

BIODIVERSITY, NATURAL INTELLIGENCE, AND ARTIFICIAL INTELLIGENCE: A NEW ALLIANCE FOR THE PLANET

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Abstract

The Biodiversity crisis is no longer a distant threat but a tangible reality that endangers the resilience of ecosystems and human well-being. In response to this epochal challenge, the scientific community is exploring innovative frontiers, including the application of Artificial Intelligence. This article aims to analyze the intersection of three fundamental concepts: Biodiversity, Natural Intelligence, and Artificial Intelligence, to illuminate how their synergy is forging a new paradigm for conservation.

Keywords

Biodiversity, Natural Intelligence, Artificial Intelligence, AI

1. Introduction

Biodiversity, natural intelligence, and artificial intelligence are three concepts that, while seemingly distinct, are deeply interconnected; they are three aspects that influence each other in a rather complex relationship.

Biodiversity and natural intelligence are closely linked, as the variety of life forms on Earth is the result of billions of years of evolution and adaptation. Natural intelligence, in turn, is fundamental to the survival and prosperity of species.

Artificial intelligence can have a significant impact on biodiversity and natural intelligence. It can be used to monitor biodiversity and detect changes in ecosystems, allowing for more effective conservation interventions. It can also be inspired by natural solutions to solve complex problems, through the development of optimization algorithms. The relationship between natural and artificial intelligence can manifest as a synergy between the millennial wisdom of nature and the computing power of AI.

Safeguarding biodiversity is one of the most urgent and complex challenges facing humanity. As the climate crisis accelerates the loss of vital ecosystems, an unexpected alliance is emerging: the union between natural intelligence, inherited

from millions of years of evolution, and the computing power of artificial intelligence (AI). This synergy is opening up new frontiers for understanding, monitoring, and protecting our planet.

However, AI can also have negative impacts on biodiversity and natural intelligence. It is therefore essential to develop strategies to manage the impact of AI on biodiversity and natural intelligence, in order to ensure a sustainable future for generations to come.

2. Biodiversity: the living fabric of the Planet

Biodiversity is the living fabric of our planet, it is the foundation of human well-being, and its rapid decline threatens both Nature and people.

Biodiversity (biological diversity) is traditionally defined as the variety, richness, and diversity of all life forms present on Earth: the millions of plants, animals, and microorganisms, the genes they contain, and the complex ecosystems they form, in which they coexist and interact, influencing each other. It is the variety of life on Earth, in all its forms, from genes and organisms to entire ecosystems like forests or coral reefs.

Biodiversity also includes human cultural diversity, which is affected by the same factors

that impact biodiversity.

It is not a simple, static collection of elements, but a dynamic and complex system, the result of billions of years of evolution. It is the living infrastructure that provides the essential "ecosystem services" for human life, such as air and water purification, crop pollination, climate regulation, and protection from natural disasters.

The theme of the 2025 International Day for Biodiversity is "Harmony with Nature and Sustainable Development," focusing global attention on the links between the 2030 Agenda and its Sustainable Development Goals (SDGs) and the Goals and Targets of the Kunming-Montreal Global Biodiversity Framework (KMGBF) as two universal agendas that must be pursued jointly in the spirit of the recently adopted Pact for the Future.

The Pact for the Future, adopted on September 22, 2024, by United Nations Member States during the Summit of the Future held at UN headquarters in New York, reaffirms Member States' commitment to the Sustainable Development Goals of the 2030 Agenda. It covers a wide range of topics, including: international peace and security, including nuclear disarmament and the prevention of arms races in outer space, sustainable development, climate change; digital cooperation, human rights, gender issues, youth and future generations, and the transformation of global governance.

Progress in halting and reversing biodiversity loss is crucial for achieving the Sustainable Development Goals.

It is necessary to monitor, preserve, and restore biodiversity through modern technologies, making biodiversity a central element on which to base sustainable development.

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own; it aims to reconcile economic development with the safeguarding of social and environmental balances.

Sustainable innovation can change the world; it can improve our planet. Just a few years ago, sustainability and innovation were considered fundamentally opposite concepts, because many technological and industrial innovations had (and unfortunately still do in some cases) a negative impact on Nature and people's well-being. Today, however, innovation can be crucial for improving

the environment in which we live.

The topic of sustainability has exploded in recent years and in some cases has unfortunately also become a trend. Sustainable innovation consists in a re-evaluation of the concept of economic development, based on the creation of private and social wealth but with the ultimate goal of eliminating the negative impact of this process on ecological systems, human health, and the well-being of the community.

To achieve sustainability goals, it is necessary to implement a circular economy, avoiding waste. This is a model of production and consumption focused on reducing the waste of natural resources, and on sharing, reusing, and recycling existing materials and products for as long as possible, unlike the traditional linear economic model, which is based on the opposite pattern: extract, produce, use, and discard, with consumer goods ending up in landfills and incinerators.

We must implement the energy transition towards renewables, freeing ourselves from fossil fuels, and the food transition, to produce food in an environmentally friendly way (Valzano, 2024).

New digital technologies, including artificial intelligence, will play a fundamental role and, in the medium to long term, must serve to:

- reduce the use and waste of natural resources to produce goods or services;
- improve the energy efficiency of production plants and buildings; use alternative and renewable energies;
- reduce the waste of water resources;
- reduce consumption and pollution;
- recycle waste products and packaging;
- adopt circular economy models;
- adopt new forms of remote work and collaboration models that contribute to people's well-being and social inclusion;
- analyze and manage data to monitor the efficacy of sustainability policies.

Biodiversity, the variety of ecosystems, is our natural capital; it is a wealth to be safeguarded. But, as we all know, it is disappearing at an alarming rate due to human activities, such as changes in land use, deforestation, overfishing, pollution, and climate change.

In addition to all this, despite the Pact for the Future, wars and conflicts between countries, such as those we are witnessing in recent years between Russia and Ukraine, and between Israel and Palestine, destroy biological and human diversity, as well as material and immaterial

cultural heritage. They cause devastating environmental damage, such as deforestation and pollution, and profoundly affect populations with deep trauma, loss of life, including that of unarmed civilians and innocent children, famines, forced migration, and the loss of their cultures and traditions.

The loss and impoverishment of biological and cultural diversity have heavy impacts on economies and societies, reducing the availability of food, energy, and medicinal resources.

It is necessary to acquire greater knowledge and awareness of issues related to biodiversity and the vital importance of its conservation through interdisciplinarity, placing collaboration and dialogue with biologists at the center.

It is necessary to reconsider environmental education curricula to promote ecological awareness among young people, positively influencing their behavior toward the environment.

As Boero (2024) says, formal education in most countries is based on abstractions that are inflicted to young people with the intent of providing them with interpretative keys to understand the world. Biodiversity and ecosystems have been included in Article 9 of the Constitution, alongside the Landscape, but "Nature is almost absent from formal curricula: the natural curiosity of young people about natural things (biophilia) is discouraged. To cope with this shortcoming, scientific communication focuses on surprising things (the ohh strategy) that never provide awareness (ahh) about natural models and processes. No one knows that diatoms and copepods are the most important plants and animals that enable the functioning of planetary ecosystems. 71% of the planet's surface is covered by the ocean, which is not a surface: it is a volume! Over 90% of the space inhabited by living beings consists of the oceanic water column. The land is an exception. The oceanic volume is the rule. It is the ocean that keeps the biological world functioning." (Boero, 2024). Natural history entertainment programs and natural history museums are largely dedicated to animals and

tend to amaze the public, so that they say "OHHH."

The Darwin Dohrn Museum, recently created in Naples thanks to the idea and coordination of Boero and other biologists, is an attempt to merge the two strategies. It is a museum where the "OHHH" of wonder leads to the "AHHH" of awareness. The museum, through a sequential exhibition path, prompts the visitor to ask questions and then find different answers (AHHH) with various moments of wonder (OHHH).

"*Ours is a world of water, a planet dominated by the mantle of the ocean that holds everything.*" wrote Rachel Carson (1951) in her book "*The Sea Around Us*" emphasizing how the planet is fundamentally a "water world" dominated by the oceans, which cover most of the surface and from which life itself originated. This essay, originally published in 1951, is part of the author's so-called "sea trilogy."

Rachel Carson (1907-1964), a marine biologist and successful American writer, is one of the pioneers of environmental movements. Through the essays of her "sea trilogy"¹ Carson maps marine history and recounts all its aspects, from the genesis of the oceans to the habits of their inhabitants, and even provides warnings about the risks of neglecting the ecosystem that allowed life on Earth. She is the biologist who changed our way of observing the marine environment: from scientific studies on the Albatross III² to the fight against waste disposal at sea. Universally recognized as the mother of contemporary environmentalism, Rachel Carson has inspired generations of activists and was an important reference point for ecofeminist thought.

The environmental foundation Marevivo, founded and chaired by Rosalba Giugni, a diver from Naples in whose veins, as she says, not blood but the sea flows, writes on its website: "The sea is our home, our mother, our life."

Since 1985, Marevivo has worked intensely for the protection of the sea and the environment, against pollution and illegal fishing, for the study of biodiversity, the promotion and enhancement of marine protected areas, and education in schools and universities for sustainable development and

¹ *Under the Sea-Wind* (1941), *The Sea Around Us* (1951) and *The Edge of the Sea* (1955). *The Sea Around Us* is the one that gave her greater fame and recognition before the widely known publication of *Silent Spring* (1962), considered the founding work of the modern environmental movement. It is the text which, for its content of explicit denunciation against the indiscriminate use of pesticides, attracted very heavy

criticism and attempts at defamation, but which is still considered one of the first fundamental texts for ecological movements.

² Rachel Carson was the first woman to board a United States government vessel, the Albatross III, to conduct her scientific and oceanographic research.

awareness on all issues related to the Sea.

Recently, in collaboration with the MSC (Mediterranean Shipping Company) Foundation, it created MOA (Marevivo Ocean Academy), a web space accessible to everyone, designed to help the largest possible number of people understand the deep and indissoluble link between our actions and the health of oceans and seas. MOA is a container (repository) of contributions from experts and educational aids extracted both from projects carried out by Marevivo with the support of the MSC Foundation, and from materials designed for teachers and students of schools of all levels, environmental education operators, and people of all ages who are curious about nature and like to stay informed to participate in the present and build the future.

UNESCO recently launched the *Sustaining Our Oceans* project, supported by Fast Retailing Co., Ltd., which aims to foster healthy relationships with the ocean among youth in South-East Asia by combining Education for Sustainable Development (ESD) with hands-on, field-based experiences at UNESCO Biosphere Reserves. In Ranong, home to Thailand's largest intact mangrove forest, the project is piloting immersive tools to connect students more deeply with marine biodiversity and conservation.

With six of the world's top ten plastic-polluting countries located in this region and marine ecosystems under increasing threat, the project responds to an urgent need: to equip the next generation with the skills, knowledge, and confidence to protect the ocean and its species.

Biological variety in all its forms is a valuable heritage, especially in Italy, which has the greatest biological diversity in all of Europe.

To study and protect this wealth, the first National Research Center dedicated to Biodiversity was established: the National Biodiversity Future Center (NBFC), which is entrusted with the important task of monitoring, preserving, and restoring biodiversity and addressing global challenges related to the protection of Italian marine, coastal, and terrestrial ecosystems. NBFC is a project funded by the MIUR with European funds and coordinated by the CNR. It brings together experts from universities, research centers, and businesses to develop technological innovation strategies for the monitoring, protection, and enhancement of species and habitats in Italy.

3. *Natural Intelligence: the diffuse ingenuity of life*

Natural intelligence is the capacity of living organisms to adapt, learn, and solve problems. It is present in different forms throughout the animal kingdom.

Natural intelligence is an intrinsic characteristic of living organisms; it refers to their general cognitive ability and should not be confused with naturalistic intelligence, which is a specific type of intelligence focused on understanding and appreciating nature. Naturalistic intelligence, theorized by the American psychologist and professor Howard Gardner (1999) in his theory of multiple intelligences, is the ability to understand and appreciate nature, living beings, and ecosystems. People with developed naturalistic intelligence tend to have a greater sensitivity to the environment, animals, and plants, and are often attracted to activities such as botany, zoology, ecology, and conservation.

Natural intelligence refers to the set of biological and evolutionary mechanisms that allow living systems to respond to and adapt to their environment, ensuring survival and reproduction. This includes both automatic, non-cognitive processes (such as genetic adaptation by natural selection) and, in some species with complex nervous systems, the ability to learn and process information at an individual level.

The adaptation of living systems manifests in various forms of complexity and self-organization, which by analogy we can define as 'intelligence' in a broad sense: Behavioral Intelligence (or individual), which is the ability of a single organism to learn from experience; Collective Intelligence or Swarm Intelligence, a phenomenon exemplified by schools of fish or colonies of ants, or swarms of bees and birds, which make complex decisions (such as choosing a new nest or searching for food) without a central leader, but through the local interaction of thousands of individuals; Ecosystemic Self-Organization (or emergent stability), a form of distributed complexity that refers to the intrinsic ability of ecosystems to generate coherent structure, functions, and patterns through the autonomous interactions of their components at lower levels; there is no "central brain" directing the ecosystem. Trophic networks (food chains), nutrient cycles (minerals, organic compounds), and ecological

succession processes are examples of complex systems that self-regulate to maintain stability (homeostasis) in the face of disturbances.

In summary, natural intelligence is the ability of nature to adapt, evolve, and respond to environmental stimuli and challenges, often described as the "wisdom" of nature.

Biodiversity and natural intelligence are interdependent, as the variety of life forms is necessary for adaptation and response to environmental stimuli; they are two closely linked concepts that describe the complexity and richness of life on Earth, but with a slight difference: biodiversity refers to the overall variety of life forms at the species and ecosystem level, while natural intelligence refers to the functional capacity for adaptation and response of the individual organism. Both, however, contribute to the resilience of ecosystems, allowing them to adapt and respond to environmental changes.

An instructive analogy for understanding the complexity of life on Earth is to think of Biodiversity as a vast living Library, and of evolutionary and self-organization processes (natural "intelligence" in a broad sense) as the dynamic systems that manage it.

The Library (Biodiversity) safeguards an invaluable heritage of genetic information (the "books," the "genes") and of survival strategies (the "stories of ecosystems"): it is the repository and archive of life's evolutionary potential.

The Management Processes (Natural Intelligence) are not a conscious librarian, but the ensemble of natural forces — such as natural selection and ecosystem homeostasis — that, over time, organize, select, and make this information available, enabling continuous adaptation to environmental changes.

Unlike a human library, which is static and artificial, Biodiversity is a natural, dynamic process: it renews itself, reshuffles, and restructures without an intentional purpose.

This analogy, though simplified, helps convey the richness of life and the value of conservation: harming Biodiversity is not merely like destroying irreplaceable volumes; it is like burning both the user manual and the spare parts of our only life-support system.

In conclusion, Biodiversity, with its invaluable network of interconnections and its millennia-old resilience, represents a system of self-organization and adaptation of extraordinary complexity and

effectiveness.

4. *Artificial Intelligence: a powerful analytical tool*

Artificial intelligence (AI) is a technology that enables machines to perform tasks that normally require human intelligence, such as learning, problem-solving, and decision-making. In recent years it has made enormous strides, thanks to the development of advanced algorithms and the availability of large amounts of data.

AI can have a significant impact on biodiversity and natural intelligence, both positive and negative. For this reason, it is essential to develop strategies to manage its effects, so as to ensure a sustainable future for generations to come.

Safeguarding biodiversity has become, in recent years, one of humanity's most urgent and complex challenges. As the climate crisis accelerates the loss of vital ecosystems, an unexpected alliance is emerging: the meeting of natural intelligence, inherited from billions of years of evolution, and the computational power of artificial intelligence. This partnership is opening new frontiers for understanding, monitoring, and protecting our planet.

In the realm of biodiversity, as in many other fields, the most relevant areas of AI include:

- Machine learning: algorithms that enable computers to learn from data without being explicitly programmed. Deep learning, a subset of machine learning based on artificial neural networks, is particularly effective at analyzing complex data such as images, sounds, and genetic sequences.
- Computer vision: the ability of computers to "see" and interpret the content of images and video.
- Predictive analytics: the use of data, statistical algorithms, and machine-learning techniques to explore possible future scenarios and estimate the probability of specific outcomes based on historical data and models.

Although natural and artificial intelligence operate on fundamentally different substrates (carbon for the former, silicon for the latter), their dialogue is rich in correlations and synergies. The main difference lies in origin and purpose: natural intelligence is the product of Darwinian evolution, a slow and unguided process whose only "goal" is survival and reproduction; AI, by contrast, is a product of human engineering, designed to achieve specific objectives efficiently.

Nevertheless, the correlations run deep:

- Many AI algorithms are inspired by nature. Artificial neural networks are a loose abstraction of how neurons function in the brain. Swarm-intelligence optimization algorithms (e.g., Ant Colony Optimization and Particle Swarm Optimization) mimic the collective behavior of social insects to solve complex logistical and mathematical problems.
- Biomimetics represents an innovative approach showing how ingenious and sustainable solutions for the human future can derive from emulating the natural world.

The complexity of ecosystems often exceeds our analytical capacity. AI allows us to process the immense quantities of data (big data) generated by environmental monitoring, revealing patterns and connections that were previously invisible. In essence, AI becomes a tool for decoding the complexity of natural intelligence.

The application of AI to conservation is no longer a futuristic concept, but an operational reality with measurable impact: a concrete practice that is already producing real, demonstrable results.

AI is essential for achieving efficient and scalable results in satellite-data analysis, bioacoustics, and environmental genomics; for monitoring and safeguarding the oceans and the planet; for protecting at-risk species (terrestrial and marine); and for combating poaching and illegal activities. Briefly, a few cases:

Oceans and remote sensing: the oceans, which cover over 70% of the planet, are vast, largely unexplored, and vital for climate regulation. Monitoring their vast surface is a daunting task, but AI offers new perspectives: it analyzes satellite imagery to detect the surface indicators of coral bleaching (such as thermal anomalies and the variation of reflectance in coastal waters), identify illegal fishing activities, and monitor the melting of polar ice sheets.

Bioacoustics: the soundscapes of oceans and forests are rich in information. Acoustic monitoring projects use hydrophones and terrestrial microphones to record environmental sounds. AI algorithms recognize whale songs, dolphin clicks, and the calls of rare birds, enabling population estimates, mapping of migratory routes, and detection of human presence in protected areas.

Environmental genomics (eDNA): every organism leaves traces of DNA in its environment

(skin, feces, etc.). By analyzing water or soil samples, it is possible to sequence this “environmental DNA” (eDNA). AI is crucial for analyzing the enormous volumes of resulting genetic data, comparing sequences against vast databases of known species and quickly identifying which organisms are present in an ecosystem, including elusive ones that are difficult to observe directly. This approach is helpful but cannot replace the analysis of the actual bodies of the organisms, the phenotypes, so as to reconstruct their role in making ecosystems function.

Protecting endangered species requires precise data on their distribution, abundance, and behavior. Every year, millions of images are collected by camera traps worldwide: analyzing them manually is an immense task. Platforms such as Wildlife Insights, developed in collaboration with Google and other partners, show how technology can serve conservation. These systems use computer vision—an area of artificial intelligence—to automatically identify species in images and videos, allowing researchers to focus on ecological analysis.

For species such as whales, whale sharks, or big cats, which exhibit unique patterns (coat spots, the shape of the caudal fin, scars), AI can recognize individual animals. Projects like Wildbook, created by the U.S. nonprofit Wild Me, employ pattern-recognition algorithms to track animals across time and space, providing crucial data for conservation.

Drones equipped with thermal and high-resolution cameras can survey remote areas to census populations (for example, orangutans in their nests or seals on polar pack ice). AI analyzes the footage to count individuals quickly and accurately, reducing risks and inaccuracies for human operators.

Poaching is one of the main threats to iconic species such as elephants, rhinos, and tigers. AI offers tools for proactive protection. Systems like PAWS (Protection Assistant for Wildlife Security) use machine learning (and game-theoretic models) to predict where poaching activities are most likely to occur. By analyzing historical data on sightings, snares, and ranger patrols, the algorithm generates risk maps that optimize patrol deployment. In several reserves, drones and acoustic sensors are connected to AI systems that detect suspicious sounds in real time (gunshots, chainsaws) or anomalous movements,

immediately alerting rangers.

The integration of artificial intelligence into biodiversity conservation has also spurred the development of innovative commercial applications in many countries (including Italy): monitoring air pollution, collecting real-time data and supporting air-quality improvement; regenerative agriculture to optimize sustainable practices; offshore seaweed cultivation to capture CO₂, enhance marine biodiversity, and improve soil health; and urban beekeeping which, in addition to producing local honey, contributes to plant biodiversity through pollination and can serve as a natural indicator of environmental pollution (De Nunzio & Rucco, 2024).

Climate change and biodiversity loss are among the most urgent challenges of recent decades. Through advanced data analysis, machine learning, and the modeling of future scenarios, artificial intelligence provides powerful tools to address them. (Benevento & Durante, 2025).

AI and advanced statistical methods enable data integration, optimized monitoring, and assessment of the effects of climate change on environmental conditions that influence biodiversity, as illustrated by the work of Diana De Padova, Michele Mossa et al. (2024), leading figures in ecohydraulics—a field that integrates hydraulics and ecology to protect aquatic ecosystems, propose an innovative approach to optimized monitoring of environmental variables, integrating advanced technologies and quantitative methods to understand and mitigate the effects of climate change (Armenio, De Padova et al, 2018; De Padova, Chimienti et al. 2025).

Many studies on climate and biodiversity remain focused on terrestrial systems, even though the oceans cover over 70% of the planet's surface and host vast and largely unexplored biodiversity. Global warming is altering the atmosphere and, in turn, the ocean climate; changes in the cryosphere (including ice melt) can influence thermohaline circulation, including the Atlantic Meridional Overturning Circulation (AMOC), with repercussions for the atmospheric climate. It is therefore essential to close knowledge gaps on marine ecosystems.

Biodiversity has evolved to become increasingly complex, through multiple diversification patterns that are still ongoing (Boero et al., 2004). According to Boero (2024), AI is not capable of detecting or describing unknown

species, nor of extrapolating the distribution of known species in the absence of adequate baseline data; therefore, modeling efforts must proceed alongside substantial exploratory work to improve our knowledge of biodiversity.

A study published in *Nature* (Pollock, Kitzes Beery et al., 2025) shows how artificial intelligence can revolutionize biodiversity research by using existing data to develop models and generate new hypotheses that guide fieldwork. Beyond scientific discoveries, the article testifies to the power of international and interdisciplinary collaboration, bringing together experts in ecology, machine learning, data science, and conservation biology from institutions in North America, Europe, and Australia.

It is therefore evident—as already emphasized—that interdisciplinary collaboration is fundamental to understanding and safeguarding biodiversity and, today more than ever, to fully harness AI's capabilities and fill gaps in our understanding of the natural world.

In this regard, we recall the “Biblio-Hydro Database,” an important Hydrozoa knowledge base established as early as 2000 by Ferdinando Boero and Cinzia Gravili, in collaboration with the Partnership for Enhancing Expertise in Taxonomy (PEET) and with the interdisciplinary contribution of experts in computer science, innovative technologies, library science, and digital archives, coordinated by Virginia Valzano. Detailed information on Biblio-Hydro (Gravili et al., 2017) was conducive to reconstruct the distribution of the genus *Halecium* (Hydrozoa: Haleciidae).

A targeted assessment of the distribution of *Halecium* species, together with new field data, could broaden and strengthen the picture that emerges from the authors' scientific analysis. The knowledge already exists: we “only” need to extract it—and AI can perform this task excellently.

According to Boero (2025), biology risks losing its essence due to an overly reductionist approach dominated by mathematics and chemistry. To rebalance, we must reinvest in natural history and taxonomy, integrate diverse perspectives into holistic frameworks, prioritize scenario-building, and accept uncertainty.

Taxonomic literature constitutes the collective memory of knowledge about biodiversity: a fundamental and unrivaled resource that gathers humanity's accumulated understanding of life's diversity, documenting, naming, and classifying all

known forms of life. This knowledge is indispensable for assessing species' conservation status, identifying at-risk areas, and developing protection strategies.

GBIF (Global Biodiversity Information Facility) is an international, government-funded data infrastructure that aggregates and makes available—through a single portal—billions of species-occurrence records from a global network of museums, botanical gardens, research centers, and communities of scientists, including citizen scientists. Its goal is to provide free and open access to biodiversity data to support scientific research, conservation, and sustainable development.

5. *Conclusions: an optimistic outlook for the future*

The alliance among biodiversity, natural intelligence, and artificial intelligence is still in its early days, but its promises are immense. AI is not a panacea, and its use raises important ethical issues—from surveillance to decision autonomy and bias—that must be addressed with rigor, transparency, and accountability.

AI can assemble information and turn it into knowledge, but how that knowledge is used depends on the questions we ask. Machines help, but we must not forget using our own intelligence, nor rely blindly on artificial intelligence. As a scientist friend of ours (F. Boero) says: "AI, if you know how to use it, is a servant; if you don't, it becomes your master."

Despite its potential, this new alliance entails ethical and environmental risks: the high energy (and water) consumption of computing systems, electronic waste, and the danger of technological "bluwashing" or "greenwashing," that is, using AI as an alibi to avoid tackling environmental problems at their roots. It is therefore essential

that the development and adoption of these technologies proceed in a sustainable, traceable, and verifiable way.

Global initiatives—bringing together technology companies, governments, and environmental organizations—are promoting the ethical application of AI for sustainability. The goal is to build a "planetary intelligence" that combines nature's millennia-old "knowledge" with AI's analytical power to navigate the complex challenges ahead.

The relationship between natural intelligence and artificial intelligence should not be seen as substitution, but as synergy. AI can provide powerful tools; yet wisdom, understanding, and the will to act remain the prerogatives of human intelligence, inspired every day by the model that nature offers us. Only then can we hope to preserve the delicate balance of life on our planet.

However, AI represents a true paradigm shift in how we address the ecological crisis. It gives us the ability to process the complexity of the natural world at scales and speeds once unimaginable, allowing us to shift from a reactive approach to a proactive and predictive one in conservation.

By studying the efficiency and resilience of natural intelligence, we can in turn design AI systems that are more robust and sustainable.

The optimistic vision for the future is one of "augmented conservation," in which biologists, ecologists, and local communities are equipped with AI tools that amplify their expertise and impact.

It is a collaboration in which our growing technological intelligence is placed at the service of protecting the ancient and boundless intelligence of life itself. If we can steer this powerful synergy with wisdom and foresight, we will have at our disposal one of the most effective tools for safeguarding the planet for generations to come.

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