DATASPHERE
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Sandboxes and Sustainability:

Exploring New Frontiers in Environmental Data and Governance

Working Paper
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About the Datasphere Initiative

The Datasphere Initiative is a think and do tank that catalyzes meaningful dialogues and co-creates actionable and innovative approaches to respond to data challenges and harness opportunities across borders. Our mission is to equip organizations to responsibly unlock the value of data for all.

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About this Working Paper

This working paper is a preliminary research output to be used as input for discussions in the context of the inaugural meeting of the Global Sandbox Forum on 22-23 July, 2024. A final version will be published in September 2024 and will include insights of the exchanges, acknowledging additional contributors.

Executive Summary

The world is facing an unprecedented sustainability and environmental crisis. Rising global temperatures, warming oceans, shrinking ice sheets and rising sea levels threaten ecological and social equilibrium. Addressing these problems requires solving challenges such as the lack of comprehensive data, the slow pace of innovation, and the availability of spaces for agile collaboration and exploration. To address the climate crisis, data must become an enabler and interoperability of solutions need to become a reality across borders. This requires creating experimentation spaces where all stakeholders can participate and test current data, new data collection methods, solutions and business models. Sandboxes can play a crucial role in fostering this innovation and in addressing the sustainability crisis the world is facing. This working paper analyzes the situation, reviews key challenges of environmental data and governance, potential avenues for application of sandboxes and highlights examples of current innovation in this space. It proposes ideas for environmental data sandboxes that could be implemented across different geographies and contexts. Finally, the paper offers policy actions and recommendations for successful implementation.

Introduction

The current climate situation is dire, with daily reports highlighting significant impacts such as rising temperatures, soaring CO2 emissions, and frequent wildfires and heatwaves.[1] Alarming statistics reveal that 85% of people have experienced weather events exacerbated by climate change, with 218 million affected by weather-related disasters annually.[2] Biodiversity loss is stark, with the WWF reporting a 68% decline in the population sizes of mammals, fish, birds, reptiles, and amphibians from 1970 to 2016, primarily due to habitat conversion.[3] Plastic pollution further exacerbates the crisis, with 14 million tons entering oceans annually and 91% of all plastic ever produced not being recycled. Soil degradation affects about 40% of the planet's soil, threatening food security for billions, while deforestation continues at a monumental scale, with forests equivalent to 300 football fields being cut down every hour.[4] Without significant intervention, the planet may retain only 10% of its forests by 2030, with the possibility of complete forest loss within a century.

Data plays a crucial role in illustrating the current state of the world and the challenges in the sustainability sector. However, lack of access to data and structural data interoperability issues have been an often overlooked barrier to overcome these challenges. On one hand, public datasets, when available, have historically been fragmented and under-resourced, lacking interoperability and the robust governance mechanisms to enable them to inform effective policy action. On the other hand, despite efforts to coordinate initiatives, concern has emerged that private datasets on environment-related issues have become increasingly protected or commodified. With growing investment in AI and analytics, venture capitalists and major corporations are investing heavily in climate data and risk models, recognizing the growing demand for detailed information about climate risks.[5]

Moreover, the lack of standardized taxonomies and regulations across jurisdictions complicate global cooperation and comparison of sustainability efforts even further. Inconsistencies makes it difficult to implement and compare sustainability efforts effectively, particularly in areas such as carbon markets, sustainable finance, and ESG reporting. Renewable energy integration, circular economy practices, and supply chain transparency require coordinated efforts across borders. In a context where frameworks for responsible data exchange, data sharing and privacy concerns exacerbate cross-border data access for environmental monitoring and decision-making. Addressing these barriers in an innovative manner is essential for enhancing global sustainability initiatives and achieving meaningful outcomes.

Current challenges in environmental data and governance

The effective governance of environmental data is a critical issue in today's sustainability landscape. Data is crucial for informed decision-making and policy formulation in

[1] Ritchie, Rosado, Samborska (2024), *Climate Change*, Our World in Data.
[2] Kaplan and Ba Tran (2011), *Climate Change Is Harming 85 Percent of the Global Population*, The Washington Post.
[3] Earth.Org (2020), *68% Decline in Species Population Sizes Since 1970 - WWF*, Earth.Org.
[4] United Nations (2024), *Land - the planet's carbon sink*, United Nations.
[5] Mankin (2024), *The People Have a Right to Climate Data*, New York Times, Jan 20, 24.

sustainability, and key for the technological innovation needed to catalyze rapid transformation towards greener economies. Nonetheless, most analyses in the sustainability sector are conducted with inadequate data (e.g., technical challenges that hinder satellite images' capacity in capturing different types of ecosystem degradation effectively) or are limited to areas with available data, leaving other regions unexplored and under-analyzed. Meanwhile, climate leaders have highlighted that approximately half of the technology required to achieve zero emissions either does not exist yet or remains prohibitively expensive for many parts of the world.[6]

There are several dimensions of the challenges related to environmental data and governance, including data quality, access, interoperability, sharing, taxonomy harmonization, and regulatory issues.

Data quality

High-quality data is the foundation of effective environmental monitoring and decision-making. However, ensuring data accuracy, completeness, and consistency is a significant challenge. Data collection often involves multiple sources with varying methodologies, leading to discrepancies. Inconsistent data can result in faulty analysis and misleading conclusions, which can undermine efforts to address environmental issues. Standardizing data collection methods and implementing robust quality control mechanisms are essential to ensure the reliability of environmental data.

The significant lack of data needed to understand the true extent of our situation is staggering. Some facts underscore this problem: for instance, 40% of the world's economy relies on biological resources. However, a staggering 86%[7] of land species, 91%[8] of ocean species, and 99%[9] of microbes remain undiscovered. Additionally, 90% of countries lack the capacity to collect and publish sufficient data on agri-food systems, and there are 88%[10] fewer weather stations in Africa than recommended by the WMO for reliable weather forecasting. This dearth of data leaves critical gaps in decision-making and forecasting appropriate courses of action in the future.

Overall, there are serious deficiencies in the capacity of governments and regulators to effectively measure and monitor steps to reduce environmental impact. This can also be illustrated by the voluntary carbon credit market[11], where a gap exists on effective measurements of the credits sold globally. This is primarily due to authorities' lack of capacity and expertise in the environmental data lifecycle.[12]

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[6] Breakthrough Energy (2021), *Breakthrough Energy Catalyst and Major Corporations Announce Partnership to Accelerate the Clean Energy Transition*, Breakthrough Energy News.
[7] National Geographic (2011), *Earth's Species: 8.7 Million*.
[8] Appaya,Mandepanda, Gradstein, Luskin, Kanz,Mahjabeen (2020), *Global Experiences from Regulatory Sandboxes*,World Bank Publications.
[9] Collins (2019), *Nearly a Million Microbes are Living on You – and that's a Good Thing, According to Stanford Study*, Stanford Report.
[10] Bearak (2021), *Africa Needs More Climate Data. These Teenagers Are Delivering It*, Washington Post.
[11] Greenfield (2023), *Revealed: more than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows*, The Guardian.
[12] Stobierski (2021), *8 Steps in the data lifecycle*, Harvard Business Review.

Access to data

Access to environmental data is a critical issue, with barriers existing at multiple levels. Many valuable datasets are owned by private entities, making them inaccessible to researchers, policymakers, and the public. The privatization and commercialization of climate data exemplifies this issue. Proprietary data on climate, now sold at high prices, leads to increasing divides between those who can afford the data and those who cannot.[13] Public institutions also face challenges in data accessibility due to bureaucratic hurdles and restrictions on data sharing. Ensuring equitable access to environmental data is essential for fostering inclusive and effective sustainability initiatives.

Data interoperability and taxonomy harmonization

Interoperability, or the ability of different data systems to work together, is vital for integrating diverse datasets into a coherent whole. However, achieving interoperability is challenging due to the lack of standardized data formats and protocols. Different organizations and jurisdictions often use incompatible systems, making it difficult to combine and analyze data from multiple sources. This fragmentation hinders comprehensive environmental assessments and coordinated responses to environmental issues. Developing and adopting common standards and frameworks for data interoperability is crucial to overcoming these barriers.

Box 3. Problems on land tenure and use in Brazil are also data governance problems

Brazil struggles with the coexistence of multiple public databases storing information on land use.[14] While property rights are registered by the countries' thousands of notaries splattered across the territory, the Ministry of Agriculture, the institute for agrarian reform, and the federal and environmental agencies have each different registries of rural areas destined to agricultural or other kinds of use, each with different purposes: public policy planification, fiscal enforcement, legal compliance. A more comprehensive registry created in 2012, the CAR (*Cadastro Ambiental Rural*), compiles environmentally relevant information in one digital database, but its slow implementation and lack of integration with other databases make it one more registry to be counted. Those databases are not integrated among themselves nor externally - for example with Federal tax databases or state and municipal agencies issuing environmental permits to rural activities. Not even the georeferencing parameters of the different databases are standardized.

Even so, the advanced systems of deforestation control based on satellite images currently in use, such as PRODES (Projeto de Monitoramento do Desmatamento na Amazônia Legal por Satélite), are reliant on the information produced by those different databases to be able to implement efficient strategies against illegal deforestation. The lack of comparability of those databases enhances problems of reliability and legal certainty in land regulations, while perpetuating reasons for social conflicts and wasting

[13] Mankin (2024), *The People Have a Right to Climate Data*, New York Times, Jan 20, 24.
[14] Chiavari, Joana, Cristina L. Lopes e Julia N. de Araujo (2021). *Panorama dos Direitos de Propriedadeno Brasil Rural*, Climate Policy Initiative.

valuable opportunities to reduce environmental risks. The international trend to require due diligence from importers of environmentally sensible commodities from high-risk areas puts pressure on Brazil to solve the issue. The lack of interoperability and reliability of data on land tenure and on the legality of land use will become an even more inconvenient issue in the next few years, considering the country's participation in international trade may be affected.

Any strategy to solve the issue would be dependent on a comprehensive digital governance approach that would allow for data produced and processed inside different governmental agencies to be accessed in a meaningful way by other agencies, while allowing for collaborative spaces to test technical solutions to inconsistencies among databases that are not primarily legal issues.

Taxonomy harmonization, or the standardization of classifications and terminologies used in environmental data, is crucial for ensuring consistency and comparability. However, different regions and organizations often use varied taxonomies, leading to confusion and misinterpretation of data. This lack of standardization complicates data integration and analysis, as different datasets may categorize the same information differently. Harmonizing taxonomies across jurisdictions and sectors is necessary to facilitate accurate data interpretation and support global sustainability efforts.

Data sharing

Effective data sharing is essential for collaboration and informed decision-making in environmental governance. However, concerns over data privacy, security, and intellectual property rights often impede data sharing. Organizations are wary of sharing data due to the risk of misuse, breaches, and loss of competitive advantage. Additionally, legal and regulatory constraints can limit the extent to which data can be shared across borders and institutions.

Not only do different companies and governments lack access to each other's data, but most data is available primarily to business and government actors. This excludes local communities and individuals, who could develop innovative solutions if they had access to sustainability data. This situation highlights complex challenges in the sustainability sector, and the need for trustworthy data sources and sharing. Establishing clear guidelines and secure platforms for data sharing is necessary to facilitate cooperation and enhance the utility of environmental data.

Regulatory challenges

Regulatory frameworks for environmental data management vary widely across jurisdictions, creating challenges for global cooperation. Differing regulations regarding data collection, storage, and sharing can lead to inconsistencies and legal uncertainties. These regulatory discrepancies make it difficult to develop and implement global environmental policies and initiatives. Harmonizing regulatory frameworks and promoting international cooperation are

essential steps toward addressing these challenges and ensuring effective environmental governance.

Exploring sandboxes for sustainability

To address some of these data challenges, we need to think beyond traditional linear solutions.Governments and the private sector could be inspired by policy experimentation and the iterative approaches of sandboxes to foster responsible data-sharing and deployment of new technologies and regulatory approaches to tackle the climate crisis.

The value of policy experimentation to face sustainability challenges is already evident, since the technological development that is needed to solve those issues have to be enabled, while ensuring any potential ecological or societal risks are managed effectively. A few examples of sustainability policy experimentation can be found across various sectors. For instance, countries have implemented pilot programs for renewable energy adoption, urban green spaces, and waste reduction initiatives. These experimental policies help policy-makers identify what works best in real-world settings and gather empirical data to inform larger-scale implementations.

Among the tools of policy and data-sharing experimentation, sandboxes have emerged as a space to enable a secure space to test new solutions and business models, and most importantly one to foster trust and knowledge sharing between the public and private sector on key challenges and dilemmas.

Sandboxes were originally modeled on enclosed software testing environments that programmers created to test and run code and applications without risking the overall system they work in. This practice can be said to have evolved in at least two different ways, particularly in its application in the public sector: regulatory sandboxes and operational sandboxes.

- **Regulatory sandboxes** are time-limited collaborative endeavors involving regulators, service providers, and other relevant stakeholders to test innovative technology and data practices against regulatory frameworks.[15] They were first used by financial regulators who adapted the software testing environment of sandboxes to create closed environments where new ‘fintech’ is tested - both to check compliance with regulations and, in some jurisdictions, to investigate if the regulations themselves needed updating. The sandbox setting ensures that the risks to consumers or the financial system are contained.

- **Operational sandboxes** are secure, collaborative spaces that pool datasets and resources together.[16] Hosted by one entity and accessed by several others, they serve new combinations and uses of data. Regulators or government agencies can create them to test capabilities on actual datasets. Alternatively, a coalition of actors

[15] Datasphere Initiative (2022), *Sandboxes for data: creating spaces for agile solutions across borders*, Datasphere Initiative.
[16] Ibidem.

can establish them to pool resources, sometimes through technologically enabled decentralized approaches (e.g., data collaboratives, fiduciaries, commons), to explore or encourage their use. Data sandboxes normally fit into the category of operational sandboxes.

The creation of data sandboxes may be the approach needed to deal with sustainability challenges that require better data creation, storage, sharing, processing and evaluation in collaborative and agile environments. Most experiences with sandboxes have focused on sectors with strict regulations and protected personal data.[17] Initially, experimentation mainly occurred in the financial sector[18], driven by a desire for growth and innovation using the large data sources from banks or pension funds. Consequently, sandboxes seemed to be a natural fit for dealing with the complexities of large datasets. However, there are limited examples of sandboxes related to sustainability to date. Regulatory sandboxes have been growing in its application in the energy sector (Box 2) and data-sharing innovations that could be interpreted as a type of operational sandbox (or data space) have also been emerging (Box 3). These initiatives provide controlled environments for testing innovative solutions aimed at promoting sustainability across various sectors.

Box 2. Regulatory sandboxes in the energy sector

In Singapore, the "Regulatory Sandbox to Encourage Energy Sector Innovations" was launched in 2017 in order to encourage more experimentation in the electricity and gas sectors, so that promising innovations can be tested and have a chance for wider adoption and also to help Singaporean regulator EMA adjust its regulatory frameworks to keep pace with advances in technology.[19] The evaluation criteria for ideas applying for the Regulatory Sandbox include solutions that i) uses technologies/products in an innovative way; ii) addresses a problem or brings benefits to consumers and/or the energy sector; iii) requires some changes to existing rules; iv) has clearly denied test scenarios and outcomes; v) has defined boundary conditions; vi) has defined monitoring and evaluation processes; vii) foreseeable risks have been assessed and mitigated; viii) has defined exit and/or transition strategy.[20]

In Brazil, ANEEL (the Brazilian Electricity Regulatory Agency) launched its call for the first cohort with the aim to foster experimentation with new tariff models and billing systems for energy consumers.[21] The sandbox featured 14 projects from various distribution groups, covering diverse themes like time-based tariffs, dynamic pricing, digital billing, prepayment systems, and tariffs for networks with distributed generation, including peer-to-peer energy surplus commercialization using blockchain. ANEEL conducted several events to engage stakeholders and disseminate project details, such as technical meetings and workshops. Throughout the process, the Sandbox Governance Committee was instrumental in evaluating, authorizing, and monitoring projects, ensuring transparency and broad

[17] Tellez-Merchan and Porteous (2021), *Four Years and Counting: What We've Learned from Regulatory Sandboxes*, World Bank Blogs.
[18] Appaya,Mandepanda, Gradstein, Luskin, Kanz,Mahjabeen (2020), *Global Experiences from Regulatory Sandboxes*,World Bank Publications.
[19] Energy Market Authority (2017), *Launch of Regulatory Sandbox to Encourage Energy Sector Innovations*, Energy Market Authority Government of Singapore.
[20]Energy Market Authority (2023), *Regulatory Sandbox*, Energy Market Authority Government of Singapore.
[21] ANEEL (2023), Sandboxes Tarifários - 1a Chamada, Agência Nacional de Energia Elétrica.

dissemination of information to society. This structured approach facilitates stakeholder engagement and promotes the effective implementation of innovative tariff models.

Box 3. Innovative spaces for environmental data sharing

Since 1988, the **Amazon Network of Georeferenced Socio-Environmental Information** (RAISG) has been generating and disseminating knowledge, statistical data, and geospatial socio-environmental information about the Amazon region, employing standardized protocols across all member countries.[22] It receives support from eight civil society organizations spanning Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela, with additional backing from Sweden, NORAD, Earth Insight, Good Energies, Quadrature Climate Foundation, and the Rainforest Foundation. One of its completed projects compiled socio-environmental data on land use change, deforestation, and fires, utilizing historical records and future projections. This initiative aims to facilitate decision-making across various planning levels to prevent and mitigate degradation in the Amazon basin, thus reducing threats to biodiversity and enhancing the quality of life for its inhabitants.

The Digital Earth Africa Sandboxes offer open-source data and products to aid decision-makers across the African continent.[23] This initiative, supported by Leona M. and Harry B. Helmsley Charitable Trust, aims to tackle diverse challenges. Projects encompass using satellite data to combat drought by monitoring Lake Sulunga in Tanzania, preserving mangroves in Zanzibar through time series analysis, promoting diversity and inclusivity within Digital Earth Africa, and enhancing access to analysis-ready water data across Africa.

So far, not many applications of sandboxes for sustainability have been developed. However, this tool presents itself as a potential avenue to solve concrete bottlenecks while enhancing cooperation between the private and public sectors - locally, nationally and globally.

Potential Areas for Sandboxes in Sustainability

There is a unique opportunity to leverage the power of sandboxes - both regulatory and operational. Rather than solely focusing on existing regulation, we can redefine sandboxes as a new tool for experimentation in the sustainability sector. This transformation entails shaping sandboxes into spaces where the primary goal is not just to consider how data can be utilized, but to foster entirely new data value creation models where both the social and economic benefits of data are maximized for all stakeholders. Below are some ideas for sustainability sandboxes with significant potential.

[22] RAISG (Amazon Geo-Referenced Socio-Environmental Information Network) (n.d), *Homepage Website*, (Accessed June 19, 2024).
[23] Digital Earth Africa (n.d), *Homepage Website,* (Accessed May 19, 2024).

Digital Infrastructure for Sustainability

While DPI is still considered an evolving concept, one of the more widely used definitions is that of "a set of shared digital systems which are secure and interoperable, built on open standards, and specifications to deliver and provide equitable access to public and/or private services at societal scale and are governed by enabling rules to drive development, inclusion, innovation, trust and competition and respect human rights and fundamental freedoms".[24] Among the three elements of DPIs - digital identity, digital payment and data exchange systems, the latter has typically received less attention. Nonetheless, data exchange systems play a pivotal role in policy effectiveness to advance sustainability goals.[25]

Adding another layer of complexity to the typically national scope of DPIs involved considering the global dimension of sustainability challenges that goes beyond borders. Developing DPIs for sustainability could also involve creating interoperable technological solutions that can be scaled internationally. Sandboxes could then serve as test and refinement spaces to these digital tools not only nationally, but also by ensuring they meet the regulatory requirements of different countries while promoting sustainability objectives. By fostering innovation and collaboration, regulatory sandboxes can help deploy DPIs that support environmental monitoring, resource management, and sustainable development on a global scale.

Supply chain transparency

Global supply chains often span multiple jurisdictions, making it challenging to ensure compliance with diverse sustainability regulations. Recently adopted regulations require substantial collaboration among different companies within the same supply chain to ensure due diligence of environmental practices of multinational companies.[26] For example, mandatory risk assessment from importers of deforestation-sensible products coming from high-risk areas require some degree of disclosure of comprehensive commercial documents.[27] In such a context, while national regulation on data and commercial secrecy may pose barriers for collaboration, private actors may be willing to test secure and effective ways of guaranteeing their businesses will comply with the law and reduce regulatory risks in different jurisdictions.

Testing technical solutions in which relevant and sensible data can be safely shared with other private actors in the supply chain in a sufficiently reliable but mostly anonymised way can unlock some of that data. For example, certain solutions are being designed by a partnership of stakeholders to develop a data exchange network enabling businesses to

[24] UNDP (2023), *Accelerating The SDGs Through Digital Public Infrastructure: A Compendium of The Potential of Digital Public Infrastructure*, United Nations Development Programme.

[25] UNEP (2024), *Digital Public Infrastructure for Environmental Sustainability*, United Nations Environment Programme.
[26] European Commission (2024), *Directive on corporate sustainability due diligence*.
[27] European Commission (2023), *Regulation on Deforestation-Free Regulation*.

share their GHG emissions data in a verified and confidential manner across industries and value chains using PETs.[28]

Nevertheless, one key issue would be whether the data produced by such a technological tool would be considered meaningful and valid by regulators. In this context, sandboxes could be used for the application of technologies that make due diligence requirements more effective, while giving private players and regulators some safe margin to react in case such innovative tools show to be unreliable or too difficult to be implemented. Sandboxes could also pilot solutions for tracking and verifying sustainable practices throughout the supply chain. By standardizing these practices, cross-border regulatory sandboxes could help companies demonstrate compliance with international sustainability standards, thereby boosting consumer trust and ensuring ethical sourcing.

Carbon Markets and Emissions Trading

Cross-border regulatory sandboxes can significantly enhance the standardization and interoperability of carbon markets and emissions trading systems. By allowing countries to test and harmonize their carbon accounting and reporting mechanisms, sandboxes can help establish a common framework that facilitates the mutual recognition of carbon credits. This collaboration can lead to a more efficient and transparent global carbon market, reducing greenhouse gas emissions and supporting international climate agreements such as the Paris Accord.

Renewable Energy Integration

The integration of renewable energy sources into national grids poses significant technical and regulatory challenges, especially when considering cross-border energy trading. Regulatory sandboxes can pilot innovative solutions for seamless renewable energy integration, enabling countries to test grid management systems, energy storage technologies, and regulatory frameworks that support transnational energy flows. These initiatives can lead to a more resilient and sustainable energy infrastructure, ensuring a consistent and reliable supply of renewable energy across borders.

Sustainable finance

Sustainable finance is crucial for driving investments in green projects, yet differing national standards can hinder the growth of global sustainable finance markets. Cross-border regulatory sandboxes can facilitate the development and harmonization of financial instruments like green bonds and sustainable loans. By testing and aligning regulations, these sandboxes can help create a unified framework that attracts international investors, promotes transparency, and ensures that financial flows contribute to sustainability goals worldwide.

[28] WBCSD (2021), Carbon Transparency Partnership publishes new guidance to enhance consistency of emissions data, World Business Council for Sustainable Development Blog.

Circular economy practices

Implementing circular economy practices involves the efficient management of resources, recycling, and waste reduction, which can be complicated by differing regulations across countries. Regulatory sandboxes can provide a platform for testing standardized approaches to waste management and resource efficiency, promoting the adoption of circular economy principles globally. These efforts can lead to more consistent regulations, enhancing collaboration between countries and ensuring that materials are reused and recycled more effectively on a global scale.

ESG reporting

Environmental, social, and governance (ESG) reporting is essential for assessing corporate sustainability performance, yet inconsistencies in reporting standards can limit comparability. Cross-border regulatory sandboxes can help harmonize ESG reporting standards, allowing companies to adopt consistent metrics and disclosure practices. This alignment can enhance the transparency and reliability of ESG data, enabling investors and stakeholders to make more informed decisions based on comparable sustainability performance metrics.

Climate resilience and adaptation

Building climate resilience requires coordinated efforts across regions, as climate impacts often transcend national boundaries. Sandboxes could facilitate cross-border collaborations on climate resilience initiatives, testing strategies and regulatory frameworks that address shared climate risks. By aligning adaptation efforts, these sandboxes can help countries develop cohesive and effective responses to climate change, enhancing the resilience of communities and ecosystems on a global scale.

Biodiversity Conservation

Biodiversity conservation is a global challenge that benefits from coordinated international efforts. Cross-border regulatory sandboxes can pilot collaborative frameworks for biodiversity protection, aligning conservation strategies and regulations across different jurisdictions. By standardizing approaches to habitat preservation, species protection, and ecosystem management, these sandboxes can enhance the effectiveness of biodiversity conservation efforts and ensure that they are globally consistent and mutually reinforcing. Moreover, operational sandboxes could be developed to foster data discoverability to inform biodiversity conservation (Box 4).

Box 4. Potential operational sandboxes and data collaboratives for sustainability

Ocean Data Collaboration: Building upon the fact that less than 1% of the world's sea species are currently known, a data sandbox could bring in various countries and companies interested in advancing oceanic knowledge to collaborate. This initiative would aim to foster a deeper understanding of the world's oceans through collective efforts and shared data resources.

Cross-Border Natural Area Data Collaboration: Consider the wealth of information waiting to be uncovered within the Sahara Desert, including data on animal species, flora, water sources, and more. A data sandbox could involve the eleven countries spanning the Sahara (Algeria, Chad, Egypt, Libya, Mali, Mauritania, Niger, Western Sahara, Sudan, Morocco, and Tunisia), as well as numerous companies, NGOs, and government agencies.

Global Species Discovery Initiative: Currently, only 16%[29] of the land species on our planet have been identified, with some species having vanished before being documented. This represents a challenge, as the task of cataloging, monitoring, and conserving species is both financially burdensome and time-intensive. It is also a unique opportunity for the private sector, the government, and the general population to work together to increase the documentation around biodiversity worldwide. Today, 40%[30] of the world's economy is derived from biological resources, but the vast majority of biodiversity still remains to be documented and described. Imagine the impact of a collaborative effort aimed at increasing our knowledge of global biodiversity by just 1%. Uncovering and documenting previously known and unknown species can occur by pooling resources and expertise globally, working collectively towards enriching our understanding of Earth's diverse tapestry of life.

Each of these projects would require several key data elements. Firstly, a standardized method for data collection would ensure all stakeholders have the capacity for quality data collection. Secondly, data processing would need specific standards for each data point. Once data collection is addressed, usability challenges would arise, necessitating enhanced cross-border data management capabilities within the involved governments, companies, and NGOs. Finally, a centralized hub for experimentation and innovation would be crucial, allowing lessons learned and best practices to be shared among all stakeholders and providing a resource for others seeking knowledge for future opportunities in other parts of the world.

Establishing more initiatives that rely on intentional policy experimentation for sustainability with clear objectives and assigning each stakeholder a defined role could foster significant learning and mutual benefits through collaboration and stand to improve not only environmental outcomes but also to evaluate the technical, regulatory, and economic dimensions. By involving every stakeholder, (including local communities and the general population) creating appropriate incentives, training, and building capacities, the value of data to address sustainability challenges globally can be unlocked. Ultimately, these emerging sandboxes could lead the way to a sustainable future, offering innovative solutions to safeguard our planet. By leveraging sandboxes, these areas can benefit from innovative, scalable, and harmonized regulatory solutions, fostering global cooperation and accelerating progress toward sustainability goals.

[29] National Geographic (2011), *Earth Is Home to 8.7 Million Species, Scientists Estimate*, National Geographic.
[30] Critical Ecosystem Partnership Fund (n.d), *Biodiversity*, (Accessed June 11, 2024).

Conclusion

To leverage data sandboxes in the sustainability sector, capacity building and knowledge sharing are crucial. Key recommendations include:

- **Fostering more evidence around sandboxes for sustainability goals:** A one-stop-shop knowledge hub for innovation using data in the sustainability sector would help to speed up the flow of ideas worldwide. This hub would make it easier for innovators and other stakeholders (governments, companies, communities) to access information and understand the direction of innovation.
- **Capacity building:** Capacity building will be fundamental for increasing the speed of innovation in the sustainability sector. This approach should focus on building capacities at a societal level. Local people and affected populations should be involved to inform about the existing data gaps and to benefit from the value created from generated data.
- **Communities of practice and experimentation:** The creation of communities of practice that support each other will be instrumental in achieving innovation in the sustainability sector using data. By forming groups of people who share a common interest in innovating in this sector, more ideas will flow and turn into projects, leading to scalable solutions across different areas and countries. The Global Sandboxes Forum proposed by the Datasphere Initiative could help advance this effort.

With an increasing number of environmental crises emerging daily, there is a pressing need to explore innovative solutions to address these changes.