEXT INGA OLFEN

Nearly ten billion people will be living on the planet in 2050—but what will all these people eat? Far-reaching changes will have to be made—and quickly—if a sufficient amount of healthy food is to be made available to the world’s population without putting excessive strain on the Earth’s natural resources

**T**he old tradition of the “Sunday roast” may hold the key to ensuring that enough food can be provided to everyone in 30 years. This will be a major challenge, given the continued growth of the global population and the increasing intensification of climate change. “We need to go back to the principle of the ‘Sunday roast,’” says biologist Alexander Popp. What he means is that we need to be more aware of how much meat we eat in all of its forms—more particularly, we need to consume meat less frequently. Popp works at the Potsdam Institute for Climate Impact Research and is one of the more than 100 authors of a special report recently published by the Intergovernmental Panel on Climate Change (IPCC). Among other things, this report points out that global per capita meat consumption has more than doubled since the 1960s.

Most scientists agree that food will be a key issue of the 21st century, and meat is only one aspect of it. The way we feed ourselves and the sources of the food we eat will decide how we live in the future. The Earth’s population is currently around 7.7 billion. Despite the extensive progress made over the last few decades, the Welthungerhilfe aid agency reports that two billion people still suffer from malnutrition, and this figure also includes people in the industrialized nations. Of these two billion people, more than 820 million suffer from hunger.

#### GREATER PROSPERITY LEADS TO HIGHER CONSUMPTION

A look into the future makes the challenge we face very clear: The Earth’s population could rise to as many as ten billion people by 2050, which would correspond to a one-third increase. All these people will likely consume around 50 percent more food than →

A shining example?  
Vegetables are grown under LED spotlights in a hall in New Jersey in the USA



# FROM FARM TO FORK

We wouldn't have any food without agriculture. But how many resources do crops and animal farming consume? And what happens to the food products? An overview of the key facts

Sources: National Geographic, OECD, FAO, AT Kearney, University of Twente, WWF

## How land is used worldwide (in km<sup>2</sup>)

About half of the habitable part of the Earth's surface (approximately 51 million square kilometers) is used for agricultural purposes. Over the past 200 years, people have cleared forested areas the size of South America in order to grow crops and raise livestock. This has had a big impact on the amount of CO<sub>2</sub> in the atmosphere.

**Earth's surface**  
510 million km<sup>2</sup>

**Ocean**  
361 million km<sup>2</sup>

**Total landmass**  
149 million km<sup>2</sup>

**1% freshwater**  
1.5 million km<sup>2</sup>

**1% urban areas**  
1.5 million km<sup>2</sup>

**10% glaciers**  
15 million km<sup>2</sup>

**27% pasture**  
40 million km<sup>2</sup>

**19% barren land**  
28 million km<sup>2</sup>

**7% shrubland**  
12 million km<sup>2</sup>

**26% forests**  
39 million km<sup>2</sup>

**9% arable land**  
11 million km<sup>2</sup>

**35% AGRICULTURE**  
51 Mio. km<sup>2</sup>

**35% NATURAL LAND**  
51 Mio. km<sup>2</sup>

## How the world's harvests are used, in millions of tons (t)

More than 3.2 billion tons of crops were harvested in 2018. Most of it was corn. However, only slightly more than one third of the harvests are directly used for food. Almost half is turned into animal feed. This is especially the case with soybeans, which are grown on a particularly large scale in the USA, Brazil, and Argentina.

**Others**  
506 million t

**Soy**  
365 million t

**Rice**  
510 million t

**Other Use**  
11%

**Biofuel**  
6%

**Food**  
37%

**Wheat**  
755 million t

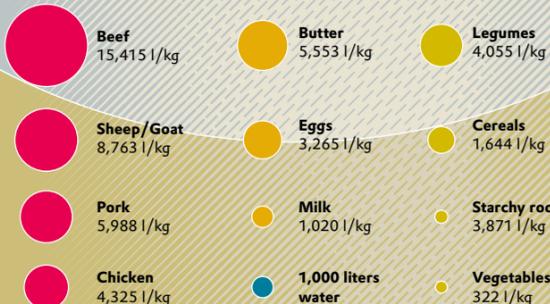
**Corn**  
1,074 million t

**Feed**  
46%

**Meat production**

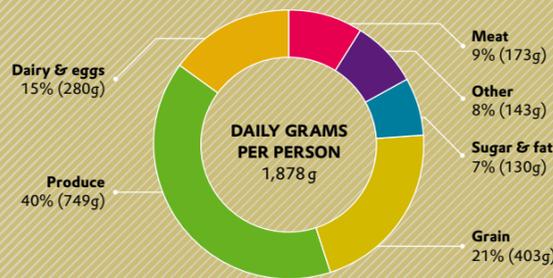
## Water use for food production, in liters per kilogram of end product

Widely different amounts of water are needed for the production of the various types of food. While two bathtubs full of water are needed on average to grow a kilogram of vegetables, almost 100 bathtubs full are required for one kilogram of beef.

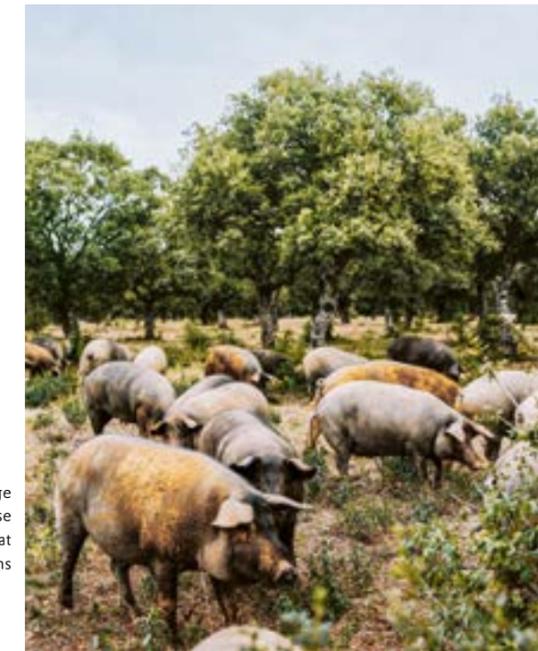


## What people eat worldwide (global averages)

People's diets consist primarily of fruits and vegetables, followed by grain, dairy products, and eggs. However, the size and composition of meals varies greatly, depending on the region and the individual person.



Small farms, such as this one in Ghana, dominate the agricultural sector in Africa



Free-range animals: These Iberian pigs eat acorns

today's global population. That's because incomes are on the rise in developing countries and emerging markets—and when prosperity increases, per capita food consumption increases along with it.

The question is: Can the planet accommodate this increase? Experts say it can. A report on future global food supplies that was published at the beginning of this year by the EAT Lancet Commission states that providing ten billion people with a healthy diet is both necessary and possible, although being able to do so will require a radical transformation. The members of the EAT Lancet Commission, which was established on the initiative of the renowned British medical journal *The Lancet*, believe that our eating habits around the globe need to change fundamentally. More specifically, people need to eat twice as much plant-based food (fruits, vegetables, legumes, nuts) as they do today and reduce their consumption of meat (including eggs) and sugar by at least 50 percent.

In order to understand why our diets are believed to have such a major influence here, one needs to understand that food production already accounts for 70 percent of total drinking water consumption, as well as 20 to 30 percent of greenhouse gas emissions.

## MORE EFFICIENT PRODUCTION

Only a little more than half of all plant-based calories produced worldwide today are consumed directly by human beings. More than one third of all crops are used to feed animals (see the chart on the opposite page). Of every 100 calories from the plants used to feed livestock, 40 make their way into the milk we drink, while 22 calories are left in eggs, and only three calories in beef. Food is the most effective means of optimizing human health and environmental sustainability around the globe, according to a report pub-

lished by the Food and Agriculture Organization of the United Nations (FAO) in 2016.

A similar view is taken by the World Resources Institute (WRI), which in its latest report, "Creating a Sustainable Food Future" (2019), calls for a dramatic increase in the efficiency of natural resource utilization. Ultimately, compatibility between environmental protection objectives and food availability can only be achieved through an increase in productivity. More specifically, this means that we need to increase the crop yields and milk and meat production achieved with each animal and acre of land used, and with each kilogram of fertilizer applied to the soil. "If today's levels of production efficiency were to remain constant through 2050, then feeding the planet would entail clearing most of the world's remaining forests," states the report.

Innovative technologies and more extensive global cooperation are needed in order to increase productivity while still conserving resources. In its report, the WRI lays out the most important challenges we face. It states that significant improvements in feed →

quality and grazing management are needed in order to prevent even more surface area from being converted into farmland.

New approaches for livestock breeding are designed to improve what is known as the feed conversion rate: When livestock process their food more effectively, fewer crops have to be planted to feed them (see article on page 16). With regard to aquacultures, alternatives to fish meal are increasingly being used, as production of the latter uses up a large amount of natural fish resources (see article on page 32). If fish production were made more sustainable, fish yields could be increased significantly, according to the WRI report. This, in turn, would make it possible to provide more people with the important proteins they need.

The fishing grounds off the coast of Senegal are a popular destination for international fishing fleets



Another effective approach, according to the WRI, would be to reduce the amount of food that is wasted and thrown away. Indeed, nowhere near all of the food that is produced today is actually used for its intended purpose, which is to feed people. According to the EAT Lancet Commission, as much as 30 percent of the food produced around the world ends up in the garbage. Sometimes this is due to the fact that it spoils during transport, while in other cases food is stored incorrectly. Then there's the food that's thrown away before it reaches the supermarket because of its flawed appearance. In addition, many consumers buy too much food and then don't use or store it properly (see article on page 56).

Many people in rich countries can afford this kind of behavior, since there's plenty more food to be had. Whereas nearly one third of the population of East Africa doesn't have enough to eat, people in the industrialized countries are getting fatter and fatter on average. A grown man in Afghanistan consumes 2,100 kilocalories on

## “Providing ten billion people with a healthy diet is both necessary and possible”

EAT LANCET COMMISSION



India is the world's leading exporter of beef, ahead of Brazil and Australia



Lettuce harvest on an organic farm in California: The USA is one of the biggest producers of organic foods

average every day; the figures for Germany and the USA are 3,500 and more than 3,600, respectively. The German Nutrition Society (DGE) recommends a diet of 2,500-2,800 kilocalories per day for a middle-aged man who is moderately physically active.

Around 1.9 billion people around the world are overweight, and more than 600 million of these people are obese. That figure corresponds to one out of every eight adults. The impact this has on health is considerable: In an international study with just under four million participants, researchers under the direction of epidemiologist Emanuele Di Angelantonio from the University of Cambridge were able to establish a direct correlation between excess weight and lower life expectancy.

### THE BEST ASPECTS OF TWO APPROACHES

There is a dispute among scientists regarding the best approach to take in order to produce food in a more productive and sustainable manner. In conventional agriculture, crop yields can be raised through more extensive mechanization and the use of modern irrigation methods, artificial fertilizer, and genetic engineering. Digitalization can also play a role here: Drones are already providing real-time images of livestock and fields, thereby making it possible

to direct water, nutrients, and pesticides to where they're needed. Sensors are also used to collect data on weather, plant growth, soil quality, and livestock health. These sensors are designed to ensure maximum crop yields and minimal crop damage.

On the other hand, those who favor local agricultural organizations and organic farming believe that the huge numbers of small farmers around the globe could increase their crop yields simply by improving soil fertility through the use of compost or by combining different types of plants in an effective way. These people also believe that advances in agricultural engineering could be applied here as well (see interview on page 24). “Both approaches offer solutions,” says Dr. Jonathan Foley, a world-renowned environmental scientist. “Each one by itself cannot get us where we need to go. The best thing to do would be to combine the best aspects of both approaches.”

Such combined expertise is also favored by Rajiv Shah, President of the Rockefeller Foundation and a member of the World Economic Forum. He states that a new food revolution has the potential to sustain our families and our planet. However, in order to solve the world's biggest problems, mankind needs to expand all of the capacities available to it. —