Research Ideas and Outcomes 11: e168765
doi: 10.3897/rio.11.e168765

Policy Brief

From Knowledge to Solutions: Science, Technology and Innovation in Support of the UN SDGs

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Reviewable v 1

Received: 14 Aug 2025 | Published: 15 Aug 2025

Citation: Arvanitidis C, Barov B, Gonzalez Ferreiro M, Zuquim G, Kirrane D, Huertas Olivares C, Drago F, Pade N, Basset A, Deneudt K, Koureas D, Manola N, Mietchen D, Casino A, Penev L, Ioannidis Y (2025) From Knowledge to Solutions: Science, Technology and Innovation in Support of the UN SDGs. Research Ideas and Outcomes 11: e168765. https://doi.org/10.3897/rio.11.e168765

Abstract

This white paper represents the collective perspectives of a network of legal entities based in Europe and with global interests, which includes biodiversity, ecology, and

engineering communities, aiming to strengthen Science, Technology, and Innovation (STI) efforts toward achieving the United Nations (UN) Sustainable Development Goals (SDGs). With their combined expertise and through European initiatives such as the Research Infrastructures, the e-Infrastructures, the European Open Science Cloud (EOSC), the Digital Twin projects and academic publishers, these communities provide a base for collaboration in strategically contributing to the implementation of the Kunming-Montreal Global Biodiversity Framework targets. Furthermore, these communities seek to forge an international alliance to further integrate biodiversity conservation into the UN Summit of the Future priorities and the post-SDG agenda.

Keywords

Science Summit 2024, UN Sustainable Development Goals, Kunming-Montreal Global Biodiversity Framework, Research Infrastructures, European Open Science Cloud, Digital Twins

Introduction

Biodiversity loss disrupts ecological balance and drastically impacts human livelihoods, economies, and global health (Díaz S et al. 2006IPBES 2019a). The three interconnected planetary crises that humanity is currently facing, climate crisis, the nature crisis and the pollution crisis, are the most urgent challenges of our time (UNEP 2021). Tackling these challenges requires collective efforts from scientific communities, Research Infrastructures, e-Infrastructures and other key players from the public and private sectors on science, technology and innovation, to work closely with decision makers and support them with science-based knowledge. Some of the topics that most urgently need knowledge-based actions are the protection and conservation of biodiversity and ecosystems, as well as the restoration of habitats, and the socio-ecological systems they support (IPBES 2019b). One of the most important targets towards mitigating biodiversity change are among the UN SDGs set by the international community (Independent Group of Scientists appointed by the Secretary-General 2019). The global community is approaching a pivotal moment for sustainable development. As the 2030 deadline for achieving the UN SDGs draws near, attention is rapidly turning to the legacy of these goals and to shaping a new vision for the future of people, planet, and prosperity. Global efforts such as the UN Summit of the Future and the development of the UN Pact for the Future are intended to renew multilateralism and redefine global cooperation for the post-2030 era.

In this context, Science, Technology and Innovation (STI) must play a central role in both realising the unfinished agenda of the SDGs and laying the groundwork for a more resilient, equitable, and sustainable world. The transformations required in our economies, societies, and ecosystems demand data-driven decision-making, cross-sectoral collaboration, and multidisciplinary and cross-domain research frameworks that can address complexity at scale. Scientific communities, especially those engaged in

biodiversity, ecology, genomics, and digital infrastructures, hold essential keys to solving these global challenges.

This white paper emerges from the 79th United Nations General Assembly and the Science Summit (SSUNGA79), as a collaborative initiative of a network of European partners, coordinated by LifeWatch European Research Infrastructure Consortium (ERIC) (Arvanitidis C et al. 2024). It presents a collective commitment to leveraging scientific knowledge and digital innovation in support of the SDGs, while also contributing strategically to the emerging UN Pact for the Future.

Crucially, the paper is informed by the evolving frameworks and ambitions beyond 2030. The transition to the post-SDG agenda must be grounded in deeper integration between science and policy, supported by open, interoperable digital ecosystems, and reinforced through inclusive participation, including the knowledge of indigenous communities, the leadership of youth, and the strategic engagement of research infrastructures across continents.

At the heart of this transition lies the recognition that biodiversity is not a siloed issue. Biodiversity is foundational to climate resilience, public health, food security, and economic stability. As such, the paper pays particular attention to the Kunming-Montreal Global Biodiversity Framework (K-M GBF) and its synergy with the SDGs, illustrating how federated data infrastructures, virtual research environments and digital twins, can strengthen global efforts for ecosystem monitoring, restoration, and sustainability.

Through holistic approaches to address the Strategic Considerations of the K-M GBF, technical insights, and policy reflections, this document contributes to shaping a science-policy interface that can attract international key-players and carry forward the spirit of the 2030 Agenda into the next decade and beyond. It seeks to inform stakeholders across sectors (i.e. governments, international organisations, academia, civil society, and the private sector and industry) on how to scale up collaborative innovation to meet our most urgent planetary needs.

As the world prepares for the UN Summit of the Future in 2026 and the accompanying high-level dialogues on Financing for Development, climate action, and digital cooperation, this white paper calls for a decisive pivot: from fragmented responses to holistic, integrated, future-oriented science systems that are fit for global purpose.

The Network of the European Communities

A network of European organisations (Annex I) has been committed to contribute to addressing the K-M GBF through an holistic and integrative approach, which was firstly demonstrated by coordinating a workshop in New York (USA) on September 26, 2024. This workshop was part of the Science Summit 2024 at the 79th United Nations General Assembly (UNGA79). This European network speaks on behalf of active scientific communities working on biodiversity, ecology, and computer engineering. Its purpose is to join forces of science, technology, and innovation efforts to achieve the UN SDGs.

These organisations have selected the K-M GBF as a testbed for contributing to the SDGs, based on long-track experience in European initiatives, such as the European Research Infrastructures, the EOSC, and Digital Twin projects.

Their collective and holistic approach focuses on the network's shared impact rather than individual achievements. By collectively contributing to the Strategic Considerations of the K-M GBF, these organisations aim to attract international support in order to develop a global and holistic approach to assist in the implementation of the framework's strategic goals, particularly its 2030 and 2050 targets.

The Kunming-Montreal Global Biodiversity Framework

The K-M GBF was adopted by the Conference of the Parties to the Convention on Biological Diversity, held in Montreal, Canada, from 7 to 19 December (CBD/COP/DEC/15/4; 15 pp.). The decision was signed by 27 countries, the European Union (EU), the African Union, the UN Food and Agriculture Organization, the UN Environment Programme, and the UN Development Programme and Tourism Montreal. It urges the signatories and other governments to implement the K-M GBF and to ensure that all components of society are involved. Based on the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report, the decision document: (a) builds on the Strategic Plan for Biodiversity 2011-2020, its achievements, gaps and lessons learned; (b) aims to accelerate transformative action by governments; (c) is action- and results-oriented in that it aims to revise and implement policies, goals, targets and national biodiversity strategies and action plans, as well as their monitoring; (d) promotes coherence, complementarity and cooperation among the Convention on Biological Diversity and its Protocols, other biodiversity-related conventions and other relevant multilateral agreements and international institutions.

In detail, the K-M GBF sets out seven strategic considerations and twenty-three targets for its successful implementation. This network has been collectively working on the seven strategic considerations.

Contribution to Strategic Consideration 1: Contribution and rights of indigenous peoples and local communities

Overall, the network recognises the contribution and rights of indigenous peoples and local communities as custodians of biodiversity and traditional knowledge for biodiversity conservation, restoration, and sustainable use of the ecosystems. In addition, the participating entities respect the origin of the material provided and are committed to the sharing of benefits with the providing countries and their indigenous people. By following the Open Science “Findable Accessible Interoperable Reusable” (FAIR) and “Collective Benefit, Authority to Control, Responsibility, Ethics” (CARE) principles and by being consistent with practices adopted by the academic and non-academic scientific

communities, the members of the network promote traceability of their work and the material they use, including those provided by indigenous people.

The network collectively contributes to this Strategic Consideration by:

1. Documenting the indigenous peoples' rights and practices through agreements on the availability and use of their data, publications or any other type of research products using a co-creation approach.

2. Ensure representativeness by including indigenous peoples in the governance workflows, to develop and enable fair decision-making processes and co-creation of strategic actions

3. Co-developing relevant guiding documents, for example in the form of a Code of Conduct on Access and Benefit Sharing (ABS), as a practical implementation step of the research community to acknowledge traditional knowledge and share benefits with the indigenous peoples and local communities, and the role played by them in nature conservation and the preservation of traditional local resources.

4. Exchange knowledge in order to develop guidelines and follow good practice in the context of ABS, both to biological resource centres and users of genetic resources, as well as developing traceability systems to allow the provider countries to track the use of their resources held in Research Infrastructures (RIs). As part of this contribution, academic publishers should request provision of collection permits and declarations of ABS compliance alongside the submitted manuscripts.

5. Ensure that the roles and contributions of indigenous peoples and local communities to biodiversity conservation is recognized in scientific publications and elsewhere, especially in journals that provide a diamond open-access option (free-to-publish-free-to-read). Such an example is the promotion of special issues which integrate traditional ecological knowledge. The inclusion of indigenous community members in collaborative research projects and as co-authors in the resulting articles, ensures their contributions are acknowledged. Other examples include: author guidelines, which emphasise ethical research practices, such as obtaining prior informed consent and sharing benefits with indigenous communities; recognition of the contributions of local guides in taxonomic studies; highlighting indigenous-led conservation success stories and traditional land management practices; promotion of the indigenous peoples voices through articles, blogs and commentaries by indigenous researchers, formalisation of the declarations reflecting the above points through controlled vocabularies in the article metadata.

Contribution to Strategic Consideration 2: Collective efforts towards the targets of the K-M GB Framework

The network significantly contributes to the K-M GBF by implementing multiple approaches to enhance the ability to monitor, manage, and protect biodiversity. It encourages multi- and cross-disciplinary, integrative approaches to boost its contribution to many of the targets set by the Framework. Its members support research on biodiversity at all levels of the biological organisation, from single-cell organisms, collections and specimens data and up to the scale of ecosystems, as well as on the ways by which biodiversity responds to climate change. A key role in this process is already played by the biodiversity RIs, both EU and global, through bi- and multi-directional linking and an increased interoperability of their data holdings, provision of advanced access to semantically structured FAIR data, delivery of one-stop access points to federate data discovery and reproducible analytics from various disciplines and domains and thus support multi-disciplinary research addressing questions of high complexity and importance for the society.

The network collectively contributes to this Strategic Consideration by:

1. Promoting the collective efforts towards the targets of the K-M GBF by supporting multidisciplinary and cross-domain approaches, through the technologies it provides for the federation, integration, discovery and access of data, and the services, workflows and Virtual Research Environments (VREs) for their analysis, the interpretation of the results and the creation of new knowledge and innovation.

2. Developing relevant portals as comprehensive platforms for biodiversity and geodiversity knowledge, which include registries linked to Europe's biodiversity, such as: those developed on the impact of specific taxa, for example the pollinators, invasive alien species, and species of special interest; registries on the interactions of European biodiversity units; registries of taxonomic experts, natural history collections, tissue samples, genetic resources and others.

3. Building the solid base for biological observation, through observatories, such as the EMO BON (European Marine Omics Biodiversity Observation Network) observatory; collaborations with UN Decade Programmes (e.g., OBON, Marine Life 2030), and relevant projects (e.g. MARCO-BOLO). Such observatories mobilise thousands of scientists from around the world towards the monitoring of biodiversity and ecosystems and the impacts of climate change. This is done by the collection of high-quality data and deployment of standard operating procedures across multiple countries.

4. Making biodiversity data available and supporting the implementation of the K-M GBF by engaging stakeholders through targeted outreach and dissemination campaigns, including civil society, international communities, ocean governance

and policy institutions, research and academia, marine data providers and users, including those from the private sector (e.g. companies, industry).

5. Developing real-time and continuous ecosystem monitoring of terrestrial and aquatic species populations, predictive analytics, and novel bioinformatic tools, by using vast amounts of data and top-notch modelling approaches leveraging High-Performance Computing (HPC); scenario modelling for the simulation of different conservation and management strategies and their impacts on biodiversity; optimised resource allocation by identifying the best management practices in terrestrial ecosystems such as forests and grasslands and marine protected areas; standardised data and models aiming to share across countries and organisations, fostering global relevance of the framework and fostering international collaboration; capacity enhancement by organising hackathons, webinars and hands-on training; public engagement including citizen science, by making complex biodiversity data accessible and understandable to the public, and by providing end-user interactive tools to develop user-tailored "*what if*" scenarios.

6. Promoting green computing, strengthening capacity-building, technology transfer, scientific and technical cooperation, and making knowledge available (e.g. partnerships with SLICES, SoBigData, and EBRAINS; projects like GreenDIGIT). Minimising the environmental impact of digital infrastructures; for example, reducing greenhouse gas emissions from research computing. Developing the ENVRI-Hub, which provides a central gateway to environmental data and services and empowers researchers to address critical environmental challenges and contribute to the K-M GBF's targets.

7. Mobilising the huge corpus of high-quality, peer-reviewed data from published literature, both historical and recent, through novel tools for data extraction, semantic annotation, dissemination and re-use.

8. Integrating biodiversity RIs and building new community of users through bi-directional linking, FAIR-ification and improved interoperability and global access to data along the whole biodiversity research lifecycle: collecting specimens > extracting molecular sequences > identifying taxa > analysing, interpreting and publishing results > constructing biodiversity knowledge graph > re-using data for generation of new knowledge and addressing societal needs.

9. Building cross-disciplinary knowledge graphs, through a centrally orchestrated ecosystem of Linked Open Data (LOD) services called "The Biodiversity Supergraph", assisted by Artificial Intelligence (AI) tools trained on semantically structured and well-curated data, that will allow ground-breaking analyses and question-answering tools that have not been possible until a couple of years ago.

10. Developing semantic publishing and data extraction workflows that would allow immediate dissemination of semantically structured, FAIR and Open, AI-ready

linked data, along with the mobilisation of critically important data from historical literature in order to understand the past, current and future projections of global change in biodiversity and ecosystem services.

11. Publishing relevant research in journals and special issues on topics like biodiversity monitoring and ecosystem restoration; developing communication strategies to disseminate scientific results to policymakers, practitioners, and the public, using summaries, infographics, and multimedia content; ensuring that research findings are freely accessible, supporting informed decision-making through publication of the relevant knowledge; engaging with policymakers, by facilitating evidence-based recommendations, thus strengthening the science - policy interface to promote effective biodiversity conservation.

Contribution to Strategic Consideration 3: Fulfilment of the three principal objectives of the Convention on Biological Diversity and its protocols and their balanced implementation

All of the legal entities of the network adhere to the three principal objectives of the Convention of Biological Diversity (CBD), namely *conservation, sustainable use, and fair sharing of benefits* derived from the utilisation of natural resources. They significantly contribute to the three above principal objectives of the CBD, by:

1. **Conservation**: the core activity of many participating entities of the network includes the study or providing support for the study of biodiversity patterns, processes and consequences from environmental changes. They all provide access to environments, organisms, habitats, experimental platforms, data collected from this access and analytical services that aim to support the preservation of nature. By making biodiversity information readily available and developing systems to support decision making and conservation efforts they are directly contributing to our ability to live sustainably with nature.

2. **Sustainable use**: the above core activity provides options from testing various hypotheses on the sustainable use of biodiversity and ecosystem services related to it, based on different scenarios. Among the strategic objectives of the network entities are the use of the rich diversity of life in a rational manner and its maintenance for future generations. Identifying priorities and targets and raising awareness of the need to streamline efforts across scientific and societal actors are crucial elements towards this principal objective. Examples include: the blue bioeconomy; sustainable aquaculture production; development of mature and well-coordinated biological observation systems support sound and ethical knowledge-based decision making and monitor effectiveness of conservation/ policy measures; production of good practices and guidelines for biological resources use to ensure fair and equitable sharing of benefits derived from them; models to improve practices like sustainable agriculture, forestry, and tourism;

Equitable sharing of the benefits arising out of the utilisation of genetic resources: technologies developed allow the sharing of data, services and other research products on genetic resources, which are used in combination with any other type of resources or products (e.g. taxonomic, literature, environmental, etc.). Measures are implemented at the individual and institutional levels to adhere to and comply with access and benefit sharing, Digital sequence information on genetic resources (DSI) and other related legislation. To this end, RIs play a significant role in ensuring a fair and equitable utilisation of genetic resources by facilitating the procedure for their users. Finally, federating these efforts through technological advancements in EOSC.

Contribution to Strategic Consideration 4: Implementation through science, technology and innovation

The network supports the implementation of the K-M GBF targets based on scientific evidence, traditional knowledge, and innovative practices. This support is addressed through the following activities:

1. Offering solutions for research, data sharing and management, scientific computing to researchers, learners, policy makers, public administration and companies. These solutions facilitate digitisation and innovation, strengthening capacity building and technology transfer. Additionally, we promote a green transition in research and development.

2. Promoting open science by publishing research findings and increasingly sharing more facets of the research cycle, as well as developing tools, protocols, standards and data visualisation tools to improve access to scientific collections and other types of biodiversity data. Additionally, developing standard operational procedures, implementing standards, and promoting open science principles to improve research integrity, accuracy and accountability in science.

3. Providing federated research services, resources, and other research products to promote multidisciplinary knowledge and innovation. For example, services from organisations within the network are accessible through the EOSC which allows them to be offered to multiple communities and promotes increased collaboration across fields.

4. Creation of models (e.g. of climate and human activity related changes in biodiversity dynamics and ecosystem services), automated data flows (from sensors to data systems) and integration (e.g. biodiversity data flows combined with environmental and human activity variables). This can help us better understand how biodiversity and ecosystem services respond to climate change and other human induced pressures. It can also provide insights into how to protect and manage biodiversity and ecosystem services in the future.

5. By building digital twins for informed decision making, such as the European Digital Twin of the Ocean (European DTO), with an ensured connection to newly

collected high quality environmental and biodiversity data. A key aspect here is the sustained connection to monitoring and observation networks, including those using innovative sensor technologies and citizen science activities.

6. Providing training and capacity-building services for innovative tools (e.g. species identification through AI apps for sound and image recognition provided by the Consortium of European Taxonomic Facilities community (CETAF) community).

Contribution to Strategic Consideration 5: Ecosystem approach

This set of activities is developed by the network to support the ecosystem approach that underlies the K-M GBF implementation.

1. Understanding the forces shaping biodiversity is essential to managing natural resources rationally. This will be a key to restoring biodiversity for people, the climate, and the environment. A key to predicting global biodiversity dynamics is the ability to predict species interactions with their environments as well as changes over time caused by environmental and anthropogenic pressure. We can gain a better understanding of biodiversity and environmental dynamics by modeling different scenarios, for example using digital twins. Digital twins can simulate and study "*what if*" scenarios by incorporating observations and models. This enables effective conservation management and policy development.

2. Developing and implementing technologies that enable a cross-domain, multidisciplinary approach to studying biodiversity and ecosystems. Combining data from several resources and from multiple levels of the ecosystem (e.g., genetics, species, habitats, environmental, socioeconomics, etc.) allows scientists to analyze ecosystems as integral systems and test multiple hypotheses simultaneously. This creates knowledge and innovation that sustains biodiversity and ecosystems.

3. Promoting ecosystem-based approaches to biodiversity management and habitat protection in innovative publications such as Nature Conservation, which focuses on conservation science and strategies; Biodiversity Data Journal, which publishes data and research on biodiversity; or One Ecosystem, devoted to ecosystem services, management and restoration research.

Contribution to Strategic Consideration 6: Cooperation synergies

The network is committed to supporting collaboration, cooperation and synergies between the Convention on Biological Diversity (CBD) and its protocols, as well as with other biodiversity-related conventions, relevant multilateral agreements and international

organisations and processes as this will facilitate the implementation of the K-M GBF. The network develops a variety of work, including:

1. Collaboration with bodies and organisations responsible for implementing the CBD and its Protocols (e.g. International Union for Conservation of Nature (IUCN), IPBES, European Commission (EC), and others) to co-design and co-develop research resources and products to support their mission. For example, by developing tools that facilitate access to interconnections between multiple legislation components, at international, European, and national levels.

2. In the EU, establishing strong links with policy agents such as the EC and European Parliament, the Joint Research Centre (JRC) and others. Taking part in relevant initiatives like the EU Biodiversity Strategy 2030 or the EU Pollinators Initiative. In addition, promoting the transferability of European efforts to other regions of the world.

3. Involvement in international forums such as IPBES and collaborating with research-related initiatives and providers across five continents, including strategic partnerships in the Global South. Integration and sharing of computational resources and expertise will not only advance the frontiers of scientific knowledge, but also ensure that data-driven research initiatives around the world are well-supported.

4. Participation in social, scientific and technical initiatives in the European arena. These initiatives include the European Green Deal, the EU Science Service for Biodiversity, the Knowledge Hub for Biodiversity and the EOSC. As well as with the private sector through the Science/Business initiative, collaborations with the European Environmental Bureau (EEB), and the EOSC Digital Innovation Hub (EOSC DIH).

5. Engagement with organisations active in biodiversity observation, monitoring, and management, like the EMO BON, an officially endorsed project of the UN Decade for Ocean Science Programme Ocean Biomolecular Observation Network (OBON).

6. Partnership and collaboration with research projects and strategic agreements on an ad-hoc basis.

7. Provision of technically advanced, semantic authoring, peer-review and publishing platform to serve the reports and assessments provided by large international organisations (International Union for Conservation of Nature (IUCN), IPBES, Intergovernmental Panel on Climate Change (IPCC) and others) that would allow rapid dissemination and re-use of data and key messages from the reports.

Contribution to Strategic Consideration 7: Biodiversity and health linkages

The network helps to understand and explore the connections between biodiversity and health and the three objectives of the Convention that will help implement the K-M GBF. A particular focus of the network is to develop the following activities:

1. Participation in initiatives and projects such as the EOSC Health Cluster, a platform for interdisciplinary research, EC projects like B4Life and BioAgora by publishing research that investigates how biodiversity impacts human health, or ENVRI-Hub NEXT aims to facilitate interdisciplinary research and drive environmental science breakthroughs by providing users with seamless access to data from environmental RIs.

2. In the context of One Health, leveraging data from multiple sources to numerically demonstrate the links between human and environmental health; developing tools to explore, search for and distribute data on biotic interactions,“hidden” in the literature (e.g. the Biotic Interaction Browser in the Biodiversity PubMed Central (PMC) literature database, both developed by the EU-funded BiCIKL project.

3. Using digital twins to create Virtual Research Environments (VREs) that produce knowledge on how biodiversity patterns derived from taxa and habitats interact with patterns derived from data and information on their health. The services and data are compliant with open data and open source principles ensuring reusability. Also contributing to digital twins to simulate and study “*what if*” scenarios enabling effective conservation, management and policy development.

4. Providing support to the Food & Health and Environmental communities, as well as facilitating joint initiatives across them.

5. Publication of research findings, such as studies on zoonotic diseases, biodiversity and mental health, and the benefits of ecosystem services for public health.

Expansion to other UN STI priorities

Recognise Biodiversity as Foundational to Planetary Health and Human Security: Position biodiversity at the core of global sustainable development strategies and the post-SDG agenda. Acknowledge the irreplaceable role of biodiversity in supporting food systems, clean water, climate regulation, and human health—integrating it as a unifying priority across all UN frameworks.

Support a Global Biodiversity Science Infrastructure Compact: Invest in the expansion and long-term sustainability of **biodiversity-focused research infrastructures**, including observatories, collections, digital twins, and genomics platforms. Ensure equitable

access to these infrastructures globally—especially for countries rich in biodiversity but limited in resources.

Implement the IPBES Nexus Framework Across UN Programs: Translate the **IPBES Nexus Assessment** into actionable policy by promoting science that addresses the interconnections between biodiversity, climate, food, water, and health. Mobilise resources to build interdisciplinary capabilities that can respond to complex socio-ecological challenges.

Mandate FAIR and CARE Principles for Biodiversity Data: Require that biodiversity data—ranging from species observations to genetic sequences—be made **Findable, Accessible, Interoperable, and Reusable (FAIR)** while also respecting **Collective benefit, Authority to control, Responsibility, and Ethics (CARE)**, particularly for Indigenous-held knowledge.

Embed Biodiversity Knowledge into Decision-Making Systems: Strengthen national and international science-policy interfaces by integrating biodiversity knowledge—both scientific and traditional—into planning and regulatory processes. Use real-time data, scenario models, and digital tools to guide actions on conservation, land use, and ecosystem restoration.

Ensure Equitable Governance and Benefit-Sharing of Biodiversity Resources: Reinforce access and benefit-sharing mechanisms under the **CBD** and **Nagoya Protocol** , and ensure traceability and accountability in the use of biodiversity-related data and materials—especially within digital sequence information (DSI) frameworks.

Mainstream Biodiversity Monitoring into the UN Development and Climate Architecture: Establish biodiversity monitoring as a required component of national SDG, climate Nationally Determined Contributions (NDC), and development strategies. Leverage remote sensing, AI, citizen science, and genomics to build integrated, cost-effective biodiversity intelligence systems.

Strengthen Local and Indigenous Leadership in Biodiversity Stewardship: Institutionalise support for Indigenous Peoples and Local Communities (IPLCs) as **co-creators and custodians** of biodiversity. Ensure their inclusion in the governance of research infrastructures, data standards, and global environmental negotiations.

Create Financing Pathways for Biodiversity-Centric STI Innovation: Direct public and blended finance towards scientific innovation that safeguards biodiversity—particularly in low- and middle-income countries. Support STI initiatives that address biodiversity loss alongside economic development, health, and climate resilience.

Anchor Biodiversity in the Pact for the Future as a Cross-Cutting Enabler of Peace, Prosperity, and Justice: Ensure the **UN Pact for the Future** includes biodiversity as a core pillar—not only of environmental sustainability but of **equity, security, and intergenerational justice**. Propose a "Global Science Commitment for Biodiversity" to unite governments, research institutions, and civil society in coordinated action.

Towards a global alliance

The network aims to establish a global alliance that will strategically integrate biodiversity into the core priorities of the UN Summit of the Future and the developing post-SDG framework. This alliance will foster synergies and complementarities among scientific communities, research infrastructures, policymakers, and societal stakeholders to move beyond sectoral silos. The alliance will serve as a convergence point for diverse knowledge systems, from cutting-edge digital tools and genomic research to traditional ecological practices, and as a mechanism for aligning efforts across thematic domains, such as climate, health, food, and equity. Grounded in the Kunming-Montreal Global Biodiversity Framework and informed by the IPBES Nexus Assessment, the alliance envisions a federated, interoperable landscape of actors and resources. The alliance's mission is to build long-term strategic collaborations, harmonize science-policy efforts, and co-design actionable pathways that embed biodiversity into multilateral decision-making processes. This includes sharing infrastructure, aligning data and standards, mobilizing joint funding streams, and strengthening collective advocacy. The network is developing a roadmap of activities to address the aforementioned tasks. The overall goal is to ensure that biodiversity is recognized as a fundamental pillar of planetary sustainability, peace, and prosperity rather than a separate concern.

Glossary

ABS: Access and Benefit Sharing

AI: Artificial Intelligence

BiCIKL: Biodiversity Community Integrated Knowledge Library

BioAgora: an EC project aiming to connect biodiversity research with decision-making processes.

B4Life: Biodiversity for Life

CARE: Collective Benefit, Authority to Control, Responsibility, Ethics.

CBD: Convention on Biological Diversity

CETAF: Consortium of European Taxonomic Facilities

DIH: Digital Innovation Hub

DSI: Digital Sequence Information of genetic resources

DTO: Digital Twin of the Ocean

EC: European Commission

EEB: European Environmental Bureau

EMO BON: European Marine Omics Biodiversity Observation Network

ENVRI-Hub NEXT: Environmental Research Infrastructures Hub EC project that bridges this gap, offering a user-friendly platform for seamless access to data from environmental Research Infrastructures.

EOSC: European Open Science Cloud

ERIC: European Research Infrastructure Consortium

EU: European Union

FAIR: Findable, Accessible, Interoperable, Reusable.

HPC: High Performance Computing

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPCC: Intergovernmental Panel on Climate Change

IUCN: International Union for Conservation of Nature

JRC: Joint Research Centre

K-M GBF: Kunming-Montreal Global Biodiversity Framework

LOD: Linked Open Data

NDC: Nationally Determined Contributions

OBON: Ocean Science Programme Ocean Biomolecular Observation Network

PMC: PubMed Central

RIs: Research Infrastructures

SDG: Sustainable Development Goals

SLICES: Scientific Large Scale Infrastructure for Computing/Communication. Experimental Studies

SSUNGA79: 79th United Nations General Assembly and the Science Summit

STI: Science, Technology and Innovation

UN: United Nations

UNGA79: 79th United Nations General Assembly

VREs: Virtual Research Environments

Annex I. Contributing organisations

LifeWatch ERIC's vision is to become the Research Infrastructure providing access to the world's biodiversity content, services and communities in one click. It aims to accelerate the research efforts of the scientific community by delivering a European state-of-the-art e-Science Research Infrastructure for biodiversity and ecosystem research. Therefore, its core business is to build a virtual "workbench" consisting of data resources, web services and other types of research products that allow its user community to analyse biodiversity patterns, processes and consequences from their change in the ecosystems. Its Virtual Research Environments enable testing of the same hypothesis with multiple data sources and analytical services and the production of knowledge produced by those disciplines or domains (synthetic knowledge).

CSC, the IT Center for Science in Finland, is at the forefront of High-Performance Computing and is pioneering the field of Biodiversity Digital Twins. CSC plays a pivotal role in architecting and implementing the Biodiversity Digital Twin platform and Climate change models, which runs on LUMI, one of the most powerful supercomputers in Europe, and the world. This platform supports a myriad of use cases, demonstrating CSC's expertise in large-scale, complex data projects. CSC provides crucial support for academia, research, public administration and industry and has a strong influence in shaping the future of AI, Climate Modelling and data-sharing in Europe.

EGI Federation, governed by the EGI Council and coordinated by the EGI Foundation, unites hundreds of data centres worldwide to provide scalable digital infrastructure for data-intensive research. EGI collaborates closely with research communities to co-design solutions supporting large-scale data processing, distributed AI/ML, federated identity management, and digital twins for science. This empowers tens of thousands of researchers with advanced computing, data analytics, and storage capabilities. In biodiversity research, EGI enables large-scale data analysis from environmental sensors and satellite imagery for species tracking and ecosystem monitoring. EGI is a key contributor within the European Open Science Cloud (EOSC) landscape and, through its global network, it drives scientific progress and innovation across diverse disciplines.

VLIZ, the Flanders Marine Institute, conducts interdisciplinary research of the ocean, seas, coast and estuaries and acts as a platform and international contact point for marine scientific research in Flanders. VLIZ uses new technologies (robotics, artificial intelligence, digital twins) and strongly focuses on blue innovation and valorisation. VLIZ is the National Oceanographic Data Centre (NODC) for Flanders and is actively involved in several initiatives of UNESCO/IOC/IODE. VLIZ was endorsed as an Ocean Decade Implementing partner and secretariat to the National Ocean Decade Committee for Belgium. VLIZ is an important factor in the Mission Ocean and in the development of the

European Marine Observation and Data Network (EMODnet) and the European Digital Twin of the Ocean (DTO), three flagship initiatives of the European Commission. VLIZ also coordinates the developments for biodiversity in the DTO through the DTO-BioFlow project. VLIZ is a renowned expert in marine biodiversity and housing the European Ocean Biodiversity Information System (EurOBIS) and a number of important global reference databases such as the World Register of Marine Species (WoRMS).

The European Marine Biological Resource Centre (EMBRC-ERIC) is Europe's distributed research infrastructure for the study of marine organisms. With 10 member states and over 70 research institutes, EMBRC supports research and innovation from genes to ecosystems. The organisation offers access to micro and macro-organisms from the Arctic to the Red Sea, and the experimental facilities to study them *in* and *ex situ.* EMBRC has also developed the first multi-national genomics observatory, the European Marine Omics Biodiversity Observation Network (EMO BON), operational across 10 countries and 20 sites and endorsed as a UN Ocean Decade project. The observatory acts like an incubator for DNA-based biodiversity observation, developing open access standardised protocols, high quality metadata standards, and data, providing a European contribution to global efforts in understanding and observing marine biodiversity.

The Distributed System of Scientific Collections (DiSSCo) is a new European Research Infrastructure focused on natural science collections. Its goal is to unify fragmented European natural science collections into a single, digitally accessible entity. DiSSCo leverages the FAIR data principles (findable, accessible, interoperable, and reusable) to provide a comprehensive knowledge base for research on the natural world. DiSSCo aims to transform European natural science collections into a center for data-intensive scientific excellence that contributes to taxonomic and environmental research, food security, health, and the bioeconomy. Encompassing over 120 collection-holding institutions across 21 countries, DiSSCo is the largest formal agreement of its kind and aims to unlock the potential of natural science collections. This will enable a deeper understanding of the natural world and contribute to solutions for global challenges.

OpenAIRE is a European e-Infrastructure dedicated to building a globally connected, interoperable, and sustainable open research ecosystem, with Open Science at its core. It promotes Open Scholarly Communication, making research outputs easily accessible and reusable. By offering a suite of services covering the entire research lifecycle, guidelines, and practices that support the adoption of Open Access and FAIR data principles, OpenAIRE empowers researchers, institutions, funders, and policymakers to advance open and transparent science. Through its extensive network of National Open Access Desks (NOADs), OpenAIRE ensures localised support, helping regions integrate into the global research community. OpenAIRE's commitment to Open Science drives scientific progress and innovation, aligning with European and global policies. By fostering collaboration and ensuring research is accessible and reusable, OpenAIRE contributes to solving global challenges and advancing the United Nations' Sustainable Development Goals (SDGs).

Pensoft is an academic open-access publishing company, well known worldwide for its novel, cutting-edge semantic publishing tools and workflows for journals, books and conference materials. Founded in 1992 "by scientists, for scientists", Pensoft has published more than 1,000 books and over 15,000 open-access articles in a number of academic journals, hosted on the ARPHA Publishing Platform developed by the company. Among them, worth mentioning is the open science journal Research Ideas and Outcomes (RIO), which was the first journal to require publications to assign to the advancement of specific SDGs. Through its Research and Technical Development unit, the company is involved in various EU-funded and international research and technology projects, providing services in science communication, project dissemination and management. Pensoft coordinated the EU project BiCIKL, (2021-2024) which established a new community of Research Infrastructures and users of FAIR and interlinked biodiversity data. Pensoft is also active in the creation of services that complete the entire biodiversity life cycle, starting from collections and specimens and ending with data extraction, re-use of FAIR Linked Open Data and building the OpenBiodiv Knowledge Graph.

The Association for Computing Machinery (ACM) is the world's largest educational and scientific computing society, dedicated to advancing computing as a science and profession. ACM fosters collaboration, knowledge-sharing, and innovation in computing and related fields through its extensive network of special interest groups, conferences, and publications. It provides a platform for professionals, educators, and students to stay at the forefront of emerging trends, technologies, and best practices. ACM’s mission is to promote high-quality research, drive technological advancement, and address societal challenges through the responsible and ethical use of computing, aligning with global efforts such as the United Nations' Sustainable Development Goals (SDGs).

Athena Research and Innovation Center is a leading Greek research institution focused on information and communication technologies (ICT) and the broader digital transformation of society. Established to advance research and innovation in areas such as data science, artificial intelligence, robotics, and cultural heritage, Athena plays a vital role in the national research infrastructure of Greece, leading infrastructures for Language Research, BioInformatics, Humanities and the national Data Repository. It actively contributes to the European Open Science Cloud (EOSC), as a leader of the EOSC Future Horizon2020 project and implementing the EOSC EU Node, promoting open science and facilitating access to scientific data and resources across Europe. Through its interdisciplinary research and collaboration with academic, industrial, and governmental partners, Athena fosters innovation, supports the Greek scientific community, and strengthens Greece’s integration into the broader European research ecosystem.

Funding program

This initiative is supported by the core projects of the participating entities (see Annex I).

Grant title

The initiative is financially supported by the core projects of the participating entities (see Annex I).

Hosting institution

LifeWatch ERIC is coordinating the initiative with the equal contribution of all participating entities (see Annex I).

Ethics and security

No ethics and security issues are considered.

Author contributions

Arvanitidis C has coordinated the drafting and editing of the article.

Concept, contribution with text and initial reviews made by all the co-authors.

Conflicts of interest

The authors have declared that no competing interests exist.
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