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ETHICAL PERSPECTIVES ON COMBINATIONS OF DIGITAL SEQUENCE INFORMATION (DSI) IN GENETIC RESOURCES: POST-COP16 COLOMBIA REPORT

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ETHICAL PERSPECTIVES ON COMBINATIONS OF DIGITAL SEQUENCE INFORMATION (DSI) IN GENETIC RESOURCES: POST-COP16 COLOMBIA REPORT

Milena Jael Silva Morales

ECOLONICAL LAB: INSIGHTS ON WATER, ENERGY, BIODIVERSITY, GEODATA, AND AI 



Introduction

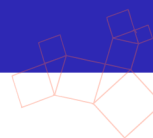
This report focuses on analyzing and presenting the emerging risks and opportunities posed by the intersection of biotechnology, artificial intelligence (AI), and environmental resource management. Following the recent #COP16 on biodiversity and climate, critical threats and urgent challenges that affect both biodiversity and humanity have been identified. In this context, it is essential to adopt an ethical and sustainable approach to the rapid technological advancements and their implications.

The aim of this report is to provide insights that encourage reflection and motivate informed actions to balance technological innovation with environmental protection and respect for community rights.



This report seeks to foster reflection and action in defense of a future that balances innovation with the protection of our environment and the respect for the rights of communities, genetic resources, and ecosystems that sustain life on our planet.

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1. RISKS OF COMBINING DIGITALIZED GENETIC SEQUENCES (DSI)

Biotechnology aims to combine digitalized genetic sequences (DSI) from different origins to create new organisms and biological products. While these techniques promise major advances in health, agriculture, and conservation, it is fair to question whether the absence of strong ethical frameworks and clear regulations poses significant risks.

This situation raises crucial questions: *who truly benefits from these innovations, and what could be the unforeseen consequences for ecosystems and local communities?*



Examples of Risks: The creation of hybrid or chimeric organisms through the combination of genetic sequences poses serious ecological and health risks. These organisms could become invasive species that displace native species and disrupt ecosystems. In some cases, they might generate unknown pathogens that surpass human and animal immune defenses, causing outbreaks of diseases for which there are no effective treatments. Genetic unpredictability adds an additional danger, as interactions between combined genes can lead to unexpected and potentially harmful expressions for the environment and public health.

Ethical Implications and Lack of Transparency: The inability to trace the genetic origin once sequences are combined implies an ethical gap in accountability. This raises concerns that promises of compensation to the communities and countries of origin of the genetic resources might be illusory or misleading. Such practices perpetuate a system of exploitation that benefits those with greater resources and power, putting local communities and less developed countries at a disadvantage.

Citizen Action / Local Communities: It is crucial for independent organizations and citizens to demand the implementation of strong regulatory frameworks that ensure traceability, transparency, and justice in the management of digitalized genetic sequences. Ethical oversight must be a priority to prevent exploitation and protect both communities and ecosystems. Innovation should be integrated with integrity and sustainability to ensure a fair and balanced future.

2. RISKS OF PATENTS AND RIGHTS ON COMBINED GENETIC SEQUENCES (DSI)

The increasing practice of granting patents on combined genetic sequences poses serious ethical and legal challenges, especially when these combinations include material from multiple origins. The lack of traceability and transparency in the process of combining sequences makes it difficult to identify the genetic origin and, consequently, complicates fair compensation to the communities and countries that have safeguarded these resources.

Risks and Challenges

- **Injustice and Exploitation of Genetic Resources:** Patents can consolidate property rights for entities that do not recognize or compensate the communities of origin, perpetuating a system of exploitation.
- **Global Inequality:** Countries with fewer resources are at a disadvantage as more powerful actors monopolize access to and the benefits of genetic innovations.
- **Lack of Transparency and Compensation Mechanisms:** Promises of benefit-sharing with the countries of origin are often empty due to the inability to accurately trace genetic contributions in combined sequences.

Examples of Risks

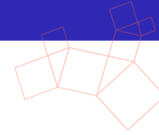
Modern Biopiracy: The practice of registering patents on genetic sequences without fair compensation results in a form of biopiracy, where the benefits are concentrated in the hands of a few corporations, leaving the communities that have preserved those resources out of the equation.

Disadvantages for Countries of Origin: Biodiversity-rich nations may witness the commercialization of products derived from their genetic heritage without receiving their rightful share of benefits, perpetuating inequality and undermining their sovereignty over their own biological resources.

Citizen Action / Local Communities

It is imperative for independent organizations, citizens, and the scientific community to advocate for the creation of an international regulatory framework that ensures traceability and fairness in the management of patents on combined genetic sequences. We must push for transparent and equitable mechanisms that guarantee that the communities of origin receive a fair share of the benefits and that their essential role in the protection and preservation of biodiversity is recognized. Equity and ethics should be the foundation upon which genetic innovation practices are built.

3. MURDER AND REPRESSION OF ENVIRONMENTAL DEFENDERS IN MEGADIVERSE COUNTRIES



Deforestation in tropical rainforests is a critical issue that contributes to biodiversity loss, climate change, and the displacement of indigenous and local communities. This problem is driven by both local and international actors, including religious groups and foreign colonies. Mennonite colonies, for instance, have been cited in various Latin American countries for their role in converting vast areas of rainforest into agricultural land. This phenomenon raises urgent questions about development priorities and natural resource management approaches in megadiverse regions.

Examples of Deforestation:

- **Peru:** Mennonite colonies have deforested over 8,660 hectares, converting rainforest into farmland and impacting areas critical for biodiversity and indigenous communities' livelihoods.
- **Bolivia:** More than 200,000 hectares of forest have been deforested for agricultural interests, transforming forest landscapes into extensive monoculture and pasture areas.
- **Paraguay (Chaco):** Over one million hectares of forest have been deforested, threatening both biodiversity and native communities that rely on the forest for their survival.



Murders


Colombia: Reports from international and local organizations indicate that the country leads in the number of murders of environmental defenders over the last decade. These deaths are frequently linked to land use conflicts and resistance to extractive projects.

Brazil: The Brazilian Amazon has witnessed systematic violence against forest defenders, driven by deforestation interests and agricultural expansion.

Citizen Action / Local Communities:

Ecolonical LAB urges independent organizations, civil society, and citizens to stand in solidarity and support the protection of environmental defenders. Creating support networks and applying public pressure to denounce and stop these practices are essential to ensure the safety of those who dedicate their lives to protecting biodiversity. It is time for society to recognize the value of these defenders as allies in the fight for a sustainable future and provide them with the necessary support to continue their vital work without fear of reprisal.

4. DEFORESTATION AND LOCAL AND INTERNATIONAL ACTORS



The fight for biodiversity protection and the defense of natural resources involves not only a commitment to sustainability and conservation but also a real risk for those who take on this role. Environmental defenders, including activists, indigenous leaders, and local communities, face constant threats and, in many cases, violence and murder. This type of repression is alarming, especially in high-biodiversity regions where economic and extractive interests prevail over environmental protection.

Risks and Consequences

- **Violence and Persecution:** Countries such as Colombia and Brazil have reported some of the highest rates of violence against environmental defenders, with documented cases of harassment, intimidation, and murder of community leaders and activists.
- **Impact on Global Biodiversity:** The repression of environmental defenders is not only a human tragedy but also compromises the protection of ecosystems. The lack of security for these actors can hinder essential conservation efforts and open the door to illegal activities such as deforestation and unregulated mining.
- **Displacement of Communities:** Violence and repression force entire communities to abandon their lands, losing not only their homes but also their ability to protect and manage their natural resources.

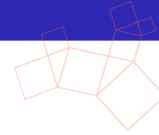
Ethical and Social Implications

Deforestation carried out by external and local actors for profit raises an ethical question about the right of communities and ecosystems to exist and thrive. Prioritizing economic interests over biodiversity conservation and the rights of local communities demonstrates a lack of balance in natural resource management.

Citizen Action / Local Communities

Ecolonical LAB urges citizens and independent organizations to become aware and take action against deforestation. It is crucial to demand stricter conservation policies and promote sustainable practices that actively involve local communities in managing their lands. Solutions should focus on protecting ecosystems and ensuring that communities have a voice and control over the natural resources they have safeguarded for generations.

5. RISKS OF SYNTHETIC BIOLOGY AND AI-DRIVEN ADVANCES



Synthetic biology, powered by advancements in AI, has become a powerful tool for research and development in fields such as medicine, agriculture, and biotechnology. However, the rapid progress of these technologies raises concerns about ethical and biosecurity risks. The ability of AI to analyze and manipulate large volumes of genetic data has accelerated the creation of synthetic organisms and genetic editing. While this opens up new opportunities, it also presents unprecedented challenges that require careful evaluation and appropriate regulations.

Risks and Challenges

- **Creation of Potentially Dangerous Pathogens:** The combination of AI and synthetic biology could facilitate the development of microorganisms with unpredictable traits that, if released, could pose a threat to public health and global security.
- **Inequality in Access to Technology:** AI-driven biotechnological advancements tend to benefit nations and corporations with greater resources, widening the gap between developed and developing countries.
- **Ethical Dilemmas in Life Modification:** Genetic manipulation and the creation of synthetic life forms raise fundamental questions about the limits of human intervention in nature and the risks of irreversibly altering ecosystems.

Ethical and Governance Implications

The governance of AI-enabled synthetic biology is an evolving topic that still lacks a robust global regulatory framework. Ethical discussions must focus on the responsibility of developers and scientists to ensure that their research and applications are conducted with a responsible and transparent approach.

Citizen Action / Local Communities

Ecolonical LAB calls on independent organizations and civil society to stay informed and actively participate in the development of ethical and regulatory frameworks for AI-driven synthetic biology. Ethical oversight and transparency must be fundamental pillars in the advancement of these technologies to prevent scientific progress from outpacing the ability to manage its consequences. Collaboration and citizen scrutiny are essential to ensure a future where innovation and integrity coexist.

6. GLOBAL INTEREST IN GENETIC SEQUENCES: CHALLENGES OF CENTRALIZATION AND CONTROL

In recent years, the digitalization of genetic sequences has captured the attention of supranational entities and global actors, marking a turning point in the management and distribution of benefits associated with these resources. Organizations such as the United Nations (UN), through bodies like the World Health Organization (WHO) and the Food and Agriculture Organization (FAO), have played a key role in promoting biotechnology and managing genetic sequence information. This push has been supported by influential entities such as the World Economic Forum (WEF) and the OECD, which have organized scientific events, conferences, and published academic articles that emphasize the potential benefits of biotechnology. However, it is essential to question whether these efforts are genuinely aimed at equity and sustainability or if they conceal a more concerning agenda of centralization and economic profit maximization for a select few. To what extent does the proliferation of events, conferences, and academic publications serve to promote a narrative that legitimizes the policies of the most powerful actors and global monopolies?

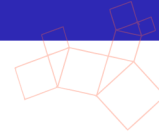


Imagen fuente: Halewood, M. New rules for sharing benefits from the use of digital sequence information. *Nucleus* 67, 5–9 (2024). <https://doi-org/10.1007/s13237-024-00487-1>

Implications for Biodiversity and Local Communities

Indigenous and local communities that have been guardians of biodiversity for centuries risk being marginalized if the frameworks for managing and accessing DSI do not recognize or protect their rights. Without equitable participation and adequate compensation, these communities could lose control over their resources and ancestral knowledge.

7. CLIMATE MANIPULATION AND ECOSYSTEM CONTROL: RISKS AND ETHICAL CONSIDERATIONS



Climate manipulation and geoengineering technologies have emerged as potential solutions to mitigate the effects of climate change. These techniques, including solar radiation management and carbon capture and storage, promise rapid responses to global warming. However, the implementation of such technologies poses significant risks to ecosystems, biodiversity, and global socioeconomic stability. The lack of ethical and regulatory consensus on their use presents an urgent dilemma.

Risks and Challenges

- **Unexpected Impacts on Ecosystems:** Deliberately altering climate systems could trigger unforeseen side effects, such as changes in rainfall patterns, affecting water availability and agricultural productivity in different regions.
- **Global Imbalance:** Climate manipulation technologies could benefit certain regions at the expense of others, exacerbating inequalities between countries.
- **Lack of Oversight and Governance:** Currently, there is no international or citizen-led regulatory framework to monitor and control the use of these technologies, allowing individual or state actors to implement them without proper consultation and review.

Examples

- **Solar Radiation Management Experiments:** Tests to reflect sunlight back into space could, in theory, cool the Earth but might also disrupt atmospheric currents and affect local climates in unpredictable ways.
- **Carbon Capture and Storage:** Although presented as a solution for reducing emissions, large-scale implementation of these technologies could impact local biodiversity and land use, displacing ecosystems and communities.

Ethical and Social Implications

The use of climate manipulation technologies without ethical consideration and inclusive consultation raises the question of who has the right to decide on the global climate. Such decisions could centralize climate control in the hands of a few countries or corporations, marginalizing the most vulnerable communities.

Citizen Action / Local Communities

Ecolonical LAB urges independent organizations, ethical scientists, and civil society to demand broader debate and ethical regulation of climate manipulation technologies.

8. PRIVATIZATION OF BIODIVERSITY AND BIOPROSPECTING: CHALLENGES TO THE SOVEREIGNTY OF NATURAL RESOURCES

Bioprospecting, or the exploration of biological resources to identify valuable components, has gained prominence with the rise of the pharmaceutical, biotechnological, and cosmetics industries. While this practice can lead to significant advancements in medicine and other fields, it has also resulted in increasing privatization of biodiversity. Genetic resources that have been safeguarded by local and indigenous communities for generations are at risk of being appropriated without fair recognition or compensation. The privatization and commercialization of these resources raise critical questions about the sovereignty of countries and communities over their biological heritage.

Risks and Challenges

- **Dispossession of Local Community Rights:** Communities that have preserved biodiversity for centuries may find themselves marginalized in bioprospecting negotiations and agreements, receiving little to no benefits from discoveries made using their resources.
- **Concentration of Patents and Corporate Power:** Biotechnological and pharmaceutical companies can patent compounds derived from biological resources, monopolizing the benefits and limiting access to essential treatments or technologies.
- **Erosion of National Sovereignty:** Bioprospecting without a robust regulatory framework can undermine a country's ability to protect and manage its own natural resources, leaving it vulnerable to foreign exploitation.

Examples

- **Patents on Medicinal Plants:** Patents on compounds derived from Amazonian plants illustrate how bioprospecting, that is, the search and analysis of genetic resources, can lead to the appropriation of traditional knowledge without any benefit returning to the original communities.
- **Restricted Access to Medicines:** The privatization of biotechnological discoveries can result in medications or products based on biodiversity becoming inaccessible to the very communities that contributed knowledge about those resources.

Citizen Action / Local Communities

Ecolonical LAB urges the creation of national and international legal frameworks and agreements that ensure truly ethical and fair bioprospecting, protecting national sovereignty from the practices of supranational entities that, under the guise of cooperation and development, conceal extractive intentions and unethical practices. Citizens and independent organizations must remain vigilant and demand genuine transparency in bioprospecting processes, avoiding narratives that attempt to legitimize unjust access to biological resources. Social and ecological justice—not empty promises of progress—must form the foundation of all policies on the access and use of resources, respecting the autonomy of nations and safeguarding communities from exploitative practices disguised as collaboration.

9. CORRUPTION AND CO-OPTATION OF ENVIRONMENTAL POLICIES: THREATS TO TRANSPARENCY AND SUSTAINABILITY

Corruption and the co-optation of environmental policies by powerful actors, both national and international, pose significant threats to biodiversity protection and the sustainable management of natural resources. These unethical practices allow economic and political interests to influence legislation and the implementation of environmental policies, undermining conservation efforts and harming the communities that rely on these ecosystems.

Risks and Challenges

- **Influence of Lobbies and Corporations:** Companies and well-funded lobbying groups can sway the creation of policies to favor their interests, sidelining environmental protection and the rights of local communities.
- **Diversion of Funds and Resources:** Corruption can redirect funds intended for conservation projects toward personal or corporate interests, weakening the capacity to implement effective environmental protection programs.
- **Compromise of Global Governance:** The co-optation of environmental policies by supranational entities and governments with hidden agendas undermines trust in international protection and regulatory frameworks, resulting in agreements that benefit a select few rather than promoting the common good.

Examples

- **Extractive Projects Approved Without Prior Consultation:** Cases where mining, logging, or oil extraction projects have been approved without the consent of the affected communities, compromising ecosystem integrity and violating the rights of indigenous peoples.
- **Superficial Environmental Commitments:** Environmental initiatives that are presented as innovative but are, in practice, designed to give an appearance of sustainability while allowing the continued exploitation of natural resources.

Citizen Action / Local Communities

Ecolonical LAB calls on citizens, independent organizations, and communities to demand greater transparency and accountability in the formulation and implementation of environmental policies. Strengthening oversight mechanisms and creating governance frameworks that are resistant to undue influence from lobbies and interest groups is vital. Only through active vigilance and strong community participation can we ensure that environmental policies genuinely serve conservation and social justice, rather than perpetuating extractive models and hidden agendas.

10. ENVIRONMENTAL EDUCATION AND REEDUCATION: THE ROLE OF SOCIETY IN PROTECTING LIVING TERRITORIES

Environmental education plays a crucial role in raising awareness and promoting sustainable practices that protect biodiversity and living territories. However, global educational programs often present a limited perspective influenced by economic and political interests, which may prioritize resource exploitation over conservation. Reeducating both local communities and “Old World” societies—encompassing Asia, Africa, Europe, and the Middle East, historically characterized by industrial and extractive development models—is vital to foster a more ethical and comprehensive approach to environmental management.

Challenges and Risks

- **Cultural and Historical Challenges:** Old World societies, shaped by centuries of development based on resource extraction, may struggle to establish an intrinsic connection with living territories. This anthropocentric view can perpetuate practices that treat nature primarily as a resource without fully recognizing its inherent value.
- **External Influences on Education:** Educational policies and programs are often shaped by entities with economic and political interests, which can shift the original aim of environmental education toward an economic growth-oriented model rather than sustainability.
- **Resistance to Change:** Implementing environmental reeducation may face resistance from actors with vested interests in maintaining traditional, extractive development models.

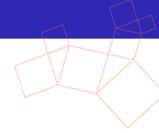
Examples

- **Local Communities and Traditional Knowledge:** Integrating the knowledge of indigenous and local communities, who have sustainably managed biodiversity for generations, can enrich educational programs and foster a respectful, balanced approach.
- **Reeducation in the Old World and the New World:** Regions in Asia, Africa, Europe, and the Middle East, historically focused on resource exploitation, would benefit from rethinking their approach. Understanding that living territories have rights and that true sustainability involves balance and respect for the environment is essential. Descendants of these communities in the New World could also gain from appropriate reeducation.

Citizen Action / Local Communities

Education must highlight the interdependence between human well-being and ecosystem health. It is imperative to value ancestral knowledge and adapt educational programs to reflect the importance of living territories as essential partners in our existence, not merely as resources to be exploited. This approach will foster collaboration and commitment toward lasting environmental protection.

11. CITIZEN PARTICIPATION AND INDEPENDENT OVERSIGHT: KEYS TO TRANSPARENCY AND ENVIRONMENTAL PROTECTION



Active citizen participation and independent observation are essential elements for ensuring transparency and effectiveness in environmental policies. In a global context where corporate and supranational interests often influence the creation and implementation of policies, it is crucial for civil society and independent organizations to play a decisive role in defending biodiversity and living territories. Citizen participation not only strengthens democracy but also fosters greater accountability and prevents policy capture by actors with hidden agendas.

Risks and Challenges

- **Lack of Representation in Decision-Making:** Local communities and citizens are often excluded from decision-making processes that directly impact their resources and environment. This lack of representation encourages policies that prioritize short-term economic interests over conservation and community well-being.
- **Institutional Resistance to Change:** Governments and international organizations may resist the inclusion of citizen participation mechanisms and independent observation due to external pressures from corporations and other economic interests.



Examples

- **Independent Monitoring of Deforestation:** Citizen-led and independent initiatives have uncovered cases of illegal deforestation and destructive practices that might have otherwise gone unnoticed. These actions have pressured governments and companies to be accountable and change their practices.
- **Civil Society-Driven Legislation:** In several countries, pressure from citizen groups has resulted in the creation of laws that strengthen environmental protection and community participation in resource management.

Citizen Action / Local Communities

Ecolonical LAB urges communities, independent organizations, and citizens to actively engage in the monitoring and promotion of fair and transparent environmental policies. Collaborating in monitoring networks and advocating for citizen-led legislative projects are key steps to ensuring that natural resources and living territories are ethically and sustainably protected. Strengthening citizen participation mechanisms and supporting independent observation is essential to prevent corporate or supranational economic interests from controlling the narrative and policies affecting the planet.

12. ETHICS AND GOVERNANCE IN AI APPLIED TO BIOTECHNOLOGY



The governance of AI in biotechnology is an increasingly relevant issue, as AI plays a crucial role in advancing genetic editing, creating synthetic organisms, and managing natural resources. While these technological developments have the potential to generate significant benefits, they also pose substantial risks if applied without an adequate ethical framework and proper regulation. The absence of clear global standards and robust control mechanisms can lead to irresponsible and potentially dangerous applications.

Risks and Challenges

- **Lack of Transparency in Algorithms:** AI models, often characterized by their opacity and complexity, are frequently referred to as “black boxes” due to the difficulty in understanding their internal processes. This lack of transparency complicates the assessment of their safety and ethical viability and can result in decisions misaligned with principles of responsibility and safety.
- **Inequality in Access and Control:** Access to advanced AI technologies in biotechnology is predominantly held by countries and corporations with greater resources. This concentration of power not only exacerbates global inequalities but also limits the ability of developing countries to compete and benefit from technological advancements, perpetuating an inequitable gap in access to scientific progress.
- **Risk of Unethical Applications:** Without strict governance, AI applications can lead to unethical uses, such as the manipulation of genetic sequences for commercial purposes without considering ecological or biosecurity risks. This includes the potential creation of synthetic organisms that, if released into the environment, could have negative impacts on ecosystems and human health.

Citizen Action / Local Communities

Ecolonical LAB urges the international community, independent organizations, and citizens to advocate for the decentralization of Digital Sequence Information (DSI) and to promote a governance framework that ensures equity and the sovereignty of countries in managing their genetic resources. A concerted effort is needed to create mechanisms that protect fair and transparent access to genetic information, ensuring that the benefits derived are distributed equitably and that the autonomy of nations and local communities is respected. Ethics and justice must be fundamental principles in any policy related to DSI to prevent power concentration that perpetuates inequality and disproportionate control over genetic resources at a global level.

CONCLUSIONS AND FUTURE PERSPECTIVES: PARADIGM OF GENETIC OWNERSHIP AND ETHICS IN DSI

The redefinition of the management paradigm for DSI and genetic resources is an urgent task to ensure a fair and sustainable future. Ethics, sovereignty, and transparency must be the pillars of any political or scientific framework that seeks to manage these resources responsibly. Cooperation between local and international actors should focus on protecting community rights and preserving ecosystem integrity. Only through an inclusive approach that fosters dialogue and collaboration can progress be made toward a model that balances innovation with responsibility and equity.

- 1. Sovereignty and Biodiversity:** The sovereignty of each country over its biodiversity must be an inviolable principle. In a global context where genetic resources are increasingly drawing the interest of corporations and supranational entities, the question arises: is the autonomy of nations in managing their biological resources fully respected, or is it eroded under the pretext of international cooperation and development? Reforming international frameworks is essential to ensure that countries can independently manage and protect their biological heritage, guaranteeing an equitable distribution of benefits without compromising their sovereignty. Transparent and respectful collaboration is key for the effective implementation of these reforms.
- 2. Redefinition of Genetic Property:** The concept of genetic property in the context of DSI requires thorough revision. Policies must be adapted to ensure that communities and countries of origin are recognized and participate in the benefits derived from their resources. Without a deep reconfiguration of intellectual property laws and international agreements that prioritize fairness, the system will continue to disproportionately benefit those who control the technology. An inclusive international dialogue is essential to achieve a fair balance.
- 3. Precautionary Principle:** This principle must be central to policies on DSI and biotechnology. The implementation of technologies without rigorous evaluation of their potential impacts is an unacceptable risk. The principle demands active prudence and responsibility, protecting the environment and the rights of communities, especially when potential risks may be irreversible. Impact assessments and periodic reviews will strengthen this principle in practice.
- 4. Right to Genetic Disconnection and Autonomy:** It is crucial to protect the right of communities to decide on the use of their genetic resources. "Genetic disconnection" means that they must have the authority to consent to or reject the digitization and use of their resources, ensuring justice and respect for autonomy. The implementation of prior consultations and clear agreements is vital to prevent exploitation and ensure fair benefits.
- 5. Scalability and Energy Cost:** Managing large volumes of DSI presents significant sustainability and energy efficiency challenges. It is essential to rethink systems to minimize environmental impact and promote technologies that balance efficiency with sustainability.

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ECOLONICAL LAB

Ecolonical LAB leads research and develops innovative and ethical solutions in the fields of biodiversity, water, energy, and urban/territorial systems. Founded on strong principles of ethics, deontology, and integrity, Ecolonical LAB adopts a multidisciplinary approach that integrates science, technology, and social justice to effectively address contemporary environmental challenges.

The R&D team promotes transparency, sustainability, and the protection of living ecosystems. Ecolonical LAB acknowledges the growing importance of AI and biotechnology in natural resource management and actively participates in the development of ethical and regulatory frameworks.

Ecolonical LAB supports initiatives aimed at establishing strong principles and ethical governance strategies to ensure that technological innovation is conducted responsibly and fairly. The organization stands out for its proactive promotion of regulatory frameworks and the development of solutions that protect the rights of local communities and ecosystems. Its mission is to anticipate the complexities of a constantly changing local and global environment and to ensure that technology is applied with integrity and an ethical vision.

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Milena-Jael Silva is a senior data scientist specializing in sustainable urban and territorial systems. She currently holds the position of Director of Research and Development at Ecolonical LAB. Her expertise blends technology with a strong commitment to sustainability, enabling her to coordinate projects that integrate ethics, social justice, and applied science to address the most pressing environmental challenges.

With a career marked by contributions in the public, private, and mixed sectors in Latin America (Colombia) and Europe (France), Milena-Jael has spearheaded transformative initiatives in the sustainable management of urban and territorial services. Her multidisciplinary approach spans phases of project development, from conceptualization and prototyping to analysis and implementation. Her work is distinguished by a commitment to the responsible application of technological innovation, emphasizing the protection of local community rights, ethics, and the preservation of ecosystem integrity.