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Biodiversity in Agri-Food Systems and the Role of Accounting for Biodiversity

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Abstract

Amid the escalating concerns over biodiversity loss and its repercussions, a paradigm shift in global agri-food systems becomes imperative. This study investigates the effectiveness of agri-food practices that support biodiversity in addressing environmental challenges and ensuring food production sustainability for current and future generations. The increasing concern about biodiversity loss underscores the urgency of transforming global agri-food systems. Realizing the full potential of these practices requires robust (and innovative) biodiversity accounting methods. By integrating ecological conservation with economic objectives, biodiversity accounting serves as a critical tool to enhance transparency, accountability, and sustainability in agri-food systems. Ultimately, the paper advocates for concerted efforts in incorporating biodiversity considerations into business strategies to build a resilient, equitable, and sustainable future.

Keywords: Biodiversity, Biodiversity accounting, Biodiversity measurement, Agri-Food systems,

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Introduction: the concept of “Biodiversity”

The term "biodiversity" covers the vast array of living organisms that inhabit our planet, spanning diverse environments. While the term "biodiversity" is relatively new, its essence has long been recognized under the name "biological diversity" (derived from the ancient Greek words "*bios*" meaning “*life*” and "*logos*" meaning “*principle*”). The term "biodiversity" was coined in the 1980s, coinciding with a growing awareness of the threats facing the natural world.

Biodiversity manifests at three distinct yet interconnected levels:

1. **Genetic Diversity**: This refers to the intricate collection of genetic information encoded within the genes of individuals within a species.
2. **Species Diversity**: This encompasses the richness of species inhabiting a specific geographical area, including the intricate relationships among these species.
3. **Ecosystem Diversity**: This refers to the variety of environments that support diverse life forms, such as oceans, forests, rivers, caves, deserts, etc...

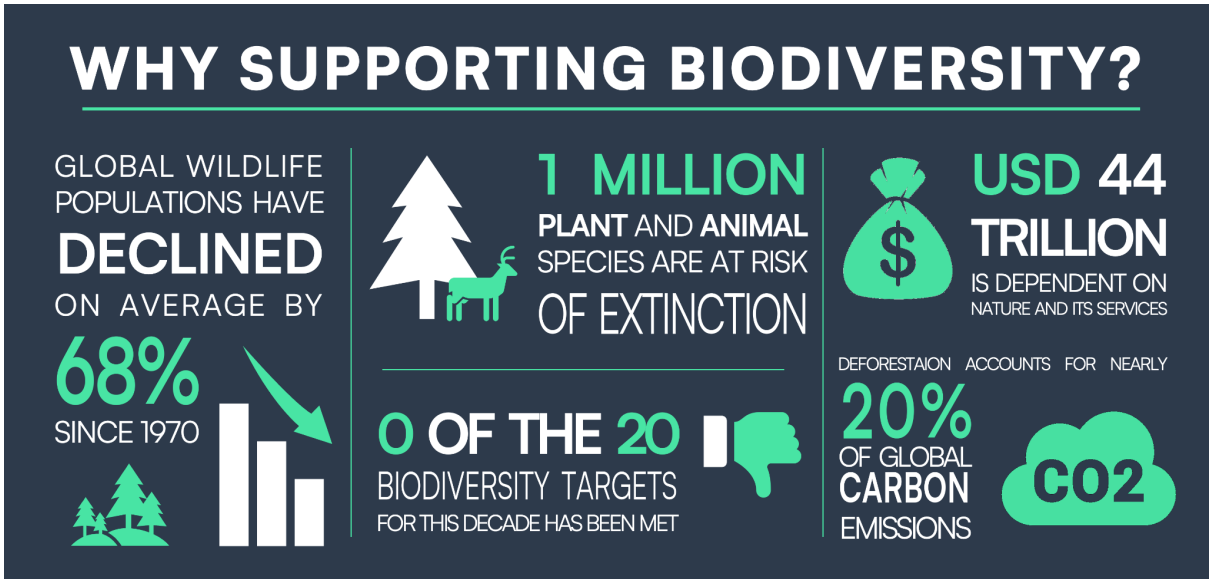
While the term "biodiversity" is often used to refer to species diversity, it is crucial to recognize the interconnectedness of all these three levels. Each species possesses a unique genetic code and interacts with its specific ecosystem in articulated and complex ways.

As complex systems, all three levels of biodiversity exhibit intricate relationships. Alterations to any single element, whether a gene, a species, or in the ecosystem, can have a strong impact and significant consequences for the entire system. While these mutations are frequently considered as the source of evolution, they usually present significant challenges and undesirable consequences.

Biodiversity decline and its linkages with Agri-Food Systems

Biodiversity encompasses the variety of life on our planet, including animals, plants, fungi, and microorganisms such as bacteria. This diversity is not just a feature of our natural world but the very foundation that supports human life and the global economy. Recent research by the World Economic Forum (WEF, 2020) highlights that over half of the world’s GDP (around USD 44 Trillion) is moderately or highly dependent on nature and its services, which include: provisioning services such as food and water; regulating services that affect climate and diseases; supporting services like nutrient cycles; and cultural services that provide recreational benefits and spiritual enrichment. This highlights the immense economic value rooted in biodiversity. Yet, this essential asset is under threat. Data from the global assessment made by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) show that global wildlife populations have declined by an average of 68% since 1970, and we are witnessing the relentless erosion of nature that has led to the irreversible loss of essential species, habitats, and crops. One million plant and animal species are now at risk of extinction, echoing an alarm for immediate action to preserve the vital diversity of life. Figure 1 offers a summary of this data.

Figure 1. Biodiversity: Key Statistics and the Economic Imperative for Action.



Source: authors elaboration, adapted from www.wartsila.com/insights

As we face systemic risks such as climate change, water scarcity, and biodiversity collapse, the need for sustainable practices within the agri-food systems becomes ever more critical. In particular, following extreme weather events, critical change to Earth systems, biodiversity loss and ecosystems' collapse, and natural resources shortages are perceived among the top 4 major global risks in a 10-year period (WEF, 2024). Biodiversity's role in agri-food systems is thus profound and multifaceted, extending well beyond the direct production of food (FAO, 2022). It underpins ecosystem services that are vital for agriculture, including but not limited to, water purification, soil health, and pest regulation, all of which are essential for sustainable agricultural practices and food security. Moreover, biodiversity is instrumental in providing a broad spectrum of resources beyond food, such as medicinal ingredients, fibers for textiles, biological sources for fuels, wood products, and other essentials, all derived from various biological sources. However, the agri-food sector also significantly impacts biodiversity (UNEP, 2021). Intensive agricultural practices, land use changes, and chemical use disrupt natural habitats and can lead to a cascade of negative effects, such as the clearing of forests, the division of natural habitats, the decline of species diversity, and the usurpation of land. These pressures further reduce species diversity and weaken the ecosystems' ability to provide essential services. However, the impacts on biodiversity are not limited to the production phase. Indeed, while the upstream stages like agriculture, fishing, and raw material extraction are typically associated with the most substantial impact on biodiversity, it's important to recognize that significant impacts also occur within the downstream stages of the agri-food value chain. The distribution and consumption of agri-food products not only lead to greenhouse gas emissions but also contribute to biodiversity loss through the generation of waste (e.g. packaging) which pollutes natural environments, while transportation can facilitate the spread of invasive species over long distances.

Historically, economic stimuli have largely promoted the expansion of commercial activities, frequently at the expense of environmental integrity, rather than the conservation or rehabilitation of ecosystems. However, the integration of the diverse benefits of ecosystem functions and nature's contributions to humanity into economic considerations has demonstrated potential for improved environmental, economic, and social outcomes. This holistic approach in economic planning is beginning to show that recognizing and valuing the full spectrum of nature's services can align development with ecological sustainability. Indeed, transitioning toward regenerative approaches has the potential to generate USD 10

trillion and boost job opportunities (WEF, 2020). Recognizing the urgent need to address biodiversity loss, international agreements and strategies such as the EU Biodiversity Strategy for 2030 and the UN's Sustainable Development Goals have been implemented. These initiatives aim to protect and restore natural habitats and promote sustainable practices within industries, including agriculture, that heavily rely on and impact biodiversity. Furthermore, the Kunming-Montreal Global Biodiversity Framework adopted in 2022 by 196 countries at the United Nations Biodiversity Conference highlights a global commitment to reversing biodiversity loss through integrated actions that include sustainable business practices and financial investment in nature conservation.

Addressing Agri-Food Challenges: The Role of Biodiversity-Friendly Practices in Enhancing Sustainability and Profitability

The intensification of agricultural practices such as monoculture, excessive pesticide use, and deforestation poses significant threats to biodiversity, subsequently impacting food security and human well-being. These practices have led to a profound alteration of the global environment: about 75% of the land surface has been significantly transformed by human activities, 66% of ocean areas face increasing cumulative impacts, and over 85% of wetlands have been lost (IPBES, 2019). The tropics, highly biodiverse regions, experienced a loss of 32 million hectares of primary or recovering forest between 2010 and 2015. Even areas showing an increase in forest cover often involve the establishment of monocultures, which do not support diverse ecosystems or restore original biodiversity levels.

The practice of monoculture, growing a single crop over a large area, exacerbates the vulnerability to pests and diseases, leading to greater reliance on chemical solutions. Excessive pesticide use in response to these vulnerabilities not only poses health risks but also leads to pesticide resistance, reducing soil biodiversity and contaminating water sources. Meanwhile, deforestation for agricultural expansion results in habitat loss, carbon release, and disruption of water cycles, further endangering the sustainability of agri-food systems and the ecosystems they rely on.

The loss of biodiversity from these human-driven changes has devastating consequences. For example, about half of the live coral cover on coral reefs has disappeared since the 1870s, with losses accelerating due to climate change and other anthropogenic pressures. Similarly, the average abundance of native species in most major terrestrial biomes has declined by at least 20%, primarily since 1900, affecting ecosystem processes and, by extension, nature's contributions to people. These compounded changes are leading to an acceleration in species extinction rates, already tens to hundreds of times higher than historical averages over the past 10 million years.

To counteract these negative impacts, promoting biodiversity within the whole agri-food system through sustainable practices is crucial. In doing so, it is important to bear in mind the role played also by food distribution and consumption phases. In the realm of agri-food business, embracing biodiversity-friendly practices presents not only an ethical alignment with global sustainability goals but also a strategic advantage in the marketplace. Diverse farming practices such as crop rotation, cover cropping, integrated pest management, agroforestry, and organic farming are increasingly recognized not merely as ecological necessities but as core components of innovative business models in agri-food systems.

Crop Rotation and Cover Cropping: These techniques improve soil health through natural processes such as nitrogen fixation and organic matter addition, which enhance soil fertility and structure. This leads to lower dependency on chemical inputs like fertilizers and

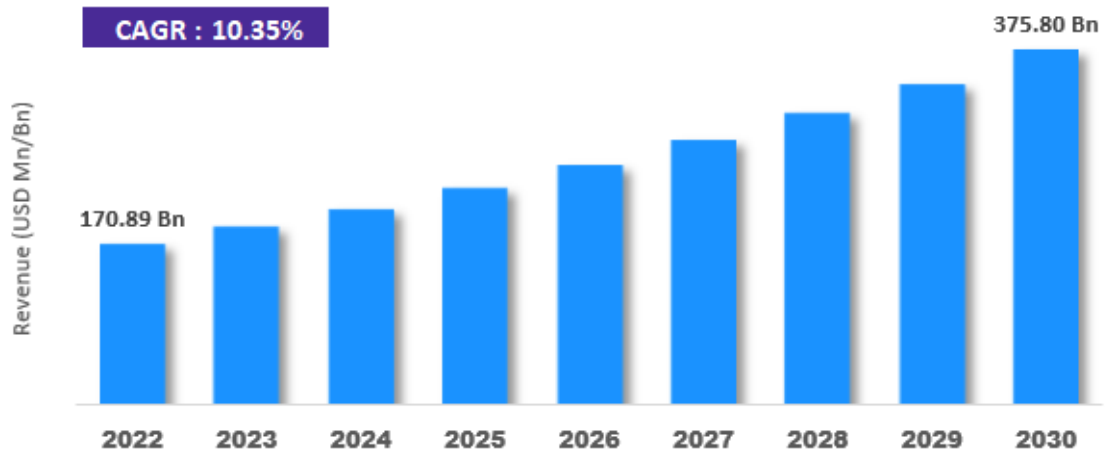
herbicides, reducing operational costs. Moreover, healthier soils support higher yields and better-quality crops, appealing to markets that favor premium, sustainably grown products.

Integrated Pest Management (IPM): IPM reduces the need for chemical pesticides by combining biological control techniques, the use of resistant varieties, and proper pest monitoring. This approach not only decreases the cost associated with chemical inputs but also mitigates the risk of developing pesticide resistance. Implementing IPM can lead to improved crop performance and access to markets that require compliance with strict pesticide regulations, thus enhancing the agri-business's competitive edge.

Agroforestry: Incorporating trees and shrubs into agricultural landscapes does more than just enhance habitat connectivity and biodiversity. It also stabilizes microclimates and moderates environmental stresses on crops, which can lead to more stable yields. From a business perspective, agroforestry can diversify income sources through the production of additional goods such as fruit, nuts, or timber. This diversification helps buffer farmers against market and crop failures, ensuring a more stable income stream.

Organic Farming: As consumer demand for organic products continues to rise (figure 2), transitioning to organic farming can open lucrative market opportunities. Organic products typically command higher prices in the market, reflecting consumers' willingness to pay a premium for goods perceived as healthier and more environmentally friendly. Moreover, organic certification can serve as a branding tool, distinguishing a business in the crowded agri-food market.

Figure 2. Global Organic Farmer Market Expected Growth (2022-2030)



Source: zionmarketresearch.com

Beyond these practices, innovative water management and perennial cropping can further enhance the sustainability and profitability of agri-food systems. Efficient water use and perennial crops reduce operational disruptions caused by water scarcity and soil degradation, issues that are becoming increasingly prevalent due to climate change.

Adopting these biodiversity-friendly practices allows businesses not only to meet regulatory standards and reduce environmental impact but also to position themselves favorably in a market that increasingly values sustainability. By integrating ecological health into their business models, agri-food companies can achieve better overall performance and resilience, ensuring long-term profitability and alignment with global sustainability trends.

In conclusion, the strategic incorporation of biodiversity-friendly practices in agri-food systems is not just about ecological conservation but about reaping tangible business

benefits — reduced costs, compliance with regulations, access to new markets, and increased consumer loyalty — all of which contribute to a robust business model in today's competitive environment.

The role of accounting in promoting biodiversity conservation and regeneration efforts within Agri-Food Systems

Environmental accounting, established as a field of study, examines the interplay between accounting entities and society, reflecting concerns over the environmental ramifications of economic growth (Schaltegger et al., 2013). However, very little attention has been paid to specific challenges like biodiversity loss and its measurement.

Highlighting the urgent need for sustainable biodiversity conservation, through this article we underscore the vital role of accounting mechanisms. These frameworks are essential for quantifying, monitoring, and managing the wide spectrum of natural assets on our planet. With the anticipated rise in demand for food and beverages in the coming years, businesses are urged to embrace innovative approaches to gain deeper insights into and effectively manage their impacts and dependencies on natural resources, including biodiversity.

Accounting offers itself as an instrument to accurately assess the value of ecosystems, species, and genetic diversity, shedding light on their importance for both ecological stability and human well-being. This, in turn, enables decision-makers to prioritize conservation efforts, allocate resources effectively, and track the impact of interventions over time (Jones and Solomon, 2013). Furthermore, several scholars have highlighted the emancipatory potential of biodiversity accounting (Atkins and Maroun, 2018). This notion emphasizes the significance of accounting practices and reporting mechanisms in raising stakeholders' awareness and promoting biodiversity conservation efforts, advocating for greater transparency and accountability in corporate impacts on biodiversity (Jones and Solomon, 2013).

Every strategy, project, and activity aiming at conserving or restoring biodiversity requires careful monitoring through measurement. Biodiversity measurement systems tailored for the agri-food industry aim to comprehensively understand how agricultural practices and supply chain operations impact on biodiversity. These systems collect and analyze data on variables such as land use, water consumption, pesticide application, and habitat conservation efforts, enabling agri-food companies to assess their biodiversity footprint. Additionally, they incorporate metrics for evaluating ecosystem health, species richness, and genetic variation, facilitating the tracking of biodiversity changes over time and across different scales, from local farms to global supply networks. The literature on biodiversity measurement and reporting encompass various innovative approaches to measuring and disclosing biodiversity related information.

Companies can decide to disclose biodiversity related information by adopting a series of guidelines that help them to understand what kind of metrics to use and how to report in their disclosure. One such example is the guideline provided by the Global Reporting Initiative (GRI). In line with the milestones outlined in the Kunming-Montreal Global Biodiversity Framework, this Standard will assist organizations in gaining deeper insights into the factors contributing to biodiversity decline, pinpointing areas within their value chain where impacts are most pronounced, and devising strategies for effective management. Concerning measurement tools, a useful instrument available to the agri-food sector and capable of enhancing the monitoring and disclosure of biodiversity-related information is the ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure)

Approach. This methodology offers users an overview of how economic activities could rely on or affect natural capital. Additionally, it offers qualitative materiality ratings for both dependencies and impacts, aiding users to identify areas that might require immediate action. One final example includes the MSCI's Nature and Biodiversity Metrics, introduced in 2023. These metrics feature more than 110 data points related to nature and biodiversity, encompassing factors like deforestation and biodiversity-sensitive areas. Its purpose is to assist clients in assessing and disclosing risks and opportunities associated with nature and biodiversity.

Towards the improvement of the restoration and regeneration of biodiversity, organizations are increasingly aware of the strategic relevance of accounting and reporting their impacts and dependencies on biodiversity. However, biodiversity accounting presents significant challenges that, so far, have limited its application. Initially, biodiversity accounting faces hurdles due to the limitations of traditional accounting methods, which primarily concentrate on financial metrics and fail to encompass the environmental impacts of organizational operations. Consequently, this necessitates the development of novel measurement techniques capable of assessing biodiversity. Additionally, a fundamental challenge revolves around determining "what" to measure. Given the multifaceted and expansive nature of biodiversity, it becomes challenging to discern the appropriate metrics that accounting should employ (Boiral, 2016). Various frameworks have attempted to provide guidelines on metrics and indexes that should be used at the corporate level to account for and report on biodiversity-related aspects (e.g. GRI, 2024) Despite that, the specificity of each sector, business, and geographical context makes it hard to find standardized and widely recognized metrics that businesses can apply.

Furthermore, the discourse surrounding biodiversity measurement has historically been marked by a schism between two perspectives. This division revolves around the question of whether biodiversity accounting should incorporate financial valuations and be translated into monetary terms. Some scholars advocate for the inclusion of financial measures, suggesting that assigning monetary values to biodiversity can support its recognition within traditional economic frameworks and help conservation efforts through market mechanisms (Nedopil, 2023). On the other hand, an opposing viewpoint believes that “reducing” biodiversity to monetary terms omits its intrinsic value and leads to commodification, aggravating environmental degradation. This reasoning underscores the complexity of biodiversity accounting and the multidisciplinary approach needed, including ethical, philosophical, and practical dimensions.

Conclusion

In conclusion, the interplay between biodiversity and agri-food companies underscores the imperative of embracing regenerative practices within agri-food systems, as well as biodiversity monitoring, and integration into accounting systems. As pivotal actors in the global food system, agri-food companies hold strong influence over ecosystems and biodiversity. This paper advocates that by comprehending the interactions between agri-food system practices and biodiversity, companies can strategically manage resources, mitigate negative impacts, and bolster ecosystem services. Furthermore, incorporating biodiversity measurement into accounting systems strengthens corporate dedication to sustainability, empowering agri-food businesses to fulfill their role as environmental stewards through emancipatory biodiversity accounting.

Références

Atkins, J., Maroun, W., (2018). Integrated extinction accounting and accountability: building an ark. Account. Audit. Account. J. 31, 750–786. https://doi.org/10.1108/AAAJ-06-2017-2957

Boiral, O., (2016). Accounting for the Unaccountable: Biodiversity Reporting and Impression Management. J. Bus. Ethics 135, 751–768. https://doi.org/10.1007/s10551-014-2497-9

FAO (2022). Framework for Action on Biodiversity for Food and Agriculture. Rome, Italy, Food and Agriculture Organization of the United Nations. Available at: https://www.fao.org/3/cb8338en/cb8338en.pdf

GRI, (2024). GRI - Topic Standard Project for Biodiversity [WWW Document]. URL https://www.globalreporting.org/standards/standards-development/topic-standard-project-for-biodiversity/ (accessed 4.15.24).

IPBES (2019), Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Brondízio, E. S., Settele, J., Díaz, S., Ngo, H. T. (eds). IPBES secretariat, Bonn, Germany. 1144 pages. ISBN: 978-3-947851-20-1

Jones, M.J., Solomon, J.F., (2013). Problematising accounting for biodiversity. Account. Audit. Account. J. 26, 668–687. https://doi.org/10.1108/AAAJ-03-2013-1255

Nedopil, C., (2023). Integrating biodiversity into financial decision-making: Challenges and four principles. Bus. Strategy Environ. 32, 1619–1633. https://doi.org/10.1002/bse.3208

Schaltegger, S., Gibassier, D. and Zvezdov, D. (2013), Is environmental management accounting a discipline? A bibliometric literature review, Meditari Accountancy Research, Vol. 21 No. 1, pp. 4-31. https://doi.org/10.1108/MEDAR-12-2012-0039

UNEP (2021). *Making Peace with Nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies*. Nairobi, Kenya: United Nations Environment Programme. Available at: https://www.unep.org/resources/making-peace-nature

WEF (2020). Nature risk rising: Why the crisis engulfing nature matters for business and the economy. Geneva, Switzerland: World Economic Forum. Available at: http://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

WEF (2024) The Global Risks Report 2024. Geneva, S

Zion Market Research (2022). Organic Farming Industry Prospective. Accessed on the 13th of April 2024. Available at: https://www.zionmarketresearch.com/report/organic-farming-market#:~:text=What%20will%20be%20the%20value,USD%20375.80%20billion%20by%202030.