Plant Biodiversity

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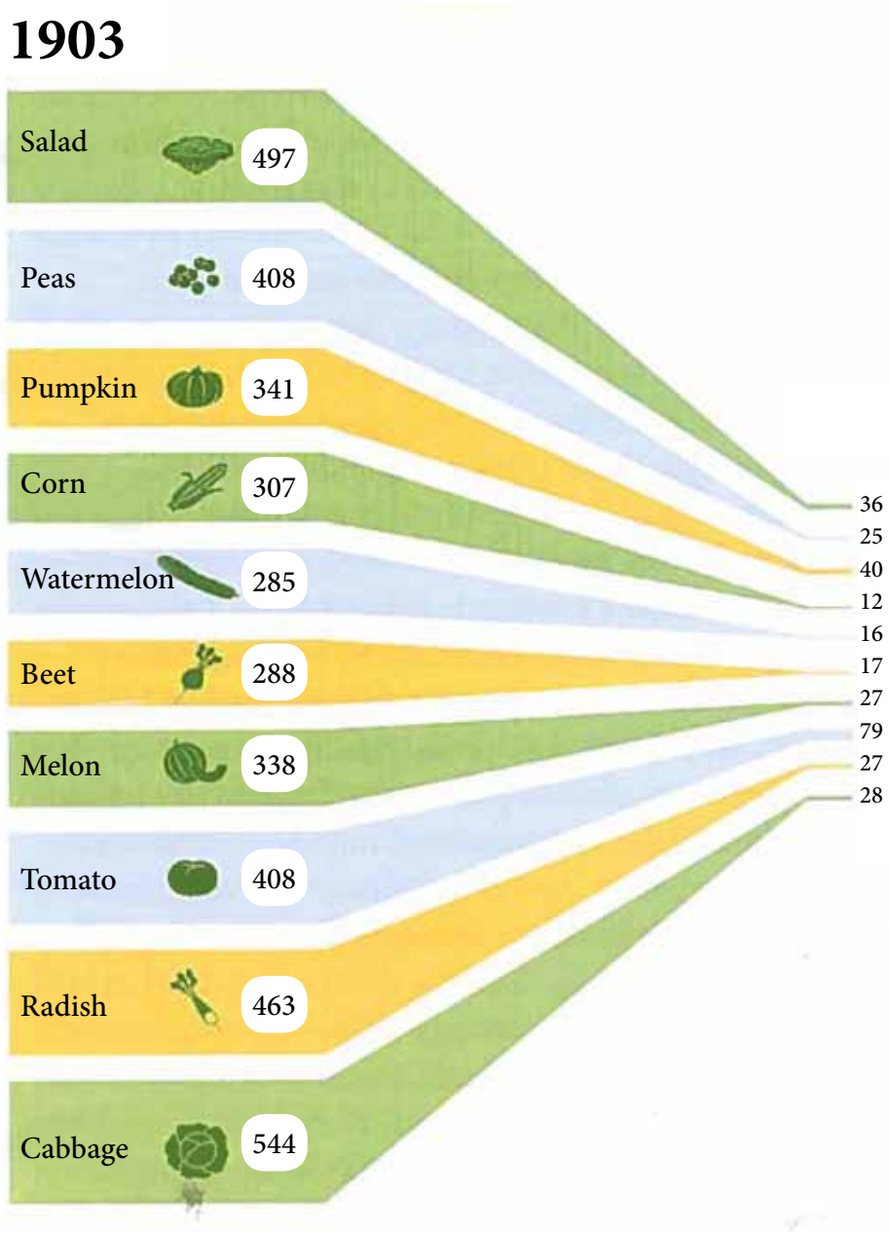
According to the FAO, 75 percent of the agricultural crop varieties existing at the start of the 20th century have now been lost.

At the start of the last century there were 7,000 varieties of apples, but 86 percent have been lost since then. Now just four appear on supermarket shelves. Likewise, of the 2,500 pear varieties once cultivated, just two share 96 percent of today's market. In China, in 1949, they were growing 10,000 varieties of grain, in 1970 just 1,000. Since 1930, Mexico has lost 80 percent of its corn varieties. The United States has lost 95 percent of many edible plant varieties.

The decline of biodiversity in the United States



In 1903 in the USA, you could buy 3,879 different varieties of fruits and vegetables. Eighty years later, the National Seed Laboratory possessed only 307.

Source: National Geographic Magazine,
Rural Advancement Foundation International

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The state of the planet's plant biodiversity is catastrophic, with three quarters of our food depending on just 12 species, three of which (corn, rice and grain) provide 60 percent of our calorie requirement. But rather than relying on the thousands of rice varieties selected by farmers that once were cultivated in India and China, or on the thousands of varieties of corn that were grown in Mexico, we depend on the few hybrid varieties selected and sold to farmers by a handful of multinationals.

Mechanization is the enemy of diversity. Industrial agriculture needs uniformity and high productivity, in other words, monocultures. Since the 1950s agricultural production has gradually orientated to depend on an ever-smaller number of species and varieties, selected to respond to the needs of the global market. They are disconnected from single local areas but capable of ensuring good yields in as many different environments and climates as possible, resistant to manipulation and transport, and possess standardized flavors. The dissemination of these new commercial varieties, which are very different from traditional native ones, has led to homogenization of consumption and the loss of genetic material, increasingly at risk of extinction. For example, the great success of the Golden Delicious apple, one of the founders of commercial varieties, is related to its "easy" flavor and lack of sharpness (it is a sweet and aromatic apple).

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A 10,000 year long journey

Plants have their origins in several areas of the world. They have traveled the world and adapted to the climates and soils that they have found in every corner of the planet, changing a little, crossing with other varieties, integrating into specific territories and communities and influencing culinary traditions. Think of tomatoes, which were domesticated in Central America and then crossed the ocean to then adapt to many European territories, diversifying into many different varieties and giving life to symbolic dishes of the Mediterranean, such as pizza, pasta with tomato sauce, Greek salad and gazpacho.

This is how, over the 10,000 years of agricultural history, farmers' knowledge has given rise to thousands of varieties and breeds which are the expression of the cultural diversity and the ecology of a territory. In turn, these have resulted in a great diversity of gastronomy, shown through shapes, tastes, scents, colors, recipes, preparations and rituals; a fundamental richness to protect the culture of a community, but also to guarantee a diet that is varied, enjoyable and healthy.

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Among the 200,000 plant species present in nature that could be domesticated, very few actually are. Many are woody or don't produce edible fruits. Only a few thousand can be eaten and only a few hundred have been domesticated.

The domestication of plants began between 9000 and 7000 BC in the Fertile Crescent, where our hunter-gatherer ancestors reproduced edible plants and those that could be used for other purposes: clothing, transport or ornamental. Between 5000 and 3000 BC, domestication occurred independently in other areas: China, Southeast Asia, Africa, Mesoamerica and Andean South America.

In some areas of the world, domestication was carried out with indigenous species, while in others it took place only after the introduction of plants from other parts of the world.

This process has produced domesticated species that are often completely different from their natural ancestors. Cereal seeds are now much larger than their primitive ancestors. Today wild asparagus still have a very thin stalk, while the domesticated version is notably thicker.

Regions of crop domestication *

NORTH AMERICA
Plum
Grape
Blueberry
Cranberry
Pecan
Sunflower
Tepary Bean
Barley
Artichoke
Zucchini

MESOAMERICA
Corn
Tomato
Sieva bean
Scarlet Runner bean
Cotton
Avocado
Papaya
Cacao
Cassava
Sweet potato
Common bean
Jicama
Yucca
Agave
Pumpkin

EUROPE
Oat
Sugarbeet
Rye
Cabbage
Grape
Olive

HIGHLAND SOUTH AMERICA
Potato
Peanut
Lima bean
Common bean
Cotton
Quinoa
Manioca
Pumpkin
Oca

LOWLAND SOUTH AMERICA
Yam
Pineapple
Cassava
Sweet potato
Cotton
Pumpink

NEAR EAST
Wheat
Barley
Onion
Pea
Lentil
Chickpea
Fig
Date
Flax
Pear
Pomegranate
Grape
Olive
Apple
Plum
Melon
Spelt

AFRICA
African rice
Sorghum
Pearl millet
Finger millet
Yam
Watermelon
Cowpea
Coffee
Cotton
Sesame
Teff
Peanut
Bottle gourd

CENTRAL ASIA
Common millet
Buckwheat
Alfaalfa
Hemp
Foxtail millet
Grape
Broadbean

INDIA
Pigeon pea
Eggplant
Cucumber
Cotton
Sesame
Flax
Bean

CHINA
Soybean
Cabbage
Onion
Peach
Foxtail millet
Pearl millet
Rice
Hemp

SOUTH-EAST ASIA
Oriental rice
Banana
Citrus
Yam
Mango
Thin sugarcane
Taro
Tea

SOUTH PACIFIC
Noble sugarcane
Coconut
Breadfruit
Taro
Yam

AUSTRALIA
Macadamia nut

*The presence of the same crops on different continents means that the fruit, vegetable or cereal was successfully domesticated only after the introduction of plants from elsewhere in the world.

Source: Hartlan, J.R.1976 The Plants and Animals that nourish Man by Scientific American Inc.
J.Diamond, 1997 Guns, Germs and Steel. The Fates of Human Societies

The words of biodiversity

Species

A species is a group of organisms capable of interbreeding and producing fertile off-spring. Each species is genetically distinct from others and recognizable thanks to its specific morphological characteristics (such as shape and color of flowers, fruit, leaves and buds). Over the centuries, individuals within a species evolve to develop useful characteristics in order to adapt to different environments. For example, plants in arid climates have developed the capacity to bear fruit even in times of water shortage. The apricot is a species, whereas the Shalakh apricot is a variety typical of an Armenian region.

In the case of wild species (those that develop spontaneously), there is no human intervention in cultivation or breeding, and so here we speak only of species, with no reference to varieties or breeds. For example, the baobab is a species, but there are no specific varieties of baobab, unless humans begin to cultivate it, selecting ecotypes and varieties.

Variety

A variety, or cultivar, is a group of cultivated plants clearly distinguishable by shape, color and flavor. A variety is stable, hence conserves its characteristics even when reproduced (through cuttings and bulbs and so on).

Easily identifiable varieties, which usually have regional names, are defined as native or local. They are generally the product of selection by single farmers or rural communities, and are consequently hardier, more resistant to stress, and in need of less water and fewer fertilizers to grow. They are closely bound up with the cultures of the communities that have cultivated them over the centuries, appearing in their recipes and dialects.

Examples of native varieties include: the Carla apple (Italy), the Öland Island brown bean (Sweden), the Lorient cabbage (France), the Akka turnip (Japan). In Europe, native varieties are generally recorded in public registers. Registration is a form of public protection that has nothing to do with patenting.

Ecotype

An ecotype is a population within a species (usually reproduced with seeds) that is genetically adapted to a specific territory, usually of a limited size. This definition resembles that of a native variety (or cultivar). The difference is that ecotypes do not have a precise genetic identity, stable and defined, and they are not part of official classifications or registers. However they are very important for the protection of cultivated biodiversity. In the future, if they are adequately studied and well selected, they may enter into the classification of a cultivar. For example, the various populations of pink apples from the Sibillini mountains, grown in Marche (Italy).

Hybrid plant

Hybrid plants are varieties or ecotypes that derive from the combination of genetic material from different species. Hybridization can occur naturally or through human interaction (in the practice of genetic improvement).

For example the main varieties of strawberries on the market today come from an ancestor born in Brest, in France, in 1766, from the cross of an American strawberry (*Fragaria virginiana*) and a white Chilean strawberry (*Fragaria chiloensis*) brought to Europe by an engineer in the service of Louis XIV.

More recently, especially in the cereal sector, we have seen a spread of the technique of producing commercial hybrids, which require hefty investment and are designed to maximize yields and standardize the final product. Commercial hybrids and varieties are often patented, but this does not stop a farmer from buying their seeds and growing them. Under the patent, a share of the price the farmer pays (royalties) will go to the company or corporation that designed or produced them. But, there is something that farmers cannot do when cultivating commercial hybrids: they cannot collect and save seeds from their own harvest to use for the next year. Farmers, therefore, must buy new seeds every year and pay the relevant royalties.

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Territory

Territory is soil, air, water and climate, but also language, dialects, religion, craftsmanship, architecture and landscape. Far from its territory of origin, a seed, vegetable, fruit tree or animal breed becomes simply genetic material.

Therefore it is important to safeguard genetic material beyond just storing it in germplasm banks (which conserve 7.4 million samples worldwide: seeds, plant tissues, pollen, single cells, DNA, etc.). Varieties must be cultivated with the help of farmers in their places of origin, where they are best able to fulfill their potential and have acclimatized over centuries thanks to the activities of humans. For this reason they are more resistant and require fewer external inputs (fertilizers, water and herbicides). They are therefore more sustainable, both from an environmental and economic point of view.

Biodiversity to protect

©Serena Milano

Corn

Seven thousand years of history have gone by from the ancient plant, the teosinte, which produced small bitter cobs no more than three centimeters long, to today's numerous varieties, with their soft sweet kernels.

In Mexico—but also in Guatemala and in the Peruvian and Argentine Andes—corn is not only just yellow or white, but may also have red, pink, purple, black and blue kernels and cobs of the most disparate shapes: round, tapered, pointed, flat or broad. In the Oaxaca region alone 85,000 different ecotypes of corn exist. This is an extraordinary wealth that is gradually disappearing, swallowed up by the logics of the global market and transgenic seed multinationals. Just think, the country where corn was born is now forced to import 40 percent of its total requirement from the United States.
Corn isn't only a crop of the plains. On the contrary, it can grow from tropical zones up to altitudes of 2-3,000 meters. It may be cultivated in small clearings in pinewoods or on steep terrains, where farmers struggle to stand up and do everything by hand.

After 1492, corn spread across the world and today many varieties are part of the gastronomic heritage of even far-off communities. We need to save the Secoya corn in Ecuador and the Argentinean Amarillo Angosto corn, but also the Biancoperla corn in Italy, the Vorarlberger Riebelmais in Austria, and the Zampung black corn in India which has been preserved by the indigenous Tang Sa community.

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Wheat

Wheat was one of the first plants to be cultivated. Its ancestor, einkorn (*Triticum monococcum*), was domesticated about 8,000 years ago in the so-called Fertile Crescent, in an area spanning from the mountains of modern-day Iran and Anatolia to the coast of Palestine. Slow Food promotes the production of Siyez wheat (Triticum monococcum) in Turkey. Wheat feeds a fifth of the population of the planet, providing about 20 percent of its energy requirement.

It is cultivated on more than 220 million hectares of land, with an annual output of more than 700 million tons. Extremely adaptable, it is cultivated from the Arctic regions to the Equator, from sea level to the plateaus of Tibet at an altitude of about 4,000 meters. Unlike rice, wheat is produced all over the world. China cultivates 16 percent of the total, followed by India and the United States, while the main exporter countries are the United States, Canada and Russia. In North Africa and the

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Middle East, it is an everyday staple and its popularity is also growing elsewhere in Asia as a result of the progressive westernization of the diet.
Ninety five percent of world production is given over to common wheat (*Triticum aestivum*), the remaining 5 percent consisting of durum wheat (*T. turgidum subsp. durum*), which, thanks to its high gluten content, is used to make pasta and couscous. Canada is the world's largest producer of durum wheat, followed by Italy. Productivity per hectare has increased from 1 ton in 1951 to the present-day 2.5 tons, thanks to extreme fertilization and genetic enhancement which has produced higher-yield varieties.

Ancient grain varieties are better suited to variations in climate. They represent precious biodiversity that must be conserved: from the Italian Timilia durum wheat to the South Korean Anjeunbaengi, from the Canadian Red Fife wheat to the Tunisian Mahmoudi and Schili varieties.
They also have better quality and nutritional properties, and are more suitable for people with food intolerances, who make up an increasing percentage of the population.

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Rice

Rice is synonymous with food. In Vietnamese, Japanese, Laotian and Siamese, the verb “to eat” is “to eat rice.” Almost all the world’s rice is grown and consumed in Asia, where 250 million poor farmers cultivate and harvest thousands of different varieties by hand: aromatic, waxy, red, purple, white and many more. Monsoonal Asia (China, followed by India and Indonesia) produces and consumes 92 percent of the world’s rice. Less than 10 percent leaves its country of origin, with the chief exporters being India, Thailand and Vietnam.

Rice cultivation occupies 10 percent of all arable land - more than 500 million hectares. It is a main course, side dish, dessert, wine, beer and whisky all in one. Domesticated on the banks of the Pearl River in China and cultivated for 8,000 years, the Oryza genus (which comprises two species: *O. sativa*, common in many parts of the world, and O. glaberrima, a red rice native to the Niger Delta

and still cultivated in West Africa, although in ever decreasing quantities) has given rise to more than 140,000 varieties cultivated worldwide.

Rice has shaped rural landscapes, economies, politics, societies, cuisines, rituals and mythologies. It has adapted to the diverse soils of the planet. It lives below sea level (on the Po delta in Italy) but also 3,000 meters above it (on the plateaus of Nepal and in the Peruvian Andes). It is found along the Equator but also in the cold Hungarian steppes, in Manchuria and on the icy Japanese island of Hokkaido. To adapt to different climates, the plant changes form, color and aroma. In tropical Asia there are even "floating" varieties that project up from six meter-deep water to expose the panicles to the sun.

Yet this extraordinary wealth of rice biodiversity is at risk. In the past, Thailand cultivated 16,000 rice varieties, but now the number has dropped to 37, and 50 percent of rice fields grow just two. The story repeats itself in Bangladesh, where the number of varieties has fallen from 5,000 to 23; and Korea, which has gone from 4,000 to 12. No one actually knows the exact number of traditional ecotypes that were grown in the past, though it would appear that India alone has lost hundreds of thousands and preserved only 6,000.

Slow Food's Ark of Taste protects some 50 varieties, including the Malaysian Bajong rice, Congo's Tule Na Bwana rice, the Kuruluthuda variety in Sri Lanka, and Pantanal native rice in Brazil.

© Oliver Migliore

Potato

Old Andean farming communities in Peru and Bolivia used to cultivate more than 5,000 varieties of potatoes of different colors, but this huge family has now lost most of its biodiversity. One example is Chiloé Island in Chile, where before the modernization of agriculture, 800 varieties of potatoes were grown, reduced today to 270. In the 1960s in the Quebrada de Humahuaca valley in Argentina, 60 or so varieties were cultivated; today this number is halved.

The potato is a tuber that grows very quickly without requiring a great deal of care and attention, adapts well to diverse climates, and is also very productive. The chief potato growing country is China; a third of all the world's potatoes are grown in China and India.
The world market is founded on four hybrid varieties: Russet Burbanck, Kennebec, Atlantic Superior and Red Norling. Recently, genetically modified varieties have been developed with a higher starch content, ideal for industry needs.
Two thirds of the world's potato harvest is grown for human consumption, while the rest is used as animal feed and to produce starch. The cultivation of just a few hyper-productive varieties is fraught with risk. In Tajikistan, for example, potato production slumped by more than 50 percent in the 1990s following a virus introduced with imported varieties that spread rapidly due to the uniformity of the local crop.

© Federica Bolla

Apple

All the apples we cultivate and eat today originate from the old forests along the old Silk Route through Kyrgyzstan, Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan. The caravans of merchants and beasts of burden that travelled the route for thousands of years unwittingly scattered the seeds of the apples and other fruits they ate along the way, which subsequently grew and interbred to produce new varieties. This area is a veritable bank of the wild genetic resources of apple, apricot, peach, walnut, pear and other fruit trees. Nowhere on the planet is comparable, yet its forests are now menaced by the expansion of pastureland, by deforestation for the production of vegetable carbon and, more recently, by climate change.

About 7,500 apple varieties are known to us, but industrial farming and the technological discoveries that have led to long-distance refrigerated transport have dealt a lethal blow to fruit biodiversity, reducing the number of varieties cultivated. Just four groups of commercial varieties (Golden Delicious, Red Delicious, Gala and Granny Smith) account for 90 percent of the world market through large-scale distribution.

© Fabio Artusi

Bean

The Americans have two words, bean and cowpea, but the rest of the world doesn't differentiate: The term bean doesn't only indicate the many species, varieties and ecotypes, but also two other foodstuffs from two distant and distinctive parts of the world: *Phaseolus* and *Vigna*.

The first originates from Central and South America, in an area that runs from Mexico to Peru and Columbia. Its wild ancestor is *Phaseolus aborigeneus,* a vigorous liana vine with small black seeds. The second is Afro-Asian-European; its wild ancestor was rediscovered in Nigeria and from there the Vigna spread in two directions, to the East and to the Mediterranean, where they each evolved into different species.

The two foodstuffs resemble and encompass an extraordinary diversity and complex classification. The seeds can be both small and large, kidney shaped or round, white, pink, yellow, green, black, blue,

spotted or striped. The plant can be a dwarf or a vine, the flowers can be a variety of colors including white, pink and purple, and it can be harvested early or late in the season.

Phaseolus is easier to cultivate and more profitable (its yield per hectare is almost double that of Vigna) and it has spread throughout the world, superseding the African species. There are 200 different species of *Phaseolus*, but only four are commonly cultivated and widespread: Vulgaris (the most important), *Coccineus* (a hibiscus species), *Lunatus* (Lima bean) and *Acutifolius* (found mostly in America under the name Tepary).

There are 80 *Vigna* species, of which five or six are domesticated. Of these, the most important and widespread is *Vigna Unguiculata*. The African beans are small, have long thin pods and on the seeds there is a well-pronounced, black encircled ileum. For this reason they are known as black-eyed beans.

Many traditional varieties are gradually being substituted for commercial hybrids, selected for their yield and resistance. Worldwide production of dried beans stands at 25 million tons. The most important producer of dried beans is India (3.4 million tons) followed by Brazil, Myanmar, Mexico and Tanzania. On the other hand production of the Vigna bean is much less common with only 4 million tons worldwide, of that almost 3 million in Nigeria.

Beans are the main source of protein in Burundi, Rwanda and Kenya, and feed over 400 million people in developing countries. However some of the areas of highest production (Latin America and Sub-Saharan Africa) could see levels reduced by half by 2050, owing to temperature increases.
In some areas of the world new varieties of corn are undermining the cultivation of ancient bean varieties. The traditional system of milpa facilitates breeding between corn, beans, squash and other vegetables, and currently this is changing the characteristics of the corn plants cultivated as well as the cultivation periods. The associated legumes, fruits and vegetables are also at risk. This is happening in parts of Mexico (Chiapas, Oaxaca, Puebla and Veracruz), Guatemala and Costa Rica.

The safeguarding of biodiversity is highlighted though the Slow Food Ark of Taste across the globe: from the Brazilian Canapu cowpea to the Bosnian Poljak bean, from the Itamba cowpea in Kenya to the Reade Krobbe (little red bean) in the Basque Country.

© Jacques Minelli Satoriz pour Guayapi tropical

Biodiversity protected by Indigenous Peoples

There are at least 370 million Indigenous Peoples in 70 countries. Of these, 150 million belong to tribal populations. Their presence goes back thousands of years; they lived on lands well before colonial societies, preserving natural habitants and protecting valuable foods and spontaneous herbs. Many active ingredients used in Western medicine pharmaceuticals are extracts of indigenous plants.

An example of biodiversity preserved by indigenous communities is waranà, a wild fruit gathered by the Sateré Mawé, a tribal community that lives in the Brazilian Amazon rainforest. The Sateré Mawé are currently threatened by pressure from multinationals trying to enforce industrial cane sugar and soy agriculture on them. The waranà, which contains up to 3-4% caffeine, is packaged into batons, which are then grated with a basalt stone.

Four hundred indigenous products have now boarded the Ark of Taste, including Black Adan Krayan rice from Indonesia and jarilud, an aromatic herb gathered by the Bhoi community in India.

Why preserve local varieties?

• Industrial agriculture is based on an enormous waste of energy and natural resources and is unsustainable from an environmental and economic point of view. Local varieties are characterized by being well adapted to the environmental conditions of their area, and for this reason normally need fewer external inputs, like water, fertilizers or pesticides. They are hardier than most 'standard' landraces and resistant to environmental stresses. Their potential to thrive in their original territories make them important agricultural resources and essential tools for food sovereignity.

• Traditional varieties can sustain local microeconomics thanks to their high qualitative value, and therefore guarantee the presence of humans in marginal and difficult areas.

• Preserving a large genetic diversity is important to be able to face risks posed by climate change, disease and the imminent shortage of natural resources; and to draw on in order to maintain an agricultural system able to feed a growing planet.

• The genetic diversity of tens of thousands of local varieties allows us to create new crosses and isolate qualitative and quantitative characteristics that can have great economic, productive or medicinal value.

• The preservation of ancient varieties and their cultivation techniques is essential in safeguarding landscapes and natural environments, and in conserving the gastronomic heritage of local communities.

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