



Slow Food®

IF BIODIVERSITY LIVES, THE PLANET LIVES

Slow Food's Position Paper on Biodiversity

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INTRODUCTION

Biodiversity is the diversity of all life, from individual genes to species up to the most complex levels, ecosystems. Without a variety of living forms, life itself would disappear, because it would lose the capacity to adapt to changes.

Slow Food's work is focused on the biodiversity that contributes to agriculture and food production: edible plant species and varieties, domesticated animal breeds, insects (including pollinators), the invertebrates and microorganisms that guarantee soil fertility and hold up the food chain in the oceans, the microflora that live in digestive systems and those that enable fermentation processes in many foods (bread, cured meats, cheeses, etc.) but also the diversity of knowledge that has allowed farmers and food producers to select and adapt plants, animals and farming techniques to different environmental contexts and to transform and preserve foods.

Slow Food was one of the first civil-society organizations to turn its attention to domesticated biodiversity and the first to have ever considered food production techniques and food products an integral part of the biodiversity in need of saving. Slow Food sees everything as connected: What happens in the realm of microorganisms influences agriculture and the health of plants, animals and humans; how mountain environments are managed triggers a series of consequences that follow the course of rivers and reach the depths of the oceans; a technique or piece of knowledge applied in the field has an impact on the resulting foods, their nutritional characteristics, their healthiness and their flavor, and so on.

Biodiversity allows agricultural systems to overcome environmental shocks, changing climates and pandemics. It provides ecosystem services that are essential to life, like pollination. It allows the production of food with a minimal impact on non-renewable resources (water and soil above all) and with less need for external inputs that are costly and harmful to the environment, like fertilizers and pesticides for plants and antibiotics for livestock.



Feeding the planet while guaranteeing good, clean and fair food for all can only be done by taking biodiversity as a starting point and inverting a dominant food production model that has generated countless environmental and social disasters and undermined the foundations of food security for present and future generations.

These days, the most authoritative international institutions have all recognized the crucial value of biodiversity and its close links with food. In its report on the state of global biodiversity for food and agriculture, published on February 22, 2019, the FAO declared that “biodiversity for food and agriculture is indispensable to food security” as well as “a key resource in efforts to increase food production while limiting negative impacts on the environment” and in reaching the 2030 Agenda Sustainable Development Goals (SDGs)¹.

And yet, despite this growing awareness, the erosion of biodiversity has not been reversed or even slowed: Food production systems, around the world, continue to reduce their levels of diversity in terms of species, varieties and breeds, and to increase their impact on the environment and the climate. Monocultures and factory farms are multiplying exponentially, control of plant and animal genetic resources is becoming concentrated in the hands of a few multinationals who focus on an increasingly small number of commercial plant varieties and animal breeds to be distributed at every latitude, land continues to be deforested in order to be used for crops and intensive livestock farming and industrial fishing and intensive aquaculture are devastating marine ecosystems like coastal waters, mangrove forests and coral reefs. As a result, plant varieties and animal breeds selected over millennia, ecosystems and wild species and knowledge passed down through the generations are all disappearing. And the very foundations of life, soil and water, are being irreversibly degraded.

The collapse of the entire food production system is inevitable if we do not change things within the next ten years, according to the same FAO report².

For over 20 years, Slow Food has been working to safeguard biodiversity with numerous projects, starting from the Ark of Taste and the Presidia, and over time has constructed a global network of tens of thousands of producers who preserve and share the diversity of food and agriculture in the world. As the understanding of the value of biodiversity becomes interdisciplinary, they find themselves no longer alone, but now this understanding must be translated into concrete actions.

This document sets out Slow Food’s position, its on-going initiatives and its proposals to European institutions.

¹ <http://www.fao.org/3/ca3129en/CA3129EN.pdf>

² <http://www.fao.org/3/ca3129en/CA3129EN.pdf>

BIODIVERSITY IN THE SOIL



Bacteria, fungi, organic matter and fertility

The soil is the greatest source of biodiversity in the world: Two-thirds of all living beings are found hidden under its surface³ and over 90% of the flow of energy in the soil is mediated by microbes⁴.

The consortia of living beings found in the earth break up the soil, decompose organic matter and facilitate plant nourishment by releasing nitrogen, producing humus and simple mineral substances that are essential to fertility and the formation of soft, porous clods that are more resistant to the action of water, wind and mechanical processes⁵ and help to control parasites and pathogens.

The communities formed by living beings in the soil are very diverse. By far the most abundant and diversified groups of organisms are bacteria and fungi, which play a vital role in the decomposition of organic matter, bonding soil aggregates to prevent erosion and allowing efficient drainage, water conservation and aeration.

3 https://www.boell.de/sites/default/files/soilatlas2015_ii.pdf?dimension1=ds_bodenatlas

4 <https://ec.europa.eu/jrc/en/publication/global-soil-biodiversity-atlas>

5 <https://www.unccd.int/actions/global-land-outlook-glo>

The soil's fauna is also made up of protozoa, nematodes, mites, springtails, enchytraeids (potworms) and worms. Together, these organisms form food networks that drive all the processes.

Fertility is closely linked to the presence of organic matter. Soil with less than 2% organic matter, often the case in countries where intensive agriculture is dominant, meaning a high use of chemicals and mechanization, is impoverished, lacking structure and degraded. Half of all European countries have a low content of organic matter in their soil, primarily those in southern Europe, but also some parts of the United Kingdom and Germany⁶. No chemical fertilizer can compensate for this shortfall.

The soil provides the nutrients and water necessary to produce food. It filters rainwater and puts it back into circulation, clean and drinkable. It also plays an important role in mitigating climate change, thanks to its capacity to store carbon. When the soil's organic matter decays, it releases carbon dioxide (CO₂) into the atmosphere; when it is formed, CO₂ is removed from the atmosphere⁷.

The spread of industrial agriculture, whose sole aim is increasing yields, is closely linked to chemicals, genetics and technology, and encourages the rise of monocultures with inevitable consequences on water and soil consumption and the impoverishment of soil fertility.

Between 1998 and 2013, around 20% of the Earth's vegetated surface showed a persistent trend of declining productivity, of 20% on cultivated land, 16% on forested land, 19% on pasture and 27% on grasslands, tundra, wetlands and deserts. This trend is particularly alarming given the increase in demand for land necessary for increasing crop growing and livestock farming.

The loss of soil biodiversity jeopardizes the functions of the soil ecosystem. Only agroecological practices, which limit monocultures and the use of synthetic chemical products, avoid deep plowing, rotate crops and introduce green manure, can preserve or regenerate soil fertility.

⁶ <https://esdac.jrc.ec.europa.eu/projects/SOCO/FactSheets/ENFactSheet-03.pdf>

⁷ <https://esdac.jrc.ec.europa.eu/projects/SOCO/FactSheets/ENFactSheet-03.pdf>

MICROORGANISMS IN FOOD

Fermentation, industrial processes and natural products

The word “fermentation” derives from the Latin *fervere*, meaning “to boil,” and originally referred to the process that turned grape must into wine.

Fermentation is an ancient practice, a natural phenomenon that humans have learned to manage. It requires no energy sources, and was already being used before people discovered how to control fire. While particularly common in East Asian countries like China, Korea and Japan, fermented products can be found in the diets of all the world’s civilizations. We eat them every day, often without realizing: bread, cheese, chocolate, salami, yogurt, vinegar, beer, wine and more are all the result of fermentation. These processes are brought about primarily by mycetes (yeasts and other fungi) and various bacteria, many of which are still unknown. Depending on the types involved and their specific metabolism, fermentation can produce many “secondary” products (such as alcohol, organic acids and carbon dioxide) which have countless functions. Some can be described as “technological” (such as the bubbles in a sparkling beverage or the holes in a loaf of bread, which affect the products’ texture) while others have a positive impact on the food’s nutritional value.

Fermentation boosts the availability of certain macro- and micronutrients (vitamins) caused by various metabolic processes (the proteolysis that takes place in soy sauce, miso and tempeh or the case of lacto-fermented vegetables, like sauerkraut, in which vitamin C can increase five-fold). Additionally, some fermentations directly improve the nutritional level of foods, enriching them with a probiotic microbial flora, important for increasing the biodiversity and health of the human microbiome.



A naturally heavy microbial load hinders the proliferation of dangerous microorganisms. It's no coincidence that the risk of the development of feared pathogens (like *Clostridium botulinum*, botulinus) is much higher in products that have undergone pasteurization, like preserves.

Lastly, fermentation gives foods unique sensory characteristics, closely linked to their terroir of origin.

The microbial communities responsible for fermentation are ubiquitous, found in the soil, in pastures, on food surfaces, on tools and in production environments.

Thanks to the modern impoverishment of microbial diversity, the efficacy of the process must often be ensured by the addition of a starter (milk or whey starter cultures, a sourdough starter or scoby, depending on the product), in other words a culture of bacteria kept alive between production cycles, able to trigger the desired fermentation. This is a good compromise common throughout artisanal food production, where processes are slow and based on the producer's knowledge and skill.

The industrial food production sector, however, needs to reach its end product quickly, with standardized production, reducing the margin of error within processes that are often automated. For this reason it tends to eradicate the biodiversity that underpins natural fermentation processes, instead introducing selected agents that can easily be controlled.

This technique standardizes and flattens flavors and aromas, and often breaks the link between product and place of origin. The use of selected yeasts and commercial starter cultures has by now become common practice in the world of wine, beer, cheeses and bread.

Slow Food wants to protect the microbial biodiversity that underpins fermentation process and works to promote natural products: cheeses made without the addition of industrial starter cultures, naturally leavened breads, cured meats made without additives and preservatives (particularly nitrites and nitrates, the most common), wines made with native yeasts and so on.



THE HUMAN MICROBIOTA



Relationships between soil, intestinal microbiota and health

Our digestive tract's microbial community, or gut microbiota, represents an ecosystem of a trillion microbial cells, the majority of which are found in the colon⁸, and contains at least a hundred times more genes than the human genome⁹. The term microbiome refers to the microbiota's genetic material, all the genes inside these microbial cells.

The many different functions of the intestinal microbiome within human health are by now well-known, and it has been recognized as being involved not just in many gastrointestinal diseases but also other pathologies such as obesity, metabolic syndrome, atherosclerosis and cardiovascular, neurologic and psychiatric diseases¹⁰.

Several studies are analyzing the main factors that determine the human intestinal microbiome. Results suggest that host genetics play a minor role in shaping the gut microbial community with an overall microbiome heritability below 8%¹¹. Thus, gut community composition must be predominantly shaped by non-genetic factors related to the environment, including lifestyle and diets

The microbial community in the gut is very dynamic. Bacteria are absorbed from food and water, as well as direct contact with the environment or the soil in which they live.

8 <https://pubmed.ncbi.nlm.nih.gov/31450753/>

9 <https://pubmed.ncbi.nlm.nih.gov/19234110/>

10 <https://healthcare-communications.imedpub.com/the-microbiome-a-key-player-in-human-health-and-disease.php?aid=18968>

11 <https://pubmed.ncbi.nlm.nih.gov/29489753/>

There are also functional similarities between the human gut and the rhizosphere, the portion of soil that surrounds the roots of plants, from which they absorb water and essential nutrients for their growth. Root hairs and the intestine's microvilli both contribute to modulating the absorption system, activating similar strategies for the control of pathogenic agents¹².

The intestine and the soil's rhizosphere are both nutrient-rich environments of extraordinary importance for the health of the host, significantly improving its functioning and, above all, its natural resistance to stress of all kinds, biotic and abiotic.

Over the last century the dramatic increase in urbanization has led to a considerable reduction in the natural biodiversity of the environment in which city-dwellers live and less exposure of the population to environmental microbes¹³.

These days, over 50% of the world's inhabitants live in urban settings and this is estimated to rise to two-thirds by 2050¹⁴. Global urbanization has led to a loss of contact with the natural environment, with negative consequences on the health of the intestinal microbiome and human health in general.

Modern hygiene standards and the use of antibiotics have contributed to reducing the risk of transmission of pathogens and thus disease and mortality. However, excessive disinfection reduces the biodiversity of bacteria present in the environment, bacteria that can help fight pathogens. A rich microbial diversity also contributes to protecting against the development of allergies and some autoimmune disorders¹⁵.

Recent studies on urban redefinition show that a greater presence of areas with high biodiversity (green spaces and parks) which encourage more contact with a diversified set of environmental microbes contributes to the prevention of immune disorders and in general an improvement in human health.

The relationship between the intestinal microbiota and the microbial vitality of the soil is also shown by the greater wealth of intestinal bacterial species in rural societies compared to urban communities¹⁶.

All the same, intensive agricultural practices, monocultures, the use of industrial chemicals and genetics and the switch to mechanization have reduced soil biodiversity, leading to a lack of some micronutrients in diets and an alteration of the human microbiota. Agriculture that respects the soil has shown significant beneficial effects on immune system functioning compared to rural populations that practice intensive agriculture.

The greater use of antibiotics in humans and livestock (on factory farms) and the increasing consumption of meat have contributed to the rise of a growing number of antibiotic-resistant bacteria, with negative consequences for the health of humans and the environment. Antibiotics do not only wipe out pathogens, but also the positive microbes that live in the human body, drastically changing the composition of the bacterial community¹⁷.

12 <https://www.frontiersin.org/articles/10.3389/fmicb.2015.01311/full>

13 <https://www.pnas.org/content/109/21/8334>

14 https://population.un.org/wpp/Publications/Files/WPP2017_KeyFindings.pdf

15 <https://pubmed.ncbi.nlm.nih.gov/19120493/>

16 <https://pubmed.ncbi.nlm.nih.gov/27518660/>

17 <https://www.frontiersin.org/articles/10.3389/fmicb.2017.01935/full>

A high-calorie diet, rich in sugars, fats and the processed foods typical of the Western diet, produced by intensive agricultural models and often subjected to post-harvest heat treatments like sterilization, also alters the intestinal microbiome¹⁸.

Conversely, a diet high in fiber and complex carbohydrates can preserve the intestine's microbial wealth.

Virtuous experiences that develop relationships of symbiosis do exist, such as the use of mycorrhiza in crop growing, in other words the introduction of specific fungi that establish close relationships with plant roots, creating an environment favorable to useful microorganisms and unfavorable to pathogens and parasites. These symbiotic associations are known to improve plants' absorption of nutrients and can also boost the nutritional quality of foods, including the content of vitamins, minerals, antioxidants and other secondary metabolites, as well as reducing parasites during storage and consequently limiting the treatments necessary for preserving the product¹⁹.

Supporting the biodiversity of soils is of vital importance for the protection of human health. It is also important to prioritize the consumption of foods produced by farms whose practices preserve or regenerate soil fertility²⁰.



18 <https://pubmed.ncbi.nlm.nih.gov/28388917/>

19 <https://pubmed.ncbi.nlm.nih.gov/29146430/>

20 <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0180442>

ZOOPLANKTON AND PHYTOPLANKTON

Life in the oceans, the food chain and CO₂

The entire terrestrial ecosystem rests on one common base: plankton, which have populated all aquatic ecosystems since the dawn of life on our planet. Plankton are a determining factor in the health of the atmosphere and even in the existence of clouds, as well as representing the base of the aquatic food chain, which in turn is the source of food for much life on land, from insects to humans.

The term “plankton” designates all of the microscopic or extremely small organisms, plants and animals, that are carried by currents: microalgae, fish eggs and larvae, mollusks, small crustaceans and other invertebrates. These billions and billions of tiny individuals populate our oceans, seas, lakes, rivers and streams. Plankton can be divided into two main categories: plant plankton, or phytoplankton, made up of microscopic single-celled algae like diatoms, dinoflagellates and cyanobacteria, and animal plankton.

These plant and animal organisms are very different in their nature and their dimensions, with sizes ranging from 0.2 microns to a few centimeters—or even a few meters, as is the case with jellyfish. Most plankton cannot be seen with the naked eye, but the thousands of species that form it constitute the majority of marine organic biomass. In the seas, the total weight of the living population (including fish, crustaceans and whales) is almost entirely made up of plankton²¹.

Around 6,000 species of marine microalgae (phytoplankton) are currently known, and over 14,000 freshwater species. They are not visible to the naked eye and can only be identified with a microscope, but in some cases when they are particularly abundant they can give the water a greenish, brownish or reddish tinge.



²¹ https://docs.eclm.fr/pdf_livre/360LeManuelDuPlancton.pdf

Phytoplankton contain the pigments that make possible photosynthesis, and thus the production of enormous amounts of oxygen, indispensable to aquatic life. Thanks to an exchange of gases with the ocean's surface, phytoplankton also generate up to two-thirds of all the oxygen found in the planet's atmosphere. The remaining third is provided by vegetation on land.

The nutritional positions assigned to the organisms that structure a food chain are known as "trophic levels." The base of the system is a myriad of microorganisms. Among these are phytoplankton, which drift in the water and are capable of photosynthesis, in other words using sunlight to synthesize sugar and use it to assemble other energy-providing substances. Scientists call this biochemical development of new biomass "primary production." On our planet, around half of the primary production comes from phytoplankton, serving as a source of food for small swimming crustaceans or fish larvae, in other words zooplankton, which in turn feeds the smallest fish and other organisms²².

Plankton represents the basis of the diet of all marine organisms: A ton of phytoplankton can feed 100 kilos of zooplankton, which can sustain 10 kilos of juvenile fish and crustaceans. Those 10 kilos can feed a kilo of small fish and produce 100 grams of tuna. In other words, it takes 10 tons of phytoplankton to produce one kilo of tuna²³.

Because of phytoplankton, the oceans play a primary role in regulating the climate and managing carbon dioxide. The algae that play a key role in the sequestration of CO₂ are the coccolithophores, single-celled marine algae found mostly in cold regions, like the seas around Canada and the northern Atlantic. Visible only under a microscope, they have a calcareous exoskeleton, a kind of scaly shell made from calcium carbonate found dissolved in water. When the organism dies, the exoskeleton falls to the sea floor, accumulating with other remains and producing a sludge that has been piling up in layers for millions of years.

Present on Earth for over 200 million years, these microalgae are the origin of the sedimentary layers that can still be seen in calcareous soil. In any part of the planet, the presence of chalk in the soil is a definitive indication of a former seafloor. Think of the Paris Basin: The French capital is built on a bed of plankton. Not far away, in Champagne-Ardenne, the region's famous sparkling wines are born from a soil made up primarily of coccolithophore sedimentation.

Coccolithophores, like phytoplankton in general, develop and multiply by means of photosynthesis, capturing suspended carbon dioxide and using it to manufacture vegetal material, releasing oxygen. Their remains eventually sink down and are "eaten" by bacteria. They are a form of carbon sink, absorbing carbon dioxide from the Earth's atmosphere and transferring it to the ocean floor. By trapping some of the carbon dioxide responsible for global warming, they contribute to stabilizing the climate and combatting the greenhouse effect caused by human activities.

Over the last 200 years, the oceans have absorbed a third of CO₂ emissions linked to human activity, but as time passes their sequestration capacity is declining. Currently they can only manage to absorb a quarter of human-produced CO₂ emissions, and in some areas we are even seeing a reversal, with the oceans starting to release carbon dioxide into the atmosphere.

²² <https://wedocs.unep.org/handle/20.500.11822/8734>

²³ Pierre Mollo, Anne Noury, *Le manuel du plancton* (2011)

Trapping carbon dioxide also brings about the acidification of the water. The presence of CO_2 in the seas leads to the formation of carbonic acid, which has an acidifying effect. In more acidic waters, marine organisms find it harder to form a protective shell, and indeed above a certain concentration of CO_2 their shells actually start to dissolve. The acidification of the oceans is harmful for plankton, but also for all animals with a protective shell, whether gastropods, other mollusks, crustaceans and even corals.

Given current CO_2 emissions, the acidification of the oceans could reach pH levels that would make the water corrosive, and unlivable for microorganisms. The coldest seas, which absorb the greatest volume of CO_2 , would be the most affected. Coccolithophores, like various other species of phytoplankton, could die out. Along with them we would lose mussels, oysters and other mollusks, and as a result there would be serious impacts on all marine biodiversity.



DOMESTICATED PLANTS



Local varieties, selection and seed reproduction

Edible plant species originated in very specific areas of the world, the same areas that still today are home to the greatest diversity.

The Andes, for example, where the potato is native, are still home to the greatest number of potato species, varieties and ecotypes, thanks to the strong link between the tuber and the local gastronomic culture.

Throughout agriculture's 10,000 years of history, rural communities around the world have selected, preserved and multiplied seeds, improving yields, flavor and nutritional values, in harmony with the characteristics and resources of the local area.

Farmers' work has always been based on complex agronomical knowledge, passed down and refined from season to season and from generation to generation. And, within communities, the principle of free exchange, based on cooperation and reciprocity, has always been valued. It was common—and still is—for farmers to exchange seeds in equal quantities, contributing to an on-going process of biodiversity conservation.

Along with people, seeds travelled the world and adapted to local soil and climate conditions, giving rise to new varieties, inextricably linked to specific areas and local communities and influencing culinary and gastronomic traditions. Tomatoes, for example, originated and were domesticated in Central America before crossing the Atlantic and adapting to many parts of Europe, differentiating themselves into many local varieties closely linked to local identities and begetting emblematic Mediterranean dishes like pizza, tomato sauce, gazpacho and Greek salad.

After being consolidated for centuries, this system of multiplying and spreading agricultural biodiversity—based on local knowledge, sharing, exchange and no cost—has changed radically in very recent times. Due to a strong push towards globalization and the demands of distribution organized on a large scale (uniformity, resistance to handling and transport, etc.), since the 1970s agricultural production has been focusing on an increasingly restricted number of species and varieties. Farmers' seeds have been replaced by seeds produced and sold by seed companies, a production system detached from cultivation environments and based on genetic models with increasingly few links to local areas. These same seed companies, initially small or medium businesses serving a specific area, have gradually disappeared, wiped out by international giants.

Now 63% of the seed market is controlled by four multinationals (Bayer-Monsanto, BASF, Syngenta Chem China and DowDuPont). These same corporations own GMO patents and are leaders in the production of fertilizers, pesticides and weedkillers. This means there is an indissoluble link between those who produce seeds and those who produce the agents used to control weeds, fungi and insects. One famous case is the herbicide Roundup®, produced by Monsanto, and the seeds of transgenic "Roundup® Ready" species designed to be resistant to the product.

This revolution in the agricultural world has had immense economic, social and environmental consequences. The most significant, and, being irreversible, the most serious, is the loss of biodiversity. Today just nine species (sugar cane, corn, rice, wheat, potatoes, soy, oil palm, sugar beet and manioc) represent over 66% of all plant production by weight. Three of these, corn, rice and wheat, provide 60% of the global population's calories. It is hard to quantify the genetic erosion within each individual species, because we don't have reliable and effective indicators. However, according to the FAO, in terms of ecotypes and varieties, 75% of the agricultural crops present at the start of the 20th century have now been lost forever. In the United States the loss of biodiversity for many cultivated varieties is close to 95%.



There is no shortage of examples of biodiversity loss among domesticated plant varieties.

Between Peru and Bolivia, ancient Andean agricultural communities used to grow over 5,000 multi-colored potato varieties, but the global potato market is now based on just four hybrid varieties (Russet Burbank, Kennebec, Atlantic Superior and Red Norling).

We know of around 7,500 apple varieties, but industrial agriculture has focused on a few groups of commercial varieties (including Golden Delicious, Red Delicious, Gala, Fuji and Granny Smith) which now represent 90% of the global market driven by large-scale distribution. Half of the world's production is Chinese²⁴.

Of the 2,500 varieties of pear once cultivated, now just two share 96% of the global market.

Hundreds of varieties of banana have different shapes, colors, textures and uses, but 90% of the market is dominated by Cavendish, putting the very survival of the species at great risk. The 10,000 varieties of wheat that were being grown in China in 1949 were already down to 1,000 by 1970. In less than a century, Mexico, the homeland of corn, has lost 80% of its corn varieties.

Rice (Oryza)

In many cultures, rice is synonymous with food. In Vietnamese, Japanese, Lao and Siamese, to say eating, one says eating rice. Almost all the rice in the world is produced and consumed in Asia, with 250 million farmers growing and harvesting by hand thousands of different varieties: aromatic, waxy, red, purple, white... Meanwhile, in the boundless plains of Arkansas, rice is sown by airplanes flying over the fields.

Rice is bread, main course, side dish, dessert, wine, beer, whisky. Domesticated in China along the banks of the Zhujiang River and cultivated for 8,000 years, it has shaped agricultural landscapes, economies, political and social organizations, gastronomies, rituals and mythologies. It has adapted to diverse environments across the planet, flourishing below sea level in Italy's Po Delta and at altitudes of 3,000 meters in the Nepalese highlands and the Peruvian Andes, in the freezing climates of the Hungarian steppe, Manchuria and the Japanese island of Hokkaido and in the equatorial tropics.

This extraordinary wealth of biodiversity is at risk. Thailand used to grow 16,000 varieties of rice, but this has been reduced to just 37. The same pattern can be seen in Bangladesh, where 5,000 varieties are now 23, and Korea, where 12 varieties are now cultivated instead of 4,000.

Local varieties, which form our plant biodiversity, have been selected over the centuries and have become highly suited to their environments, adapting and acclimatizing to their local conditions, where they express the best of their agronomical, productive and quality potential.

They flourish in equilibrium with the climate and the soil, with the natural resources of their chosen territory. Often they are more resistant to biotic and abiotic stresses and require fewer external inputs.

²⁴ <https://www.oecd-ilibrary.org/sites/832cfaee-en/index.html?itemId=/content/component/832cfaee-en>

This makes them more sustainable, both environmentally and economically. The traditional reproduction of biodiverse seeds makes it possible to dynamically preserve all of these characteristics, allowing the natural evolution of varieties through free pollination and ensuring the on-going adaptation to changing natural conditions, year after year. Traditional varieties perform best in their original local contexts, where they represent important agricultural resources or even essential tools to food sovereignty. Thanks to their high quality they can support local microeconomies, thus ensuring the presence of people in marginal and difficult areas.

Maintaining a wide base of genetic variability is important to be able to address the risks linked to climate change, diseases and the future inevitable shortage of natural resources that can maintain an agricultural system able to feed the planet's growing population.

The great genetic variability of the tens of thousands of local varieties makes it possible to produce new crosses or isolate qualitative or quantitative traits of great economic, productive or even medical interest. The preservation of ancient varieties and their related cultivation techniques is also essential to the safeguarding and maintenance of landscapes and natural environments and for the safeguarding of the gastronomic heritage of local communities.

Registration and Patents

The registration of traditional varieties is defined by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) approved by the FAO in 2001.

Registering a variety means that it is known, described and protected. This is a very useful tool and not a restriction on the freedom of small-scale producers. Excluding small-scale production from registration obligations would be a mistake. On the contrary, it is important to invite communities to report their native varieties, and if countries do not have a register, institutions should be encouraged to establish one.

Registration is free, public and accessible online. Registers can be regional, national and international and are managed by different entities.

Registration should be promoted, including by introducing reward mechanisms for those who register varieties, however, it should also be clarified that it is not forbidden to cultivate unregistered varieties. Otherwise we risk losing another important part of biodiversity.

Whoever requests the inclusion of a variety in the register should also make themselves available for its preservation, becoming a custodian of that variety. Guardian farmers undertake to apply a variety conservation protocol through targeted sowing and cultivation, reproducing the seeds, saving them for the following seasons and making them available to other local farmers, who will join together in a network.

It is crucial to distinguish registration from patenting. Not only are they two completely different things, but one excludes the other. A variety that has been registered cannot subsequently be patented by other parties, particularly if its connection to tradition and the local germplasm is clear.

For more details, see Slow Food's position paper on seeds.

EDIBLE WILD PLANTS



Nutritional value, traditional knowledge and deforestation

Edible wild plants are an essential component in the diet of rural populations in various parts of the world and play an important role in ensuring food security and sovereignty and the nutritional diversity of hundreds of millions of people. Despite this significance, they are rarely studied, meaning there is a lack of identification and classification, not much understanding of their exact distribution and little known about their biology and socio-economic value. The most important knowledge about edible wild plants and their use is held by rural communities, especially indigenous peoples.

The term “wild” in the context of plant species refers to plants that grow spontaneously in natural or semi-natural ecosystems and which can exist independently from direct human action. The distinction between wild and domesticated is not simple or clear-cut. Indeed, the definition of wild plants comprises a wide range of species, differentiated based on the level of intervention or management by people²⁵. Sometimes wild plants grow within domestic ecosystems, other times human intervention is minimal. In the Amazon, for example, the Sateré-Mawé collect the seedlings sprouting from seeds fallen from waranà plants and transplant them into clearings, raising them as bushes and rendering them productive through a form of primordial domestication.

²⁵ <http://www.fao.org/state-of-forests/en/>

The definition of wild, semi-domesticated and domesticated plants is also relative to the socio-cultural context. The same plant might grow naturally in a specific environment, while in others it requires human intervention. There are many cultivated species that still grow commonly in the wild, like capers or aromatic plants like rosemary, dog rose, sage, thyme and oregano.

Some wild plants are annuals, others perennials. Some are linked to complex harvesting and processing techniques, like Manoomin wild rice (United States), which is collected from canoes, dried and smoked, or Harennna wild coffee (Ethiopia), which is dried in the sun and toasted. Others involve simpler processes, like radìc di mont (Italy), picked in the mountains and preserved in extra-virgin olive oil, or Ballobar capers (Spain), harvested by hand and salted. A wild product might often have gastronomic, cosmetic and medicinal uses.

In the majority of cases, edible wild plants are freely available and can make a significant contribution to nutrition and diversity in a diet. Many species of wild foods are richer in vitamins, minerals or macronutrients like fats and protein compared to the conventional domesticated species that dominate agricultural production²⁶ and they often provide secondary metabolites like essential oils, alkaloids and phenols.

Food biodiversity, particularly when wild, able to adapt to the environmental context and resist difficult conditions, does not only make a nutritional contribution but also represents a strategy for providing enough variety to the diets of urban and rural populations throughout the year and for managing hunger and the risk of malnutrition during food shortages.

Rural communities that often struggle with periods of famine or food scarcity just before the harvest season can benefit from wild fruits and other plant species that mature during the times of year when food stocks are limited²⁷. When integrated into mixed-crop cultivation systems, fruit trees, resilient to climate variability, can provide healthy, nutritionally rich foods all year, thanks to their micronutrients (vitamins and minerals), macronutrients (protein and carbohydrates) and phytochemical substances (antioxidants)²⁸.

The management and use of wild edible plants is essential to guaranteeing their availability and access to species that are part of the local diet. The challenge is combining the need to preserve natural areas with an improvement of living conditions for local communities. Including wild plants in family diets is one of the best ways to provide nutrients and safeguard the knowledge linked to their harvest and processing and the protection of the ecosystem where they grow, whether forest, mountain, lagoon or other.

The sustainability of the harvest depends on many factors: the information available to the community, the quantity of the product harvested, the harvesting technique, processing methods, how the plant reproduces. Research should focus on the analysis and mapping of species, but also the traditional knowledge linked to them.

²⁶ <https://www.who.int/globalchange/publications/biodiversity-human-health/en/>

²⁷ <https://www.bioversityinternational.org/mainstreaming-agrobiodiversity/>

²⁸ <https://pubmed.ncbi.nlm.nih.gov/23633245/>

Wild edible plants can be found in almost all the world's ecosystems, in grasslands, mountains, highlands, deserts and swamps, but one of the places with the highest rate of diversity of these species (and related knowledge) are forests.

Deforestation and the degradation of forests continue to happen at alarming rates, making a serious contribution to the on-going loss of biodiversity. Since 1990, it is estimated that 420 million hectares of forest have been lost due to conversion of the land to other uses, even if the rate of deforestation has slowed in the last three decades. Between 2015 and 2020 the rate of deforestation is estimated to have been 10 million hectares a year. The area of primary forest around the world has been reduced by over 80 million hectares since 1990.

Agricultural expansion continues to be the main driving force behind deforestation and forest degradation and the consequent loss of forest biodiversity. Among the main causes of deforestation are monocultures (oil palms and soy in particular), timber and wood pulp production and intensive livestock farming.



MACROALGAE AND SEAGRASS MEADOWS

Oxygen and carbon for the planet, CO₂ sink, food for communities and shelter for marine species

Macroalgae (seaweed) and seagrasses play an indispensable role in marine biodiversity. Seagrass meadows are made up of vascular plants with roots, stems and leaves, while macroalgae are multi-celled structures that are mostly or entirely lacking in vascular tissue²⁹.

Macroalgae can be divided into three groups: red algae (Rodophyta), which generally grows at the greatest depths, green algae (Chlorophyta), which prefers shallow waters, and brown algae (Phaeophyceae), found in the middle waters. Experts estimate that there are 6,200 types of red algae, 1,800 types of brown algae and 1,800 types of green algae living in marine environments.

The overall impact of algae on the global ecosystem is immense. We owe two-thirds of the oxygen in the atmosphere to them (more than what is produced by rainforests) and every year they can produce between 2 and 14 kilos of organic carbon per square meter of surface area, while terrestrial plants rarely go beyond one kilo³⁰.

At the same time they play a key role in the human diet. Their content of mineral compounds is up to ten times higher than plants growing on land. People who regularly eat seaweed tend not to suffer from a deficiency of salts. They also contain important traces of microelements and vitamins, while being low in calories. In general the protein provided by algae provides all the most important amino acids, especially those essential ones that our body is not able to synthesize on its own and which must be acquired from food³¹.

Gathered along the coasts or directly from the sea, eaten fresh or dried, seaweed has been appreciated for thousands of years by gastronomic cultures around the world. Peruvians living along the coast harvest and dry a red algae called yuyo (*Chondracanthus chamissoi*), which they then sell inland, where it is used as an ingredient in soups. Rich in iodine, it helps to prevent goiters, an endemic ailment in the country. In Great Britain, seaweed has been sold in markets and used in the kitchen since the Middle Ages. The biggest consumer of seaweed, however, is indubitably the Asian continent. The Japanese eat an average of 5 kilos of dried seaweed each every year³².

Algae can reduce greenhouse gases: Adding a small amount of seaweed to fodder for dairy cattle can cut their methane production by as much as 60%.

In a world where arable land and healthy soils are being systemically exploited, seaweed represents an important source of food and a vital resource that could feed many people. Seaweed does not require fresh water or fertilizers, and in fact responds well to waters polluted from agricultural run-off.

29 <https://myfwc.com/research/habitat/seagrasses/information/seagrass-vs-seaweed/>

30 <https://www.americanscientist.org/article/the-science-of-seaweeds>

31 <https://www.americanscientist.org/article/the-science-of-seaweeds>

32 Oscar Caballero, Océanos, peces, platos. Una historia cultural del mar (2017)

Multi-cellular algae and seagrass meadows provide refuge and nutrition for many species, like mollusks, crustaceans and fish, and a vital habitat for juvenile fish and fry. They also filter the water and serve as a bulwark against marine storms, absorbing much of their energy.

These underwater meadows are also one of the greatest sinks for carbon dioxide on the planet. They can capture up to 83 million tons a year (the equivalent of the CO₂ emitted in one year by 61 million cars), meaning they play an essential role in controlling climate change and stabilizing the carbon cycle. And yet they are retreating from the sea floor at a rate of 1.5% a year. Already we have lost 35% of these marine prairies. The plants are able to adapt to changing environmental conditions, like storms, or animal-origin stresses, like herbivores feeding on them, but they are vulnerable to the impacts of human activities, which are responsible for almost all of the losses seen over the last decades. When the seagrass meadows are lost, the carbon dioxide trapped in their structures returns to the atmosphere³³.



³³ <https://iucnrlc.org/blog/seagrass-meadows-the-marine-powerhouses/>

POLLINATING INSECTS



Link between food cultures and animal pollination, beekeeping and pesticides

The vast majority (87.5%) of wild plants in the world, around 308,000 species, depend at least in part on animals for pollination. In the tropics, this figure is 94%, and 78% in temperate zones³⁴.

Globally, the production, yield and quality of over three-quarters of the main food crop types, covering around 35% of all agricultural land, benefit from animal pollination. Around 60% of the world's agricultural production comes from crops that do not rely on the work of insects (for example, cereals and root crops), while the remaining 40% comes from crops that depend at least in part on entomophilous pollination.

While pollination can also be carried out by vertebrates like bats, birds, primates, marsupials, rodents and reptiles, in practice insects are responsible for almost all pollination. Bees are the most famous pollinators, but many other insects are also important, like wasps, butterflies, moths, beetles, ants and flies.

³⁴ <https://ipbes.net/assessment-reports/pollinators>

Insects are not always beneficial to crops; many are a threat to production because they feed on leaves, stalks or roots, damaging them, sucking out the sap and transmitting diseases that can cause serious harm to yields. For example, worldwide losses in corn, rice and wheat production due to insects are estimated to be between 5% and 20%, depending on the region and the crop type.

However, insects can also contribute to improving yields: Almost 90 species of insect are reproduced in order to be used for the biological protection of crops, but the number of wild species that can also play a helpful role is much higher.

In over 130 countries, insects are a direct form of food, containing many nutrients and often representing one of the most effective weapons against malnutrition³⁵.

Pollinating insects are under serious threat, particularly bees and butterflies, which in some places account for over 40% of species at risk of extinction. Recent evaluations on a European scale (despite the lack of significant data on a large number of families of Apoidea and butterflies) indicate that 9% of bee and butterfly species are threatened with extinction while population numbers have fallen by 37% for bees and 31% by butterflies. In regards to vertebrate pollinators (hummingbirds, squirrels, bats, lizards, etc), 16.5% of known species are considered at risk of extinction globally.

The main threats, due to intensive agricultural production and environmental management, are soil consumption (habitat loss, fragmentation, agricultural intensification, urbanization), pesticides, pollution, pathogens, climate change and the influx of exotic species. The consequences of any one of these threats are even greater when they act in combination with each other.

Science can provide a broad and multi-dimensional overview of the world of pollinators and offers detailed information about their diversity, but we still do not have a complete and exhaustive understanding of their functions and the measures necessary to protect them. It is fundamental to take into account the cultural heritage of indigenous peoples, who know, understand and celebrate pollination processes and are able to manage them holistically.

If profit is the main reason for patterns of production that focus on maximizing returns to the detriment of environmental conservation and the health of the planet, then one of the arguments in favor of protecting pollinators is the economic value of pollination services to agriculture, estimated to be around €260 billion a year around the world³⁶. But this risks becoming an incomplete way of identifying the best choices for conserving the ecosystem.

A similar discourse can be applied to bees and beekeeping. The focus on the crisis among pollinators tends to focus in particular on farmed bees, because they are closely linked to a money-making activity (apiculture and honey production), but the vast majority of the bees known in the world are wild.

35 https://www.foeeurope.org/sites/default/files/biodiversity/2020/insect_atlas.pdf

36 <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0035954#s3>

Just as we can no longer pursue a model aimed at maximizing yields at all costs in the food production world, so in the smaller world of apiculture it is clearer every day that continuing to push for the selection of bees with traits considered favorable for beekeeping or rearing methods aimed at maximum production is proving to be a losing strategy. A strategy which over the years has weakened the genetic heritage of bees; think, for instance, of the consequences of introducing hybrids instead of subspecies and native populations. *Apis mellifera ligustica* or populations of *Apis mellifera mellifera*, for example, whose characteristics of productivity and docility respectively have been used to create hybrids and who then became victims of these hybrids. Commercialized and used on a large scale over the span of a few decades, they have destroyed ancient equilibriums constructed on the relationship between a bee and the local area where it has settled. The conservation of native populations, where still present, is even more urgent now because they are better adapted to facing the various threats they must confront. For the same reasons, the irresponsible and uncontrolled shipping of queen bees worldwide, with the aim of exploiting and replicating presumed productive advantages, is just one of the many problems linked to beekeeping today.

Beekeeping has significant livelihood potential. For many rural economies it is an economic lifeline and a source of many educational and recreational benefits in both rural and urban contexts. Within many rural economies apiculture has spread because of the minimum investment required, the flexibility of times and location of the activity and the possibility of generating a diversified production.

Beekeeping as it is practiced within small-scale rural economies is one of the greatest basins for the conservation of the biodiversity of ecotypes and bee populations.

Industrial agriculture represents one of the greatest challenges to the survival of pollinators. Pesticides have a wide range of lethal and sublethal effects. The risk comes from a combination of toxicity and level of exposure and varies geographically, depending on the composts used, the type of land management and the presence of untreated semi-natural or natural habitats in the landscape.

Exposure to pesticides can be reduced by lowering their use and adopting agroecological practices. Policy strategies that aim at the gradual reduction of the use of pesticides, as well as comprising compensation mechanisms for farmers who follow good practices, should also include support for training initiatives for the different actors along the production chain.

This would make it possible to restore natural ecosystems in agricultural areas, ensuring a greater diversity of habitats and encouraging the presence of diversified communities of pollinators able to more effectively pollinate crops and wild plants. Sowing nectariferous varieties with different blossoming times, paying particular attention to those periods when there are less flowers in nature, is the best way to help pollinators to feed and reproduce. The creation of green infrastructures generates positive effects for agricultural pollination in fragile areas but it is necessary to ensure they are in communication with each other, taking advantage of uncultivated land and roadsides in order to encourage the movement of pollinators.

DOMESTICATED ANIMAL BREEDS



Selection, adaptation, intensive farming and grazing

Of the 50,000 known species of birds and mammals, only 40 or so have been domesticated by humans since the end of the Pleistocene, around 12,000 years ago.

The reason for this small number is linked to the fact that few wild species have characteristics useful for people. The first farmers selected the least aggressive animals with a strong herd instinct (those that developed a tendency to follow a leader and form expanded groups of different species), those which suffered the least stress from living and reproducing close to humans and those which grew rapidly and had shorter intervals between births. It is also much easier to domesticate herbivores than carnivores, because in transhumant systems it is easier to obtain the plants needed to feed them.

Domesticated breeds are smaller than the wild species they originated from (with the exception of poultry, which are generally larger than their wild relatives), making them simpler to raise. They reach sexual maturity sooner and have greater muscle mass (so more meat, particularly in the hindquarters, as in cattle) and a lower fat percentage, often concentrated in specific organs (like the zebu's hump and the fatty tails of many heirloom sheep breeds, like southern Italy's Laticauda). The density of the fleece on certain breeds, like Alpine sheep, is also due to their adaptation to the harsh mountain climate.

Human selection and adaptation to different conditions and environments has led to thousands of different breeds developing from these few domesticated species. But today this heritage of biodiversity is under threat³⁷.

In 2019, of the circa 15,000 breeds registered in different countries around the world, 8,803 were recorded in the FAO's global databases. Among these, 7,745 are considered "local" (i.e. found in only one country), and of these breeds, 594 have died out³⁸ (99 between 2000 and 2014).

Just over a quarter (26%) are considered to be at risk of extinction, with less than 1,000 animals remaining, while 67% have an unknown status. This last figure has increased over the last decade, and in the global south 85% of local breeds belong to this category³⁹. Only 7% seem not to be in danger.

25% of landfowl breeds, 83% of cattle breeds, 44% of goat breeds and 50% of pig breeds are under threat of extinction (the category just before being at risk of extinction).

The parts of the world with the highest number of breeds at risk of extinction are Europe, the Caucasus and North America, places where intensive livestock farming, dominated by just a few breeds, has been the rule for decades.

In Europe, half of the breeds existing at the start of the 20th century have died out—Spain's Campurriana cow, Greece's Drama sheep, Belgium's Huttegem chicken—and a third of the remaining 770 risk extinction in the next 20 years, like the Limpurger cow in Germany and the Provençal goat in France. In Germany, for example, only five of the circa 35 native cattle breeds are still surviving. In North America, over a third of all farmed breeds are considered rare or in decline.

The conservation status of the wild relatives of domesticated livestock has also worsened. These wild relatives represent reserves of genes and characteristics that can provide resistance to future climate change, parasites and pathogens and can improve the current genetic pools, which have been heavily impoverished. Lands where indigenous populations and pastoral communities live are often important areas for the preservation of the remaining breeds. The available data show that genetic diversity within wild species at a global level has declined by around 1% per decade since the middle of the 19th century. The genetic diversity of wild mammals and amphibians tends to be lower in areas where human influence is greater⁴⁰.

Livestock farming around the world is concentrated on five species: cattle, sheep, goats, pigs and chickens.

37 <http://www.fao.org/3/a-a1250e.pdf>

38 <http://www.fao.org/3/ca3129en/CA3129EN.pdf>

39 <http://www.fao.org/3/a-i4787e.pdf>

40 <https://ipbes.net/global-assessment>

Cattle

The planet is home to 1.5 billion cattle, about one for every five people. Of these, 32% are farmed in Asia and 27% in Latin America, with Brazil the country with the highest number of cattle in the world, accounting for 14% of the total. Among the 10 main cattle breeds, eight are European and have been exported from the continent to the rest of world. The most commonly farmed is the Holstein Friesian (also known as Holstein or Friesian), found in 128 countries, followed by the Jersey (82), the Simmental (70), the Brown Swiss (68) and the Charolais (64). Almost all originated in northwestern Europe, particularly the United Kingdom, followed by France, Switzerland and the Netherlands.

The Holstein Friesian produces much milk and is well suited to raising indoors, including at high densities—some farms are home to many thousands of animals. Increasingly brazen selections, aimed at improving production, mean that one cow from this breed can now produce up to 60 liters of milk a day during peak production. Effectively a milk machine, it must live indoors, fed on corn and high-protein soy-based feed. The animal is quickly “used up”; after two or three births it can no longer guarantee a good yield of milk and is slaughtered, while a cow from a traditional breed can live for 20 to 25 years. Cattle raised in industrial systems are inseminated artificially. Farmers buy vials of semen from a few multinationals, known as breeding companies, based on their needs. Commercial breeds like the Friesian have weakened over time. The breeding bulls, selected by the breeding companies, are fewer and fewer in number. The animals raised by big milk or beef producers are increasingly genetically similar, and this consanguinity makes them weaker.



Sheep

There are 1.2 billion sheep in the world, around one for every six people, with 37% farmed in Asia, primarily China, India and Iran.

The sheep is the most widespread domesticated species, because it is multifunctional (producing milk, meat and wool), has adapted to different environments and can be consumed by people from all the major religions, unlike beef, goat and pork.

Just like with cattle, the push towards specialization has prioritized the traits able to favor milk production or the development of muscle mass for meat production, as required. This has led to secondary products being considered as waste or “necessary evils.”

The most common sheep breed is the Suffolk, which from England has spread to 40 countries, followed by the Spanish Merino and the Dutch Texel. But if all the lines deriving from the original Merino are considered, then that breed takes first place.

Almost all the most common sheep breeds come from England. The colonizers who left from Europe took them to the Americas and the Pacific. Most of the 440 sheep crossbreeds developed over the past four centuries originated from European sheep.



Goats

The goat is the least numerous of the most farmed species in the world. There are just under a billion, one for every eight people, with 56% in Asia, mostly China, India and Pakistan.

For small-scale farmers in the global south, and more generally anyone living in marginal, arid or mountain areas, goats are the most useful livestock species, because they can survive where other domesticated animals would struggle.

The most common breed is the Swiss Saanen, followed by the Toggenburg, also Swiss, the Anglo Nubian from the UK and the Turkish Angora, highly prized for the quality of its wool. The Saanen produces a large amount of milk but cannot survive in challenging terrain where it would struggle to climb the rocks in search of grass.



Pigs

About a billion pigs are farmed around the world, one for every seven people. Two-thirds are in Asia; half in China, but there are also many pig farms in Vietnam, India and the Philippines. In the 18th century, light pigs were imported to Europe from China and Southeast Asia and crossed with local dark-coated breeds descended from wild boar. These were the ancestors of modern European pigs.

The most common pig breed is the Large White, which has high meat yields and is ideal for the industrial production of charcuterie, but would struggle to survive on acorns and tubers foraged from the undergrowth, as its predecessors did. In intensive systems the pigs are artificially inseminated. Farmers choose the semen best suited to producing pigs for pork or for making salami or ham from the breeding companies' catalogs. Sows are selected based on how fecund they are; they don't need to be good at suckling their piglets as the babies will be taken away very early for fattening up.

The global pork market is currently in the hands of the Chinese company Shuanghui, which controls the entire chain from genetics to production of pork products to final distribution.



Chickens

Over 21 billion chickens are farmed around the world, 2.5 for every person. Numbers are growing everywhere except for North America, with 53% raised in Asia and 15% in Latin America and the Caribbean.

Chicken breeds account for 63% of all poultry breeds. The most common is the White Leghorn, farmed around the world due to the high number of eggs it produces (280 a year). The breed was developed in the United States but derives from the Italian Livornese breed, exported to America in the early decades of the 19th century (Leghorn is the Anglicized name of the city Livorno). The next most popular are the New Hampshire and the Plymouth Rock, selected in the second half of the 19th century.

Common breeds of Asian origin include the Aseel (India) and some Chinese breeds (Brahma, Cochin and Silkie). Among these is the ancestral breed from which all modern chicken breeds derive, the Southeast Asian jungle fowl. There are breeds for eggs, meat and both meat and eggs as well as fighting and ornamental breeds. In the global north, the commercial egg-laying breeds and broilers farmed for meat dominate, as they are suited to intensive battery farming. Broilers are hybrids based on a secret formula. Two multinationals control the market for layers (Wesjohann from Germany and Hendrix Genetics from the Netherlands) while two others (Tyson Foods from the US and Grimaud from France) control the market for chickens for meat: genetics (including organic farming), feed, drugs and processing (from slaughtering to butchery and even to ready meals). The entire production chain is dominated by these giants, who supply the fast food industry, mass catering operations and supermarkets.



In Europe and North America, local breeds have almost completely disappeared and survive only thanks to hobby farmers. In the global south, however, they continue to play a fundamental role.

The main threats to domesticated animal biodiversity are increasingly intensified industrial farming; indiscriminate crosses; the rise in consanguinity or inbreeding, which weakens the animals; the introduction of exotic breeds; the lack of public conservation policies; poor competitiveness with commercial breeds' yields; the loss of pastures and environmental pollution. Epidemics and natural disasters can also contribute to the extinction of local breeds. In 2003 Vietnam, one of the countries with the greatest poultry biodiversity, culled 43 million chickens due to the threat of avian flu: 17% of its poultry population, including many native breeds.

The export of animals from the global north to the global south is also a threat to diversity. These imported animals replace local breeds, considered less productive, but often they cannot adapt to the new environment, cannot replicate their performance and require invasive treatments with drugs that are highly dangerous to the environment. They also tend to need a high input of imported feed.

The modern Western production model is perhaps the foundational element generating negative effects all along the chain. Productivism has encouraged the selection of no more than around 30 livestock breeds, designed for maximum yield of milk or meat and their suitability for intensive farming.

Livestock farming is becoming increasingly geographically distant and separate from crop cultivation, with animals ever more often reared in stables that do not allow access to outdoor space and pastures, treated extensively with medicines, fed on feed and transported over long distances. Productivity has increased, but to the detriment of ecosystem health, biodiversity and mutually positive interactions between different spheres. Many grasslands have been degraded

due to excessive grazing or because of conversion to industrialized agriculture. The livestock sector is responsible for 14.5% of greenhouse gas emissions⁴¹.

Tackling the loss of livestock biodiversity means setting up in-situ conservation programs that can support guardian farmers, but also safeguarding genetic heritage through the establishment of semen banks (only 64 countries have genetic conservation centers). Also crucial is developing consumer awareness about the value of domesticated animal biodiversity.

Saving local breeds is important for many reasons, both economic and environmental, social and cultural.

Over time, animal breeds have adapted to different climates and environments and to hostile conditions (arid, cold, swampy, etc.) and marginal areas, where the presence of humans can actually help protect the environment.

If reared sustainably in their homeland, they can provide milk and meat of high quality for the production of cheese, cured meats and other products—a wealth of gastronomic traditions preserved and passed down over the centuries within local communities.

The genetic heritage of local breeds is also useful for research and the agro-industrial sector itself, so that the most resistant and tolerant animals can be selected. More genetically diverse animal populations also seem to be less susceptible to large-scale epidemics.

Local breeds—more resistant, hardy, fertile and long-lived, used to making the most of poor pastures for millennia—improve producers' chances of surviving climate change. Despite the close relationship between livestock production and biodiversity, many evaluations of environmental performance in the livestock sector have paid great attention to greenhouse gas emissions while ignoring the value of animal biodiversity in environmental performance.



⁴¹ <http://www.fao.org/3/CA2607EN/ca2607en.pdf>

FISH SPECIES

Wild fish, industrial fishing, aquaculture and coastal communities

There are over 30,000 known fish species in the world (Fishbase.se). Some are just a few centimeters long and live hidden amongst the coral. Others, like the Atlantic blue marlin, live in the open seas and can reach 3 meters in length. Herring streak across the North Sea in huge shoals, while other fish swim alone in the deep abysses of the ocean, waving bioluminescent bait attached to their foreheads. All of these different types of fish are part of a habitat, an ecosystem, and have their role within a complex web of interdependence with many other species along the food chain⁴².

Over the millennia humans have established a close relationship with fish, a source of protein, healthy fatty acids, vitamins and other indispensable nutrients. The world consumption of fish has climbed from 9.9 kilos a year per capita in the 1960s to 20.5 kilos in 2018, and this estimated to rise to 21.8 kilos by 2025⁴³.

Direct fish consumption varies greatly depending on countries and customs. In poorer countries it is often the only abundant and cheap source of animal protein. In these cases the consumption of fish tends to be based on seasonal products, available locally. In better-off or rich countries, fish consumption is an individual choice. Growing globalization has created more efficient distribution channels, transforming fish into one of the most traded foods in the planet⁴⁴. Global trade has boosted exports from food-poor countries in the global south to meet the dietary preferences of richer regions⁴⁵.

Since the process of industrialization began, the biodiversity of the oceans has fallen drastically. Among the main causes of this loss are the destruction of habitats due to trawling and coastal urbanization, the impoverishment of fishery resources damaging fish stocks and pollution and the eutrophication of the seas caused by industrial waste, human settlements and agriculture. Not to mention the climate crisis.

At the same time only a small part of the species living in the depths and the polar seas have been identified and classified. This makes monitoring and quantifying the loss of ocean species very difficult⁴⁶. Despite these challenges, it is clear that marine biodiversity plays a vital role in maintaining the functionality and productivity of ecosystems, as well as making habitats less vulnerable to environmental change⁴⁷.

The species that we tend to prefer for food (cod, tuna, swordfish, etc.) tend to be large and slow growing. Their populations are declining, and so fishers are turning to other species: smaller fish (mackerel, sardines, etc.) located further down in the food web.

42 <https://wedocs.unep.org/handle/20.500.11822/8484>

43 <http://www.fao.org/3/ca9229en/CA9229EN.pdf>

44 <http://www.fao.org/3/i3720e/i3720e.pdf>

45 <http://www.ecomarres.com/downloads/Loss3.pdf>

46 <https://wedocs.unep.org/handle/20.500.11822/8734> e <https://wedocs.unep.org/handle/20.500.11822/8484>

47 <https://wedocs.unep.org/handle/20.500.11822/8734>

Often smaller fish are preyed on by larger ones, so catching small fish means harming the larger species' ability to replenish their populations. One example is cod fishing in Norway. When populations began to decrease, fishers switched their interest to another species, pout, which lives on krill and copepods. Krill also feed on copepods, as do juvenile cod. The more pout were caught, the more the krill population increased, leading to a decline in the copepods. So the young cod struggled to find food, making the recovery of cod stocks harder than ever⁴⁸.

For a long time we considered species of commercial interest as separate cases, isolated from their context. Fishery management measures were focused on annual catch quotas (certain volumes of cod, herring or sardines that were allowed to be caught) and the presumed size of the remaining population. Only in the last ten years or so has there been a recognition of the need to take into consideration ecosystems in all their complexity in order to preserve fishery resources over the long term and effectively manage fishing. Catching excessive volumes of fish can transform the entire marine habitat⁴⁹.

According to some, the solution to finding a healthy and cheap protein supply with a modest ecological footprint while relieving the pressure on fish stocks is aquaculture⁵⁰.

In some parts of the world this form of farming has 4,000 years of history. From the mid-1980s, however, the industrial production of fish, crustaceans and mollusks using aquaculture techniques began to grow exponentially. This is now the sector with the fastest growth in the food industry, and indeed around half of all the fish consumed in the world is obtained using aquaculture practices.

The most farmed species are those lower down the food chain: mollusks, herbivorous fish and omnivorous fish, which eat both plants and animals. But the market demand from richer countries means that the production of carnivorous species (shrimp, salmon, sea bass, sea bream, etc.) is exploding.



48 <http://www.fao.org/3/i3157e/i3157e.pdf>

49 <https://wedocs.unep.org/handle/20.500.11822/8734> e <https://wedocs.unep.org/handle/20.500.11822/8484>

50 <https://changingmarkets.org/wp-content/uploads/2019/04/REPORT-WEB-UNTILL-THE-SEAS-DRY.pdf>
e https://www.greenpeace.to/publications/Aquaculture_Report_Technical.pdf

According to FAO projections, by 2030 a total of 109 million tons of fish, equal to 60% of the world's requirements, will be obtained from this technique.

Far from alleviating the pressure on wild fish stocks, the use of caught fish for the production of feed is instead exacerbating it. Industrial aquaculture is putting great strain on so-called "forage" fish: sardines, anchovies, mackerel, herring and crustaceans, mostly krill. These nutritious species are rich in vitamins, minerals and omega-3 fatty acids.

Almost 70% of the forage fish landed by fishing boats undergoes industrial processing to make fish meal and oil. The oceans, particularly in Asia, are being ransacked by fishing for feed production, with juveniles and species that did not used to be of commercial interest being caught in huge quantities.

According to some estimates, between 3 and 6 million tons of fish of little value are used directly for feed, perhaps accounting for 20% of all the fish caught in Southeast Asia and as much as 50% in Thailand and China. The extremely common phenomenon of illegal fishing means that it is difficult to get precise information about what is happening in Asia, the region of the world where aquaculture is most widespread. As a result it's likely that the problem is more serious than what is shown by the data we have.

The large-scale exploitation of these species can trigger a domino effect on other forms of marine life, including mammals and birds, producing unpredictable consequences, given the extreme complexity of marine ecosystems and the effects of climate change.

In West Africa and Southeast Asia, in particular, increasing recourse to wild-caught fish to feed farmed fish is a serious threat to food security, not to mention the harm caused by pollution. Industrial fish meal producers often use advanced fishing technologies or are willing to pay high prices for forage fish. They enter into competition with local fishers, to the detriment of local communities. In Peru, fishing for feed production is responsible for the degradation of coastal ecosystems and the extinction of local bird and fish species, while fish meal production has a negative impact on air and water quality, with harmful effects on human health (dermatological disorders and respiratory problems).

Aquaculture must move closer to sustainable production methods, with an understanding of its environmental and social impacts in all their complexity. One possibility could be to limit farming to only herbivorous species, whose diet does not need wild-caught fish, or to adopt extensive aquaculture, integrated with nature, with a low density of fish and minimal human intervention.

Ownership of Marine Genetic Resources

For thousands of years people have believed in the therapeutic power of the sea, and products from the sea have been an integral part of folk medicines around the world.

Today there are approximately 10,000 known natural substances⁵¹ from the sea, most of which were isolated from marine organisms over the past 20 years. Their potential in the medical or industrial field is inspiring growing interest in the scientific community and among businesses.

The use of genetic resources from outside areas subject to the national jurisdictions, however, brings unresolved legal questions, especially given that these areas cover over half of the planet's surface. Currently as many as half the patents linked to the genetic heritage of marine species are held by a single business active transnationally (BASF, the world's largest producer of chemicals) and more generally 98% of all the patents linked to marine genetic resources can be attributed to just 10 countries⁵².

Legal experts are seeking to establish which countries have the right to exploit these resources on a case-by-case basis. The main problem is the geographical position of the organisms and the extent to which a natural substance or a genome sequence can be patented. To complicate matters, different patenting legislation is in force in different parts of the world (World Ocean Review 1).

Initially the United Nations Convention for the Law of the Sea (UNCLOS) took only the country of origin into account. If a research institute applied to collect biological samples from the ocean depths during an expedition, its activities would be attributed to the country of origin of the research vessel. Alternatively, the country of origin of the syndicate or biotechnology business involved would be the determining factor (World Ocean Review 1)⁵³.

The Convention on Biological Diversity adopted in 1992 in Rio de Janeiro demands "the fair and equitable sharing of the benefits arising out of the utilization of genetic resources," meaning that the biological treasures found in nature should be shared out fairly between industrialized and developing countries. This objective, however, refers only to areas under national jurisdiction and not to maritime regions far from the coast (World Ocean Review 1)⁵⁴.

No international convention or agreement in force offers clear provisions for the exploitation of genetic resources collected from the ocean floor. Some in the international community believe that they should be fairly shared between nations, while others consider that any nation should have free access to these resources. As a result, the situation has stalled, with everyone interpreting the provisions of the Convention on Biological Diversity and the UNCLOS according to their own interests.

Until international bodies find a solution, individual nations must resolve the legal issues around the protection and exploitation of biological resources from the oceans themselves. Genetic resources are a common good, part of the collective heritage of the human race, so it is necessary to develop measures to prevent the commercialization and uncontrolled commodification of this living bounty.⁵⁵

51 Substances of plant, microbial, animal or mineral origin which represent a potential reservoir of solutions for human health and which should be subject to research and control by the competent authorities (www.iss.it)

52 <https://advances.sciencemag.org/content/advances/4/6/eaar5237.full.pdf>

53 54 <https://wedocs.unep.org/handle/20.500.11822/8734>

55 <https://worldoceanreview.com/en/wor-1/climate-system/>

THE BIODIVERSITY OF KNOWLEDGE

Food products, agricultural and fishing techniques and rural landscapes

The concept of culture refers to the knowledge shared by a certain population: from linguistic knowledge to history, mythology, spiritual beliefs, world vision, values, behavioral norms and the customary organization of social, economic, political and religious life.

As soon as culture is defined as shared knowledge accumulated and transmitted from generation to generation to facilitate the fulfillment of human needs and give a response to certain questions, then culture also becomes the way in which a population lives, chooses to behave, adapts to changing circumstances and comes up with means of subsistence.

Farming and fishing communities have developed and passed down through the generations tens of thousands of techniques, some simple, some more complex and refined. These can be ways of adapting to different terrains and climates, enabling survival in the most extreme conditions, or ways of preserving fresh food, transforming raw materials (milk, meat, fish, grains, fruits, leaves) into artisanal products: cheeses, breads, cured meats, preserves, sweets.

At the origin of these traditional food products is the knowledge of a community, a knowledge that tends to be oral, passed down within families and uniting different competences, the result of experience and everyday practice: an understanding of food chemistry, manual skills, capacity for observation.

Artisanal processing gives the initial ingredients an important added value, because it enables the production of singular products, more complex from a sensory perspective, able to reflect a local culture, free from seasonal cycles and therefore from market fluctuations. Often local ecotypes and breeds can be saved, if only beyond domestic consumption they can also be used for food products suited to commercial trade (local and national).



Food products even make it possible to preserve raw materials for many years. Some cheeses can be aged for up to 10 years, while wine, mead and vinegar can last for 20 years or more.

Tiny variations can lead to very different final products: Just think of the thousands of types of cheese that all start from the same three ingredients, milk, rennet and salt; cured meats, where the technique of cutting the meat, a single spice or the type of wood used for smoking can all produce extremely diverse results; the hundreds of types of bread, made from wheat, spelt, rye, potatoes or chestnuts, all with different ingredients, shapes and cooking techniques; the infinite varieties of couscous, made from different grains, of different sizes, flavored with herbs, leaves or dried flowers; traditional oils pressed from olives, mustard, sesame, linseed, pumpkinseed, argan, hemp or nuts; alcoholic beverages like wine, cider and sake or vinegars made from wine, apple cider, rice, honey or persimmons.

Some techniques can render inedible ingredients edible or improve the nutritional characteristics of the product.

Olives, for example, cannot be eaten raw due to their high concentration of oleuropein, a substance that protects the plant from parasite attacks but makes the fruit very bitter. To make them edible, this molecule must be transformed through brining.

Nixtamalization is an ancestral Central American technique by which corn is boiled in an alkaline solution of water and lime, making niacin available for absorption by the body. This vitamin can prevent pellagra, a disease that used to be very common amongst populations that ate large quantities of unprocessed corn.

Another example is slatko, a preserve made in the Balkans using a recipe that manages to make wild figs not only edible but delicious. The long procedure involves boiling the figs nine times to eliminate the milky white sap and then immersing them in a sugar syrup.



Food products can also be closely linked to non-food crafts, like the manufacture of tools (such as woven traps for fish) or vessels like amphorae, barrels and others.

According to Slow Food, then, the cultural and gastronomic heritage of food products falls fully within the category of biodiversity to be protected. These products must, however, be artisanal and closely linked to their place of origin. Industrial products are detached from their natural context, deseasonalized and manufactured using elements extraneous to traditional knowledge like synthetic starter cultures, chemical preservatives and artificial flavorings.

Preserving intact this biodiversity does not mean turning our back on modernity or technology, but ensuring that these do not alter the link of a product with its place of origin.

Geographical Indications to Protect Food Products

Protecting its best traditional food products with clear, mandatory production rules and safeguarding that special mix of culture, geography, soil and climate that the French call *terroir* should be the objective of every country in the world. The European Union has developed a system of public protection for traditional food products that certifies their link with their place of origin and the uniqueness and identity of the production techniques needed to make them through a series of brands that can be used on labels: Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), Traditional Specialty Guaranteed (TSG). This protection mechanism is accessible to countries that are not part of the EU as well. Currently the European Geographical Indication system protects over 3,300 products and represents the best system in the world for protecting traditional products. But it could be improved, with better definition of the criteria for recognizing quality and traditionalness⁵⁶. Currently the definition of what is traditional and therefore deserving of protection is established by producers' consortia, often run by industrial producers. Artisanal producers, who usually preserve those artisanal techniques that are able to give products unique and identity-forming characteristics, are often in the minority in the consortia and struggle to have their perspective valued. At times they even prefer not to join such consortia, to avoid their products being confused with others that they believe have been devalued by production rules that do not represent the product's historical identity.

Over the millennia, rural populations have developed agricultural techniques that have allowed them to adapt to very challenging environments, growing crops on steep slopes and in drought-prone areas or harsh climates.

In Peru, for example, *andenes* are mountain terraces that allow cultivation up in the Andes. Many date back to the pre-Colombian period, include various components—cisterns for collecting water, canals, containing walls, cultivation platforms—and are important structures for optimizing water use and combatting soil erosion. In Peru alone there are over 340,000 hectares of *andenes*, 24% of which are in a state of abandonment.

⁵⁶ https://www.slowfood.com/wp-content/uploads/2020/12/ENG_DOP.pdf

The Mexican milpa, a system of intercropping that dates back to the Neolithic period, has long represented a key element for food security for Mesoamerican peoples. The emblematic products of the milpa are corn, beans and squash, which coexist in the same field and establish a synergetic relationship with peppers, tomatoes, amaranth, quelites (wild greens), fruit trees and other vegetables.

The oases found in North Africa and Arab countries are extraordinary water management systems, differing from country to country but generally composed of tunnels, wells and underground passages, as well as intricate networks of open raw-earth channels, with comb dividers. Within them are three levels of cultivation: The first is for aromatic and medicinal herbs, vegetables and grains, the second for fruit trees like fig, pomegranate, almond and citrus and the third for date palms. Highly refined hydraulics, agroecological practices and co-management by the community underpin the good functioning of the oasis.

To make steep slopes cultivable, at the end of the 19th century the inhabitants of Carema in the Northern Italian region of Piedmont created small terraces at altitudes between 350 and 650 meters above sea level. These spaces, accessible via stone stairways and bordered by kilometers of drystone walls, are perfectly flat and planted with pergola-trained vines held up by wooden beams and truncated cone-shaped stone columns. As well as providing support, these columns also accumulate heat during the day and release it at night, helping to maintain a milder microclimate within the vineyards as well as making the most of the space, with vegetables grown under the pergolas.

Alongside cultivated land, semi-natural environments are also of extreme importance. These are home to the same species as natural habitats and develop based on the same biological processes, but they depend on human intervention (like mowing, grazing livestock or pruning) to maintain their equilibrium. For example, Europe's semi-natural agricultural lands include a wide variety of grasslands, shrublands and fields that range from the Mediterranean macchia or maquis and garigue to the permanent multi-species meadows in the mountains, from the northeast Atlantic coast's heaths to the floodplains and wooded pastures around the Baltic. Another important example of semi-natural environments on the continent are permanent traditional farming systems like ancient olive groves and chestnut woods.

Pasture

The work of herders, which includes clearing forests and riverbeds and maintaining hydraulic works like drainage channels and embankments, is crucial to the prevention of wildfires and landslides, and to keeping alive meadows and pastures that would otherwise be invaded and suffocated by shrubs. Pasturing livestock, as well as having a great social and cultural value, also provides a series of important ecological services. The animals' browsing and the excrement they leave, which acts as fertilizer, ensure greater plant variety and more abundant grass production. The repeated use of grazing areas helps prevent the formation of layers of dry grass, which in the winter can facilitate sliding snow and create dangerous snowlips, and in the summer can lead to wildfires. Grazing and browsing increase the biodiversity of pastures and forest undergrowth. Small animals in particular can help tidy the underbrush, preventing the development of forest fires.

The grasses in meadows used for grazing, particularly in the mountains, change depending on the altitude, exposure, slope, soil characteristics and management techniques. The grasslands most rich in biodiversity are wild and multi-species meadows in the hills and mountains, where 20 to 60 different species grow in the spring and summer, ensuring a rich range of flowers. High-altitude pastures have even greater variety, with over 80 species found in some Alpine meadows. These characteristics of the vegetation mean that mountain cheeses have a particularly prized flavor and nutritional characteristics.

On modern industrial livestock farms, particularly in Western countries, where animals are mostly kept indoors, grass has disappeared from the animals' diet and hay is administered in very reduced quantities. This hay rarely comes from multi-species grasslands, but rather from single-species lowland fields, sown with a single type of plant, like ryegrass or alfalfa, and is poor in nutrients and aromatic compounds. Apart from the environmental, landscape and usage aspects, for this reason it is important to put in place policies that support forage production in mountains, meadows and perennial pastures.

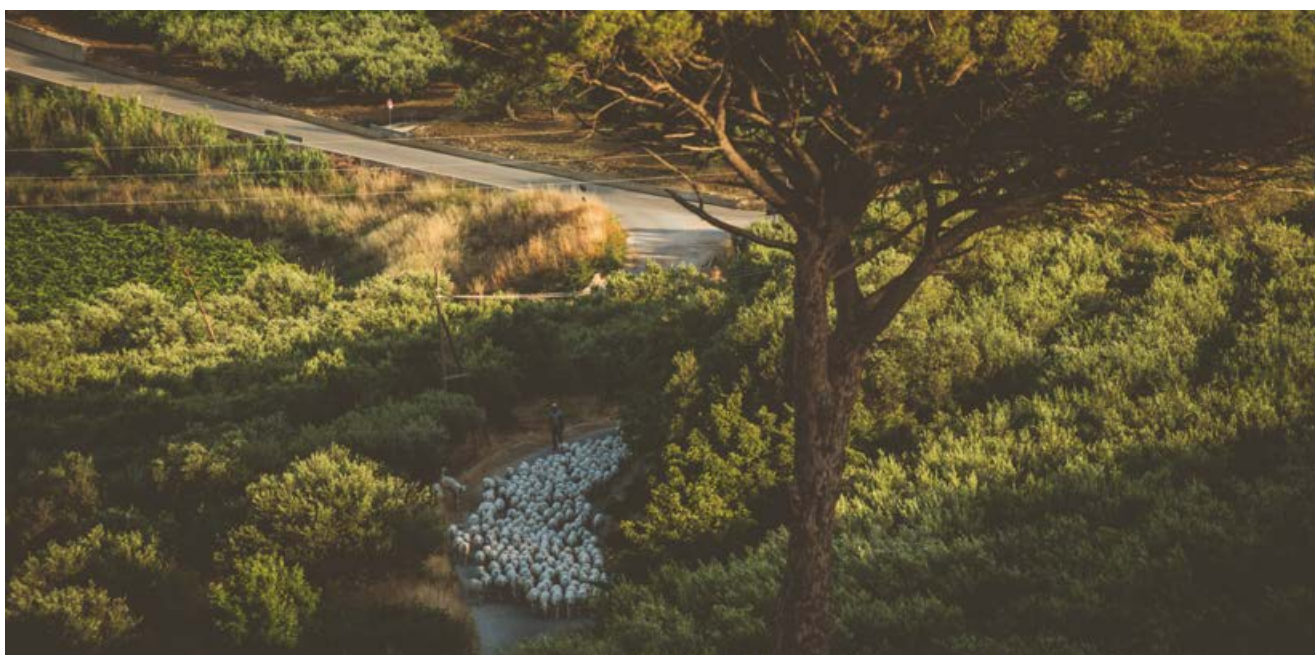
The FAO's Network of Globally Important Agricultural Heritage Systems (GIAHS)

The GIAHS (Globally Important Agricultural Heritage Systems) program was created by the FAO to preserve and promote unique rural development models, the result of ancient traditions and knowledge, whose preservation ensures the survival and sustainability of landscapes, biodiversity, hydrogeological systems and the economy of rural populations.

GIAHS are landscapes of outstanding aesthetic beauty that combine biodiversity, resilient ecosystems and agricultural techniques able to meld tradition and innovation.

Since 2005, FAO has designated 62 systems in 22 countries as agricultural heritage sites.

In 2020, FAO published a technical note⁵⁷ comparing the GIAHS and Slow Food Presidia, highlighting specificities of each approach and exploring possible synergies.



⁵⁷ <http://www.fao.org/3/cb1854en/cb1854en.pdf>

Among small-scale fishing communities, their fishing culture includes all the adaptations they have developed based on their local marine ecosystems during the different seasons of the year.

The individual kinds of technology used by small-scale fishers are the result of meticulous adaptations to specific marine ecosystems and the species targeted by different fishing practices. The term “technology” here does not designate only the tools or other material aspects, but also includes the knowledge that revolves around the acquisition, use and maintenance of such implements.

Often fishing techniques and the related equipment used for small-scale fishing are also important cultural symbols, an integral part of the fishers’ identities and their community. In small-scale fishing communities, certain products from material culture are often displayed as indicators of skill, courage and professional identity. Additionally, the cultural adaptations of small-scale fishing communities to specific ecosystems are often echoed in their religious beliefs, values, symbols and community rituals.

Small-scale fishers have an intimate, detailed and functional knowledge of their local marine ecosystems and the main fish species. Their knowledge includes the periods and situations when certain species are available, practical information about fishing methods and the most effective equipment to use in different seasons and the best way to protect a certain species to ensure it will still be available in the future.

Small-scale fishers almost always adopt an extensive approach to fishing, catching many different species. Invariably working in waters close to their homes, they must preserve the good health of the marine ecosystems that provide their livelihoods, avoiding their collapse at all costs. As a result, their ecological knowledge about the sea and fishing places, times and methods has significantly facilitated efforts to promote cooperative co-management strategies. In some zones, thanks to this knowledge, it has been possible to throw light on some ecological subtleties that were all but unknown to officials and experts. This means that traditional ecological knowledge has important potential for modern fishery management practices and policies⁵⁸.

58 <http://www.fao.org/3/y1290e05.htm>

THE ROLE OF INDIGENOUS PEOPLES



Right to land, traditional knowledge and food sovereignty

Indigenous peoples' livelihoods, identity, language, culture and well-being are rooted in the deep connection they have with their lands. Their traditional knowledge, practices⁵⁹ and innovations relating to biodiversity conservation and the sustainable use of genetic resources have long been at the heart of their food sovereignty.

Indigenous peoples now make up less than 5% of the global population, but they own, occupy or use a quarter of the world's land and safeguard 80% of its remaining biodiversity⁶⁰. They make an essential contribution to agricultural biodiversity and its associated practices, introducing, for example, crop rotation⁶¹, sustainable harvesting, fishing and hunting techniques and practices to preserve the diversity of crop varieties and livestock breeds⁶².

59 <https://www.cbd.int/traditional/what.shtml>

60 <https://www.worldbank.org/en/topic/indigenouspeoples>

61 https://www.iwgia.org/images/publications/0694_AIPPShifting_cultivation_livelihoodfood_security.pdf

62 <https://thousandcurrents.org/perus-potato-park-buen-vivir-in-practice/>

Despite their crucial role, indigenous peoples are among the poorest on the planet⁶³. Even with a growing awareness of their contributions to biodiversity conservation, the lack of recognition of their right to their lands has both direct and indirect impacts on all aspects of their lives, including their access to food.

Indigenous peoples, like everyone else, have a right to adequate food and freedom from hunger. This was stipulated in Article 11 of the International Covenant on Economic, Social and Cultural Rights of 1966⁶⁴ and constitutes binding international law. In addition, the UN Declaration on the Rights of Indigenous Peoples, adopted in September 2007⁶⁵, states that indigenous peoples have the right to own, use and develop and control their lands, territories and resources and to follow their own traditional ways of conservation and protection of the environment and the productive capacity of their lands or territories and resources, and therefore have the right to follow their own traditional ways of growing food.

For indigenous peoples, the right to food is not just individual, but has an additional collective value, because it is closely linked to collective rights to land. Often land and resources are managed by the community and subsistence activities carried out collectively are not only part of indigenous peoples' cultural identity, but are often essential for their very existence⁶⁶.

A thriving traditional food system, the essential foundation for food sovereignty, needs a healthy natural environment and a well-organized community to manage and protect it. Food sovereignty encompasses the concept of biocultural diversity: biological and cultural (including linguistic) diversity as well as local knowledge, institutions and practices. These are factors of vital importance in allowing societies to sustainably manage their farming systems, natural resources, landscapes and social life.

Conservation initiatives run by indigenous peoples combine traditional knowledge, practices and innovations that encompass spiritual and cultural aspects⁶⁷ and work towards building a healthy ecosystem based on landscapes that are far more diverse than those typically used for agriculture, able to support other ecosystem functions and services. Indigenous peoples' profound understanding of their environment also guides their conservation practices and use of resources and allows them to live in harmony with nature.

A landmark 2019 report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)⁶⁸ presented a bleak picture of the current on-going ecological decline⁶⁹, showing constant growth of agricultural production, fishing harvests, bioenergy production, etc. and an alarming reduction in ecosystem services. The report also found that in areas inhabited or managed by indigenous peoples, the ecological decline was far less severe—and in many cases had been avoided altogether⁷⁰.

63 https://www.ilo.org/asia/media-centre/news/WCMS_BK_PR_26_EN/lang--en/index.htm

64 <https://www.ohchr.org/en/professionalinterest/pages/cescr.asp>

65 https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf

66 https://www.un.org/esa/socdev/unpfii/documents/Right_to_food.pdf

67 Pimbert, M.P, 2018c. "Food Sovereignty". In: Encyclopaedia of Food Security and Sustainability. Elsevier

68 <https://ipbes.net/global-assessment>

69 https://ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf

70 <https://ipbes.net/global-assessment>

The fundamental factors in ensuring food sovereignty for indigenous peoples are the recognition of land tenure rights, traditional knowledge associated with their food practices, control over natural resources and strengthening their governance. These would contribute not only to the survival of vital knowledge systems for indigenous peoples but also to the health and biodiversity of the ecosystems on which we all depend.

Sateré-Mawé Waraná, Brazil's First Indigenous Appellation

The native waraná produced by the Sateré-Mawé⁷¹, an indigenous people from the Amazon forest, has been a Slow Food Presidium since 2002. In 2020, it was awarded a Brazilian appellation of origin, the first time that this important recognition, which certifies products with a proven link between their specific qualities and their place of origin, has been assigned to a Brazilian indigenous people and an Amazonian product.



⁷¹ <https://www.fondazione Slow Food.com/en/slow-food-presidia/satere-mawe-native-warana/>

BIODIVERSITY AND DIET

Human health and planetary health

Two of the major challenges of our time are malnutrition in all its forms (undernutrition, micronutrient deficiencies, overweight and obesity) and the degradation of environmental and natural resources. Both are worsening at an accelerated pace.

Among the leading causes of both these challenges is the current food system, which is seriously threatening the health of humans and the planet. The same production systems that are destroying biodiversity (intensive crop cultivation and livestock farming, monocultures, a heavy use of pesticides and additives) are also behind ways of living based on an excessive consumption of foods of animal origin and ultra-processed foods packed with sugar, fat, salt and preservatives. These ill-advised lifestyles are contributing to the spread of overweight, obesity and chronic degenerative diseases. At the same time, 820 million people do not have enough food to meet their daily nutritional needs.

Current food trends, plus estimated population growth (we are looking at 10 billion people on the planet by 2050) are aggravating the risks of human and planetary health and making current food systems unsustainable. Experts predict a rise in the incidence of non-communicable diseases (NCDs) like heart disease, stroke, diabetes and some kinds of cancer and an increase of the impact of food production on greenhouse gas emissions, nitrogen and phosphorous pollution, biodiversity losses and the over-exploitation of common goods like water and soil.

The challenge in the coming years will be ensuring that all people can have a healthy diet that can meet their individual nutritional needs and guarantee an appropriate state of health, but that also has a low environmental impact so that the health of the planet is not further destroyed.

The 2019 report by the Intergovernmental Panel on Climate Change (IPCC) states that “consumption of healthy and sustainable diets presents major opportunities for reducing greenhouse gas emissions from food systems and improving health outcomes”⁷².

According to the FAO’s 2019 definition, “Sustainable Healthy Diets are dietary patterns that promote all dimensions of individuals’ health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable. The aims of Sustainable Healthy Diets are to achieve optimal growth and development of all individuals and support functioning and physical, mental, and social wellbeing at all life stages for present and future generations; contribute to preventing all forms of malnutrition (i.e. undernutrition, micronutrient deficiency, overweight and obesity); reduce the risk of diet-related NCDs; and support the preservation of biodiversity and planetary health.”

Ensuring everyone can have a healthy diet produced by sustainable food systems will require substantial changes to dietary patterns, important reductions in food waste and significant improvements to food production practices.

⁷² <https://www.ipcc.ch/report/srccl/>



A healthy and sustainable diet is based on abundant consumption of plant-based foods and the reduction of animal-origin products and energy from free sugars and fats; unsaturated fats are prioritized over saturated and trans fats and salt is limited. Unprocessed or minimally processed foods feature heavily, with few industrially processed products; instead, whole foods are purchased and prepared at home.

Sustainable food production has as little impact on the environment as possible, making the most of land already in use rather than exploiting new areas; managing water use responsibly, reducing consumption and waste; reducing nitrogen and phosphorous pollution; and not emitting carbon dioxide and not furthering increase methane and nitrous oxide emissions. It preserves plant and animal biodiversity, whether crop varieties, animal breeds, food sources from forests or aquatic species, and does not encourage excessive fishing and hunting.

During production phases, antibiotics are administered carefully and sparingly, and a minimum of plastic should be used in the packaging.

Foods and production and processing methods that can have negative effects on human health are also those with the greatest environmental impact: animal-origin fats, highly processed foods and beverages rich in fats, salt and added sugar and fruits and vegetables grown conventionally using synthetic chemicals. Conversely, foods that encourage good health have a lower impact. Fruits, vegetables, grains and legumes, especially when cultivated organically, require less exploitation of raw materials compared to animal-origin foods. At the same time, thanks to their minerals, vitamins, fiber, antioxidants and low energy density, their consumption helps to prevent cardiovascular diseases, diabetes, cancer and all forms of malnutrition.

As numerous studies and analyses have shown, one of the foods with the greatest environmental impact is meat, particularly from animals farmed hyperintensively and particularly when consumed in excessive quantities. The average consumption by one person living in a Western country is around 80 kilos of meat a year. That's already too much for the planet now, but over the next decades, with the current world population growth rates, it will become literally unsustainable.

Intensive livestock farming has an enormous environmental impact. According to the FAO, it is responsible for 14.5% of greenhouse gas emissions⁷³, greater than all cars, trains and airplanes put together.

Excessive consumption of meat and cured meats, particularly as part of an already-unbalanced diet, brings serious health risks.

What's more, over half of the grains grown globally are used for animal feed, with a disadvantageous balance between plant food consumed to produce animal food. The farming of large numbers of animals in confined environments often demands an excessive use of drugs, first and foremost antibiotics, amplifying the problem of antibiotic resistance. According to some estimates, by 2050 this will cause more deaths than cancer.

The loss of biodiversity and the destruction of natural habitats due to forests being cut down to make space for corn and soy monocultures for the production of animal feed, plus the precarious health conditions of animals packed into factory farms, are among the main causes triggering the explosion and spread of viral diseases, epidemics and pandemics.

From a nutritional point of view there are differences between meats from different types of farm. A range of research suggests that pasturing animals can significantly improve their meat's fatty acid composition and antioxidant content. A grass-based diet leads to a higher level of omega-3 fatty acids and vitamin A and E precursors, as well as anti-cancer antioxidants like glutathione and the superoxide dismutase enzyme⁷⁴.

Various studies have also shown that animals raised outdoors where they can graze freely have meat with less fat and more protein.

Grass-fed animals produce milk with a higher content of omega-3 fatty acids and conjugated linoleic acid (CLA), which have anti-inflammatory, antithrombotic and immunomodulatory properties, and with lower quantities of palmitic acid, a saturated fatty acid, and omega-6 fatty acids with aggregating and pro-inflammatory activities⁷⁵.

Forms of sustainable livestock farming are associated with healthier land: The crops used for feed are cultivated without the use of pesticides and fertilized naturally. The pesticides used to grow crops not only pollute the air, water and soil, but also concentrate in the meat of the animals that feed on them, ending up on the consumer's plate. The effects of contact with pesticides vary depending on the type of product used and the level and method of exposure, but range from skin and eye irritation to endocrine disruptions up to alterations of the nervous system and an increased risk of cancer.

73 <http://www.fao.org/3/i3437e/i3437e.pdf>

74 <https://pubmed.ncbi.nlm.nih.gov/20219103/>

75 <https://pubmed.ncbi.nlm.nih.gov/31426489/>

The Environmental Impact of Slow Food Presidia

Since 2013 Slow Food has carried out a series of studies on Slow Food Presidia products with the scientific support of Indaco2 (a University of Siena spin-off company that provides environmental consultation and communication services) to measure their carbon footprint and environmental impact.

They compare small-scale sustainable food production with products from industrialized systems, measuring the emissions from the production processes through life-cycle analysis (LCA) and impact (carbon footprint) expressed in amount of carbon dioxide (CO₂ equivalent). The differences shown by the analyses are significant, and at times remarkable: All the Slow Food Presidia products studied show emissions savings greater than 30%⁷⁶.

The research has highlighted the differences between a virtuous, climate-friendly, healthy diet, and a diet that is unsustainable for the planet and for our health. An unhealthy everyday diet, based on animal protein from factory-farmed meat, sugary drinks and highly processed fatty foods (ice cream, frozen pizza, packaged snacks and sweets) and refined foods (white bread and pasta made from refined flours) was compared with a healthy diet, based mostly on whole, fresh, plant-based foods, cultivated following sustainable or organic practices and in some cases coming from Slow Food Presidia.

The results showed that the production processes for foods on which an unsustainable diet is based generate almost triple the greenhouse gases produced by a healthy, climate-friendly diet⁷⁷.



⁷⁶ https://www.slowfood.com/wp-content/uploads/2018/10/ING_Indaco_schede-1.pdf

⁷⁷ <https://www.slowfood.com/a-meatless-healthy-diet-is-a-climate-friendly-diet/>

Food biodiversity, defined as the diversity of plants, animals and other organisms used as food, contributes in various ways to a healthy and diversified diet.

Researchers and experts agree that the most appropriate and sustainable long-term solution to improving public health and tackling malnutrition is the use of foods rather than supplements. We need to move beyond the idea that a food is the simple sum of the nutrients it contains. An approach based on diet rather than individual nutrients is highly recommended to combat all forms of malnutrition, from undernutrition to micronutrient deficiencies to overweight and obesity, as well as all the non-communicable diseases linked to diet⁷⁸.

A valid nutritional support can come from plant and animal biodiversity, through the consumption of a wide range of foods rich in nutrients. In this respect, biodiversity has been recognized as a fundamental principle in some recent versions of national and regional dietary guidelines, including in Brazil⁷⁹, the New Nordic diet⁸⁰ and the Mediterranean diet pyramid⁸¹.

Studies on the composition of foods show that there can be important differences in the content of nutrients (macro- and micronutrients) between different species and between cultivars of the same species, and that wild species generally have a higher content of nutrients than domesticated varieties.

Some analyses have shown that the consumption of 200 grams of rice a day can provide anywhere from less than 25% to more than 65% of the recommended daily protein intake, depending on the variety⁸². Differences in the composition of nutrients can also be surprising. For example, the content of beta-carotene (a vitamin A precursor) can range from 100 to 23,100 micrograms in a hundred grams of raw sweet potato depending on the variety, and from 1 up to 8,500 micrograms in a hundred grams of different banana cultivars. These differences can have important impacts in terms of nutrition, allowing vulnerable populations to meet their nutrient needs. For example, while the world's most popular banana variety, the Cavendish, contains insignificant amounts of beta-carotene, the To'o cultivar has 7,000 micrograms of beta-carotene equivalents, an amount which would meet the daily vitamin A needs of women and children in East Africa⁸³. Another banana variety, the Asupina, from the Pacific region, has such high carotenoid levels that a preschool-age child could get 50% of their daily vitamin A by eating just one banana (around 77 grams); they would have to eat a kilo of Williams bananas (which belong to the Cavendish group) to get an equivalent amount of vitamin A⁸⁴.

Native species are characterized by good adaptation to their local environmental conditions and often have less need of external inputs—like water, fertilizers or pesticides—because they are hardier and therefore more resistant. Environmental stresses like high temperatures, water deficits, cold damage and salinity in the soil can cause the production of free radicals (or ROS, reactive oxygen species) able to damage the plant's DNA.

78 <https://www.bioversityinternational.org/mainstreaming-agrobiodiversity/>

79 <https://pubmed.ncbi.nlm.nih.gov/26205679/> e http://bvsms.saude.gov.br/bvs/publicacoes/dietary_guidelines_brazilian_population.pdf

80 <https://pubmed.ncbi.nlm.nih.gov/22251407/>

81 <https://pubmed.ncbi.nlm.nih.gov/22166184/> e https://dietamediterranea.com/piramidedm/piramide_INGLES.pdf

82 https://www.researchgate.net/publication/248510169_Analysis_of_food_composition_data_on_rice_from_a_plant_genetic_resources_perspective

83 <https://www.bioversityinternational.org/e-library/publications/detail/provitamin-a-carotenoid-content-of-unripe-and-ripe-banana-cultivars-for-potential-adoption-in-easter/>

84 https://www.researchgate.net/publication/6592730_Carotenoid_Content_and_Flesh_Color_of_Selected_Banana_Cultivars_Growing_in_Australia

To defend themselves, plants activate resistance mechanisms that involve the production of molecules with antioxidant capacity (ascorbate, glutathione, alpha-tocopherol, beta-carotene, carotenoids and flavonoids). These are secondary metabolites, molecules with a toxic action on herbivorous animals and pathogenic microbes. Secondary metabolites are not essential to the growth, development or reproduction of an organism, but have a fundamental importance to the ecological interactions between the plant and its surrounding environment.

Consuming native plant species, which develop protection against environmental conditions or external agents, can increase the content of protective substances in our diet like terpenes, which include molecules of great importance like carotenoids and vitamin E, as well as phenolic compounds (including flavonoids), alkaloids and compounds containing nitrogen and sulfur, which all have notable antioxidant activities. The consumption of these compounds helps to reduce the risk of degenerative diseases and prevents the DNA damage caused by the action of free radicals.

The nutritional decline of crops is a widespread, global phenomenon that threatens the world's food security. Since the Second World War, with the spread of centralized, industrialized cultivation methods and the rise of monocultures that require the intensive use of chemical fertilizers and pesticides, we have seen a fall in the nutritional content of agricultural products⁸⁵.

The nutritional value of food biodiversity, with many different local varieties and breeds, could compensate for this loss. As research in the nutritional field continues, the important role of food biodiversity in improving community nutrition is increasingly being recognized. However, so far analyses have only looked at a marginal part of the biodiversity of local varieties, which is why it is necessary to continue with further research in order to understand the nutrient content of each variety. This would allow the selection of species, varieties and breeds that are richer in nutrients and their promotion in farms, markets and public-health campaigns, with the aim of maximizing the nutritional adequacy of diets.



85 <https://medcraveonline.com/MOJFPT/soil-regeneration-increases-crop-nutrients-antioxidants-and-adaptive-responses.html>

BIODIVERSITY AND PANDEMICS

Natural habitats, spillover and zoonoses

Many of the so-called emerging diseases that have affected wide swathes of the planet, like Ebola, AIDS, SARS, swine flu, bird flu and most recently SARS-CoV-2 (aka Covid-19) are not random catastrophic events, but the consequence of human activities in nature. Empirical studies show that high levels of biodiversity are associated with high levels of diversity of pathogenic agents⁸⁶. However, the rise of epidemics is associated with a decline in biodiversity, as deforestation, mining, the introduction of invasive species, urban development and agricultural intensification increase contact between wild fauna, domesticated animals and humans, encouraging the spread of zoonotic diseases⁸⁷.

The infectious diseases mentioned above share a zoonotic origin, meaning they are transmitted by animals⁸⁸, particularly in the wild. Over 60% of human infectious diseases originate in animals and soil exploitation, food production and the agricultural sector are responsible for almost half of all emerging infectious diseases (EIDs). Their incidence has increased over the past 20 years and could continue to grow in the near future.

Certain viruses are endemic in wild animal populations but usually have little impact as species that have a high genetic diversity can support a high diversity of pathogenic agents. These viruses can, however, threaten the health of humans when spillover takes place, in other words a species jump, with a transfer to humans directly from the wild species or through intermediate hosts, like domesticated and farmed animals.

For centuries the existence of natural barriers has hindered the spread of viruses, creating a defense against contagion. Large forests, populated by rich biodiversity, prevented the transmission of viruses through the so-called “dilution effect”: The viruses were blocked as they found many obstacles to propagation in non-receptive species⁸⁹.

The growing global demand for food and natural resources and consequent human activities are creating significant environmental modifications, like the loss of huge swathes of natural habitats to make space for intensive livestock farms and other agricultural activities. Large-scale deforestation is destroying the forests and natural habitats that once hosted a rich biodiversity of animal and plant species, and, inside them, many unknown viruses. The destruction of these ecosystems liberates the viruses from their natural hosts and they may find a new host in humans, facilitated by the increased opportunities for contact between humans and wild animals, due to the construction of roads and settlements, greater mobility of people in remote regions and poor socio-economic conditions and food shortages leading to the hunting of wild animals.

86 <http://www.fao.org/documents/card/en/c/ca3129en/>

87 <https://www.who.int/globalchange/publications/biodiversity-human-health/en/>

88 <https://www.nature.com/articles/nature06536>

89 <http://www.fao.org/documents/card/en/c/ca3129en/>

The FAO reports that over 250 million hectares of land have been lost to deforestation over 40 years. Tropical regions where the primary forest has been devastated by deforestation, plantations, mineral mining and the extraction of gas and oil have been particularly affected. Countless species of wild animals are being killed because of deforestation or end up trying to make a home in urban zones, while others are caged and taken to “wet markets,” where fresh meat and fish and other perishable products are sold, either legally or illegally. These markets, which tend to have precarious hygiene and sanitation, offer the perfect conditions to become new epidemic hotbeds.

While the destruction of habitats and biodiversity is creating favorable conditions for the spread of emerging zoonotic diseases, the creation of artificial habitats, or simply nature-poor environments with a high human population density, can facilitate their transmission even further⁹⁰.

The risk and impact of infectious diseases are not limited to urban areas, but high-population-density environments offer greater potential for the diffusion of pathogens. Around the world, over 800 million people live in informal settlements, where overcrowding and poor hygiene conditions further facilitate the spread of viruses⁹¹.

Numerous studies show that the multiplication of intensive livestock farms exponentially increases the risk of the spread of zoonoses. This is particularly likely when farms are located at the edge of forests, wetlands or other high-biodiversity natural areas, where the opportunity for contact with wild animals is greater. The intensification of livestock production, which generally involves a high density of animals, an abnormal use of antibiotics for prophylaxis or to encourage animal growth and a lack of genetic diversity among individual animals, produces the ideal conditions for the spread and evolution of pathogens, particularly between genetically similar breeds or in immune-suppressed animals. Livestock often plays the role of intermediate host in the transmission of zoonoses from wild animals to humans and in some cases acts as an amplifying host, in other words an organism in which a virus or other pathogen can replicate rapidly and from which it can easily spread. One example is the Nipah virus, which appeared in humans in Malaysia in 1998 and whose natural reservoir was the fruit bat. The virus spread following the conversion of a piece of forest into an intensive pig farm which allowed bat-pig contact and the subsequent transmission from pigs to humans.

If we do not curb anthropic activities, slowing the ravaging of natural habitats, deforestation and the uncontrolled development of factory farms, the destruction of biodiversity will create the preconditions for new viral emergencies at a planetary level. Safeguarding biodiversity means protecting humanity from new pandemics⁹².

90 <https://www.wwf.it/news/pubblicazioni/?52801/Pandemie-leffetto-boomerang-della-distruzione-degli-ecosistemi>

91 <https://ij-healthgeographics.biomedcentral.com/articles/10.1186/1476-072X-12-45>

92 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7049118/>

CLIMATE CRISIS AND BIODIVERSITY



Agriculture as cause, victim and solution

With the signing of the Paris Agreement, which came into force on November 4, 2016, 195 countries committed to limiting the rise of the average global temperature to less than 2°C. If this effort is not successful, by 2100 the world's temperature could rise by over 5°C, and extreme atmospheric events could threaten global food production, with unimaginable social, economic and political consequences.

Global emissions continue to increase and the average global temperature has already risen by around 1°C compared to the pre-industrial era.⁹³ Emissions reached their peak between 2000 and 2010, and since 2015 we have experienced the five hottest years since records began.

Agriculture and climate are closely linked, as are biodiversity and climate. Already in 2005, a projection estimated that climate change represented one of the main causes of biodiversity loss.⁹⁴ In 2009, researchers at the Stockholm Resilience Centre and the Australian National University came up with a monitoring system based on nine limits relating to planetary processes within which human life on Earth could continue to flourish without damaging the environment. After passing a control value, the Earth system would begin to destabilize, bringing dangerous and unpredictable consequences. Three of these limits, including biodiversity loss, had already been breached in 2009.⁹⁵

93 <https://www.ipcc.ch/sr15/chapter/spm/>

94 <https://www.millenniumassessment.org/en/Global.html>

95 <https://www.stockholmresilience.org/research/planetary-boundaries.html>

The climate crisis is bringing both more frequent extreme weather events (droughts, wildfires, cold snaps, floods, hailstorms) and medium- and long-term effects, like the reduction of available surface and underground water and soil degradation. The consequences on crops and agricultural yields, livestock herding and food systems are extremely serious. Climate change can also have a negative impact on the nutritional properties of some crops.

In many parts of the world we are seeing adaptation to new crops, primarily linked to the movement from south to north of species like grapes and corn. But many species and varieties that are now grown in specific areas will not be able to adapt themselves quickly enough to the changes taking place. Essential ecosystem services, like pollination, are also at risk (see section 22).

The rising air and sea temperatures almost everywhere on the planet are also leading to the spread of parasites and plant and animal diseases to areas where they were previously unknown, as well as invasive species that further threaten the survival of local biodiversity.

According to the FAO, the global agricultural sector produces around 21% of the world's greenhouse gas emissions,⁹⁶ due to an excessive use of fossil fuels and synthetic chemicals, emissions from the livestock sector and deforestation.

The soil plays an important role in climate change mitigation, thanks to its capacity to store carbon, but if it loses its organic matter, an inverse process takes place. Soil that has deteriorated and been impoverished from intensive agricultural practices releases carbon dioxide (CO₂) into the atmosphere rather than absorbing it.

Intensive livestock farming and monocultural agricultural systems, which tend to be linked (corn and soy are primarily used for feed production) are the main causes of the incredibly high environmental impact of the agricultural sector and are responsible for 14.5% of all climate-altering emissions. At the same time, monocultures are extremely vulnerable to the effects of climate change.⁹⁷

If we add to the emissions caused by agriculture those created during post-production phases—packaging, storage, distribution, waste, disposal and the processing of raw materials—we can start to see the extent of the true impact of the global food system. According to one EU report, the food sector in its entirety accounts for around 31% of the EU's greenhouse gas emissions.

Thanks to phytoplankton, the oceans have absorbed around 30% of carbon dioxide produced to date by human activities, buffering some of the greenhouse effect, but this also causes the waters to acidify and damages marine biodiversity, starting with ecosystems of vital importance, like coral reefs (see section 10).

The food sector is both cause and victim of the climate crisis, but also part of the solution.

⁹⁶ <http://www.fao.org/3/a-i4910e.pdf>

⁹⁷ <https://www.tandfonline.com/doi/full/10.1080/14735903.2013.806408>

Maintaining a wide base of genetic variability is essential to confronting the risks linked to climate change, diseases and future shortages of natural resources. Hardy local plant varieties and livestock breeds, more resistant and tolerant, improve the chances for producers to cope with the looming environmental crisis.

Following a healthy and sustainable diet can, according to the 2019 Intergovernmental Panel on Climate Change (IPCC), improve the state of health of the population while at the same time reducing the greenhouse gases produced by food systems.

A study carried out by Slow Food (see section 49) has shown that the production process of foods on which an unsustainable diet is based generate almost triple the greenhouse gases compared to those produced by a healthy, climate-friendly diet.

Agroecological practices, based on biodiversity and the safeguarding and regeneration of natural resources (soil and water) are therefore the best path to follow both to contain the climate crisis and to activate processes of climate adaptation for agricultural systems.



POLICIES OF INTERNATIONAL INSTITUTIONS

European Union

Green Deal, Farm to Fork, Biodiversity Strategy for 2030 and the CAP

According to the last “State of Nature” report from the European Environment Agency⁹⁸, biodiversity in Europe continues to fall at an alarming rate. Many species, habitats, and ecosystems in Europe are threatened by urban expansion, unsustainable agriculture, and forestry practices and pollution. The number and total surface area of sites protected as part of the Natura 2000 network in the last six years has increased, but overall the objectives of the EU 2020 Biodiversity Strategy have not been met.

Some figures:

- Only 15% of the habitats evaluated were in a good state of conservation.
- Just half of the bird species in the EU are in a good state of conservation, 5% less than the last reference period (2008-2012).
- The state of conservation of pollinators’ habitats is worse compared to other habitats.
- There is a concerning lack of data about marine regions, which continue to have an “unknown” state of conservation.

The agency clearly identified intensive agriculture as the main source of pressure on habitats and species in the EU, followed by urban expansion and unsustainable forestry activities. Air, water, and soil pollution also have an impact on habitats, as does the on-going exploitation of animals through illegal capture and unsustainable forms of hunting and fishing.

The European Green Deal, announced in 2019, is the new umbrella strategy for the European Commission. It aims to transform the EU into a fair and prosperous society, defending, preserving, and adding value to natural capital and protecting the health and well-being of citizens from risks and environmental impacts, with the objective of reaching climate neutrality by 2050.

Among the first documents produced by the European Commission with a view to a tangible ecological transition are the Farm to Fork Strategy⁹⁹ and the Biodiversity Strategy for 2030¹⁰⁰, which represent the vision for safeguarding biodiversity for the next decade.

The Farm to Fork Strategy wants to accelerate the transition to a sustainable food system and highlights in a significant way the role of agroecology as a model for managing the agricultural production system. The strategy sets out ambitious targets for an increased percentage of organic agriculture, a substantial reduction in the use of pesticides and herbicides, better animal welfare, and a more important role for small-scale farming.

98 <https://www.eea.europa.eu/publications/state-of-nature-in-the-eu-2020>

99 https://ec.europa.eu/food/farm2fork_en

100 https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/eu-biodiversity-strategy-2030_en

The Biodiversity Strategy for 2030 has two main objectives: increasing the network of protected areas both on land and at sea, and developing a new plan to protect nature in the EU. The EU has set the objective of protecting at least 30% of land and 30% of the sea, which means a further 4% for land and 19% for marine areas compared to today. The strategy also includes various measures and objectives to which food systems must contribute.

These two strategies should interact in order to contribute together to the attainment of the zero emissions objective by 2050, and protect and restore biodiversity in the EU.

Through these strategies, the European Commission aims to protect biodiversity by:

- recognizing the key role that farmers play in conserving biodiversity and the need to incentivize farmers to switch to fully sustainable practices. To accelerate this transition, the EU undertakes to reduce by 50% the use of and risk from chemical pesticides by 2030 and to reduce the use of the most dangerous pesticides by 50% by 2030.
- setting the objective of bringing back at least 10% of agricultural area under high-diversity landscape features.
- proposing to revise the existing legislation relating to water, soil and air.
- proposing to have 25% of EU agricultural land under organic by 2030 (compared to 7% in 2020).
- aiming to obtain a reduction of the loss of nutrients of at least 50% and to reduce the use of fertilizers by 20% by 2030, reducing nitrogen and phosphorous pollution.
- underlining that there will be zero tolerance for illegal fishing practices. The strategy will be based on the full implementation of the EU's Common Fisheries Policy, the Marine Strategy Framework Directive and the Birds and Habitats Directives. Additionally the aim is to maintain fishing at maximum sustainable yield levels and to eliminate by-catch of species at risk of extinction.
- emphasizing that the EU's commercial policy will actively support the ecological transition, ensuring the application of biodiversity provisions in trade agreements and promoting



sustainable farming and fishing practices and actions to protect and restore the world's forests through international cooperation.

Slow Food welcomes the European Union's new Biodiversity Strategy to 2030, and especially the EU's commitment to implementing policies based on measures that should slow, and ultimately stop, the loss of biodiversity in Europe, as well as accelerating the transition to sustainable food systems through a more integrated policy.

In particular, Slow Food approves of:

- the fact that the new strategy contains important references to agriculture and fishing.
- the commitment to targets for restoring degraded ecosystems and reducing unsustainable farming methods like the use of pesticides and fertilizers.
- the European Commission's recognition that agroecology "can provide healthy food while maintaining productivity, increase soil fertility and biodiversity, and reduce the footprint of food production." The EU is starting to listen to the demands of civil society for greater support for agroecology. Nonetheless, the concrete measures proposed to promote agroecology beyond organic farming are few.
- the new recognition by the European Commission that the decline in agrobiodiversity must be reversed, including by encouraging the farming of local varieties and native breeds.

All the same, as evaluated by the European Environmental Agency, industrial agriculture is the main driving force behind the loss of biodiversity in the EU, which means that the EU's Common Agricultural Policy (CAP) has a very important influence on the attainment, or not, of the biodiversity-related objectives.

A recent study¹⁰¹ of the CAP's impact on habitats, landscapes and biodiversity showed that when well designed, targeted, and implemented on a sufficient scale, some of the CAP measures have benefitted biodiversity, notably agri-environmental measures, the Natura 2000 network and some of the "greening" aspects.

But beyond these few examples, the overall impact of the CAP on biodiversity has been alarming. The CAP has led to an intensification of farming practices over the decades, a drastic increase in the use of pesticides, a reduction of grazing land, and important support for industrial livestock farms, which seriously impact the environment. Additionally, its "greening" measures have proven generally ineffective in maintaining or restoring biodiversity and too often are poorly controlled. A recent report from the European Court of Auditors confirmed this, attesting to the failure of the EU's policy aimed at safeguarding biodiversity¹⁰².

Unfortunately, the new post-2020 CAP reform does not offer any hope for reversing the loss of biodiversity. Despite the ambition of Farm to Fork and the Biodiversity Strategies proposed by the European Commission, the CAP is not coherent with these two tools and it will be up to each EU member state to contribute to the biodiversity strategy by including more ambitious measures in their own national strategic plans for agriculture.

101 https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/ext-eval-biodiversity-final-report_2020_en.pdf

102 https://www.eca.europa.eu/Lists/ECADocuments/SR20_13/SR_Biodiversity_on_farmland_EN.pdf

United Nations

The 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development, adopted by all United Nations member states on September 25, 2015 and approved by the UN General Assembly, is made up of 17 Sustainable Development Goals (SDGs)¹⁰³, a series of environmental, economic, social and institutional objectives to be reached by 2030. The 17 SDGs take into consideration the three dimensions of sustainable development—economic, social and ecological—and aim to bring an end to poverty, fight inequality, tackle climate change and construct peaceful societies that respect human rights.

Two of the goals from this important international agenda make specific reference to safeguarding biodiversity:

Goal 14 - Life Below Water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Goal 15 - Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt land degradation and stop biodiversity loss.

Convention on Biological Diversity

Opened for signature at the Earth Summit in Rio de Janeiro in 1992, and entering into force in December 1993, the Convention on Biological Diversity is an international treaty for the conservation of biodiversity, the sustainable use of biodiversity components and the fair sharing of the benefits deriving from the use of genetic resources.

With 196 parties, the convention has almost universal participation from the world's countries. The convention seeks to deal with all the threats to biodiversity and ecosystem services, including those deriving from climate change, through scientific evaluations, the development of tools, incentives and processes, technology transfer and good practices and a full and active involvement of interested subjects, including indigenous and local communities, youth, NGOs, women and the business sector.

The Cartagena Protocol on biosafety and the Nagoya Protocol on access and sharing of benefits are supplementary agreements to the convention. The Cartagena Protocol, which came into force on September 11, 2003, aims to protect biological diversity from the potential risks posed by modified living organisms deriving from modern biotechnology. To date, 173 parties have ratified the protocol. The Nagoya Protocol has the purpose of enabling the sharing of the benefits deriving from the use of genetic resources in a fair and equal way, including through adequate access to genetic resources and appropriate transfer of related technologies. It came into force on October 12, 2014 and has been ratified by 127 states.

The objective of the next Conference of the Parties (COP 15), which will be held in China in 2021, is to adopt a global plan for biodiversity post-2020. This plan should make it possible to implement wide-ranging measures for the transformation of the relationship of society with biodiversity and ensure that by 2050 a shared vision of living in harmony with nature has been realized.

The plan aims to stimulate urgent action by governments and society as a whole, including indigenous peoples, local communities, civil society and businesses.

Slow Food is actively participating in the preparatory works leading up to the UN Conference of the

¹⁰³ <https://www.un.org/sustainabledevelopment/>

Parties, providing contributions to the first draft of the post-2020 biodiversity plan in a constructive discussion with the convention's secretariat.



SLOW FOOD'S PROJECTS **FOR SAVING BIODIVERSITY**

Ark of Taste

Since starting the Ark of Taste project in 1996, Slow Food has been publicizing the risk of extinction of thousands of animal breeds and varieties of fruits, vegetables and legumes, as well as cheeses, breads, traditional sweets and all the artisanal knowledge required for their production. Already two decades ago, Slow Food was aware of the environmental, cultural and economic value of this extraordinary heritage and the need to preserve it and transform it into an opportunity for local communities. Thanks to the collaboration of 12,000 nominators, who have interviewed farmers, cooks, artisans, cheesemakers, bakers and many more and compiled nomination forms, over 5,400 products from 150 countries have been welcomed into the Ark. The nominations are evaluated by technical commissions, involving a total of 130 agronomists, veterinarians, gastronomic historians, journalists and university lecturers, including teachers and researchers from the University of Gastronomic Sciences in Pollenzo. Behind this cataloguing lies the work of over 100,000 small-scale food producers, custodians of biodiversity. The Ark of Taste has brought the attention of the media, public authorities, experts and many chefs and consumers to a previously unknown heritage in need of saving. The Ark of Taste has served as



the foundation on which Slow Food has built its subsequent biodiversity-protection projects.

Slow Food Presidia

Based on the nominations received by the Ark of Taste, Slow Food has launched the Presidia project, whose objective is provide concrete assistance to producers who preserve biodiversity, add value to their local areas, revive traditional crafts and techniques and save from extinction not just native breeds and fruit and vegetable varieties but also rural landscapes and ecosystems, promoting sustainable farming and fishing systems.

To support the producers from its 600 Presidia, Slow Food organizes training activities, promotes products at events and fairs, networks them with other actors (cooks, experts, universities, journalists), encourages direct sales (through buying groups or Earth Markets) and tells the stories of products, producers and places through all of Slow Food's communication channels and thanks to narrative labels. Attached to Presidia products, these provide in-depth information about the production process, ingredients, place of origin and farms or producers.

Various studies of the results obtained by the Presidia, carried out in collaboration with the universities of Turin and Palermo and based on over 50 quantitative and qualitative indicators, have shown how Slow Food's activities have had extremely positive economic, environmental, social and cultural impacts.



Slow Food Cooks' Alliance

The Slow Food Cooks' Alliance brings together a thousand cooks from all kinds of restaurants, from Michelin-starred fine-dining establishments to pizzerias, not to mention food trucks and street-food stalls, who are working to support small-scale producers, the guardians of biodiversity, by using Presidia and Ark of Taste products in their kitchens every day as well as locally produced fruits, vegetables, cheeses and more. Alliance cooks commit to listing the names of their supplying producers in their menus, in order to give recognition and visibility to their work. Over time the Cooks' Alliance has evolved into an extensive network of chefs



who travel, meet, participate in events, cook together and organize initiatives to support biodiversity and local producers.

Earth Markets

These collectively managed farmers' markets are places for gathering, socializing and taste education. The Earth Markets offer a wide variety of fresh produce, preserves, meat, dairy products, eggs, honey, sweets, bread, oil, wine and many other foods. The producers are



local and only sell their products. They are selected based on quality criteria that reflect the Slow Food principles of good, clean and fair. The Earth Markets regularly host educational activities, tastings with producers, themed events and local promotion initiatives.

Slow Food Gardens

In the mid-1990s, Slow Food's first school garden was founded in Berkeley, California, designed by Alice Waters, chef and Slow Food vice-president. In Italy Slow Food launched a national project for the creation of food gardens in schools in 2004, called "Orto in Condotta." Little by little, the project has become a tool of vital importance for introducing food and environmental education into schools.

Together with the pupils, teachers, parents, grandparents and local producers are also involved in the project, and around each school they create learning communities that are essential for transmitting knowledge linked to food culture and environmental safeguarding to younger generations.

For its 2012 International Congress in Turin, Slow Food launched a new challenge: to create thousands of food gardens in communities, villages and schools across the African continent.



The objective was to ensure a supply fresh, healthy food for communities, but also to create and train a Slow Food network for promoting local food and an agricultural model based on agroecology and biodiversity.

Slow Food and Biodiversity: Key Steps

1996

- Following discussions with cooks and producers, Slow Food begins thinking about the loss of food biodiversity.

1997

- Slow Food publishes the Ark of Taste Manifesto, which sets out the strategies on which the association will base its actions over the next 20 years.

1998

- A conference organized at Salone del Gusto in Turin launches the Ark of Taste project.

1999

- The Presidia project takes its first steps.

2000

- The first 90 Presidia take part in Salone del Gusto in Turin.
- The first Slow Food Award for Biodiversity ceremony is held in Bologna, recognizing those working around the world to safeguard agricultural and food biodiversity and local traditions and cultures.

2001

- Slow Food launches the No GM Wines campaign against the commercialization of transgenic vines in Europe.
- The Slow Food Manifesto in Defence of Raw Milk Cheese is published.
- Slow Food Editore publishes an atlas of typical products from Italian parks, which gathers the results of research into traditional and typical products from 19 national parks and 60 regional parks in Italy.

2003

- The Slow Food Foundation for Biodiversity is founded, which coordinates and promotes the Slow Food Award, the Presidia and the Ark of Taste around the world.
- In April, in Brasilia, Slow Food signs a protocol of understanding with the Brazilian government as part of its Zero Hunger policy for food security for the poorest people, facilitating projects to support the safeguarding of small-scale agricultural production.

2004

- In February the FAO officially recognizes Slow Food as a non-profit organization with which it has a relationship of collaboration.
- The first Terra Madre is held in Turin in October, a gathering of 5,000 producers from food communities around the world.
- Slow Food establishes the University of Gastronomic Sciences in Pollenzo, in the north of Italy, a hub for the transmission of gastronomic culture and a new interdisciplinary cultural approach which values the conservation, promotion and protection of agrobiodiversity.
- Inspired by the “Edible Schoolyards” created since 1994 in California by chef and organic pioneer Alice Waters (vice-president of Slow Food since 2002), Slow Food Italy launches the Orto in Condotta school gardens project.

2005

- The General Meeting of the Italian Presidia in Sicily brings together over 500 delegates from all over Italy to discuss and tackle the problems of small-scale traditional production and ask for a brand that protects small-scale traditional food products.

2006

- Slow Food inaugurates the Earth Market in Montevarchi, in Tuscany, the first of a network of markets of small-scale producers that will later spread to all continents.
- At Terra Madre, a thousand cooks from around the world meet to lay the foundations for a network of solidarity with small-scale producers, taking on the role of promoters and spokespeople for good, clean and fair agriculture.

2008

- Slow Food Italy registers the “Presidio Slow Food®” brand and assigns it to the producers of over 170 Italian Presidia.

2009

- The Slow Food Cooks’ Alliance is established, a pact between cooks and producers to save biodiversity and support local food production that’s good, clean and fair, particularly from the Presidia.
- Slow Food launches three awareness-raising campaigns, to promote sustainable fishing, to condemn land grabbing and to fight the spread of GMOs.
- Slow Food Italy contributes to the text of draft bill no. 2744, put forward by Italian MP Susanna Cenni, “Provisions for the safeguarding and promotion of agricultural and food biodiversity,” and supports its presentation and approval process.

2010

- The first regional Terra Madre gatherings are held around the world, in Argentina, Azerbaijan, Brazil, Canada, Georgia, Kazakhstan and South Korea, while in Bulgaria the Balkan food communities meet for the first time.

2011

- Indigenous Terra Madre food communities gather for the first time in Jokkmokk, Sweden.

2012

- Slow Food launches the Thousand Gardens in Africa project.
- In New York, Slow Food's president, Carlo Petrini, speaks at the United Nations Permanent Forum on Indigenous Issues alongside Olivier De Schutter, Special Rapporteur on the right to food, and representatives from the FAO, indigenous populations and governments.

2013

- The first Earth Market in Africa is started in Maputo, Mozambique.

2014

- The Ark of Taste is the main theme of the 2014 Salone del Gusto and Terra Madre. Delegates from around the world bring 2,000 products at risk of extinction to Turin, where they are displayed in a huge ark set up in the Lingotto pavilions.

2015

- At the Expo 2015 in Milan, architects Herzog & de Meuron create the Slow Food pavilion, dedicated to agricultural and food biodiversity.
- Slow Food Italy collects 150,000 signatures asking the Italian Agriculture Minister, Maurizio Martina, not to comply with the European Union's request to abolish a law that has banned the use of powdered milk to make yogurt and cheeses since 1974.

2016

- There are now 500 Presidia, involving over 10,000 producers from around the world.
- Carlo Petrini is named FAO Special Ambassador Zero Hunger for Europe.

2017

- The VII Slow Food International Congress is held in Chengdu, China. One of the five congressional motions is dedicated to biodiversity.
- Slow Food launches the international communication and fundraising campaign "Food for Change," which highlights the relationship between food and climate change.
- The first Australian Earth Market is opened.
- With a letter to President Museveni and a communication campaign, Slow Food stops the passage of a law that would have cleared the way for transgenic crops in Uganda.

2018

- In Uruguay, a national law makes it obligatory to label all products containing GM ingredients with a T on the label, a victory for a campaign run by Slow Food and other civil-society organizations.

2019

- The Ark of Taste reaches 5,000 products from 150 countries, including over 800 products from indigenous communities.
- Slow Food launches a campaign in defense of natural cheeses and cured meats and turns its attention to the invisible biodiversity of bacterial microflora, microbiota, yeasts, etc.

2020

- During the Covid-19 pandemic, Slow Food Italy launches the “Ripartiamo dalla Terra” (“Let’s start again from the land”) appeal to support Alliance cooks and gathers over 7,000 signatures from cooks, producers, teachers, journalists and artists asking for regulations in favor of those who buy locally produced foods.
- To support the recovery of local economies in Italy, Slow Food creates a fund to finance projects from “communities of change.”
- In autumn, the conference “20 Years of Biodiversity” officially launches the new snail brand for the Presidia. The snail will also be the logo for the Slow Food Cooks’ Alliance and the Earth Markets.
- After 15 years, the Rove Brousse Goat Cheese Presidium in France obtains a PDO recognition, making it Europe’s smallest cheese PDO, with a strict production protocol.
- After 20 years, the Sateré-Mawé people in Brazil receive a Brazilian appellation for their native waraná, a Slow Food Presidium since 2000.

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