Glossary of Biophilia

Words and ideas of modern biophilic thought

Bruno Massa & Toni Puma

I Edition 2025

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INTERACTIVE INDEX OF ENTRIES

FOREWORD

We need a new environmental awareness
on a global scale.
To achieve this, we need to educate people
(Mikhail Sergeevich Gorbachev)

We have often reflected on the need to continue to nurture a positive relationship with other living beings in young people, a relationship that for many requires slow, continuous and constant education. The widespread uneasiness of modern man, which often degenerates into frustration, depression and curious behavior, must absolutely find a way out, perhaps by strengthening the bond between man and nature, which is the basis of biophilia. It would be enough to achieve a serious connection between human populations and the natural resources that characterize the territory in which they live. One opportunity could be the national biodiversity strategy; a system should be put in place to reward those who ensure the conservation of nature. For example, now that the ecological network has been established, the State could commit to rewarding the populations living within Natura 2000 sites who contribute to the good maintenance of biodiversity. It is well known that the rewards that attract the most interest in humans are of an economic nature; therefore, a tax reduction for the populations involved could be envisaged, but if an inspection were to reveal a loss of biodiversity or evidence of acts that would lead to such an event, the reward would be cancelled.

Victor Hugo wrote, "*Be like trees: change your leaves and keep your roots; change your ideas but keep your principles*". We need schools to provide a thorough education and adults to be re-educated through widespread dissemination of information. Getting rid of widespread ignorance is the only real step we can take to achieve a sincere and convinced awareness of environmental issues.

This website, through an alphabetical glossary, brings together a series of experiences of environmental activism, often involving clashes with hypocrisy and corruption as a sign of changing times and economic growth, but above all as a sign of a misunderstood and unjustified attitude of breaking with the past. The intention is to provide information that should form the basis of civilized living, mutual respect between humans and respect for the lives of other living beings, who have the same right as us to inhabit this planet, because, as Ernest Hemingway wrote, "*The world is a fine place and worth fighting for*". These pages contain true facts that may give pause for thought to those who have not yet reached the point of resignation defined here as "*Syndrome of Gluck street boy*". We will use a number of key topics in alphabetical order.

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ENTRIES

Aeroplankton – It is the combination of arthropods, fungal spores and pollen grains carried by the wind. These organisms can be carried by the wind for thousands of kilometres; unlike larger species, the movements of small species (under 5 mm) depend on the wind. Several species of birds, swallows, martins, swifts and other similar birds feed on aeroplankton thanks to their large mouths, which they use like a net while hunting in flight. There is undoubtedly a co-evolutionary relationship between organisms that move with the wind and those that have specialized in capturing them. Naturally, the decline in aeroplankton should have an impact on predators, but in reality, while there has been a general decline in insect species, including those that make up aeroplankton, there has been no similar decline in the species of birds that feed on them.

Agroecology – It is the application of ecological principles to agricultural production. Agroecology constitutes a context, or a particular environment of study, and as such does not provide a universal formula or recipe for organising an ideal agroecosystem; it is a context in which regenerative agriculture represents one of the most promising frontiers for sustainable innovation in various agricultural sectors. Regenerative practices, integrated with the principles of organic farming, are transforming production, offering concrete solutions to address

climate challenges, improve soil fertility and promote biodiversity.

Albedo – The albedo (from the Latin albēdo, "whiteness," from albus, "white") of a surface is the fraction of light or, more generally, the fraction of incident solar radiation that is reflected in all directions. It therefore indicates the reflective power of a surface. The exact value of the fraction depends, for the same material, on the wavelength of the radiation considered.

Alien – Allochthonous taxon, i.e. originating from a different biogeographical region, accidentally or deliberately introduced into a country foreign to it.

Allele – Abbreviation of allelomorph, from the Greek ἄλλος (= other) and morpho (= form). One of two genes in a pair that occupies a specific position on a chromosome.

Allergen – A foreign molecule that causes an immune reaction; it is an antigen that, when it comes into contact with an antibody, causes allergic reactions.

Allochthonous – From the Greek ἄλλος (àllos, other) and χθών (chthòn, earth): not belonging to the place where it is found. It refers to species introduced from other biogeographical regions. See also alien.

Allogrooming – Cleaning behaviour towards another member of the colony, typical of social species.

Allopatric – This refers to species that have evolved in

separate lands; the opposite is sympatric.

Amber – Fossil resin; the different varieties are named according to their geographical origin. Sometimes they contain insects that were trapped when the resin was fresh.

Amblypygi – Order of the class Arachnida, characterized by a large cephalothorax, flattened body and spines.

Amoeba – From the Greek amoibe (= mutation, transformation), derived from améibein (= to change). Protists that move using extensions of the cytoplasm called pseudopods.

Amphibious – From the Latin amphibion and the Greek amphíbios (amphí = double, bios = life; double life as larva and adult). Organisms that can live both on land and in water; they are a group of vertebrates that colonized the terrestrial environment, probably descended from the Dipnoans, capable of breathing with a swim bladder or a primitive lung, about 400 million years ago.

Anaerobic – Metabolic activity in the absence of oxygen.

Ancestral – From the Latin antecessor (from ante-cedere = to go before). Progenitor of recent species.

Angiosperms – Angiosperms are distinguished because their seeds are enveloped in a fruit, which protects them and facilitates their dissemination. The name in fact means "protected seed" (from the Greek αγγειον, receptacle, and σπερμα, seed). The flower of the Angiosperms is a more complex

structure than the strobili of the Pinophytes, which share with the former reproduction by means of seeds. Angiosperms are also distinguished from Gymnosperms by the presence of true tracheae combined with larger and more specialized canals, the “vessel elements”, which make water transport more efficient, and by being the only division that includes true herbaceous plants. They are a broad division that includes annual or perennial plants with the highest degree of evolution; plants with true flowers and seed protected by a fruit fall under this definition. They are also known under the name Magnoliophyta. They appeared in the Triassic (around 200 million years ago), gradually differentiated in the Jurassic and reached their maximum variety in the Cretaceous, around 130 million years ago. However, the attribution of these fossils to Angiosperms remains controversial. The Angiosperms, thanks to their extreme morphological and physiological variety, have become the largest and most diverse group of plants on our planet, with around 275,000 species living today, corresponding to more than 80% of all terrestrial plants, are present in all the major biomes of the earth, from deserts to rainforests. The main reason for this evolutionary success seems to be a transformation in the capillarity of the leaves, which improved their photosynthetic efficiency. The grouping includes a variety of herbaceous, shrubby and tree-like plants, from trees as tall as 100 metres to small herbaceous plants of just a few millimetres.

The origin of the Angiosperms transformed the terrestrial world and stimulated animal evolution.

Animal vision – See *Rhodopsin*.

Anophthalmia – From the Greek, meaning 'without eyes'; anophthalmic organisms are those without eyes, generally living in caves or underground.

Antibody – Plasma globulin that is synthesised in the body by specialized cells (plasma cells) when a foreign substance (an antigen) is introduced. The antibodies responsible for allergic reactions can be natural (genetically transmitted from parents, normally present in serum) and reaginic (developed in allergic individuals); there are also induced antibodies (anaphylactic, which appear following the injection of powerful antigens) and blocking antibodies (able to bind before reaginic antibodies to antigens introduced into the circulation).

Antigen – From the Greek anti- (suffix) and genes (= generating). A substance, often of a protein nature, recognized as foreign by the body and capable of causing the formation of specific antibodies in the body into which it is introduced, triggering an immune response.

Aploid – From the Greek haploos (= simple, single). Refers to a cell with a single set of chromosomes, therefore lacking homologues. It is indicated by the symbol n, as opposed to diploid, indicated by the symbol 2n.

Apomixis – Apomixis is a form of asexual reproduction that allows the formation of clonal seeds that are genetically identical to the parent plant. Apomixis allows a plant to generate viable seeds without undergoing meiosis and fertilization, resulting in a cloned embryo that is identical to the parent plant. There are several forms of apomixis, gametophytic apomixis (Diplosporia or Aposporia) and sporophytic apomixis. This reproductive mechanism has been documented in over 300 species of Angiosperms, particularly in the Asteraceae, Poaceae, Rutaceae, and Rosaceae families. It was discovered in the 19th century when some female Australian plants grown at Kew Gardens in London produced viable seeds in the absence of male individuals. This biological peculiarity has recently been recognized as having significant potential in agriculture, as it can reduce production costs.

Aposematism – From the Greek, *ἀπό* and *σῆμα –ατος*, *ἀποσεμαίνω*, to give a contrary sign; a phenomenon widespread in many arthropods, which use bright colors to signal their dangerousness. There is a type of mimicry, known as phaneric mimicry, which occurs when a species imitates the colouring of an aposematic species. Phaneric mimicry is called Batesian (named after the entomologist Henry Walter Bates) when it involves an appetising species that mimics the colour of an unappetising species; it is called Müllerian (named after the German zoologist Fritz Müller) when several unappetising

species resemble each other in their aposematic colouring pattern. Insectivorous predators mistake them for disgusting or poisonous species and do not catch them. If an insectivorous bird attempted to catch a *Zygaena ephialtes*, it would immediately release it because it is disgusting to its palate; once it has had this experience, it will no longer approach any zygene or species that resemble it. However, taste is a subjective factor: some spiders, in fact, find zygene tasty and edible and feed on them regularly. There are species of plants that are poisonous to humans but not to some arthropods. For example, oleander produces substances that are poisonous to humans, but there are some insects that feed on oleander leaves and seeds; indeed, the heteropteran *Caenocoris nerii* and the homopteran *Aphis nerii* use the glycosides in oleander seeds, which, when added to their own secretions, transform them into a toxic substance that is unpalatable to potential predators. These insects are aposematic, but there is a third species, the homopteran *Cercopis intermedia*, which is harmless and has a similar coloring to the first two (red and black). Adults and caterpillars generally rely on mimicry for defence against enemies, which can be cryptic or phaneric. However, there are species, generally rather slow-moving, that rely on the production of toxic or poisonous substances to deter predators; this characteristic is mostly linked to very striking colors, which signal danger. There are various ways in which this broad phenomenon, known as

aposematism, manifests itself, with butterflies being the most obvious and well-known examples. These species are chemically protected thanks to the production of substances that are toxic, poisonous or simply unpleasant to the palate of a potential predator. Aposematic insects have brightly colored markings, which serve as a warning signal to predators. Examples of aposematic species, characterized by bright colors such as red, orange, etc., are found among the Nymphalidae and Zygoptera Lepidoptera, which are capable of releasing small doses of hydrocyanic acid, and among the Papilionidae, Danaidae, Arctiidae and Pieridae, which produce various toxic substances. Insectivorous predators recognize and avoid them.

Arthropoda – From the Greek árthron (= joint) and podos (= foot). Organisms with articulated limbs.

Asphalt – The word means 'Conglomerate of limestone impregnated with bitumen, natural or artificial'.

ATP – Adenosine triphosphate; a molecule that stores energy in the form of a phosphoric bond during the Krebs cycle, inside the mitochondrion.

Apterous – From the Greek *a-* privative and *pterón* (= wing), wingless.

Autochthonous – From the Greek *autòs*, meaning "same", and *chthòn*, meaning "earth", referring to species native to the biogeographical region in which they are found.

Autotrophy – This refers to the metabolism of plants, which are able to use carbon dioxide from the atmosphere, organizing carbon, building sugar and releasing oxygen.

Bacterium – From the Greek bakterion, rod. The name was coined by German naturalist C.G. Ehrenberg in 1838, who discovered the first rod-shaped species and named them bacterium.

Bald eagle, mascot of the Lazio football team – We don't want to get inside the mind of a football fan, let alone that of the hooligans who gravitate towards certain sections of the stadium, but we do wonder what logic could lie behind the use of a Bald eagle *Haliaeetus leucocephalus* as the mascot of a European football team. In fact, it is a North American species, a symbol of the United States; why use it as the mascot of a European football team, such as Lazio and Nice? If an eagle must be used, let it be a symbol of a heraldic figure, sacred in Greek mythology, an icon of the Roman Empire, the only one would be the Golden eagle *Aquila chrysaetos*! But evidently there were none available when, in 2010, Lazio's mascot began to circle above the playing fields where the team's players ran. This premise is not intended as a reproach to Lazio for not having obtained a Golden eagle, but merely a reflection on the carelessness with which sports clubs sometimes make their choices. Many sports clubs, including football clubs, have birds in their symbols, and this should make us happy if it serves to

promote greater respect for these animals in their natural environments. However, flying a Bald eagle over a football pitch at the start of a match is not respectful towards this bird, and we are certain that, despite the food reward the eagle receives after each flight, it certainly does not live a good life in those conditions of captivity. Even if it was born in captivity, it is still a wild animal, conditioned by those who believe they have trained it.

Bioacoustics – Study of sounds produced by animals and interpretation through spectrograms and sonograms. See also *Sound Communication*.

Biocapacity – The amount of biologically productive land and sea area available in a given region or entire country.

Biocoenosis – From the Greek bíos (= life) and koinósis (= exchange). A group of interacting organisms that live in a habitat and form an ecological community.

Biodiversity, 8 February 2022: the word enters the Constitution – If we analyse Christianity, humanism, capitalism and Marxism, without distinction, in one form or another, they have all considered man as the central element and foundation of their respective doctrines, ignoring Nature or considering it subservient to man. The environmental problem is hardly addressed at all, and the concept of the centrality of man persists, thus demonstrating blindness and inadequacy

with respect to the times in which we live. According to many Oriental religions, all living beings are sacred; to our knowledge, in the Christian sphere, biocentric religious positions are rare and episodic. Pope John Paul II stated that "*the ecological crisis is a moral problem*" and that "*all animals have a soul*". His successor, Pope Benedict XVI, recalled in August 2006 that "*Christians must care for creation*", and in his own way, Orthodox Patriarch Bartholomew I declared that damaging the integrity of the earth, polluting, destroying biological diversity and causing species extinction are serious sins. Pope Francis even introduced the concept of "*ecological conversion*" as an integral part of the Christian faith, arguing that care for the environment is a responsibility shared by all, regardless of their faith: he wrote that nature challenges us to be supportive and attentive to the care of creation, also to prevent the most serious consequences. We can say that, at least in words, these important religious figures take the protection and conservation of nature seriously, probably more so than political representatives, who seem fairly indifferent to environmental issues. Many years have passed since the Italian Constitution was approved on 22nd December 1947 and came into force on 1st January 1948. the total absence of ecological culture among decision-makers and legislators, a historical ecological neglect that has lasted three quarters of a century, and a disproportionate focus on the man-made landscape and the

artistic aspects derived from the talent of individuals are the real reasons why there has been such a huge delay in filling the "*ecological*" void in the Constitution. However, on 8th February 2022, the Italian Parliament approved the amendment of Articles 9 and 41 of the Constitution, introducing a new paragraph to Article 9, recognizing the principle of "*environmental protection*", "*biodiversity*" and "*ecosystems*" alongside the protection of the landscape and historical and artistic heritage. The new words written in Article 9 are "*Protect the environment, biodiversity and ecosystems, also in the interest of future generations. State law regulates the ways and forms of animal protection*"; in Article 41, the following is added: *"Private economic initiative is free. It cannot be carried out in conflict with social utility or in such a way as to damage health, the environment, safety, freedom or human dignity. The law determines the appropriate programs and controls so that public and private economic activity can be directed and coordinated for social and environmental purposes*". In short, the natural environment, ecosystems and biodiversity will be part of the terminology within the Italian Constitution from 2022. However, this does not mean that the terminology used in the new Article 9 of the Constitution is clear to everyone. Try reading some technical reports by self-proclaimed experts, which talk about fungal biodiversity, must biodiversity, crop biodiversity and so on: a veritable riot of terminological abuse.

Why? Biodiversity means biological diversity and is a noun that contains the first three letters of the adjective biological as a prefix: "*bio-diversity*". Adding other adjectives is proof of not understanding its meaning. We have tried to explain its meaning on several occasions, but we realize that we have not been very successful if technical reports with a misunderstanding of the term are still being read today. Repetita juvant: Article 2 of the United Nations Convention on Biological Diversity defines biodiversity as "*the variability among living organisms from land, sea and other aquatic ecosystems, their genetic variability and the ecological complexes of which they are part; this includes diversity within species, between species and ecosystems*". Diversity within species coincides with genetic diversity. The concept of biodiversity is multidimensional and also takes into account evolutionary processes that can only take place if populations maintain sufficient numbers, otherwise genetic laws are not respected. The multiplicity of living organisms is the end result of evolution and, at the same time, its driving force. Biodiversity is therefore not an aspect of life and does not constitute a measure of it, but is the essence of life itself on the planet. It is a fundamental law, like other physical laws that enable the Earth-Sun system to function.

Those who study the complex interactions between living organisms and ecosystems seek to better understand the

concept of biodiversity; in order to convincingly support the importance of biodiversity conservation, it is essential to have a clear understanding of the concept. Biodiversity is a term with a complete meaning; it makes no sense to add another adjective. Therefore, it is correct to write "*plant diversity*" or "*animal diversity*", but not "*plant biodiversity*" or "*animal biodiversity*". Biodiversity is unique and includes all living beings. 8 February should become an important date for Italians and should be commemorated every year with appropriate cultural, educational and scientific events, as it represented a courageous political turning point in environmental protection choices.

Biological control – Control carried out using living organisms that establish antagonistic, predatory, parasitic or interspecific competitive relationships with the species to be controlled.

Biomass – From the Greek bíos (= life) and the Latin massa (= paste). Animal and plant organisms found in a given quantity and in a specific space or environment. The term was coined in 1927 by German zoologist Reinhard Demoll (1882-1960) and taken up again in 1931 by oceanographer Lev Aleksandrovich Zenkevich (1889-1970).

Biomimicry – The term derives from the Greek words "bios" (life) and "mimesis" (imitation); it is a discipline that studies the processes, structures and strategies of nature in order to develop

innovative and sustainable technological solutions. Biomimicry aims to create artificial systems inspired by certain biological characteristics of plants and animals to solve complex problems in various fields such as architecture, mechanics, etc. Well-known examples include aeroplane wings, based on the flight of birds, and radar and sonar, based on the geolocation apparatus of bats.

Biophilia – The term, of Greek origin (love of life), was used by Edward O. Wilson in 1984 to mean an innate curiosity about the living world on the part of people who constantly ask themselves about the reasons, causes and effects of the natural phenomena with which they live and the secrets of nature. It is likely that this tendency is genetically transmissible and recessive and therefore found in a small portion of the human population.

Biosphere – From the Greek *bíos* and *spháira* (= sphere). Space inhabited by living organisms, a unique and complex biological system that includes all living organisms on Earth and interacts with the physical environment.

Biotope – A *biotope* is defined as the ecological complex in which an animal or plant organism lives, and *biota* is the set of organisms (plants, animals, etc.) that occupy a given space.

Biotremology – The study of biological vibrations produced by particular organs of insects and other arthropods is called

biotremology. Among the first to study this phenomenon was Swedish entomologist Frej Ossiannillsson (1908-1995) in 1949. Treehoppers, which are close relatives of cicadas (homopterous hemipterans), communicate by an entirely different system from the acoustic system, namely by the vibrations they emit through their legs on host plants; their timbal is the homologue of the tympanum with which cicadas emit sounds. It appears that at least 200 thousand species of insects employ this communication system; the number goes up if we also include spiders, scorpions, crabs, nematodes, etc. This form of communication has been studied in cidnid Heteroptera, particularly of the genus *Tritomegas*, and only later was it discovered that scorpions of the genus *Paruroctonus* use vibrations to detect the origin and direction of possible prey. Scorpions, which have chelicerae, pincer-shaped pedipalps, used mainly for catching prey and for defense, and four pairs of legs, are covered with different kinds of sensory hairs and on the underside have a pair of sensory organs called “combs”, larger in the male and with more “teeth”; they are supposed to be used to detect the conformation of the ground they walk on and more importantly function as chemioreceptors of pheromones of individuals of their own species. Vibrations can also be used by some species of spiders to detect prey, such as by certain parasitoid Hymenoptera (e.g., braconids) to detect host insect larvae inside plant twigs on which they lay their eggs. In short,

these insects can detect any form of vibration coming from the earth and could be used to know in advance about certain ground vibrations from earthquakes or tsunamis.

Blastos – From the Greek *blastós* (= germ). Used in compound words.

Brachypterous – From the Greek, short wings; brachypterism is the phenomenon.

Bridge over the Strait of Messina – Currently, the longest suspension bridge in the world is the Dardanelles Bridge in Turkey, road only, no railroad tracks, which spans approximately 4.5 kilometers, with a suspended span of 2,023 meters and a height of 70 meters, allowing cruise ships to pass underneath. Next in length is the 1,991-meter single-span Akashi-Kaikyo Bridge in Japan, followed by a couple of bridges in China, 1,650 and 1,700 meters long respectively, the bridge between Sweden and Denmark, 1,624 meters long, and the Turkish Osmani Gazi Bridge across the Gulf of Izmit, 1,550 meters long. There are no bridges as long as the one that is to be built in the Strait of Messina, which is also to be designed for trains to cross.

For more than 50 years, there has been talk, with varying degrees of conviction, of the need to build a land bridge between Calabria and Sicily, which are currently connected by ships and hydrofoils. The challenge is considerable, as the distance to be covered in a single span is approximately 3.3-3.4 kilometers. In

fact, the seabed of the Strait is so deep that it does not allow for an intermediate interruption. The justification for such a bridge has always been vague and has referred to the growth of relations between the mainland and the island, economic growth and an overall improvement in infrastructure. Beyond the political issues and economic interests surrounding the construction of the bridge, let's examine the most recent facts concerning it. The most unique aspect of this project is the fact that there is €15 billion in state funding for a project with phased design stages; this means that the approval of the final design will take place in construction phases. Furthermore, we know that the bridge will be 65 meters above sea level, which means that some container ships and cruise ships will no longer be able to cross the Strait of Messina! In addition, the bridge will be supported by two cables on each side, presumably of adequate diameter, which will be very difficult to manage and, above all, difficult to test for resistance. It is important to emphasize that if one cable fails, the entire bridge will fail. As there is no executive project, there are obviously no tests of the combined effects of wind and traffic on the bridge (car and rail). What is the risk? The most easily conceivable is the famous "*cathedral in the desert*", i.e. the construction of land works, roads, tunnels, ramps and expropriations, for a total of 10 billion euros, for something that will not be possible to build and which at the

moment is expected to cost 5 billion, but which will undoubtedly increase over the years.

Another very important aspect to bear in mind is the so-called "*flutter*", consisting of self-perpetuating oscillations, i.e. oscillations that increase in intensity and danger over time due to winds. The best-known example is the Tacoma Bridge, which connected the towns of Tacoma and Gig Harrows in Washington State. Approximately 850 meters long, it was inaugurated on 1st July 1940 but remained standing for only 129 days. Although it was designed to withstand winds of up to 200 km/h, this bridge had shown a certain propensity for oscillations; on windy days, the oscillations were such that motorists saw the car in front of them disappear into the wave formed by the oscillating road. The serious problem came to an end at dawn on 7th November 1940, during a particularly windy day, when an abnormal loosening of the cables occurred. It was immediately evacuated and closed to traffic, but at 10 a.m. the dizzying oscillations of the central part of the bridge turned into twists, and the bridge seemed to turn into a rope, twisting in one direction and then in the opposite direction. The unstoppable swaying continued for 70 minutes, when even the last steel cable broke, causing the bridge to collapse, with only the two side spans remaining standing. In practice, the Tacoma bridge collapsed due to a resonance effect.

There are many challenges involved in a construction project of this kind, but some seem impossible to overcome: earthquakes. One significant difficulty concerns the area where the bridge is to be built, one of the areas with the highest seismic risk. Is it worth attempting such a daring construction project in an area where, on 28th December 1908, the fifth most destructive earthquake in human history occurred? According to the National Institute of Geophysics and Volcanology, there is an active fault beneath the planned pylon in Calabria, and the area is one of the most prone to seismic risk. An *active fault* is defined as a fault that shows evidence of movement over the last 40,000 years, so it is assumed that movement may still occur, while a *capable fault* is defined as an active fault considered capable of producing surface faulting, i.e. deformation or displacement of the ground surface or near it. A risk to the foundations is obviously a risk to the entire bridge. Despite these critical premises, the Ministerial Technical Scientific Committee approved the construction, albeit with 68 requirements, and the Environmental Impact Assessment Committee gave a positive opinion, albeit with 62 recommendations. According to the Report programme, there was a lack of impartiality throughout the procedure; in this latest Committee (which should be purely technical), 20 of the 50 members are political representatives of the three governing parties.

Another incredible aspect is that if the bridge cannot be built, which is certainly not unlikely given the circumstances, the Italian government would have to pay a very hefty penalty to the Eurolink Consortium, of which Webuild is a member. At present, there is no document detailing the precise costs of each component that will be part of the bridge, which is a fundamental and essential aspect of any project.

Finally, a few words about Webuild, the company that is supposed to build the bridge. It has been commissioned by Romania to build a bridge over the Danube in Braila. It will be a single-span bridge measuring 1,120 meters, with a total length of 1,975 meters, making it the second longest suspension bridge in Europe. The construction of this bridge over the Danube did not go very well; in fact, according to a report broadcast on Rai3 on 19th January 2025, a month after its inauguration (July 2023), waves of unevenness had already appeared in the asphalt, which had to be completely redone, and it was discovered that 400 bolts in the railings had not been screwed in. Was it excessive haste or poor materials? The same programme reported a fact that caused quite a stir in 2015: Pietro Ciucci, CEO of Società Stretto di Messina, in his capacity as president of Anas, inaugurated (again without testing) the Scorciavacche bridge near Mezzojuso on the Palermo-Agrigento motorway in December 2014, which collapsed on New Year's Eve 2015, less than 15 days after opening. Due to a series of

conflicts of jurisdiction, the trial for the persons under investigation was time-barred.

Three highly respected Italian engineers, Mario De Miranda, Federico M. Mazzolani and Santi Rizzo, recently published a scientific article entitled "*A 'suspension' bridge over the Strait of Messina: reality or utopia?*"; this is not the place to go into detail about the technical aspects of the authors' long and complex report, but here is a brief summary of the most significant points. The single-span suspension bridge solution of 3,300 m proposed for crossing the Strait of Messina and formalised in what was entitled the 2011 Final Design (far from being *final*) presents numerous objective critical issues, concerning: a) the scale of the single span, which goes well beyond the limits of current experience and raises doubts about its safe constructability; b) the high deformability and tendency to vibrate of the deck in relation to the safe transit of trains and vehicles; c) the results of aerodynamic investigations, which have so far shown possible effects of instability; d) the results of geophysical investigations, which highlight the presence of seismic faults in close proximity to the tower foundations and the anchor blocks on the Calabria side. Finally, the authors note that the critical issues identified have not yet been fully resolved in the "*Definitive 2011*" Project, which has remained unchanged until the end of 2024. Therefore, the full and safe feasibility of

the entire project in its current configuration is clearly called into question.

We like to draw a conclusion. Have you ever thought about travelling around Sicily by train? Imagine having to travel by train from Trapani to Syracuse, two cities at opposite ends of an island measuring 25,400 square kilometers. By car, you can cover that distance on the motorway in at least three and a half hours, but what about by train? If you search the Trenitalia website, the fastest train leaves Trapani at 11:24 a.m. and arrives in Syracuse at 10:38 p.m., just over 11 hours later, with four changes at railway stations, a real slalom. And if you are looking for a train to take you from Trapani to Messina, you can cover the approximately 300 kilometers in 8-9 hours with 3-4 changes. This is just to understand what a "*cathedral in the desert*" is, but the question to ask is: from a political point of view, would you have more appeal by proposing to fix the railways in Sicily or by creating a unique work in the world (perhaps or almost certainly unachievable)?

Butterfly – Butterflies are Lepidoptera and represent one of the most popular groups of insects. They are considered excellent ecological indicators for at least two reasons: 1) the larvae (caterpillars) are generally phytophagous, have mandibles and feed on plants, are sometimes monophagous (i.e. they feed on only one species of plant) and lead a completely different life from the adults; 2) the adults (butterflies) fly and

move around considerably (some species are known for their migrations), and have mouthparts equipped with a proboscis that collects nectar and pollen from flowers. Therefore, larvae and adults have very different ecological needs and, as a result, Lepidoptera are more threatened than many other orders of insects.

Cairomone – A chemical substance emitted by one species and perceived by another species; for example, a fly can use human sweat (in this case, a kairomone) to locate a suitable host for laying eggs.

Carapace – Part of the exoskeleton that protects the cephalothorax in crustaceans.

Carbon dioxide – See *Autotrophy* and *Decarbonization*.

Catabolism – From the Greek *kata-* (= down) and *metabole* (= change). Chemical reactions through which organisms break down food in order to absorb or eliminate the resulting parts.

Caterpillar – Lepidoptera larva.

Cecidophagy – Organisms that feed on galls induced by other organisms.

Cecidozoan – Vd. gall inducer.

Cell – From the Latin *cella* (= small cell). Term introduced into scientific terminology by the English physicist Robert Hooke (1635-1703). The microscopes he built, which used new optical systems and a new lighting system, enabled him to make a series

of discoveries that he described in his book *Micrographia*: from findings on the anatomy of insects to his famous discovery, in cork, of those cavities separated by walls, which he called *cells*, to observations on crystals that were essential to the nascent science of crystallography.

Cell pump – The best-known example is the sodium-potassium pump (Na+/K+ ATPase), which expels three sodium ions and transports two potassium ions into the cell. Also known as an ion pump, it allows ion exchange between the cell and its surrounding environment, more precisely allowing the exit of sodium ions, which are about 14 times more concentrated outside the cell, and the entry of potassium ions, whose concentration inside the cell is 10 to 30 times higher than outside. The presence of potassium in the diet of many animal species has a significant influence on their metabolism and is essential for species with a fast metabolism.

Coelom – From the Greek *koiloma* (= cavity). Body cavity that houses the internal soft organs in vertebrates, echinoderms and some warms.

Cerci – Pair of appendages inserted into the last urite, found mainly in the most primitive insect orders.

Chelicerates – The name Chelicerata derives from the Greek words *chele* (claw) and *keras* (horn), referring to the appendages called chelicerae, which are located in front of the

mouth and are often used to capture prey or for defence. It is a subphylum of arthropods, characterized by the presence of chelicerae. It includes the sea spiders, horseshoe crabs, and arachnids (including harvestmen, scorpions, spiders, solifuges, ticks, and mites, among many others).

Chelicerae – Appendages on the head of arachnids used to penetrate and anchor themselves to hosts and, in some cases, to obtain food.

Chickunguya – A viral disease that causes joint limitations, transmitted by the tiger mosquito *Aedes albopictus*.

Chilopoda – Class of the phylum Arthropoda, including centipedes and scolopendras, characterized by a pair of legs per segment.

Chitin – Polysaccharide from the exoskeleton of insects.

Chromosome – From the Greek *chrôma* (= colour) and *sôma* (= body). A strand of DNA molecules and proteins in the nucleus of eukaryotic cells that carries genetic information that can be passed on to subsequent generations. Homologous chromosomes are pairs of chromosomes found in diploid cells; each pair consists of one chromosome inherited from the mother and one from the father, and they contain the same genes in the same positions.

Circadian – From the Latin *circa* (= around) and *dies* (= day). It refers to certain phenomena in living beings that relate to daily activity.

CITES – Acronym for "Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora". In Italy it is enforced by the Forestry Carabinieri; among other things, it imposes restrictions on the export of certain animal and plant species, whether alive or dead. It is very useful to be informed about the provisions of the Convention by consulting the website 'https://cites.org/eng'.

Climate change – Oil is the most common fossil fuel. It is generally believed to have been generated by the transformation of decomposing biological material, such as zooplankton and phytoplankton, which remained buried underground for hundreds of millions of years, particularly during the Palaeozoic era (between 540 and 250 million years ago), when these marine organisms were extremely abundant. Due to rising temperatures and the covering of geological layers, chemical processes occurred at a depth of about three thousand meters that transformed this organic matter into oil. These hydrocarbons then tend to migrate towards the surface, appear on the outside (bitumen accumulations) or remain trapped inside porous impermeable rocks. Hydrocarbons can be found in a gaseous state (natural gas, such as methane) filling the

upper porosity, or in a liquid state (under pressure of hundreds of atmospheres) occupying the lower porosity.

The Report on the Limits to Growth, the study published by Meadows, Randers & Behrens in 1972, stated that 25% of the world's oil reserves would be depleted by 2000. According to data published by British Petroleum, the amount of oil used in 40 years (1969-2004) was 116 billion tonnes, and only 162 billion tonnes were expected to remain available. If these figures were truly reliable, we would have consumed more than 40% of the available oil and, at the current rate of extraction, it would run out around 2040 or shortly thereafter. Now, it seems obvious that there are no infinite reserves of fossil fuels and that those currently available and still active will sooner or later run out. Wouldn't it be wise for a far-sighted politician to start thinking about alternative energies? Of course it would, and this process began in the 2000s, but it has recently been reversed by short-sighted Arab and American policies that only look to the present. In this regard, the International Court of Justice (https://www.icj-cij.org/home) gave its advisory opinion on the duties of all states to protect the global climate system.

Chloroplasts – Organelles in autotrophic cells responsible for chlorophyll photosynthesis.

Clypeus – Front part of the head in insects, between the forehead and the upper lip.

Cnidaria – From the Greek *knída* (= nettle). Phylum comprising jellyfish, sea anemones, sea cucumbers, etc., characterized by possessing special stinging structures called nematocysts.

Cnidoblast – A cell typical of cnidarians that contains a stinging structure called *nematocyst*, consisting of a filament coiled around itself, which is expelled when subjected to even the slightest mechanical or chemical stimulus.

Coevolution – Parallel, almost synchronous evolution between two different species that interact with each other. Coevolution can occur between insects and plants (for example, in gall-inducing insects).

Coinobiont – Parasitoids are divided into coinobionts and idiobionts, depending on whether or not they allow the host insect to continue to develop and feed for a certain period of time. Coinobionts have a prolonged parasitic phase, during which rather complex physiological relationships can develop between the two symbionts; idiobionts, on the other hand, have a short parasitic phase, with simplified host-parasitoid relationships.

Collembola – Order of the class Entognatha, characterised by having the Tömösvary sensory organ behind the antennae, which perceives chemical and environmental stimuli. They also have a furca in the fifth abdominal segment. They do not have

compound eyes.

Color – It is determined by unabsorbed radiation, i.e. reflected radiation, which enters the visible range; therefore, color is determined by the absorption of visible radiation.

Commensalism – From the Latin *cum* (= with) and *mensa* (= table). Organisms that coexist and exploit the same food resources.

Community – From the Latin *communis*, *cum-munus*, meaning "performing one's duties together with others". A group of organisms united by common relationships and bonds, forming a single organism.

Coprophagia – Behaviour of organisms that feed on *faeces* (copros in Greek).

Crustaceans – Class of the phylum Arthropoda, characterized by the presence of two pairs of antennae, compound eyes and a variable number of appendages.

Cytokines – From the Greek *cito-* and *kynesis* (= movement). A group of proteins that do not function as antibodies, produced by certain cells (especially T lymphocytes) that have come into contact with a specific antigen, which act as intercellular mediators to initiate an immune response.

Cytoplasm – From the Greek *cito-* and *-plasma* (= inner part of the cell). Refers to what is found inside the cell, excluding the nucleus.

DDT – Dicloro-Difenil-Tricloroetano, an insecticide widely used until the 1970s and 1980s, which, together with its metabolite DDE, accumulates in predators through the food chain, causing a decrease in their reproductive capacity. It was the first modern insecticide and is undoubtedly the best known; it has been used since 1939, mainly to eradicate malaria. In Italy, it is particularly remembered for its use for this purpose in Sardinia, where the disease was endemic and its use led to its eradication. Its discovery as an insecticide is attributed to the Swiss chemist Paul Hermann Müller, who was searching for an effective product against lice, but its creation dates back to the Austrian chemist Othmar Zeidler, who synthesized it in 1873. It was chosen as a product to combat the *Anopheles* mosquito, responsible for spreading malaria, as it was believed that, although highly toxic to insects, it was harmless to humans. Initially, it was used successfully to combat the spread of malaria and typhus among both civilian and military populations. Swiss chemist Paul Hermann Müller was awarded the Nobel Prize in Medicine in 1948 "...for the discovery of the great effectiveness of DDT as a contact poison against many arthropods". In 1948, the entomologist Guido Grandi published a "*reflection*" on the dangers of using chlorinated derivatives in a speech in memory of Lionello Petri. In 1950, the Italian entomologist Giuseppe Salvatore Candura, director of the Phytopathological Observatory in Bolzano, published *Malefatte*

nel frutteto (Misdeeds in the Orchard), the result of five years of research into the damage caused by DDT in agriculture. These studies were subsequently taken up and validated by the Food and Drug Administration, which stated that "*in all likelihood, the potential risks of DDT had been underestimated*" and placed certain restrictions on its use. In 1962, the American biologist and environmentalist Rachel Carson published the book *Silent Spring*, which denounced DDT as a cause of cancer and harmful to bird reproduction, thinning the thickness of eggshells. The book caused a public outcry, resulting in DDT being banned for agricultural use in the US in 1972 under pressure from the environmental movement, and in Italy in 1978.

Decarbonization – The global energy system requires a major transformation in the way energy is supplied, transported and consumed. Energy production and use account for more than 75% of the EU's greenhouse gas emissions, and currently almost 75% of the EU's energy comes from fossil fuels. The implementation of the EU Green Deal (see below "Green Deal") consists of a series of proposals to transform policies on climate, industry, energy, transport, etc. in order to reduce greenhouse gas emissions by at least 55% compared to 1990 levels by 2030. The European Union (EU) aims to become the first climate-neutral continent by 2050. The transition to renewable energy requires increased investment by the EU in renewables. It is

undoubtedly an ambitious project and it will be very difficult to achieve it by the deadline, given the international political changes and the scepticism (and, we would say, ignorance) of a large percentage of politicians around the world on these issues.

Detritivores – Organisms that feed on organic debris.

Detritivory – Behaviour of species that feed on organic debris.

Deuterostomes – These are characterized by having a so-called coelomatic cavity, a cavity that encloses the internal organs, of mesodermal origin. They include echinoderms and vertebrates. See also *Protostomes*.

Diploid – From the Greek *diploon* (= double). Cells with double homologous chromosomes. Indicated by 2n.

Diplopoda – Class of the phylum Arthropoda (millipedes), characterised by two pairs of legs per segment.

Diplura – Order of the class Entognatha characterized by the absence of eyes, the presence of lateroventral sensory organs, and the presence of styles and cerci.

Dipnoans – They are also known as lungfish, as they have a primitive lung that allows them to obtain oxygen from the air as an alternative to breathing with gills, which is typical of fish. They appeared at least 400 million years ago and most are now extinct; however, six species belonging to three families still live today in freshwater in the Amazon, Australia and Africa.

Diptera – From the Greek *dípteros* (= two wings). Order of the class Insecta characterized by the presence of only one pair of wings, the second pair being reduced to two halteres.

Diversity – In ecology, it refers to the variety of different organisms; it is one of the parameters that contribute to biodiversity. There are numerous mathematical indices that measure diversity or specific richness; the best known is the Shannon-Wiener index (see below).

DNA – Deoxyribonucleic acid; a chemical substance that makes up genes. It consists of two chains, linked together by pairs of bases: adenine (A) and thymine (T), guanine (G) and cytosine (C). It has a typically right-handed helical structure.

Dominant – In a pair of alleles, it is the one that dominates over the recessive allele; the dominant allele is the one that manifests itself in the phenotype.

Dunes – One of the most fragile ecosystems in the Mediterranean is that of sandy coasts, dunes and dune-behind environments, which, particularly in Italy, can be considered endangered, along with the species that inhabit it. Coastal and sub-coastal beaches and dunes, and the silty-sandy wetlands behind the dunes and along the coast that are often associated with them, are among the most vulnerable and seriously threatened ecosystems in the world. At least three types of dunes found in Italy are considered priority habitats by the European

Habitats Directive 92/43; as they are at risk of disappearing, the European Union has a particular responsibility. Labelling environments would be pointless without the commitment of Member States to protect those habitats; yet many dunes are regularly levelled by bulldozers every year, on behalf of certain municipalities that have an interest in growing tourism in their area. Environmental protection is the last thing on the minds of local administrators, who are only concerned with revenue for the municipality.

Dunning-Kruger Effect – Shakespeare already wrote in '*As You Like It*': "The wise man knows he is stupid, it is the stupid man who thinks he is wise". The socio-psychologists David Dunning and Justin Kruger wrote that the distortion stems from an internal illusion in people with low ability and their external misperception of highly skilled people, and concluded that: 'The misjudgment of the incompetent stems from a misjudgment of one's own account, while that of the highly competent stems from a misunderstanding of the account of others'. The Dunning-Kruger effect is a cognitive distortion in which low-skilled and inexperienced individuals in a field tend to overestimate their own preparation by wrongly judging it to be above average. The distortion is related to the cognitive bias of illusory superiority and results from people's inability to recognize their own lack of ability. The two researchers Dunning and Kruger hypothesized that, for a given skill, inexperienced

people: 1) would tend to overestimate their own skill level; 2) would not realize the actual skill of others; 3) would not realize their own inadequacy; 4) would not realize and would not recognize their own previous lack of skill if they received training for the task in question.

Ecdysis – From the Greek, deprivation; also known as moulting, it is the process of loss and reforming of the surface layer of the integument in arthropods and other animals.

Ecdysozoa – Include Nematoda and Arthropoda.

Eco-anxiety – This is a new form of psychological stress, dependent on awareness and concern about climate change, environmental disasters and their impact on the environment. This stress, which is much more widespread than one might imagine, manifests itself through feelings of anxiety, fear, sadness and, above all, helplessness in the face of the global environmental crisis.

Ecological footprint – The term "*ecological footprint*" refers to the average amount of productive land and sea that each individual person appropriates for his or her own consumption of food, water, energy, transport, trade, waste absorption and for housing; in practice it measures man's use of the Planet's resources. It seems that the current ecological footprint has already exceeded the sustainable measure for the planet for many years, more than thirty. In the last fifty years,

the ecological footprint has more than doubled. Humanity's wellbeing depends on being able to produce food and minimize waste. Biological capacity (see '*biocapacity*') is the amount of biologically productive land and sea area available in a given region or country. We must obviously try to balance the relationship between supply and demand in strictly ecological terms; we need to know what the locally and globally available biocapacity is and how much of it we are using. So, to summarize, by ecological footprint we mean the biocapacity that we are using, it is a measure of human use of the resources of the biosphere, i.e. the amount of land and sea surface, biologically productive, needed to meet the needs of a population. If one makes a comparison between the ecological footprint and the biocapacity of a country or of the world as a whole, one can appreciate whether the ratio is more or less in deficit. Due to the globalized economy and the almost unlimited capacity for transport, mankind's demand for resources has exceeded the Earth's natural productive limits by 25 per cent.

Ecology – From the Greek *ôikos* (= house, environment) and *–logía* (= discourse). The first person to use the term was the Jena biologist Ernst Haeckel, who introduced the word in its German form Oekologie in his 1866 work *Generelle Morphologie der Organismen*. Ecology deals with populations, communities, ecosystems, biomes and the biosphere, studying the interactions between organisms and the environment and

integrating biology with physics and chemistry. Due to the vastness of the subject, many define themselves as "*plant ecologists*" or "*animal ecologists*", but there is only one ecology, and interactions are recognized at all levels, between animal, plant and microorganisms.

Ecosystem – According to the Treccani dictionary, an ecosystem is the fundamental functional unit in ecology, i.e. the set of living organisms and non-living substances with which the former establish an exchange of materials and energy, within a defined area.

Ecotone – Marginal zone, transition zone between one habitat and another; generally the most species-rich environment.

Ectoderm – From the Greek *ecto-* (= outside) and *dérma* (= skin). It is one of the three layers of cells that form during embryonic development of triblastic organisms.

Ectognatha – Class of the phylum Arthropoda, superclass Hexapoda, which includes Archaeognatha, Zygentoma and Pterygota. Also known as Insecta, they are characterized by mandibles and jaws that are not hidden in the mouth cavity. Apterism in ectognaths is acquired, not primitive.

Ectotherms – Animals that cannot regulate their body temperature, as they lack a central nervous system regulation mechanism and their body temperature depends on that of the

surrounding environment; these include all lower vertebrates (fish, reptiles and amphibians).

Edeagus – Male chitinous genital organ of insects.

Elytron – From the Greek *élytron* (= casing). Elytra are the completely sclerotized wings of beetles that serve as protection for the pair of membranous hind wings suitable for flight.

Embryo – From the Greek *émbryon* (= growing inside), composed of *en-* (= inside) and *brýein* (= to sprout).

Emigration – From the Latin *emigrare*. Active movement of organisms from one geographical location to another, without return. See also Migration.

Endemism – Taxa whose distribution is limited to a geographically confined area, often small and localised, are defined as endemic; endemism is the phenomenon. The number of endemic taxa contributes significantly to the recognition of a *hotspot*.

Endoderm – From the Greek *éndon* (= inside) and *dérma* (= skin). It is one of the three layers of cells that form during embryonic development of triblastic organisms.

Entognatha – Class of the phylum Arthropoda, superclass Hexapoda, which includes Collembola, Protura and Diplura. Characteristic features are the mandibles and maxillae hidden inside the mouth cavity. Apterism is primitive.

Entomophagous – From the Greek *éntomos* (= insect) and *–phagos* (= feeding). Organisms that feed on insects.

Environmental organizations – Decades have passed since the 1960s, yet Italy has not developed a particular type of awareness, and true environmental consciousness has not spread. This awareness should have emerged as early as 1962, when biologist Rachel Carson published her book Silent Spring, in which she made a cold and serious analysis of the ecological and environmental situation. The metaphor of the silent spring derived from the risk posed by DDT (see above), which had emerged in those years and caused a dramatic decline in the reproductive success of many birds, which could no longer be heard singing. These were the years of the economic boom that had blinded almost everyone, with profit and money largely distracting attention from environmental problems, despite the fact that the International Union for Conservation of Nature (IUCN) had been founded in 1948, Italia Nostra in Italy in 1955 and Pro Natura Italica in 1959 (actually a name change of the Italian movement Protezione della Natura, founded in 1948 in Val d'Aosta). In 1961, just before the publication of Rachel Carson's book, the World Wildlife Fund (WWF) was founded in Switzerland, a sign of the growing need to do something to protect the environment, and it quickly spread to all Western countries, arriving in Italy in 1966. It immediately attracted a large number of members, most of whom came from

spontaneously formed groups, motivated by the desire to stop degradation and pollution and eager to initiate a process of respect for natural resources. In 1965, the National League Against the Destruction of Birds was also founded in Italy, a small association that later grew under the new name of the Italian League for the Protection of Birds (LIPU), evolving to represent BirdLife International in Italy. A few years later, in 1971, another important international movement was launched, Green Peace, initially as a protest against nuclear testing, and in 1972, the first United Nations Conference on the Environment was organized in Stockholm, in the wake of which numerous environmental and cultural groups organized many other demonstrations, with increasingly large numbers of participants, often anti-nuclear. Greenpeace is a non-violent, independent association that uses direct, concrete action to denounce environmental problems and promote alternatives for a green and peaceful future. It does not accept funds from public bodies, companies or political parties. It was founded in 1971, the year in which its founders set sail for the Arctic to stop nuclear testing. Today, Greenpeace's fleet of four ships crosses the oceans to defend the planet and denounce environmental crimes. It is present in 55 countries in Europe, America, Asia, Africa and Oceania, with national and regional offices. Its members include long-standing pacifists, journalists, trade unionists, lawyers, illustrators and many others. Greenpeace, in

collaboration with the TV programme Report (Rai3), recently discovered that since mid-2024, ghost ships belonging to the Russian fleet have been transferring crude oil in the waters off the Gulf of Augusta, a few hundred meters from Italian territorial waters, circumventing European sanctions against Russian oil. This is happening because there is a lack of vigilance on the part of the Italian authorities. Beyond the political issue, these ships are old and dilapidated, poorly maintained and therefore dangerous for our waters in the event of an accident; since they fly the flags of states that are indifferent to international regulations, it would be difficult to obtain compensation in the event of environmental damage.

The youngest Italian environmental association, Legambiente, founded in 1980, was the heir to the first environmentalist groups and the anti-nuclear movement that developed in Italy and much of Europe in the second half of the 1970s, inspired by the thinking of Arne Naess (act locally, think globally). A drastic renewal of nature conservation had taken its first steps in 1972, with deep ecology, during the Conference on the Future of the Third World held in Bucharest. Norwegian philosopher Arne Naess spoke in peremptory terms, insisting that all living beings have an equal right to live and rejecting the concept that man is at the center of everything. The anthropocentric view had to be replaced by an ecocentric view, according to which nature must be protected for its own sake, for its intrinsic value, regardless

of its usefulness to man. The most interesting aspect of this thinking is "*act locally, think globally*", rethinking human society and man's place in the context of nature. Deep ecology became widely known in Europe in 1973 and in the United States in the 1980s, when an environmental movement with aims very similar to those of Eastern religions, derived precisely from Naess's deep ecology, was very active. Also in 1972, the report "The Limits to Growth" was published, which the Club of Rome (made up of a group of philosophers, scholars and entrepreneurs) had commissioned from the Massachusetts Institute of Technology. It is a well-documented milestone that warned of the problems of pollution, human population growth and the depletion of natural resources. The most significant impact of this report was undoubtedly the growth of ecological awareness, the emergence of an environmental debate and a clear stance taken by researchers and intellectuals against irrational development. Of course, all this was not enough to stem the tide of economic and political decision-making at the international level, but it is reasonable to assert that without this awareness there would not have been so many environmental struggles for the conservation of natural resources and so much speculation would have found more fertile ground. And there probably wouldn't have been any international conferences on the environment.

The Wildlands Project, which began in 1992 with a declaration by Dave Foreman, John Davis, David Johns, Reed Noss and Michael Soulé that they wanted to "*help protect and restore the ecological richness and indigenous biodiversity of North America through the establishment of a system of interconnected nature reserves*", was also of some importance. ... "*The Wildlands Project aims to establish reserves to protect natural habitats, biodiversity, ecological integrity, ecological services and evolutionary processes, i.e. vast interconnected areas of authentic wilderness. We reject the idea that wilderness is simply an attribute suitable for defining a remote scenic area suitable for hiking*". It was created within the Society for Conservation Biology, founded in 1987 with the aim of intervening in the social fabric to stimulate and implement initiatives useful for the conservation of biodiversity. In Europe, a similar project entitled Pan-European biological and landscape diversity strategy was proposed in Sofia in 1995. The Sofia meeting was preceded by a study commissioned by the European Union from a Dutch research institute in Wageningen (Department of Physical Planning and Rural Development), the results of which were published in 1993 by Rob H.G. Jongman under the title Tentative Ecological Main Structure for the European Community. There is no doubt that the European Union has been very committed, with ups and downs, to nature

conservation. In fact, the Habitats Directive, through which the Natura 2000 sites were established, dates back to 1992.
Environmental movements have had the merit of keeping public opinion alert to certain ecological and conservation issues, perhaps on certain occasions with an excess of catastrophism, which at times may have caused reactions opposite to those expected. Today, the approach is slowly changing, with attempts to focus on involvement rather than guilt, on love rather than justice, and on the potential of each individual as an alternative to catastrophism. Individuals must be involved and become an active part of the processes of conservation and protection of biodiversity, participating in every small environmental action, from separate waste collection to saving natural resources (water, non-renewable energy, etc.), participating in the fight for the eco-sustainable use of resources, for a change of course in the exploitation of renewable and clean energy, and even critical awareness in the choice of consumer products that bear the mark of more environmentally friendly companies. During the Third World Congress on Environmental Education, held in Turin between 2 and 6 October 2005, numerous teachers and environmental educators from all over the world complained that environmental education is seen as something episodic, a subject like any other, whereas, precisely because of its interdisciplinary nature, it should be a starting point for education in relationships, both between different teachers and

between teachers and students. This is probably a view of school and teaching that is not very common in Italy, and the responsibility is shared equally between teachers and the political and administrative world. Developed countries differ from less developed countries in terms of both economic resources and knowledge; this should make us reflect on the importance of public economic investment in education, teaching and research in richer countries. This growth would undoubtedly help less developed countries. Education is the fundamental basis for improving living conditions and supporting the conservation of natural resources. Information is the best antidote to ignorance.

In February 2015, some Dutch Feyenoord fans damaged the side decorations of the Barcaccia (Rome, Piazza di Spagna), a work of art sculpted by Gian Lorenzo Bernini and his father. This is not the first case of vandalism against sculptures; many will remember that Michelangelo's Pietà (Rome, St. Peter's Basilica) was also attacked with a hammer by a madman. The media and the press generally comment on these events at length and with words of indignation. This is certainly correct, but such indignation is almost never present when a piece of our planet's natural history is lost, when a species becomes extinct. It seems more reasonable to argue that the extinction of a species caused by humans should be considered a worse crime than the destruction of a sculpture, but this may appear to be an

iconoclastic view of the humanistic culture that characterizes our society. People generally regard the works of human talent with deference, much more so than the works of Nature, and public opinion is much more emotionally involved when it comes to the works of human talent.

Our culture is essentially permeated with humanism. In high schools, students study the history of philosophy, but not the history of science. Our lack of scientific culture stems from this humanistic culture, and it is precisely because of this anti-scientific tradition that the works of human ingenuity and talent are generally viewed with respectful consideration, while nature is still considered to be in the aesthetic and recreational sphere. In this regard, we recall that Letizia Moratti, when she was Minister of Education, proposed removing evolution from the compulsory school curriculum; and it was in opposition to this decision that Darwin Day began to be celebrated in Italy. The Minister of Education, Giuseppe Valditara, is a Legionary of Christ and teaches at the European University of Rome (where other Legionaries of Christ also teach). He has proposed changing school curricula to include the study of the Bible, but certainly not that of nature. Roberto De Mattei was also a Legionary of Christ and was appointed vice-president of the CNR by Minister Gelmini. For those who may have forgotten, De Mattei organized the conference "*Evolutionism, the decline of a hypothesis*" at the CNR headquarters and then published a

book with the same title, with CNR funding. Who knows what texts inspire someone to come to the conclusion that evolution is only a theory!

When Charles Darwin and Alfred R. Wallace proposed the theory of natural selection in 1858, they were inspired by Malthus' economic prophecy about the limited nature of global resources. If we measure our progress solely in terms of economic wealth, then we ignore much of what it means to be an inhabitant of this planet. The arrogance of humanism lies in considering only parameters such as gross domestic product, trade balance and competitiveness index, without giving due value to nature, biodiversity and the ecosystem services of the earth we live on.

Enzyme – From the Greek *én* (= inside) and *zýme* (= yeast). A protein molecule that catalyzes specific chemical reactions in other substances without being destroyed or altered after the reaction is complete.

Epiphysis – Also known as the pineal gland, it receives light signals through the retina of the eye and regulates circadian rhythms through the synthesis of melatonin.

Epigeous – From the Greek *épigeios*, composed of *épi*, above, and *ge*, earth; complex of organisms that occupy surface habitats, as opposed to hypogeous, which refers to underground forms.

Ergotism – A term derived from the French word "*ergot*" (= spur), referring to the black, horn-shaped tip that the fungus *Claviceps purpurea* produces on ergot-infected rye. Ergotism, known since the 17th century, led French scientists as early as 1676 to convince the authorities to ban the use of rye instead of wheat for making bread. In fact, it could be fatal and had devastating effects on the communities affected, causing neuroconvulsive symptoms, hallucinations and superstition, which were widespread in agricultural environments. In 1853, French botanist Louis René Tulasme identified and described the reproductive cycle of *Claviceps purpurea*, finally shedding light on the causes of ergotism. Farmers generally knew how to recognise plants affected by "*black horns*" and discarded them. Despite this, in the past, a lot of rye flour containing the hallucinogenic fungus was sold.

Eukaryotes – From the Greek *eu-* and *káryon* (= nut, nucleus). Eukaryotic cells contain DNA in a nucleus, rather than scattered throughout the cytoplasm, as in prokaryotes.

Eusociality – From the Greek (good sociality), it is the highest level of social organization in animal organisms; the term was coined by Suzanne Batra in 1966 for alictid Hymenoptera.

Evolutionary convergence – Similar characteristics found in organisms that are evolutionarily distant from each

other; examples include Mantidae (Mantodea) and Mantispidae (Neuroptera).

Extinction – It occurs when the last reproductive unit of the last population dies, even when some individuals are still alive but unable to reproduce. On 1st September 1914, Martha, the last living specimen of the Passenger pigeon *Ectopistes migratorius*, died at the Cincinnati Zoo (Ohio, USA). It was certainly one of the most unexpected extinctions of birds, because this gregarious pigeon numbered 3-4 billion individuals between southern Canada and Virginia in the early decades of the 1800s. In the early 1900s, it lived only in domestication; the Cincinnati Zoo had an aviary with a small flock of these birds, including George and Martha. Martha was widowed on 10th July 1910, and four years later, the species became extinct forever.

This, like the sad stories of the Great auk *Pinguinus impennis* that lived in Iceland and Greenland, the Dodo *Raphus cucullatus* from the island of Mauritius and other extinct birds, should have been lessons that forced us to protect the nature around us, but this did not happen. The extinction of the Passenger pigeon, the Great auk and the Dodo occurred when they encountered humans; these birds are now icons of extinction due to human destructive activity. Many pieces of the biodiversity mosaic, birds, insects, plants and other organisms, even if abundant, could disappear in a few years due to human activities, the activities of those 8 billion people who inhabit this

wonderful planet. Although the passenger pigeon evolved to avoid the impact of predators, it failed to avoid the direct impact of humans.

It seems paradoxical, but a much larger animal was saved while the Passenger pigeon became extinct. In fact, the American bison *Bison bison* could have suffered a similar fate: in 1884, its population reached a low point of less than 1,000 individuals in the plains of North America, where there had once been 30 million! However, it was saved and today there are about 500,000 individuals.

The factors causing species extinction are: i) biotic factors (competition, predation, parasitism and disease); ii) isolation; iii) habitat alteration (slow geological changes, climate, disasters, direct human action). The main factors contributing to species extinction today are probably habitat loss and fragmentation, but in the case of the Passenger pigeon, direct human impact accelerated the extinction process. The largest Holocene extinction event occurred in the Pacific islands, where late Quaternary fossils have revealed the loss of thousands of bird populations following human colonization of the region. Two-thirds of the populations on these islands became extinct in the period between the first arrival of humans and contact with Europe, with extinction rates linked to island characteristics that increased susceptibility to hunting and habitat destruction. It has been calculated that human

colonization of remote Pacific islands (over the last 1,000-4,000 years) has caused the global extinction of approximately 1,000 non-passerine bird species; seabirds and passerines, which could add to the total number of extinctions, were excluded from the calculation.

Since 1500, 131 bird species have become extinct, another 15 species considered critically endangered are probably extinct, and four other species live only in domestic conditions and are extinct in the wild. The extinction rate is 0.30 per year, but if we reduce the period to 1900, the total number of extinct species is 59 and the extinction rate is 0.56 per year. Even among wading birds, there are species that are becoming extinct. For example, the Eskimo or Boreal Curlew *Numenius borealis* was once very abundant in the tundra of western Canada and Alaska. At the end of the 1800s, at least 2 million individuals were killed each year. In 1863, an autumn flock was observed in Nantucket, a small island off the coast of Massachusetts; there were thousands of individuals, which exhausted the ammunition of the island's hunters, and 7-8,000 were shot down! This species is now considered extinct! Another wader, the Slender-billed Curlew *Numenius tenuirostris*, once common in winter in Western Europe, was considered extinct in 2024; all that is known is that it nested in an area of Russia. The only species of Parrot in North America, the Carolina Parakeet *Corunopsis carolinensis*, also became extinct in the last century.

A lesser-known case with a very high risk of extinction is that of the Common Bottomquail *Turnix sylvaticus*, widespread in the 19th century in various Mediterranean regions, now present only with a few pairs in a small area of Morocco, where it can be considered on verge of extinction. Undoubtedly, when the Mediterranean population disappears, there will be no individuals available for reintroduction projects, as the Asian and sub-Saharan populations are biometrically (and perhaps genetically) different. Therefore, we will probably lose this endemic Mediterranean taxon forever.

According to the biodiversity paradox, all species that lived in ancient times are now extinct, and the number of living species is higher than in the past. According to some estimates, 99% of species have become extinct since 3.5 billion years ago; therefore, a very large number of chrono-species have succeeded one another to produce the current specific diversity. Of course, the risk of extinction is different for each species. The current rate of bird extinction is probably between 100 and 1,000 times higher than that of natural conditions, as mentioned above, mainly due to humans. Many species in Europe are in decline, some of which were very abundant only a couple of decades ago, such as the Turtle dove *Streptopelia turtur*, which is now in decline in Europe but was still a very abundant migrant in the 1990s. This consideration brings us back to the sad fate of the Passenger pigeon; in fact, not only endemic species limited to

small areas or islands, but also very common and widespread species living in continental regions can face a fatal fate, for one of the reasons mentioned above, in particular habitat alteration due to human activities. There is no doubt that humans are destroying biological diversity at an alarming rate.

Fibonacci – Leonardo Fibonacci (c. 1170-1242) from Pisa is considered one of Italy's greatest mathematicians; the Republic of Pisa granted him a lifetime pension that allowed him to devote himself entirely to his studies. He is known for the "*Fibonacci sequence*": 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 ..., in which each number is the sum of the two preceding it. This sequence appears to be present in various natural forms, such as the spirals of shells. The Fibonacci sequence is also interesting from a mathematical point of view, as the ratio between successive pairs of numbers tends towards 1.61803, known as the golden ratio.

Food chain – Vd. Food web.

Food web – It is the set of trophic relationships between organisms in an ecosystem. It can be said that every ecosystem has its own food chain or food web, a sort of pyramid of trophic relationships between different organisms with different trophic levels, from predators to consumers and decomposers of different levels. At each step of the food web, a large amount of potential energy (80-90%) is consumed in the form of heat and, as a result, a food web is generally quite short vertically; in fact,

in order to have numerous vertical trophic levels, the food web must have a rich primary production.

Foresis – This is a mode of transport used by some arthropods; some insects are carried by other insects, and even some pseudoscorpions can cling to large winged insects to be transported from one place to another.

Fossil – In palaeontology, "*fossil*" refers to intact or partial remains of organisms that lived in geologically ancient times. The term was introduced by Gregorio Agricola to describe what could be obtained from the earth by digging. Subsequently, it was used only for animals and plants. Fossilization is a rare event as it occurs in the following ways. The organism must be buried immediately after death and not degraded by other destructive organisms; as it does not undergo putrefaction, it remains buried in mud and then slowly (a process that can take millions of years) mineralizes completely. Obviously, it is almost impossible for the soft parts of an organism to fossilize.

Furca – A bifurcated appendage under the abdomen of springtails, which allows them to make remarkable jumps.

Gaia theory – In its initial formulation, the Gaia hypothesis is based on the assumption that the oceans, seas, atmosphere, Earth's crust and all other geophysical components of planet Earth are maintained in conditions suitable for life thanks to the behavior of living organisms. For example, temperature,

oxidation state, acidity, salinity and other chemical and physical parameters that are fundamental to the presence of life on Earth have constant values. This homeostasis (i.e. the regulation of the physical and chemical environment at a level close to that favorable to life) is the effect of active feedback processes carried out autonomously and unconsciously by the biota, i.e. the complex of animal and plant organisms that occupy a given space in an ecosystem. Furthermore, all these variables do not maintain a constant balance over time but evolve in synchrony with the biota. Therefore, evolutionary phenomena do not only concern organisms or the natural environment, but the entire Gaia. In 1979, James Lovelock developed his ideas in detail and stated that the physical and chemical conditions of the Earth's surface, atmosphere and oceans have been and are actively maintained as suitable and favorable by the very presence of life. The author is aware that this contrasts with conventional views that life has adapted to the conditions of the planet and evolved in separate ways. According to this theory, the entire Earth has homeostasis capabilities, meaning that it maintains the physical and chemical environment at a level conducive to life, and all cycles involving matter and energy are self-regulating in order to allow for an optimal balance in the biosphere. In this sense, the theory sees the entire living mass on Earth, from microorganisms to the largest trees and vertebrates, as a single living entity, a kind of *superorganism* consisting of all the

organic and inorganic structures of the planet, closely connected to the Sun, the result of the global interconnection between life, soil, oceans, and the atmosphere. The Gaia hypothesis is based on the observation that the oceans, seas, atmosphere, Earth's crust, and all other geophysical components of planet Earth are maintained in conditions suitable for life thanks to the behavior of living organisms; temperature, oxidation state, acidity, salinity, and other chemical-physical parameters fundamental to the presence of life on Earth have constant values.

Gaia predicts that the evolution of living organisms must be closely related to the evolution of their physical and chemical environment; together they constitute a single self-regulating evolutionary process. Therefore, the climate, the lithological composition of the earth, the air, and the oceans would not be determined solely by geological history, but would also be a consequence of the presence of life on Earth. It is precisely thanks to the incessant activity of living organisms that conditions have remained favorable for life on the planet for over 3.5 billion years. In Gaia's hypothesis, the biosphere consists of all living organisms on Earth. Gaia is the planetary life system that includes everything that is influenced by and influences the biosphere; plants, animals, and microorganisms influence the climate and the surface environment, and the planet as a whole is considered a biological *superorganism*, capable of self-regulation, which lives thanks to solar energy,

breathes, transforms its own biomass, 'gets sick' (greenhouse effect), and may risk collapse. The guiding principle is that our planet comprises the atmosphere, solar energy, water, the Earth's crust, and ecosystems.

Gall – A physiological manifestation of abnormal growth in plant tissue, with a more or less constant shape and structure, produced as a defensive reaction in response to the action of certain arthropods, which lay their eggs on or inside the plant tissue. There are numerous gall-inducing insects belonging to the Hymenoptera Cynipidae and Diptera Cecidomyiidae, but other groups of insects (other Hymenoptera and Coleoptera) and even mites can induce galls on certain plant species.

Gall inducer – Species-specific arthropod that induces gall formation.

Gamete – From the Greek *gamétes* (= spouse). Each of the sex cells of animals and plants that fuse during the process of sexual reproduction.

Gene – From the Greek *génesis* (= generation). Term first used in 1909 by Danish geneticist Wilhelm Johannsen (1857-1927).

Genetic code – The set of 64 combinations of nitrogenous bases in DNA, taken three at a time, encoding the 20 aminoacids. It can be considered the basis of life.

Genetic drift – As a result of chance, the frequency of a gene can increase or decrease from generation to generation; in

populations that are too small, the frequency of alleles no longer respects the ratio between homozygotes and heterozygotes, and there may be a high presence of recessive homozygotes. See also Natural selection: the case of *Biston betularia*.

Genetics – The science that studies the mechanisms of hereditary transmission of characteristics.

Genome – The genome comprises all the genetic material contained in the chromosome set of an organism.

Genotype – Set of all the genes that make up DNA. See *Phenotype*.

Gondwana – Alfred Lothar Wegener (1880-1930) coined the term Pangaea (from the Greek = whole earth, single land), a continent that in the late Permian period (about 260 million years ago) included North America, South America, Europe, Africa, India, and Australia, i.e., a land that collectively constituted a single block of all emerged surfaces. About 140 million years ago, Pangaea was divided into two parts, one in the northern hemisphere, corresponding to Laurasia, including present-day Eurasia and North America, and another in the southern hemisphere, for which the Austrian Eduard Suess (1831-1914) coined the name *Gondwana*, a large landmass consisting of present-day India, Africa, South America, and Australia; it was named after the Gondi, inhabitants of central India. Its most important parts, South America and Africa,

subsequently began to break away, with South America slowly moving westward. This continental drift caused the formation of remarkable mountain ranges, such as the Andes, stretching from Venezuela to Chile, and consequently an important river system that produced the vast Amazon basin. Between 750 and 580 million years ago, the Earth's surface was almost completely covered with ice; the Sun provided less energy and the ice sheet expanded, increasing its ability to reflect heat (albedo) and thus further lowering the temperature. The land masses were still concentrated around the colder latitudes, which contributed to a further drop in temperature. However, this was counteracted by volcanic eruptions that increased carbon dioxide in the atmosphere and caused a significant greenhouse effect, which is sadly well known today, but which at the time allowed the perennial ice to melt. The most stifling climate occurred about 100 million years ago, in the Cretaceous period, when the average temperature was around 22 °C, i.e., 7 °C higher than today.

Green Deal – Spain has a Ministry of Ecological Transition; based on this model, in 2021 the Italian government approved the creation of the Ministry of Ecological Transition, which, in addition to the responsibilities of the former Ministry of the Environment, was also supposed to have some key functions for ecological transition, mainly in the energy sector. It was a short-lived ministry because, in 2023, with the change of government,

it changed its name again, becoming the Ministry of the Environment and Energy Security. 2022 and 2024 were characterized by extremely hot and dry summers, a record for the last 200 years, with the Marmolada glacier losing four meters of ice thickness in the summer of 2022 alone. The Italian government, like all other EU member states, has committed to limiting temperature increases, both to slow down the melting of glaciers and to restore environmental conditions to a balance that has been lost over the decades. In fact, on 29th July 2021, the European Union issued Regulation 2021/1119/EU, which establishes a general framework on climate and commits Member States to reducing greenhouse gas emissions by 55% by 2030 compared to 1990 levels, as part of the decarbonization commitment launched by the European Commission in the 2019 Green Deal. According to Article 2 of this Regulation, the balance between greenhouse gas emissions and removals across Europe can be achieved by 2050, thereby reducing net carbon dioxide emissions to zero. The commitment to climate neutrality has a deadline of 2050, but once again the ecological vision of managing the planet is losing momentum in the process; in fact, the Italian government continues to insist on achieving "*nuclear fusion*" within ten years (see "*nuclear*" below). The European Union's industrial policies envisage accelerating the green transition; the Green Deal industrial plan envisages the transformation of industry to net zero emissions and setting

Europe on the path to climate neutrality. This is undoubtedly a challenge that every EU country will have to help to achieve.
The EU's new industrial strategy aims to become more competitive by reducing carbon dioxide production (see "*decarbonization*") through new technological solutions and a clear green footprint. The industrial carbon management strategy adopted by the EU in February 2024 guarantees investment in technologies capable of capturing and storing carbon in a sustainable manner and reusing it, with the aim of achieving climate neutrality by 2050. However, international political changes are causing some scepticism about the possibility of achieving these objectives.

Grooming – Body cleaning behaviour in most animals.

Gymnosperms – They are generally woody plants with needle-shaped or squamiform leaves and include more than 1,000 species. Gymnosperms originated in the late Carboniferous period, replacing the lycophyte rain forests of the tropical region. Most of the present-day Gymnosperms are conifers (Pinophyta), such as firs (*Abies* and *Picea*), larch (*Larix*), giant sequoia (*Sequoiadendron*), pines (*Pinus*), Juniperus (*Juniperus*), and Cypresses (*Chamaecyparis* and *Cupressus*). Unlike Angiosperms, the seeds of Gymnosperms are not formed inside an ovary, which becomes the fruit, but are naked and arranged on the scales of a strobilus (or pine cone), or similar structure (such as the pine nuts of the stone pine).

Gymnosperms are heterosporeal: they produce microspores (male) that develop in the pollen sac (microsporangium) and macrospores (female) that remain enclosed in the ovule (macrosporangium). Following fertilization, an embryo develops which, together with the cells of the ovule, is transformed into the seed (sporophyte).

Habitat – From the Latin *habitat* (= dwelling place). The term entered widespread use in English in 1796, in French in 1812 and subsequently in Italian; being of Latin origin, it does not change in the plural in Italian. It represents the complex of physical and chemical factors that characterize the environment in which an animal or plant species lives.

Hematophagous – From the Greek *hâima* (= blood) and –*phagos* (= feeding). An organism that feeds on blood.

Hemipteron – From the Greek *hemi-* (= half) and *pterón* (= wing). These are insects whose front pair of wings has partially sclerotized, transforming into hemielytra.

Hermaphrodite – From the Greek *Hermaphróditos*, name of the son of Hermes and Aphrodite, who was merged into the body of the nymph Salmacis. An individual with reproductive organs of both sexes.

Heterometabolism – Incomplete metamorphosis of certain orders of insects that develop through the stages of nymph, pupa and adult, all resembling the perfect insect.

Heterotrophy – Refers to the metabolism of animals that use oxygen released by plants and release carbon dioxide.

Heterozygous – Genotype in which a given pair of alleles of homologous chromosomes consists of one dominant and one recessive allele.

Hexapoda – They are a superclass of the phylum Arthropoda that includes the classes Insecta or Ectognatha and Entognatha.

Holometabolism – Holometabolous insects (also known as endopterygotes) are insects that undergo complete metamorphosis during their development, passing through several larval stages, a quiescent pupal stage, and finally reaching the adult stage. This metamorphosis involves a radical change in body form and function, with the larva being markedly different from the adult.

Homeothermic – Homeothermic vertebrates, commonly referred to as "*warm-blooded*", are a group of animals that includes birds and mammals, capable of maintaining a constant body temperature regardless of changes in external temperature.

Homologs – Chromosomes in diploid cells, of paternal and maternal origin, that carry genes responsible for the same characteristics.

Homozygous – Genotype in which a given pair of alleles of homologous chromosomes consists of two dominant alleles

(homozygous dominant) or two recessive alleles (homozygous recessive).

Hormon – From the Greek *hormôn* (= to stimulate). Hormones are chemicals produced by the body's endocrine glands that act as messengers to regulate various vital functions, such as growth, metabolism, reproduction and mood. The term was coined in 1905 by the English physiologist Ernest Henry Starling (1866-1927).

Host – From the Latin *hospitem* (= one who gives hospitality or also one who receives it). In scientific terminology, a host is the organism in which a parasite or parasitoid settles.

Hotspot – Hotspots for biodiversity conservation; they are areas exceptionally rich in endemic species and taxa and are home to habitats that are probably unique. They are often threatened by habitat loss, fragmentation, climate change and, of course, species loss. Globally recognized hotspots have always been based on knowledge of botanical species and, more recently, have also been confirmed on the basis of knowledge of vertebrate fauna (especially birds and mammals). However, considering the extremely high number of insect species (at least those known) on Earth (about one million), it seems clear that hotspots should be investigated primarily from an entomological point of view.

Hypophysis – Also known as the pituitary gland, it controls the development of the gonads by producing hormones (such as prolactin) that enter the bloodstream and are intercepted by receptors in the gonads.

Iconoclastia – From the Greek, *eikòn* (= image) and *kláō* (= break): doctrine that during the Byzantine Empire (8th-9th century) opposed religious worship and the use of sacred images, considering them forms of idolatry; figuratively, the term is applied to those who argue against principles considered fundamental by common opinion.

Idiobiont – vd. Coinobiont.

Imago – From Greek *imagos* (= image). Perfect insect or adult.

Immunoglobulin – A protein that takes on different forms and constitutes the antibody adaptable to almost any foreign molecule or allergen.

Indice di Shannon-Wiener – The Shannon-Wiener index is used in ecology to measure the diversity of a community of organisms; it assesses both species richness (the number of different organisms present) and their even distribution (how many individuals of each species have been observed). It was devised in 1948 by engineer Claude Shannon and the mathematician Norbert Wiener; it is based on information theory and measures the probability that a randomly selected individual belongs to a species different from the one previously

selected. The formula is: H' = - Σ [pi * log(pi)]. It is often mistakenly referred to as the Shannon-Weaver index, named after Warren Weaver, with whom Shannon worked on a well-known model of information theory in 1949. The Shannon-Wiener index gives rise to the Pielou equitability index, which expresses how evenly individuals are distributed among the different species that make up a community; it is the ratio between the Shannon-Wiener index and its maximum value for that community and varies between 0 and 1. There are other valid statistical indices used in ecology, but their discussion goes beyond the scope of this glossary.

Infodemic – Virtually unlimited excess of information, or information epidemic, which can influence people's behavior in real life. An infodemic occurred during Covid (discrepancies between scientific explanations and interpretations that refuted the very existence of the pandemic) and is still occurring with information related to climate change.

Insect – From Latin *insectum* (= divided into sections). A term first used by Pliny, who translated in this way the Greek term *éntomos*.

Interferon – Glycoproteins that exert host-specific but not virus-specific antiviral activity, triggering the transcription process of cellular genes that encode the production of antiviral proteins which, in turn, inhibit the synthesis of RNA and viral proteins.

Insect Apocalypse – It is the inexorable and unprecedented decline of insects that should compel every government to understand the reasons for this decline and find ways to protect them. The most important causes of insect decline appear to be: 1) habitat loss, agricultural intensification and urbanization; 2) pollution, especially from synthetic pesticides and inorganic fertilizers; 3) biological factors, such as the presence of pathogens and the introduction of alien species; 4) climate change, at least in tropical areas; 5) light pollution. These issues, which fall under the broad topic now known as the *insect apocalypse*, should be the subject of serious debate, but this is slow to materialize.

Insurrection – There have been several insurrections in our history, but the one that took place in Padua on 8th February 1848 is considered the first politically motivated uprising, in which students became both interpreters and protagonists of what was to become a true season of renewal.

IPCC – The IPCC (Intergovernmental Panel on Climate Change) is a United Nations body established in 1988 by the World Meteorological Organisation and the United Nations Environment Programme with the aim of providing politicians with an objective assessment of scientific and socio-economic literature on climate change and its consequences. Every six years, this body produces a scientific assessment report, as well as special and technical reports. It is therefore the official body

that provides scientific information for United Nations decisions on climate change. 100 countries with different levels of development and different political tendencies have approved the IPCC report, with a paradoxical distinction made by two major producers of harmful gases, the United States and China, and a third country, Saudi Arabia, which has too great a conflict of interest to agree to change the current rates of exploitation of non-renewable energy. In economic terms, the United States accounts for a high percentage of the world economy and produces over 20% of pollutants, China, which has been engaged in an economic race for years, cares little about environmental issues, and Saudi Arabia is probably among the countries that care least about reducing harmful emissions. After exhausting negotiations, these countries succeeded in having the scientific reliability level of the IPCC results changed from 90% to 80%. The denialist and eco-sceptic countries belonging to the Sino-Saudi-American triad obtained a temporary delay, while many other countries remained powerless to watch the incredible contradiction between economics and ecology. Naturally, there is a great deal of scepticism among environmentalists about future political choices, particularly with the structures that have been emerging in recent years, based largely on unscientific denialism (see Negationism).

IUCN (International Union for Conservation of Nature) – It is an international non-governmental organisation (NGO) based in Switzerland. Today, it is the largest global network of authoritative bodies on the subject of biodiversity conservation, bringing together more than 1,200 affiliated organisations, of which 200 are governmental and 900 are non-governmental, involving nearly 11,000 volunteer scientists and experts, engaged in six commissions, from around 160 countries worldwide. It manages and promotes thousands of field projects and activities around the world. One of the IUCN's main initiatives is the IUCN red list of threatened species, established in 1948 and representing the most comprehensive database of information on the conservation status of animal and plant species across the globe.

Kleptoparasitism – Term used to describe organisms that steal food resources from others.

Landscape – According to the European Convention, "*Landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*".

Larva – From the Latin *larva* (= ghost). Stage of development of lower organisms preceding the adult stage.

Leaf miners – A species of insect whose larvae dig thin tunnels (mines) inside leaves, feeding on the tissue.

Lessepsian species – The Mediterranean Sea is invaded by alien species; according to recent estimates more than 550 species alien to the native fauna have entered this basin, 44% of which are defined as Lessepsian, a term derived from the name of the engineer Lesseps who designed the construction of the Suez Canal, which artificially connected the Red Sea with the Mediterranean, allowing a fair number of species to move into the latter basin. The Mediterranean, whose surface area is 0.82 percent of the total area of the oceans, with a water volume of 0.32 percent of the total area of the oceans, is home to about 8500 known native species of large marine animals (including 900 fish species), diversity constituting 8-9 percent of the total number of marine species in the world.

Ligula – Typical of pollinating Hymenoptera, it is a type of proboscis used to collect nectar, other sugary liquids and water.

Lipids – From the Greek *lípos* (= fat), to which the ending *-ide* was added in 1923 by the Frenchman Gabriel Bertrand (1867-1962). They represent one of the four main classes of biomolecules, along with carbohydrates, proteins and nucleic acids, and are mainly composed of carbon and hydrogen atoms.

Locoism – The term comes from the Mexican name given to certain herbs, hierbas locas ("crazy herbs"). It is a phenomenon of animal "pathological addiction" that is widespread in large areas of the world. It refers to the addiction of various animal

species to particular species of plants known as locoweed ("herbs that cause madness"), at least forty of which belong mainly to the legume botanical group and induce psychoactive effects and neurological disorders. Plants considered locoweed include *Astragalus* species, *Cystium diphysum* (Fabaceae), but also *Dioon edule* (Zamiaceae). The animals identified to date as being affected by this addiction are: cows, mules, horses, sheep, antelopes, pigs, rabbits, chickens, and llamas. Animals affected by locoism often die, not because of the toxicity of the plants, but because of fasting caused by the frantic search for locoweed; in fact, after acquiring the ability to distinguish these particular plants, they become habitual consumers of them, avoiding other nutrients. Some wild and domestic animals, in the throes of hallucinations and uncontrollable attacks, after devouring the flowers and leaves of 'mad grass', begin to dig to extract and eat the roots as well. It is possible that the plants have selected an active ingredient that is addictive and at the same time ensures the spread of seeds by animals.

Lophotrochozoa – They include Platyhelminthes, Mollusca and Annelida.

Lymphofagia – Organisms that feed on plant sap.

Malaria – Mal'aria, a vulgar Italian term that attributed morbid conditions to unhealthy environments such as swamps; the term then spread throughout the world. The term malaria (= bad air) was coined in 1700 by the Italian Lancisi, who had

observed that the disease was widespread in marshy areas characterized by foul miasmas and believed that poisonous gases must be the cause of the disease itself. We owe the discovery of the relationship between mosquitoes and malaria to the Italian Gianbattista Grassi. In 1888, he began studying malaria in birds and discovered the different stages of the plasmodium. Two years later, when malaria was rampant in the Roman countryside, Grassi began to take an interest in this serious problem. He understood almost immediately that the disease was induced in the human body by external vectors, certainly winged insects, so he began campaigns to collect the different species of mosquitoes present in the marshes of the countryside around Fiumicino and identified the probable culprit, the most frequent species and considered the most annoying by farmers, *Anopheles maculipennis*. One of his collaborators, named Sola, volunteered for Grassi's experiments, allowing himself to be bitten every evening by a different species of mosquito, but he did not contract malaria until one evening Grassi had him bitten by a mosquito that had already bitten sick people, and after a few days Mr Sola also showed the typical symptoms of malaria. After him, patients in an entire ward of the Ospital del Santo Spirito were bitten by mosquitoes that had been released after being fed sugar water; as they were infected, all of them contracted malaria. Grassi then realized that in Italy not all mosquito species transmitted

the malaria plasmodium, but only *Anopheles maculipennis*, *Culex vexans* and Culex penicillaris, and that only females sucked blood. At the same time, the Frenchman Alphonse Laveran isolated the parasites in the blood of patients suffering from malaria (for which he was awarded the Nobel Prize) and in 1897 the Englishman Ronald Ross further demonstrated that these parasites are transmitted by mosquitoes.

Mastigophora – From the Greek *mastigophóros*, armed with whips; Protists historically divided into Phytoflagellates (equipped with chloroplasts) and Zooflagellates (without chloroplasts), whose phylogeny is still uncertain.

Merostomata – Classis of Phylum Arthropoda, subphylum Chelicerata.

Mesoderm – From the Greek *mésos* (= middle) and *dérma* (= skin). It is one of the three layers of cells that form during embryonic development in triblastic organisms, located between the ectoderm and the endoderm.

Messinian Salinity Crisis – About seven million years ago, during the Miocene epoch, the climate across most of the Earth's surface was torrid, and the waters were inhabited by tropical species such as bull sharks, marlins, seals, and manatees. Between five and six million years ago, in the second half of the Messinian, an exceptional event occurred: the drying up of the Mediterranean Sea. This event is known as the

Messinian salinity crisis. The drying up of the basin coincided with the interruption of relations between the Atlantic Ocean and the Mediterranean, an event that in turn caused the accumulation of evaporitic rocks in the abyssal parts of the basin and the formation of deep canyons by rivers. Only a few large brackish lagoons remained; it was during this period that thick layers of evaporitic rocks, such as rock salt, precipitated. Sedimentary rocks are the result of processes of alteration, erosion, transport, and accumulation of sediments carried out by water, wind, ice, and other exogenous agents. Sicilian sulfur and gypsum have sedimentary origins dating back to that period, when the Mediterranean was dry and inhabited by animal species that have now disappeared, such as hippopotamuses and other species currently found in Central Africa. Water was scarce for at least half a million years, and lions, buffaloes, monkeys, and elephants moved to the only areas where the precious liquid still remained. The salinity crisis in the Mediterranean lasted until the Strait of Gibraltar reopened and water from the ocean entered; a huge crust of salt was buried under the clay, and this must have lasted for several centuries, characterized by the presence of species adapted to hyperaline conditions. Intensive pollen research carried out by an international group of scholars has made it possible to establish with a high degree of accuracy that the Mediterranean area was then characterized by two types of vegetation; in the

southernmost part, conditions were dry and hot and the vegetation was rather sparse, while in the northernmost part, hot and humid conditions allowed forest-type vegetation to grow. The researchers were also able to establish that the salinity crisis was not directly caused by the climate and that during this period the climate did not change substantially, particularly in the southernmost part of the area, where it remained very dry and hot before, during, and after the salinity crisis.

Metabolism – From the Greek *metabole* (= change). The set of processes that determine the transformation of food into tissue, body heat, mechanical work and the elimination of waste substances.

Metamere – From the Greek *metá* (= coming after) and *méros* (= part). A metameric structure is a body made up of identical parts that follow one another.

Microplastics – While a fair amount of plastic is pretty big, a lot more (primary microplastics) is made up of tiny particles added during the industrial process to creams, cosmetics, gels, etc., or from the abrasion of synthetic fabrics or tyres during the production process. Nanoplastics (<0.001 mm) and secondary microplastics (0.001-5 mm) are invisible particles that originate from the degradation of plastic when exposed to abrasion, photodegradation and similar processes. The life of organisms is now affected by the accumulation of microplastics in the food

chain across ecosystems. The European Environment Agency's "*Microplastic pollution from textile consumption in Europe*" report informs us that in 2019, almost 370 million tonnes of plastic and around 70 million tonnes of synthetic fibres were produced, 58 million tonnes of which came from Europe. In subsequent years, of course, these numbers increased. Microplastics entering the food web produce dimethyl sulphide (DMS), which is the olfactory keystone in the sea for natural trophic interactions, being a volatile compound that signals productivity at the food web level. Pelagic birds use their sense of smell to detect dimethyl sulphide as an olfactory sign of the presence of plankton and therefore of fish species that feed on it. Plastic residues emit a smell of marine chemicals, creating an olfactory trap for marine fauna. It has recently been shown that exposure to microplastics causes a reduction in photosynthesis of between 7.05 and 12.12% in terrestrial plants, marine algae and freshwater algae.

Migration – From the Latin *migrare*. Active movement of organisms from one geographical location to another and back again. See also Emigration.

Mimetism – It is the ability of an organism to resemble another organism or its surrounding environment in order to gain an advantage (e.g. not being eaten or being able to prey without being easily detected). See also Aposematism.

Myrmecophilia – From Greek, *mirmeco-* (= ant) and *–filia*

(= friendship), friendly behaviour towards ants. It may be symbiosis, commensalism or parasitism with an ant community. The term can refer to a variety of life forms such as plants, arthropods and other organisms. Numerous pieces of evidence suggest that the evolution of myrmecophilous interactions contributed to the ecological success of ants, giving them a competitive advantage over other invertebrate predators.

Mitochondrion – From the Greek *mítos* (= thread) and *chondríon* (= small grain). Term coined by Carl Benda in 1898. It is an organelle found in cells, with a highly differentiated microscopic structure, responsible for respiration (Krebs cycle) and energy production. It was only after the discoveries made in 1948-1950 by Eugene Kennedy and Albert Lehninger that the Krebs cycle, the oxidation of fatty acids and oxidative phosphorylation take place in the mitochondria, and following the use by Britton Chance and Graham R. Williams of the oxygen electrode and spectrophotometry to study the electron flow in the respiratory chain, the fundamental function of the mitochondria was defined: cellular respiration, in which molecules derived from the metabolism of carbohydrates, proteins and lipids are oxidized to form water and carbon dioxide, and the energy derived from biological oxidation is made available in a disordered form, as heat, and in an ordered form as ATP or electrochemical membrane gradients. Since the

1970s, the mechanism of mitochondrial biogenesis has become clearer: mitochondria are "*semiautonomous*" organelles in that they synthesize only a few proteins (about 5%) and import those synthesized in the cytoplasm. The interaction between the cytoplasm and mitochondria is reciprocal, and changes in mitochondrial function are reflected in the biochemistry of the cytoplasm. Mitochondria, "*enclosed spaces*" within the cell, communicate with the cytoplasm and therefore with other cellular components, resulting in intense traffic of metabolites, proteins and cofactors to and from these organelles within the cell. The mitochondrion may have originated from a protoeubacterium, possibly photosynthetic, which transferred most of its genetic material to the nucleus. Traces of this origin can be seen in the DNA and protein synthesis machinery present in mitochondria as a legacy of the system necessary for the life of the ancestral cell.

Mollusca – From the Latin *mollem* (= soft). Phylum characterized by a soft, unsegmented body, often covered by a calcareous shell (snails, mussels, octopuses, etc.).

Monitoring – Observation for the purpose of checking a parameter, quantity or variable function of an organism or ecosystem, carried out using special instruments over a specific period of time.

Monophagia – Characteristic of monophagous organisms, which feed on a single species, usually plants.

Moulting – See ecdysis.

Mutation – Random changes in genes; if they become established in the population, a previously non-existent morphological trait may appear.

Mutualism – A form of symbiosis in which both species benefit.

Mycorrhiza – Mycorrhiza (from the Greek = fungus-root) is a unique symbiosis phenomenon that occurs through simple contact (ectotrophic mycorrhiza, typical of basidiomycetes and certain ascomycetes). Symbionts lead a life of mutualism with other living organisms; the mycelium enters into symbiosis with the terminal rootlets of higher trees, shrubs or herbaceous plants, establishing a continuous exchange of nutrients with them. The fungus generally does not penetrate inside the cells of the host. The fungal hyphae form a thick layer around the roots (called the mantle) and from there extend considerably, in mycelial cords, into the surrounding soil. The combination is advantageous for both the fungus and the plant, as the plant uses the mycelium to greatly extend the surface area from which it draws nutrients (inorganic), which it takes in by using the mycelial hyphae as “extension tubes” for its roots. It is also advantageous for the fungus (mycelium), which receives from the plant the now photosynthesized excess nutrients (organic substances), with which it can feed itself. It has been proven that

trees with symbiotic mycorrhizae in the root system grow more luxuriantly. The fungus in turn, thanks to the symbiosis, is able to complete its life cycle and form fruiting bodies.

Mycorrhizal fungi are among the most widespread microorganisms in the soil. They belong to several thousand species and are present in some 250,000 plant species, including the most important plants of agricultural and forestry interest; there is growing attention by scholars to the importance of these fungal mycelia that are mutually associated with the roots of more than 80% of plants. Right from seed germination, the mycelia facilitate the uptake of water, phosphorus and other minerals needed by the plant, increase the rate of conversion of sugar into storage compounds, aid the formation of auxins, vitamins and other compounds, increase disease resistance, toxicity tolerance, resistance to moisture and aridity, and accumulate phosphorus in the soil and make it available to plants through direct connections between the hyphae (filaments of the fungus) and the plant roots. The greater aridity resistance of plants with mycorrhizae compared to plants without them depends on the greater amount of soil involved by the roots with mycorrhizae rather than the greater water uptake by the symbiont fungi. Furthermore, mycorrhizae increase the effective root surface area and enable a direct connection between decaying material and plant roots. Ultimately, through mycorrhizal symbiosis, based on nutrient exchange, the plant

improves its vegetative development while the fungus successfully completes its life cycle. Mycorrhizae make the cycle of essential elements fast, preventing losses due to movement to portions of the soil that are too deep and have little biological activity; the endosymbiont fungus receives carbon-based organic compounds in return. It depends almost exclusively on symbiosis; soluble phosphate is available at very low concentrations, and mycorrhizae greatly increase the plant's ability to obtain it. Thus, nutrient flow in mycorrhizae is generally bidirectional. It has also been documented that links exist between mycorrhizal mycelia of different plant species.

Nanometer (nm) – A unit of length equal to 10^{-9} meters (one billionth of a meter).

Natura 2000 – It is the European Union's tool for protecting biodiversity; it constitutes the ecological network spread throughout Europe, established under the habitats directive 92/43/EEC (conservation of natural habitats and endangered or rare species of fauna and flora) and the birds directive 2009/147/EC on the conservation of wild birds. The sites of community importance (SIC) established by the habitats directive in each EU country were subsequently designated as special areas of conservation (ZSC), which also include the special protection areas (ZPS) established under the birds directive.

Natural environment – The term "*natural environment*" refers to all living and non-living entities, as well as their activities and interactions that occur naturally. It includes vegetation, fauna, microorganisms, soil, rocks, the atmosphere and the interactive natural phenomena that take place there. Water, air, climate and energy flow are also part of the natural environment.

Nature Restoration Law – The Nature Restoration Regulation is the first global law of its kind at continental level, approved on 18th August 2024 as part of the European Union's Biodiversity Strategy, dating back to 2020. It sets binding targets for the restoration of degraded ecosystems, particularly those with the greatest potential for carbon capture and storage and for preventing and reducing the impact of natural disasters. The principle behind it is that European nature is in decline, with over 80% of habitats in poor condition. Restoring wetlands, rivers, forests, grasslands, marine ecosystems and the species they host will help increase biodiversity, ensure the things that nature does for free, such as cleaning water and air, pollinate crops and protect us from floods, limit global warming to 1.5 °C, strengthen Europe's resilience and strategic autonomy, prevent natural disasters and reduce risks to food security. The Nature Restoration Law introduces mandatory tools for EU Member States aimed at restoring nature. It is based on scientific data showing that we can reverse the decline in biodiversity by the

middle of the century, and we must do so for our children and grandchildren. Italy is already above the European average in terms of protected areas, thanks to the work carried out in past decades. Unfortunately, however, the current Italian government does not have an ecological culture and voted against the proposal, which tells us that it will do everything it can to prevent its implementation. The new European Commission elected in 2024 has also got off to a bad start, weakening the Green Deal, which was supposed to put Europe on track for ecological and energy transition by 2030. Needless to say, this means we will continue to depend on the United States and China for our energy.

Natural selection – It is really difficult to demonstrate how natural selection works; the case of the *Biston betularia* moth is probably the most suitable for teaching purposes. In this nocturnal butterfly, a recessive gene is responsible for the black color, so the melanistic form is quite rare. Due to air pollution in Manchester, England, the trunks of the birch trees on which this moth usually lives, as indicated by its Latin name "*betularia*", had blackened. This gave the melanistic form of this moth greater opportunities to camouflage itself and defend itself from predation by insectivorous birds (e.g. Redstarts). This chain of events caused a decrease in the number of light-colored (normal) *Biston* moths, which were discovered and preyed upon in large numbers by predators on the darkened trunks. It is a

well-established fact that predation can indirectly influence evolution; in fact, predators influence the evolution of their prey through the numerical effect in ecological times, reducing the abundance of prey; and through the evolutionary effect, acting as selective agents that influence the morphology of the prey, its behavior and natural history characteristics, which in turn determine the activities and roles of prey in the ecosystem. The 37-57% predation recorded on *Biston betularia* is generally recognized as evidence of strong selection by birds on the evolution of the morphological and behavioral traits of this insect.

When populations consist of too few individuals, the effect of natural selection becomes negligible compared to that of genetic drift. In a population of less than 500 individuals, selection coefficients of around 1% on a single gene locus appear ineffective. The genetic consequences of a "*bottleneck*" can consist of the loss of rare alleles, the low probability of replacing them as long as the population remains small (qualitative consequences) and a decrease in the range of variability of certain characteristics (quantitative consequences). Gene flow can modify the gene pool, thanks to the movement of genes in and out of the population, mutations change alleles, and natural selection leads to differentiated reproductive success. When natural selection modifies the genetic equilibrium, adaptive changes occur, i.e. the accumulation of characteristics that

adapt a population to the environment in which it lives. If the environment changes, natural selection will favor characteristics adapted to the new conditions. This is why genetic variability is important. The diploid condition preserves variability by means of "*hidden*" recessive alleles. Balanced polymorphism can result from the advantage of heterozygosity.

The term genetic drift is considered by some geneticists to be somewhat inaccurate; in fact, a drifting boat moves due to the effect of the current, which always flows in the same direction, while chance, which dominates genetic drift, causes the frequency of a gene in a group to increase or decrease from generation to generation. For this reason, Japanese geneticist Motoo Kimura proposed random genetic drift. If the population is large, the effect of drift will be modest; for example, if a population of 20 individuals changes significantly due to chance over 20 generations, it will take 20,000 generations to observe a similar effect in a population of 20,000 individuals. In the case of humans, this means almost half a million years. According to Kimura's neutral theory, most genetic variability exists not because of natural selection, but because it produces nothing different; mutations would continuously cause variations with no effect, which would subsequently be eliminated by genetic drift. Random changes that have no influence, but changes nonetheless!

In some species, such as the butterfly *Acrea encedon*, the numerical ratio between the sexes is 97% in favour of females. This phenomenon is known as sex chromosome drift, dependent on dominant genes on the female sex chromosomes that, in a sense, impose "*feminisation*". There is growing evidence that homosexuality is a biological fact, an innate inclination and not the result of cultural influences or deliberate choices, and that it depends on a gene located on the X chromosome, as reported by Ridley in 1999 in the book '*Genome*'. In this regard, Buiatti in 2004 in the book '*Il benevolo disordine della vita*' (The benevolent disorder of life) has rightly pointed out that complex behaviors are never determined by a single gene or a few genes, but rather it is likely that some people have a congenital fragility in their psychological responses to the environment compared to others. Therefore, the genetic component would provide responses to messages from the environment in which the individual lives. The traits expressed in the phenotype are not always encoded by a single gene. In some cases, multiple genes are involved, perhaps located on different chromosomes; in other cases, phenotypic expression requires the coordinated action of numerous genes. The number of genes in a species varies considerably depending on the systematic group and complexity; bacteria have around 1,000, some fungi have 10,000, many higher plants and some animals have up to 400,000, a small mammal such as the house mouse *Mus*

musculus has 100,000, and humans have 25-30,000, which represent only about 1.5% of DNA.

Negationism – According to Antonio Cederna, one of the fathers of Italian environmentalism, "*it is senseless to continue to believe in the myth of unlimited growth, measured according to that fetish god that is gross domestic product: growth that, moreover, causes (in terms of waste, desertification, pollution, land consumption, etc.) enormous social costs*". In recent years, regrettably, we have been faced with political regression both in Italy and in the rest of the world, which undermines the cultural foundations of Christian coexistence. This regression has also involved unscientific political attacks on the robust scientific bases that have made it possible to calibrate certain behaviors for the serious care of our natural heritage and an approach to ecological sustainability, which is the very foundation of humanity's future life. Climate change denial is a clear example of unscientific behavior dictated solely by political expediency and blind partisanship. The indisputable scientific data on global warming are treated with inexplicable indifference, contempt and scepticism by some politicians and self-styled scholars. It is well known that there is a wealth of irrefutable evidence of global warming, but perverse denialism shows a desire to look only at the present and completely ignore the ancient Indian proverb that says, "*We did not inherit the world from our fathers, but we borrowed it from our children, and we*

must return it to them in better condition than we found it". Democracy, cooperation, collaboration, respect for human and civil rights, respect for diversity, the fight against inequality, the separation of powers, the prevention of future conflicts, etc. are the principles that inspired the creation of the United Nations, which currently has 193 member states. But the man who governs behaves in a manner that is inconsistent with the commitments he has made.

Many people confuse weather and climate and tend to make judgements based on the weather on a given day in the place where they live. The heat of recent summers is not normal, according to statistics, and we know that science is based on large numbers. Temperatures have been measured and recorded since the end of the 19th century. Riccardo Luna, in an article published in "la Repubblica" on 11th July 2023, writes that in recent weeks, unbearable temperatures, even above 40 degrees, have been recorded in large areas of China, Japan, the southern United States, Mexico, Spain and Portugal, South Africa and South America, where it should theoretically be winter; in certain areas, the thermometer never dropped below 30 degrees. At the South Pole, the 31.9 degrees below zero in July 2023 (when it is winter there) represents the highest temperature ever recorded in that month; in Canada, in the Arctic region, the 37.9 degrees recorded in the same period is almost three degrees higher than the previous record, set in

1989. Extreme events such as fires, floods and hurricanes are on the rise, with consequences we can only imagine (think, for example, of what happened in Los Angeles in January 2025).
This has given rise to a new type of refugee, the "*climatic refugee*", who leaves their country in search of more stable climatic conditions. Denialists arrogantly claim that fires, floods and hurricanes have always existed; we must respond that they have never been so violent or so frequent. These are data derived from statistics and science, we insist on this point, based on large numbers. One of the authorities who has highlighted this problem most strongly was Pope Francis, who spoke of a "*beautiful challenge*". If there are deniers, it means that scholars have failed to convince them with irrefutable data. It is true that many people are deaf to certain topics, but it is important to persevere, to continue to explain how the climate is changing and to try to do so at different levels than has been done so far, i.e. starting in primary school, at least to ensure that we have educated, not convinced, the younger part of the population, from whom we can hope for a bottom-up education, i.e. children who are more educated than their parents, who are ignorant or simply sceptical about everything related to nature.

Nematocysts – From the Greek *némato*s (= filament) and *ciste*. Special offensive and defensive structures characteristic of Cnidarians.

Nematoda – From the Greek *némato*s (= filament) and *-ode* (= having the shape of). Nematodes form a phylum of pseudocoelomate roundworms, many of which are parasites of vertebrates and invertebrates, others of plants.

Neonicotinoids – They appeared on the market in the 1990s and quickly became the most widely used insecticides in the world. They have been shown to have a high impact on pollinators; they attack the nervous system of insects and, even at low doses, bees and bumblebees become disoriented and cannot find their hives. In January 2020, the European Commission decided not to renew the license for the marketing in Europe of the insecticide thiacloprid, one of the five active substances in the neonicotinoid class authorized in the EU, on which the Union has imposed restrictions since 2013. In April 2018, EU Member States voted in favor of a permanent EU-wide ban on the three neonicotinoid active ingredients most harmful to bees: clothianidin, imidacloprid and thiamethoxan. It is interesting to note that not all European countries voted in favor of the proposal; 16 Member States (76.1% of the European population) did so, including Italy. Without pollinators, a third of what we eat every day could disappear and the balance within many ecosystems could change.

Nuclear – We must be wary of those entrepreneurs who are close to unscrupulous politicians, characterized by greed that arises from opportunities to pocket money made available by the

state. Some may remember that during the earthquake in Abruzzo (2009), while many residents died under the rubble (including young people in the student residence), a phone call was intercepted from an entrepreneur who thanked the earthquake for the personal gains it would bring him! Do you think this cynicism can coexist with "Christianity" as understood by Carlo Levi? We would like to revisit some important passages from an article by Angelo Tartaglia, Senior Professor in the Department of Applied Science and Technology at the Polytechnic University of Turin, published in early 2024 in "I Quaderni della decrescita" (The Degrowth Notebooks). Protons, particles of the atomic nucleus, are electrically charged and have charges of the same sign; this causes a violent repulsion. The repulsion is overwhelmed by the even more intense attraction due to the intensity of the energy, but the conflict between the two effects, combined with the peculiarities of quantum mechanics, tends to generate two types of instability. One can affect all nuclei composed of at least three particles and is called radioactivity, which consists of a rearrangement of the nucleus with the emission of excess energy in the form of radiation (gamma rays). The other occurs in very heavy nuclei, composed of more than 230 particles (92 protons and 148 neutrons in the case of the most famous uranium 235); this has a tendency to "*explode*", splitting into two lighter nuclei plus a few neutrons. This latter phenomenon is called "*fission*". In the case of fission,

the initial energy of the nucleus is partially converted into kinetic energy of the “fragments”, which in turn are radioactive. A reactor is a device that, by exploiting nuclear fission, transforms the energy released into electrical energy. Inside the reactor core are bars of Uranium 235 together with Uranium 238 (much more abundant). Each collision of the fragments generates kinetic energy; the energy from fission is thus converted into heat, which can activate a turbine that in turn converts the energy into electricity that enters a distribution network. Only 30% is converted into heat, while 70% is dispersed into the environment through cooling towers or even the sea or a river.

The interesting thing is that this energy is presented as “*clean*”, by some simply out of naivety or ignorance, by others for convenience; some politicians and industrial stakeholders fall into the latter category. In reality, the nuclear process does not cause climate-altering emissions, but the waste is highly radioactive and decays with a variable half-life (the time it takes for the number of nuclei to be reduced by half), which can be tens of thousands of years; it seems that the mixture as a whole needs a hundred thousand years. Current technology can simply reduce the time from millennia to centuries. But who do you think would be willing to store this waste in secure areas? Pro-nuclear propaganda glosses over this issue, but it is part of the “*nuclear*” package and cannot be separated from it. Radioactive

waste from Italian power plants is still stored in lead containers on the grounds of the plants themselves; no region is willing to receive it. Decommissioned nuclear power plants in Italy (e.g. Caorso, in the municipality of Zerbio, in the province of Piacenza, where a nuclear power plant was built and then decommissioned in the 1970s) contain 24,000 cubic meters of radioactive waste, 284.5 tonnes of spent uranium for energy purposes, and 30 cubic meters of vitrified radioactive waste.

Furthermore, according to Enrico Martini, it is wrong to believe that nuclear power plants are hermetically sealed facilities and that nothing radioactive can escape into the atmosphere in the absence of malfunctions. In fact, a nuclear power plant is designed and built to release water vapor into the atmosphere throughout its operation, and this water vapor is radioactive to a certain extent.

At the end of January 2025, there was a debate by the Spirito di Assisi commission of the Italian Peace and Disarmament network on the possible use of existing and future nuclear power plants to ensure disarmament through the dismantling of warheads in arsenals, consuming the plutonium recovered from dismantling to produce energy. One might naively think of this as a pacifist approach, but sometimes one has to think of the worst; it could be an attempt to give nuclear power both a green label and a pacifist label. Angelo Tartaglia gave a brief account of the meeting, starting with plutonium, which would be

extremely rare in nature if it had not been produced by humans. There are two isotopes of plutonium derived from the dismantling of nuclear warheads: Pu239 and Pu240. Pu239 is suitable for producing fission bombs; to understand this better, it should be noted that the bomb that exploded in Nagasaki was plutonium-based, while the one in Hiroshima was uranium-based; plutonium bombs can be used as fuses to trigger thermonuclear (fusion) warheads. In light of what we know about the instability of plutonium, achieving nuclear disarmament requires dismantling warheads without reusing the accumulated plutonium for energy purposes; the plutonium set aside should be treated like the nuclear waste produced by power plants, or even better, mixed with it. The dangerous life span of waste is measured in tens or hundreds of thousands of years; treatment such as that mentioned above can reduce this to a few millennia or centuries. Do you think that is not long enough? Man began building the first villages about six thousand years ago. Do you think such a duration is acceptable? Finally, there is the "*nuclear fusion*" project, which is the reverse process of "*fission*"; starting with two light nuclei, they are made to collide with each other until the electrical repulsion between them is overcome, allowing them to touch and come close enough for the nuclear force to bind them tightly together and create a new stable nucleus. If the atomic number of the nuclei is less than 28 (nickel), energy is released, but the temperatures

required are measured in millions of degrees; if two isotopes of hydrogen, deuterium and tritium, are used, the temperature required ranges from 200 million degrees upwards. '*Nuclear fusion*' is truly a clean energy source, leaving no radioactive waste, but scientific research is still a long way from being able to design a nuclear fusion reactor that can produce the energy required by a population.

The question that some unscrupulous politicians and entrepreneurs must ask themselves is this: should we plan to build nuclear power plants without knowing where to locate them or, equally importantly, where to store the radioactive waste? We are a country without nuclear fuel, the price of which is rising and unpredictable. The price of uranium has been rising: in 2001 it was $15/kg, in 2007 it rose to $297/kg, mainly due to demand from China. The market is based on supply and demand, so it is impossible to say what the price of uranium will be when the first Italian nuclear power plant is ready and the mineral needs to be purchased. When it comes to energy, we also need to talk about costs and benefits.

According to Angelo Tartaglia, we should avoid increasing the amount of fission waste produced in power plants or by decommissioned or dismantled nuclear warheads. It would therefore be a good idea to: a) stop producing new ones, with their plutonium content; b) manage to separate waste and plutonium in deep, impermeable geological repositories in non-

seismic areas; c) research into nuclear disarmament should not be used as a pretext to continue building new power plants that would in fact continue to produce what we want to eliminate.

Nucleus – From the Latin *nucleum* (= kernel); it is the inner part of the cell that contains the chromosomes, responsible for transmitting genetic information.

Nucleotid – One of the structural components of DNA or RNA, consisting of one of four nitrogenous bases [adenine, thymine (uracil in RNA), guanine, cytosine], a sugar molecule and a phosphoric acid molecule.

Ocellus – From the Latin *ocellum* (= small eye). An organelle consisting of an aggregate of photosensitive pigmented cells found in many invertebrate organisms, with a probable visual function.

Ommatids – From the Greek, *ómma -atos* (= eye), with the suffix –*ídion*; thousands of tiny elements that make up the eyes of arthropods.

One Health – The concept recognizes that human health, understood as a state of physical and mental well-being, is interconnected with that of other living beings and the environment and must be guaranteed. It is officially recognized by the Italian Ministry of Health, the European Commission, the Food and Agriculture Organisation of the United Nations (FAO), the United Nations Environment Programme (UNEP), the

World Organisation for Animal Health (OIE) and the World Health Organisation (WHO) as a relevant strategy in all sectors that benefit from collaboration between different disciplines. One Health recognizes that the health of humans, domestic and wild animals, plants and the environment in general (including ecosystems) are closely linked and interdependent. It is undoubtedly still a vision that sees humans at the center of the system. The "*One Health*" concept will probably help to protect both the environment and other living organisms, but it will necessarily require the will of governments and all human populations; a development project in harmony with nature must have as its ultimate goal an improvement in the quality of life.

Ontogenesis – From the Greek *óntos* (= that is) and *gènesi*. The term Ontogenesis was introduced in 1866 by biologist Ernst Haeckel (1834-1919) to refer to the set of processes involved in the development of an individual, from the fertilized egg to adulthood.

Oophagous – It generally refers to small parasitoids that lay their eggs inside the eggs of phytophagous insects. They are widely used in biological control.

Opisthosome – Rear segment of chelicerates, also known as the abdomen.

Organ of Jacobson – The organ of Jacobson, also known as the vomeronasal organ, is a chemosensory system found in many vertebrates, including amphibians, reptiles, and mammals. It is located near the upper incisors and connected to the palate; it performs an accessory olfactory function and intercepts chemical signals and is involved in detecting pheromones (see below).

Organogenic limestones – Structures created by generations and generations of single-celled or multicellular organisms, autotrophic or heterotrophic, which share the ability to build calcareous structures. We often see them when admiring monuments built with these materials (e.g. Greek temples).

Oribatida – From the Greek *oros* (= mountain) and –*bates* (= to head towards). Non-parasitic mites, decomposers of organic matter and intermediate hosts of certain cestodes.

Orthoptera – Dal greco *orto-* (= retto) e *pterón* (= ala). Commonly known as grasshoppers, crickets and locusts, are a large order of insects comprising almost 30,000 species, mainly distributed in the warmer regions of the planet. In Italy, there are more than 380 taxa (including species and subspecies), many of which are endemic, while in Europe there are just under 900 known species. A distinctive feature of Orthoptera is their average size, which is larger than any other order of insects.

Other distinctive features are their jumping hind legs and the widespread presence of stridulatory organs. They have a very ancient origin. Gryllidae have been known since the Triassic period and Tettigoniidae since the Jurassic period, while Acrididae have been more prevalent since the Tertiary period. The first fossil remains of insects date back to the Devonian period, in the middle of the Palaeozoic era, between 410 and 360 million years ago. The origin of Orthoptera in particular can be traced back to the Carboniferous period, between 360 and 290 million years ago.

Osmosis – From the Greek *osmós* (= impulse). Phenomenon of diffusion between two miscible liquids through semi-permeable membranes.

Ovipositor – Female organ for laying eggs.

Ozone – Ozone, also known as trioxygen, the layer of gas that protects our planet from the harmful action of ultraviolet rays, is concentrated at a height of about 25 km in the so-called ozone layer; it absorbs part of the energy from the sun and allows the earth's crust to warm up. There was much talk some 40 years ago of the "*ozone hole*" caused by the chemicals used in refrigerators, the chlorofluorocarbons, also known as CFCs, which would cause the earth's temperature to rise by at least 2.5 °C by 2100. The abolition in 1987 (Montreal Protocol) of CFCs also had the effect of limiting the temperature rise to just 1.5 °C,

as had been envisaged in the agreements made by the world's major countries in Paris in 2015.

Palynology – The science that studies pollen is called palynology, from παλύνω, to scatter, or from πάλη, flour, and λόγος, word, discourse, study. It is the science that studies pollen (see Pollen) and other microscopic biological elements (spores of mosses, ferns, fungal parts, algal cysts), both current and fossil. The objects of study are considered to be "*palynomorphs*", i.e. of a palynological nature. Palynology is an interdisciplinary science that develops its themes mainly in botany, ethnobotany, ecology and other aspects of biology, but also in palaeontology, geology, climatology, aerobiology, criminology and even food science. Some aspects of palynological research focus on the relationship between humans and the environment, while others focus more on understanding environmental changes.

Palynology has applications in numerous fields of study and is divided into several sectors: 1) palaeopalynology, which studies fossils (or sub-fossils) to reconstruct changes in flora, vegetation and therefore climate that have occurred over geological periods; 2) archaeopalynology, which studies changes in the landscape and environment with a focus on the last 12,000 years or so; 3) melissopalynology, which studies pollen and other biological particles contained in honey and bee products; it is based on the possibility of identifying the geographical and

botanical origin of honey through the floristic characterization of its pollen content; it may include studies of pollen in herbal products, foods or natural resins; 4) aeropalynology (see aeroplankton), which studies the content of pollen and fungal spores dispersed in the air and, consequently, its quality in relation to allergies for the drafting of pollen calendars; the study of fungal spores is also inherent in the conservation of cultural heritage; 5) criminopalynology or forensic palynology, which deals with materials related to cases of forensic interest, palynomorphs found at crime scenes, vehicles linked to crimes or the search for plant-based drug crops.

Parasite – From the Latin *parasitum* (= commensal). Organisms that live at the expense of other organisms, obtaining food from them; they generally coexist with their host.

Parasitoid – An insect that lays its eggs inside the eggs of other arthropods, on their larvae (*ectoparasitoid*) or inside them (*endoparasitoid*); the larva that hatches feeds on the host organism, killing it.

Parthenogenesis – From the Greek *parthénos* (= virgin) and *génesis* (= birth). A type of reproduction in which the egg develops without fertilisation.

Patogen – An agent of a different nature that can cause the onset of a disease.

Pedipalps – Prehensile or sensory appendages found in

chelicerates.

Pedofauna – Soil fauna (from the Greek, *pedon*).

Permafrost – It refers to permanently frozen ground, typical of the far north of Europe, Siberia and North America. It can also be found at very high altitudes in the mountains (e.g. in the Alps).

Pesticides – These are all plant protection products used in agriculture and include insecticides, fungicides, etc.

PFAS – These are "*poly- and per-fluoroalkyl substances*", chemical compounds consisting of chains of carbon atoms bonded to fluorine atoms and other functional groups. They are used on certain fabrics, paper, food containers, carpets and similar coverings to make them resistant to grease and water; they are also used to coat non-stick cookware, fire-fighting foams, paints, varnishes, mobile phone microphones, cosmetics, certain medicines and many other applications. Greenpeace News 155 (XXXV, 2024) reports on the investigation carried out by this association to investigate the contamination of drinking water. These substances are in fact not very biodegradable. Greenpeace technicians collected 260 samples (mostly from public fountains) in 235 municipalities throughout Italy in order to create the first independent national map of PFAS contamination in drinking water. At least one of the 58 molecules that make up PFAS was found in 206

samples (79%), demonstrating that a high percentage of Italian drinking water is contaminated by these substances. Consequently, only 21% of samples showed no traces of these substances. It will be interesting to follow this research on the Greenpeace website (https://www.greenpeace.org/italy/) and the development of the results in different regions.

Phenology – Stages of development of an organism in relation to seasons, latitude and other ecological factors.

Phenotype – From the Greek *pháinein* (= to appear) and *týpos* (= model). The set of visible characteristics of an individual or population. See also *Genotype*.

Pheromone – From the Greek *pherein* (= to transfer) and *hormao* (= to excite). A substance secreted externally by an animal in very small quantities which, when perceived (usually by smell) by another organism of the same species, causes a specific reaction (aggregation, sexual attraction, alarm, etc.).

Phloem – From the Greek *floiós* (= bark, rind). Vascular tissue in higher plants that transports sugars and other organic molecules from the leaves to other parts of the plant.

Photoptarmosis – Photic sneezing reflex, also known as heliociliosternuteogenic reflex or ACHOO syndrome (from the English acronym Autosomal dominant Compelling Helio-Ophthalmic Outburst) is an autosomal dominant genetic condition characterized by paroxysms of sneezing following

exposure to strong light sources. In 1964, Henry Everett was the first to call light-induced sneezing the “photic sneeze effect”, hypothesizing that the syndrome is linked to the human nervous system and caused by confusion of nerve signals. The genetic basis of photic sneezing remains unclear, and no individual genes for this condition have been found and studied. However, the condition often occurs within the same family, suggesting that light-induced sneezing is a hereditary, autosomal dominant trait.

Photosynthesis – From the Greek *photos* (= light) and *synthesis* (synthesis). Process that takes place in the chloroplasts of autotrophic organisms (reaction between carbon dioxide and water and synthesis of a six-carbon sugar); carbon organication is the synthesis of organic carbon (contained in the glucose molecule) from inorganic carbon (contained in the carbon dioxide molecule). The energy required is provided by the sun and is trapped by the chloroplasts.

Photovoltaics – This is a system that uses sunlight to produce electricity. According to ISPRA, in 2023 photovoltaic fields accounted for only 0.83% of all land occupied by concrete, asphalt and other artificial coverings; the photovoltaic field needed to ensure Italy's net zero emissions by 2050 will be only 8% of the usable agricultural area that was abandoned in the forty years between 1980 and 2020, and which is currently unproductive, and 0.9% of the entire national territory. The

problem with the impact of photovoltaic systems on agricultural land is that the soil is alive, contains living organisms, and cannot be considered a substrate to be exploited simply because it is not cultivated. Photovoltaic systems should be installed on the roofs of houses, warehouses and industrial buildings, or distributed across the land, mixed with vegetation that can attract pollinators in different seasons through flowering.

Phylogeny – From the Greek *phýlon* (= lineage) and *génesis* (= birth). The history of the evolutionary development of living organisms from the time of their appearance on Earth to the present day.

Phylum – From the Greek *phýlon* (= lineage); the plural is Phyla. Taxonomic classification level between Kingdom and Class.

Phytophagous – From the Greek *phytos* (= plant) and –*phagos* (= feeding on). Organisms that feed on plants.

Plasmodium – From the Greek *plásma-* (= creature). Protozoan agent of disease, particularly malaria.

Platyhelminthes – From the Greek *plat-* (= flat) *helmins* (= warm). Acelomate warms, also known as flat worms.

Poliphagy – Characteristic of polyphagous organisms, which feed on different species of prey.

Pollen – Pollen or pollen grains are microgametophytes produced by spermatophytes; in Gymnosperms, they are

produced by male cones, while in Angiosperms, they are produced in the anthers. Their function is to transport the male gamete to the female gamete. According to microscopic research, pollen grains have a special wall made of sporopollenin, a resistant and stable polymer that protects the pollen during its long journey from the stamens to the pistil in Angiosperms, or from the male cone to the female cone in Gymnosperms. Pollen itself is not the male gamete, but its container. As soon as pollen comes into contact with a compatible pistil or female cone, it germinates, producing a pollen tube that transfers the male gamete to the ovule, which contains the female gamete. Pollen can be spherical, ovoid, vermiform, or polyhedral in shape, and yellow, reddish, brown, white, or blue-green in color. It is very rich in protein and is an important food source for many insects. Pollen is haploid and can be unicellular (microspore) or multicellular (male gametophyte). The size of pollen grains varies considerably, from 250 micrometres to 5 micrometres. Each pollen grain contains vegetative cells (in Angiosperms there is only one vegetative cell, in Gymnosperms there are several) and a generative cell (reproductive, which divides by mitosis to produce gametes). The vegetative cell produces the pollen tube and the generative cell divides to form the two gametes. On the wall of the pollen grains are glycoproteins that allow recognition of the female part of flowers of the same species, enabling

pollination. These glycoproteins are easily released and absorbed by the mucous membranes, can be allergens (see Allergen) and cause an immune system response by forming antibodies against them.

Pollinators – Animals that visit flowers to collect pollen or nectar, thereby contributing to pollination. This refers to insects, although some pollinators can also be birds, but mainly in regions other than ours. The best-known pollinator species is undoubtedly the honeybee *Apis mellifera*, which is also bred by humans to produce honey; however, its fundamental role is the pollination of wild and cultivated plant species. Other important pollinators are all the other Apoidea, i.e. "*wild bees*", most of which are highly social. Many other insect species pollinate flowers, but Apoidea undoubtedly have unique morphological characteristics for collecting pollen.

Polycrisis – The term was first introduced by French sociologist Edgar Morin in 1993. He believed that economic, ecological, social and cultural challenges cannot be addressed in isolation, as they create a cascade effect; therefore, they must be addressed in a comprehensive and non-fragmented manner. Attention to environmental risks has increased, partly stimulated by publications such as '*The Limits to Growth*' in 1972, and concerns about the ozone layer and climate change have highlighted humanity's dependence on limited planetary resources. The interconnectedness of these crises shows us that

solutions in one area can often lead to unintended consequences in another, creating a vicious cycle that exacerbates the overall situation. The term polycrisis suggests a complex situation in which multiple, interconnected crises converge and amplify each other, creating a situation that is difficult to manage or resolve. The term gained popularity in the early 2020s as a way to refer to the overlapping effects of the COVID-19 pandemic, war, rising public debt, climate change, the possible depletion of non-renewable energy resources, social inequality, etc.

Polyploidy – From the Greek *poly-* (= many), *haploos* (= simple) and *êidos* (= form). Cells with chromosomes consisting of many homologues. Polyploidy is a genetic condition in which a cell, or an entire organism, has more than two complete copies of each chromosome. In simpler terms, it is when the number of chromosomes is greater than the normal diploid set (2n), which is the typical chromosome number of somatic cells. This increase can be a multiple of the haploid number (n), which is the typical chromosome number of gametes (sex cells).

Polyvoltine – See univoltine.

Popolazione – From the Latin *populum* (= people). A group of organisms of the same species inhabiting a place.

Pre-image – Subadult stage of an arthropod, preceding that shown in the image (= adult).

Prion – From the English term 'PRoteinaceous Infective ONly

particle' (PRION), an infectious particle composed solely of protein that has the ability to transform itself into a rigid, compact form.

Proboscis – From the Greek *proboskís*. It is the typical organ of elephants and, by analogy, is also extended to protrusions that extend from the head of some invertebrates, such as acanthocephalans. Also the mouthparts of Lepidoptera are elongated, proboscis-like and rolled up; the insect unrolls them to insert them into the flower and suck the nectar.

Procariota – Primitive single-celled organisms lacking a nuclear membrane and most cellular organelles; they include bacteria.

Prosoma – The front part of chelicerates, also called cephalothorax.

Protein – From the Greek *prôtos* (= first). Term coined in 1838 by Dutch chemist Gerardus Johannes Mulder (1808-1880) to indicate an essential constituent of living matter. Following a suggestion by Jöns Jacob Berzelius (1779-1848), Mulder used the term protein in a paper dated 1838, where he also subtly proposed that animals derive most of their protein from plants.

Protists – Single-celled eukaryotic organisms, i.e. organisms with a cell divided into a nucleus, nuclear membrane, cytoplasm and various cell organelles.

Protostomes – Organisms with primitive body cavities; they

are divided into Lophotrochozoa (Platyhelminths or flatworms, Mollusca, Annelida) and Ecdysozoa (Nematoda or roundworms, Arthropoda). See also *Deuterostomes*.

Protozoan – From the Greek *proto-* and *zoon* (= primordial animal). Unicellular eukaryotic organisms.

Protura – Order of the class Entognatha, described by Italian entomologist Silvestri, lacking eyes and antennae.

Pullulation – Population explosion of certain species of phytophagous insects.

Pycnogonida – Class of Phylum Arthropoda, subphylum Chelicerata.

Raptatory – Specialised for capturing prey.

Recessive – A gene that does not manifest itself in the phenotype in the presence of a dominant gene.

Resilience – It is often argued that ecosystems are homeostatic, meaning that when an environmental stress factor is removed, they return to their previous state; this is the concept of "*resilience*", a term that is widely misused today, even by politicians. It was a little-used term with an obscure meaning for many until the European Union approved the National Recovery and Resilience Plan (PNRR) proposed by Italy in 2021. In ecology, according to the Treccani dictionary, "*resilience*" means "*the speed with which a community (or ecological system) returns to its initial state after being subjected to a*

disturbance that has removed it from that state". Technically, it is the ability of a material to withstand an impact by absorbing its energy through elastic deformation, then returning it and returning to its original shape. The classic example is that of tennis racket strings, which deform under the impact of the ball, accumulating a quantity of energy that they immediately return in the return shot. It seems clear that resilience also has its limits; most human interventions in nature do not give the system the possibility of even a minimal form of resilience. In short, the string cannot be stretched indefinitely because it would break.

Reptile – From the Latin *reptilem* (= crawling). Class of vertebrates including lizards, snakes, turtles and crocodiles.

Rhizosphere – From the Greek *rhíza* (= root) and *spháira* (= sphere). The environment surrounding the roots of plants.

Ribosome – A word composed of *ribose* (a sugar component of ribonucleic acid or RNA) and *soma* (body). Cellular organelles containing RNA present in the cytoplasm, the site of protein synthesis encoded by messenger RNA.

RNA – Ribonucleic acid, a polymeric molecule involved in various biological roles of encoding, decoding, regulating and expressing genes.

Rhodopsin – The structure of light receptors, called rhabdomeres, is equipped with molecules that are able to react

to light (rhodopsin, a protein in the eyes that is sensitive to light and sends the signal to the cerebral ganglia). It is possible to backdate by several hundred million years the photoreceptor neurons that are capable of responding to light and rendering every possible type of vision from the “birth” of the actual eyes. It seems that the first eyes appeared during the Cambrian evolutionary explosion, around 540 million years ago, which lasted at least 65 million years. Little is known about the photoreceptor neurons that predate the eyes, as they obviously do not leave fossils. These receptors are present as many small eyes along the mantle of bivalve molluscs, presumably inherited from distant relatives. Rhabdomeric and ciliary receptors can be found in the same group of organisms, regardless of whether they are Protostomes or Deuterostomes; this fact already proves that they appeared before the division into Protostomes and Deuterostomes.

Robert Hooke in 1665 was among the first to draw a compound eye, that of a tabanid dipteran. The pair of eyes, which touch each other in the centre, consists of a large number of hemispherical facets; these are larger in the male than in the female, as the male must recognize the female in flight in order to mate. This is somewhat the case in bees, whose males have larger eyes than the females, precisely because during the nuptial flight they must locate the queen and fertilize her. These compound eye facets, called ommatidia, are units with a lens

and photoreceptors below it. Each ommatidium sees an inverted image; the mosaic of images is rendered as complete vision at the nervous level, a fact that Sigmund Exner was able to demonstrate in 1891. The rod-shaped receptors made up of microvilli receive part of the image from different angles. For a human to have the same visual capacity as an insect, eyes one meter in diameter would be required! Most insects do not have the ability to move their heads and therefore need to move their entire bodies in order to see in other directions. In contrast to this majority, praying mantises, on the other hand, are able to turn their heads at will, which gives them an advantage in their predatory abilities. Dragonflies, on the other hand, have ommatidia in their eyes with a different resolution turned upwards, precisely so that they can check for prey in the background of the sky. An interesting aspect of the eye of nocturnal butterflies is the fact that at night, if their eyes are illuminated, they reflect like a cat's, thanks to the reflective pigments at the base of the light receptors.

Salticid spiders have four pairs of eyes, three are secondary eyes, the fourth pair is larger. They are simple eyes, not very different from human eyes, they have a curved cornea that is responsible for producing the image on the retina. The secondary eyes are immobile, so vision depends on the position of the body, the main eyes on the other hand can move, not the lenses but certainly the retina; they allow the head to move towards the

source of possible prey. The result is a high-resolution image. Human vision is based on three visual pigments, some birds and butterflies can have up to five pigments, but the record is achieved by the peacock mantis shrimp *Odontodactylus scyllarus* with twelve visual pigments, which is the maximum known in the animal kingdom.

Butterflies make use of color vision when searching for flowers. In contrast to the trichromatic retina of humans (cones for blue, green and red; and rods) and bees (photoreceptors for ultraviolet, blue and green), the retina of butterflies usually has six or more classes of photoreceptors with distinct vision spectrum sensitivities. The eyes of the Japanese swallowtail *Papilio xuthus* contain receptors for ultraviolet, violet, blue, green, red and a broad band; each ommatidium houses nine receptor cells in one of three fixed combinations. The eye of the swallowtail is therefore a random mosaic of three types of ommatidia that are heterogeneous in terms of the visual spectrum.

Sensilla – Sense organs of invertebrates, particularly arthropods, consisting of one or more sensory cells. They are particularly present on the antennae.

Sexual dimorphism – This is said in cases where the two sexes have clearly different morphologies.

Symbiont theory – According to modern symbiont theory, internal membranes and the cytoskeleton, a system of

filamentous proteins that gives shape to the cell and allows it to move, appeared in some ancestral anaerobic prokaryotes, enabling new types of organisms (called proto-eukaryotes) to incorporate solid particles, thereby contributing to evolutionary success. The proto-eukaryote could also feed on prokaryotes; some of these would have survived as endosymbionts within the predatory cell, giving rise to a symbiosis that was beneficial to both the host microorganism and the guest. A bacterium capable of producing ATP (adenosine triphosphate, a high-energy compound required for metabolic chemical reactions) using oxygen present in the environment would have obtained in return substances useful for its metabolism and protection from other predators. Over time, the genetic information essential for the host prokaryote to live independently would have been lost, while that useful for cellular respiration would have been transferred to the nucleus of the host cell. This would have led to the transformation of the endosymbiont into a mitochondrion and thus to the emergence of a new type of cell, the eukaryotic cell, capable of respiration, i.e. the set of complex metabolic processes by which cells obtain energy following the breakdown of nutrients into simpler molecules. A similar phenomenon of endosymbiosis would have occurred with an ancestor of a cyanobacterium hosted within a proto-eukaryote, which would have allowed the appearance of chloroplasts within plant cells. The symbiont theory is essentially a theory of an endosymbiotic

association, based on the host cell's ability to perform respiration and the advantage of the host cell in acquiring this ability, and would seem to be confirmed by the presence in the eukaryotic genome of genes of bacterial origin, but the presence of certain genes that are unrelated to respiratory functions and of mitochondrial-type genes in the genome of eukaryotes without mitochondria are considered arguments against the credibility of this theory.

According to more recent hypotheses, the first eukaryotic cells appeared thanks to a symbiosis between an autotrophic hydrogen-dependent archaeobacterium and a bacterium whose anaerobic heterotrophic metabolism allowed it to eliminate hydrogen and carbon dioxide; while the archaeobacterium required the total absence of oxygen and used hydrogen and carbon dioxide as its only sources of energy and carbon, the hydrogen-producing bacterium could be facultative anaerobic, and therefore could live both in the presence and absence of oxygen. The transfer of genes from the endosymbiotic host would have provided the host cell with the genetic information necessary for the production of glycolysis enzymes, the biochemical process that precedes respiration and produces ATP in the absence of oxygen, and mitochondrial membrane proteins that allow the passage of molecules necessary for the respiration process. In this way, the host cell would have favored and preserved the guest cell within it. The cell that originated

from these transformations must have had a very different metabolism from that of the first archaea, would have been able to use complex organic molecules, and would no longer have needed hydrogen and carbon dioxide to survive. According to this hypothesis, it was at this stage that the host became the modern mitochondrion. The main difference between this theory and the previous one is that one of the two microorganisms involved is capable of producing hydrogen, while the other depends on the former for its hydrogen supply. Endosymbiosis is therefore a consequence, not a preliminary event, of the new interaction between the metabolism of one microorganism and that of another. The hypothesis attributes evolutionary significance to hydrogenosomes and provides a rational explanation for their common ancestry with mitochondria. Hydrogenosomes are anaerobic mitochondria that produce ATP, usually by converting pyruvate into hydrogen, carbon dioxide and acetate. The hypothesis provides a straightforward explanation for the observation that eukaryotes are genetic chimeras with genes of archaeal and eubacterial origin. Furthermore, it would imply that archaea and eukaryotes diverged after the emergence of modern archaeal groups. Most theories within the endosymbiotic theory predict that some eukaryotes never possessed mitochondria. The hydrogen hypothesis predicts that primitive eukaryotes without mitochondria never existed. This hypothesis would also

explain why the eukaryotic genome contains genes responsible for the synthesis of membrane proteins that are not connected with the process of respiration, and would explain the presence of mitochondrial genes in eukaryotes without mitochondria (*Monocercomonoides* and some species of Metamonads such as *Trichomonas* and *Giardia*, even though the latter possess organelles derived from mitochondria, namely mitosomes or hydrogenosomes).

Simpatric – This refers to species that have evolved while coexisting in the same area; the opposite is allopatric.

Sinomones – Chemical substances emitted for the benefit of both the emitting organism and the receiving organism.

Siphonaptera – From Greek *síphonos* (= pipe) e *apteros* (= wingless). Order of the Class Insecta which includes fleas.

Social – According to the Treccani dictionary, a social media user is someone who uses the internet as a place to share and exchange information and experiences. It seems that tens of millions of users now choose to read newspaper articles through new "*social*" channels, such as online platforms like Facebook, Instagram, X (formerly Twitter), TikTok, etc. Many politicians presently also communicate almost exclusively through these platforms. Unfortunately, however, the system of communication via the internet is heavily polluted by many alleged truths, slander and falsehoods, often managed by

controversial figures, in some cases seeking shares that they could not hope to obtain in any other way. The excessive use of social media channels has been and continues to be the subject of study by psychologists and is probably also an indication of the loneliness of many users and their need to be in contact with someone, even if only virtually.

Sound Communication – Many insects communicate through sounds; the best known among them are undoubtedly crickets. How do these and other insects make sounds? Stridulation is the result of the rubbing of two parts of the body with reliefs, the stridulatory crest (or bow) and the plectrum; the two parts may be the hind legs rubbing on the wings, the wings rubbing against each other, specific areas of the thorax producing sounds with the rhythmic movement of the abdomen, etc. Some hemipterans, such as reduvids, rub their rostrum on the sternum, some male and female neuropterans emit a sound by vibrating their abdomen in a characteristic way (this sound can be perceived by the candidate partner through the auditory organ of the tibiae), lepidopterans move their hind wing on the front one. Beetles have various ways of emitting sounds; for example, Carabidae may rub the apex of the head on the joint cavity of the thorax or the legs on the margin of the elytra or the margin of the elytra on that of adjacent abdominal segments, Cerambycidae emit a characteristic sound by rubbing the prothorax on the mesothorax, Geotrupidae by rubbing the

femur on the cavity of the coxae or the elytra on the mesothorax. *Xestobium rufovillosum* is a beetle belonging to the subfamily Anobiinae, also known by the name “death watch”, due to the fact that its sexual call consists of banging its head against wood, generating an audible but faint noise at regular intervals.

Undoubtedly the masters in this type of sound message are the Orthoptera, crickets, grasshoppers, locusts, but also Diptera and Hymenoptera are communicators of this type; ants and moths perform a stridulation by means of an organ located in the margin of the third abdominal segment, which is very knurled, and which runs on the next segment and produces a sound, which is intended to alarm individuals of the same species. The beating of wings in some insects produces a characteristic sound, which is a very unique source of communication; the frequency of a mosquito's wing movement can reach a thousand beats per second and is associated with courtship, each species of mosquito has its own frequency and males have different frequencies to females. The stridulation of orthopterans and many other insects has the main purpose of sexual courtship, although it is certainly not the only one; it has such a specific characterization that it allows a well-defined separation between species, avoiding the risk of hybridization. The sound of the males is a secondary sexual character; the females are in fact stimulated by the stridulation of the males. In some species of Orthoptera it is both males and females that stridulate in

response to the other sex; in some micropteran species (with vestigial wings) only the female makes a modest stridulation, which has the obvious purpose of attracting male. Since stridulation is based both on the number of pads in the *pars stridens* rubbing together and on the speed and rhythm of rubbing, each species that stridulates emits different sounds based on morphological characteristics, and the number of possible stridulations is so great that overlap between related species is rather difficult. Selective pressures over generations have influenced more or less consistent changes in the sounds, producing differentiation, both of the individual trills and of their intensity and frequency; in some groups of crickets and grasshoppers, these differentiations in the course of evolution have produced separate species, whose partners can be recognized because they emit different sounds.

The hearing systems of orthopterans evolved at least 200 million years ago, in the Triassic; fossils found in Denmark, dating back 55 million years, have modern tympanic structures, quite similar to those of today's species. Sound communication in tettigonid orthopterans therefore evolved before the appearance of bats, their predators; the latter, around 50 million years ago, in the mid-Eocene, had a fully developed echolocation system, not unlike the one they have today, and therefore already represented a substantial predation risk. Sounds in Eocene environments must have represented a widespread and

developed communication system.

Some wingless cockroaches, such as the Madagascan species of the genus *Gromphadorhina*, expel air from the stigmas of their thorax and produce a very loud blow, which they use as a defence. The death's-head sphinx *Acherontia atropos* emits a very peculiar sound through its mouthparts; like all butterflies, the sphinx is equipped with the spirit tube, which in its case is short and sclerosed. When it dilates the pharynx, by inhaling air through the spirit trumpet, the air enters the pharyngeal cavity and causes a lamella located in the epipharynx to vibrate, producing a low sound; the contraction of the pharynx and the expulsion of the air brushing against the lamella produce a high-pitched sound. These two sounds to the human ear almost sound like moans, which, combined with the design of the thorax, which resembles a skull, have given rise to a series of superstitions around this harmless insect, which have perhaps also served to create a fearful respect for it.

In North America, there is a group of cicadas belonging to the genus *Magicicada*, which has a periodicity of 13 and 17 years. They spend almost their entire lives underground, feeding on the roots of plants in forest environments; depending on the species, after 13 or 17 years, when the first 20-30 cm of soil reach a temperature of 18 °C for 4-5 days, the nymphs emerge from the soil and metamorphosis into winged adults takes place. Then, with constant periodicity, true cicada invasions and their

concerts occur, lasting for a month or even a month and a half. The females, attracted by the males, mate and then lay eggs on the plants. From these hatch young larvae that go underground, where they will remain for the typical 13 or 17 years. In the years when these large cicadas emerge, any outdoor activity is difficult due to the noise they produce. It seems that this strategy of emerging from the ground every 13 or 17 years is a form of self-defence against possible predators. 13 and 17 are in fact prime numbers, which can only be divided by themselves; a predator with a short biological cycle therefore has no chance of synchronising with the event that takes place every 13 or 17 years. At the base of the abdomen of the cicadas, between the two hind legs, is a peculiar organ that produces a peculiar and generally monotonous sound, sometimes a real concert in coniferous forests. The tympanic membrane of the cicadas is supported by a chitinous ring and a muscle inserted in the centre of the membrane; the contraction of the muscle attracts the membrane, which deforms and produces a sound, its relaxation brings the membrane back to its original position, producing another sound. The muscle of the tympanum is very robust and can contract and relax at very high frequencies, even 100-500 times per second, thus producing a sound that seems continuous, but is actually bitonal. Cicadas are also known for their longevity, but most of their time is actually spent in the larva stage, underground. In fact, from the eggs laid by the adult

in the bark of trees and shrubs, small larvae hatch. After a short time, they make their first moult and then drop to the ground by means of a thin thread of silk produced by themselves and, thanks to their front legs suitable for digging, they move underground, where, depending on the species, they can spend from four to 17 years, feeding on roots! When they are ready to carry out their final metamorphosis, they emerge during the summer and leave their exuvia attached to a grass stalk, making their first flight and making their first sounds; only 5% of the larvae have the good fortune to reach maturity, the others die for many reasons. Their adult lives last only one season.

Chiroptera (bats), winged mammals distinguished by their poor eyesight and high ability to locate obstacles through ultrasound emission and an efficient hearing apparatus, are the best known ultrasound emitters and thus the real reason why bat detectors were produced. A very interesting case is the predator-prey relationship that has been established between bats and certain lepidopteran nottuids, which recognize the ultrasounds emitted by the bats and avoid them by letting themselves fall to the ground; one species of nottuid, *Melese laodamia*, even emits other ultrasounds to avoid capture, which disorientate the bats' "sonar". For this strategic reason, the anti-radar defence squadron of the British Air Force (R.A.F.) has included this butterfly in its coat of arms. The intense acoustic signals attract predators, who take advantage of the very sounds emitted by

their prey to locate them.

It is interesting to note that the song of certain birds has inspired musicians to compose pieces of music. One example is the lyrebird *Menura novaehollandiae*, which, together with other Australian birds, inspired French composer Olivier Messiaen (1908-1992) in his last orchestral work, *Èclairs sur l'au-delà*, which debuted on stage at Lincoln Center in New York shortly after the composer's death.

Specific richness – In ecology, this refers to the number of species present in a given area. See also Diversity.

Sphaecidae – They are a family of solitary apoids that paralyze large prey, which they then hide in underground burrows, laying an egg there; the larva that hatches feeds on the body of the paralyzed insect.

Successors – Arthropods that use the empty gall left on the plant as a shelter, entering through the exit hole of the gall-inducing insect.

Superorganism – A group of individuals (colony) with such a high level of social behavior that together they possess the functional organization implied in the formal definition of an organism.

Sustainability – The term was coined to explicitly indicate that it is possible to achieve economic growth and industrialisation without necessarily causing damage to the

natural environment. The use of the term "*sustainable*" continues to be inappropriate in many cases, as can easily be understood by reading documents or reports on aspects of economic and environmental management written by government bodies, economic and planning professionals, etc. The topic of sustainable development is often addressed in economic planning, as an ethical concept, in the form of a desire to express a desirable outcome of economic and social decisions. It is generally addressed as an aspiration, mostly rhetorical, which is then ignored in practical decisions. It can certainly be said that it is discussed more out of duty than conviction. The term '*sustainable*' is also often used in projects involving the use of non-renewable resources; in very general terms, a process is sustainable, within a given context, when it can continue to take place for an indefinite period of time without compromising the material bases that allow it to take place. This is not the case with any process that irreversibly consumes any physical resource of the system in which it takes place and changes the conditions that guarantee the dynamic equilibrium of the system. For example, nuclear power, fossil fuels, and any process that consumes resources at a faster rate than the rate at which those resources regenerate, are not sustainable. The concept of sustainability has evolved over the decades; initially, it was defined as "*development that meets the needs of the present without compromising the ability of future generations to meet*

their own needs". Although vague and anthropocentric, this definition achieved the dual objective of warning about the problems of environmental degradation that commonly accompany economic growth and, at the same time, emphasizing the need for economic growth to reduce poverty rates. Sustainability, like many other environmental issues related to human population growth, necessarily leads to a broader debate on biodiversity conservation, as was the case in Rio in 1992, when global environmental change, the loss of natural resources and climate change were discussed. Sustainability must be addressed in an interdisciplinary manner, and the fundamental ecological and natural resource conservation aspects, which are at the very core of the concept, cannot be ignored. In fact, the environment is part of natural resources, while the economy is created by society to increase well-being; in a sense, the foundations of society and its economy are constituted by the natural environment, as the resources available in the Earth-Sun system offer a limit to human activities.

Symbiosis – From Greek *syn-* (= together) e *bíos* (= life).

Syndrome of the Gluck street boy – The "*Syndrome of the Gluck street boy*", inspired by Adriano Celentano's 1966 character, who no longer recognized the places of his childhood, covered with houses and concrete, coincides with the resignation of a large number of people, who are now so

accustomed to seeing natural environments disappear and helplessly witnessing their degradation that they willingly accept to commit themselves only to trying to protect the most important sites and safeguard the most extensive environments, in the disillusionment that nothing more can be done to curb the general natural disruption, widespread degradation of the planet and indifference to nature. We are becoming so accustomed to the dissipation of natural resources that we now try to focus only on the biggest problems; to paraphrase Carlo Levi's "*Christ stopped at Eboli*", the way in which natural environments and animal and plant populations have been treated in recent decades is not "*Christian*".

In 1960, a twelve-year-old boy, accompanied by his seventeen-year-old brother, could take tram 33 from Via Vitruvio in Milan to the terminus in Roserio, where there was a large irrigation tank and several irrigation ditches with crystal clear water, teeming with frogs, tree frogs, newts and even rare pelobates. The two young men were animal lovers and had several terrarium where they kept amphibians. Six years later, the same boy, now eighteen, wanted to visit the pond full of amphibians in Roserio, so he took the 33 tram again, but the terminus had changed and he could no longer recognize the places where he had collected tree frogs and newts. There were many new

buildings and many new roads, but no trace of the pond[1]. Milan was a rapidly expanding city, and it is symptomatic that in 1966 Adriano Celentano wrote and sang "*Il ragazzo della via Gluck*" (The Boy from Via Gluck), the story of a young man from Milan who leaves his country home to go and work in the city, but after a few years returns and no longer recognizes the places, where he finds only houses and concrete. It's all true! Celentano was undoubtedly a pioneer of environmentalism and is known for his commitment to protecting natural environments and respecting nature.

Finally, who was Christoph Willibald Gluck? A German composer (1714-1787), active mainly as an opera composer, one of the major initiators of the so-called period in music history that goes by the name of Classicism in the second half of the 18th century.

Systematics –The science that deals with the classification of living beings and identifying their relationships. Today, a natural system is used in which genetically closer organisms are classified together on the basis of phylogenetic relationships. See also Taxonomy.

Taxon – Plural: taxa; from the Greek: *ταξις*, *taxis* (= order); taxonomic unit, grouping of organisms that are morphologically

[1] The two boys, Bruno and Renato Massa, followed different academic paths, the former in Palermo and the latter in Milan, but they never forgot those days in the 1960s.

distinguishable from others by unique characteristics. Organisms can be organized through Systematics into a hierarchy, giving rise to a Classification.

Taxonomy – From the Greek *táxis* (= order, arrangement) and *-nomia* (= law). Science that defines taxa, studies and names species, genera and, moving up the hierarchical scale, other taxonomic groupings. It is a method and a system for describing and classifying organic bodies.

30 by 30 – Objective 3 of the Global Biodiversity Framework (GBF, Kunming Montreal Global Biodiversity Framework) – according to which countries should ensure that at least 30% of the Earth is covered by protected areas or regulated by other conservation measures by 2030 ("30 by 30") – is considered by many to be the agreement's flagship target and has been compared to the Paris Agreement's 1.5 °C temperature target. An analysis carried out by Carbon Brief with 'The Guardian' revealed that more than half of the world's nations have not committed to protecting 30% of land and sea for nature by 2030 in the plans submitted to the United Nations and are failing to protect 30% of terrestrial and marine areas to be protected. Seventy of the 137 countries (51%) that submitted UN plans outlining how they will achieve the GBF targets have not committed to achieving "30 by 30" within their borders, but are committing to protecting a smaller percentage of their territory for nature or are not explicitly committing to a numerical target.

The analysis showed that countries that do not consider themselves committed to achieving the “30 by 30” target in the UN plans represent just over a third of the Earth’s surface. The list includes some of the most nature-rich nations on the planet, such as Indonesia, Peru and South Africa, as well as developed countries such as Finland, Norway and Switzerland.

All countries were asked to submit plans to the UN Convention on Biological Diversity outlining how they would achieve the GBF targets within their territories ahead of the COP16 nature summit in 2024. These are known as National Biodiversity Strategies and Action Plans (NBSAPs). To check whether countries have committed to meeting the “30 by 30” target within their borders in these plans, Carbon Brief and the Guardian analyzed the full text of each NBSAP, as well as every target that was labelled as related to GBF target 3. The analysis found that of the 137 countries that submitted plans to the CBD, more than half – 70 countries, or 51% – do not commit to protecting 30% of their land and sea by 2030. Of these, 21 countries did not provide a numerical target for the protection of their land area, 26 set land protection targets below 30%, and eight set land targets above 30% but sea protection targets below 30%. Of the remaining countries, 13 have not submitted any targets for protected area coverage, two others have set targets further ahead than 2030, and 10 other countries, or 7%, do not make it clear from their submitted plans whether or not they

have a commitment that meets the “30 by 30” conditions. Only 42% of countries – 57 in total – are committed to protecting 30% of land and sea by 2030. The analysis shows that, collectively, more than a third of the Earth's surface is covered by a commitment that does not meet the “30 by 30” target, while about half is covered by a “30 by 30” commitment. According to the analysis, seven of the 17 countries with high biodiversity – which together are home to 70% of the world's biodiversity – have not committed to achieving the “30 by 30” target. These are Indonesia, Malaysia, Mexico, Peru, the Philippines, South Africa and Venezuela. Another 61 countries have not submitted a national action plan or national targets and were therefore not assessed in the analysis. These include Brazil, the country with the greatest biodiversity in the world. The figures do not even include the United States, which, despite being a country with great biodiversity, has not signed up to the Convention on Biological Diversity and is therefore not subject to the GBF targets. In fact, former US President Joe Biden had committed to the “30 by 30” pledge, but Donald Trump's Project 2025 turns back the clock and eliminates the “30 by 30” commitment. Carbon Brief and the Guardian contacted the most biodiverse countries and developed nations to ask them why they had chosen not to commit to “30 by 30” in their UN plans. Indonesia, a country that is home to the third largest rainforest in the world, did not provide a numerical target for the amount of land

it is able to protect for nature in its NBSAP. Mexico, a country with high biodiversity, has committed to protecting 30% of its oceans, but only 22% of its land area. The EU has presented a national action plan for the environment covering the 27 Member States and is committed to achieving “30 by 30”. However, individual countries are also party to the Convention on Biological Diversity and must submit their own national plans. For the purposes of this analysis, EU Member States were considered to be in compliance with the “30 by 30” target only if they had submitted their own NBSAP or a national target to that effect.

Tick – It seems to be of Lombard origin (Zëkka). Blood-sucking mite.

Tipping points – In the final statement of the second international conference (held at Exeter University, Great Britain) on the Tipping Points that the Earth system is in danger of overtaking due to human intervention leading us into unmanageable situations, with the participation of leading scientists working on the subject, it is written: "To prevent tipping points in the climate system, it is essential to minimize both the magnitude and duration of the 1.5 °C temperature overshoot. Every year and every fraction of a degree above 1.5 °C is important. To minimize the overshoot, global greenhouse gas emissions must be cut in half by 2030 from 2010 levels, which requires an unprecedented acceleration of decarbonization.

Only in this way can the world achieve net zero emissions in time to peak global temperatures well below 2 °C and begin to return to 1.5 °C and then below. This will also require accelerating the sustainable removal of carbon from the atmosphere".

Trimethylbenzoyl Diphenylphosphine Oxide – Abbreviated as TPO, is a photoinitiator used in UV-curing products such as gels and nail polishes. It allows nail polishes to transition to a solid state when exposed to UV or LED light, creating a durable, glossy finish. However, due to its classification as toxic, its use has been banned in cosmetic products, including nail products, within the European Union, as of 1 September 2025.

Triungulin – Larva of certain insects (e.g. Strepsiptera and Meloidae beetles), characterized by legs adapted for clinging, a slender body and rapid movements, which enable it to easily reach a host on which to be transported by phoresy.

Troglobite – Species linked to cave habitats or other underground environments.

Univoltine – Species that reproduce once a year; in contrast, polyvoltine species have several generations each year.

Vaccine – From the Latin *vacca* (= cow, bovine). The first trials of "*vaccination*" were carried out by Edward Jenner (1749-1823), who injected cowpox pus into humans. E. Jenner is considered the father of vaccination for his discovery of the

smallpox vaccine in 1796; he noticed that milkmaids who had contracted cowpox (a milder form of human smallpox) seemed to be immune to human smallpox. Based on this observation, Jenner developed a vaccine by inoculating cowpox into a boy, who then proved to be immune to human smallpox. This was the first effective vaccine ever developed and marked the beginning of modern vaccination.

WMO Global Annual to Decadal Climate Update (2025–2029) – The World Meteorological Organisation (WMO) publishes an annual global climate update every year, providing a summary of global annual and decadal forecasts produced by WMO-designated global production centers and other contributing centers. The key messages from the latest report are as follows: 80% probability that at least one of the next five years will exceed 2024 as the warmest on record; 86% chance that at least one of the next five years will exceed the 1850-1900 average by more than 1.5°C; 70% chance that the average five-year warming for the period 2025-2029 will exceed 1.5°C; long-term warming (averaged over decades) remains below 1.5°C; Arctic warming is expected to continue to exceed the global average; precipitation patterns have large regional variations.

Xenotransplantation – Genetic transfer between two organisms of different species.

Xilophagous – Insects that feed on wood (from the Greek word *xylon*, meaning wood).

Zoocecide – From the Greek *zoo-* (animal) and *cecidium* (gall). A gall produced in a plant by an animal (usually an insect); it can be an acaroid gall, nematode gall, entomoid gall, etc., induced respectively by a mite, a nematode, or an insect. See *gall inducing*.

Zoraptera – From Greek, *zor* (= pure) and *apteros* (= wingless); order of insect described by Filippo Silvestri (1873-1949) in 1913.

Zygote – From the Greek *zýgosis* (= mating). Cell resulting from the fusion of male and female gametes.

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Useful Links

https://www.connettere.org/paesaggio-e-fonti-rinnovabili-la-nuova-alleanza/

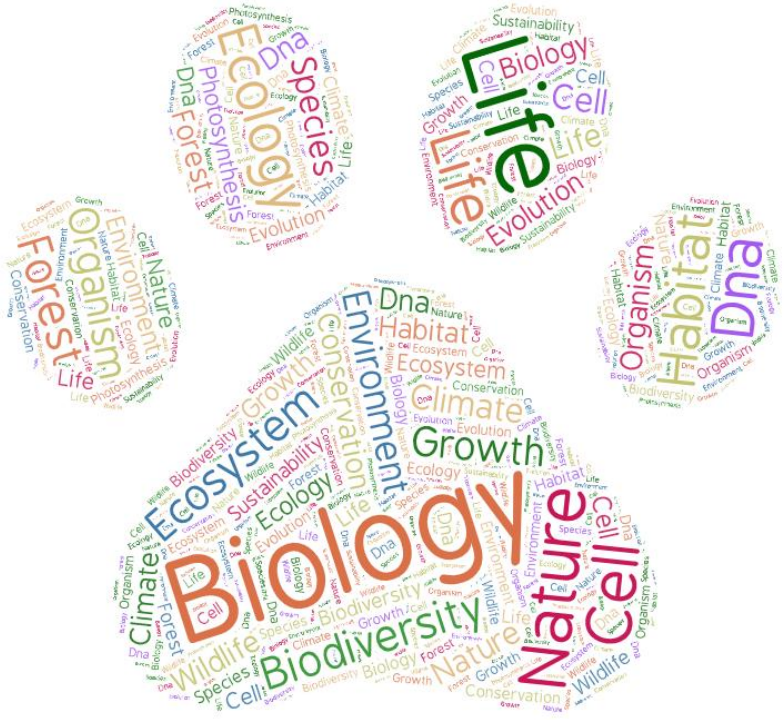
https://www.spun.earth/

Bruno Massa was a full professor of General and Applied Entomology at the University of Palermo, Department of Agricultural, Food, and Forestry Sciences, retiring in 2018. He is a member of the Italian National Academy of Entomology, the Accademia Roveretana degli Agiati, the Accademia dei Georgofili, and the Academy of Sciences, Letters, and Arts of Palermo. He is a member of the IUCN/SSC Grasshopper Specialist Group and the Scientific Community of WWF Italy. He is editor-in-chief of the journal Il Naturalista Siciliano and a member of the Editorial Board of *Biogeographia, Biodiversity Data Journal, European Zoological Journal, and Forests*. He has conducted extensive entomological research on the taxonomy and ecology of Orthoptera in Europe and tropical Africa, on the interrelationships between leafminers and parasitoids, and on root-knot insects and their parasitoids. He has also been actively involved in ornithology, studying insectivorous birds in forest habitats in a long-term (30-year) study, arthropods as a food source for insectivorous birds, and two pelagic bird species (Corus's shearwater and storm petrel) on two small Mediterranean islands (Linosa and Marettimo) for over thirty years. He has published over 500 scientific articles and several popular books on these topics.

Toni Puma, Mathematics and Science teacher at the Provincial Adult Education Center in Ragusa; www.tonipuma.it.
He graduated in Geological Sciences in 1994 and collaborated with the University of Catania for many years. An experienced scientific photographer, he has taught numerous nature photography courses and manages his personal website www.tonipuma.it, dedicated to the fauna and flora of the Iblei Mountains. He has contributed to the publication of several popular books on various aspects of nature; the most recent is *Il Pianeta degli Insetti e di altri Arthropodi* published by Ricca ed., in collaboration with B. Massa.

" The limits of my language mean the limits of my world."
Ludwig Wittgenstein

We hope this glossary is a small contribution to expanding your horizons of knowledge and your freedom of thought.
Bruno Massa & Toni Puma



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