Biodiversity Needs AI: Infusing Intelligence into Biodiversity Preservation and Restoration

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AI systems can help companies preserve biodiversity that's essential for growing and de-risking business.

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Corporate interest in preserving nature and biodiversity is at an inflection point. Our analysis of earnings calls of 2,000 companies found that the percentage of companies mentioning "biodiversity" rose from 1.5% in 2017 to 10.5% in 2022.

These numbers are only set to increase. In our recent survey of 1,500 business executives, 71% stated that their business success depends on the preservation of natural ecosystems. 84% believe that biodiversity loss poses a significant threat to their business, and more than half said that their understanding of how biodiversity loss impacts their organization has increased over the last three years.

Apart from other factors, governments and regulations also have a lot to do with the increasing focus on biodiversity. Two recent developments have ensured that businesses now put nature and biodiversity on par with climate or net-zero goals: The acceptance of the **30x30** goal at COP15 (committing to the protection of 30% of land and 30% of coastal and marine areas by 2030) and the **UN High Seas Treaty** (offering protection to the vast tracts of ocean that are beyond national control).

Detailed interviews with more than 24 senior executives revealed that a transition is under way, with biodiversity moving from a "for good" initiative to being a core part of the business. However, the executives also stated that the transition is far from smooth. This view is supported by our survey results, which show that only 19% of executives strongly agree that the private sector is doing enough to protect biodiversity. There are numerous challenges companies need to overcome to identify their nature-related interdependencies and act on them, one of them being scarcity of information.
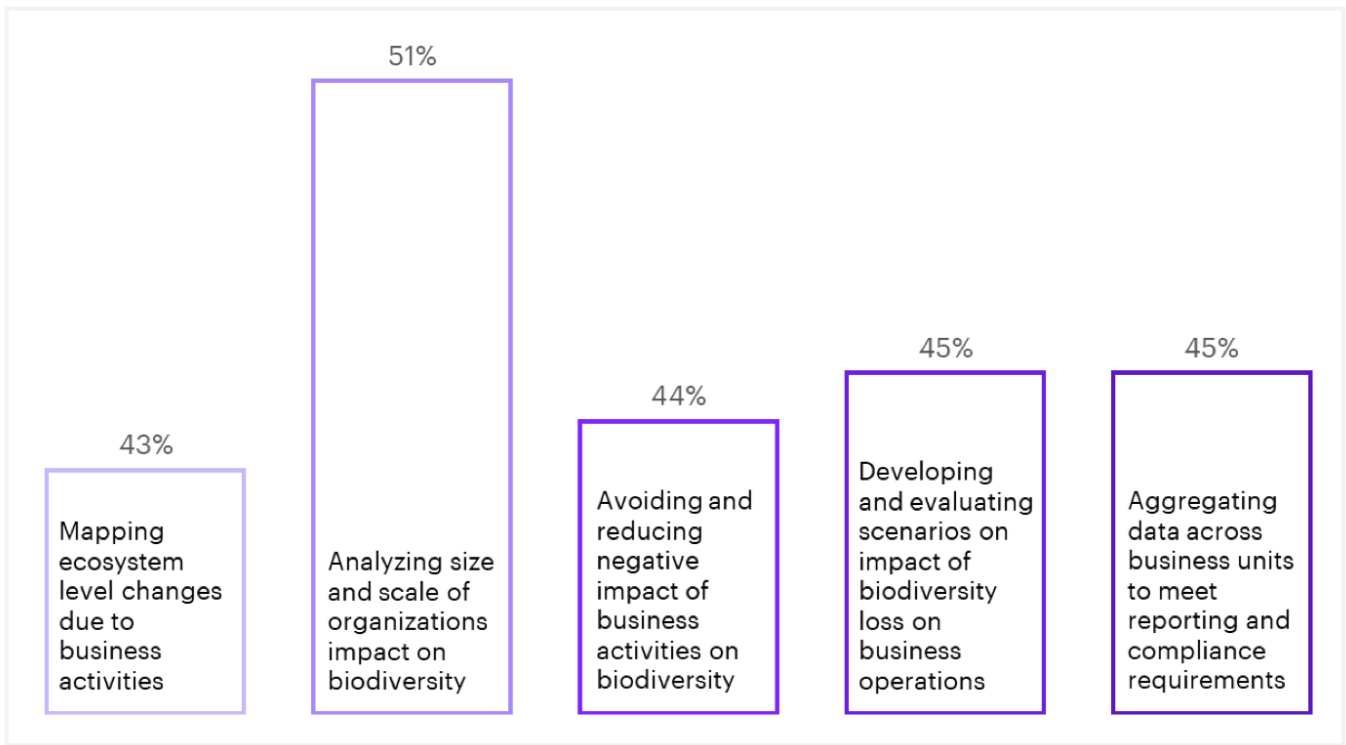
Technology can bridge this knowledge gap. AI-enabled systems can apprehend and make sense of underlying patterns too complex for the unaugmented human brain. Armed with this new knowledge, these systems can potentially predict where biodiversity loss might cause supply chain interruptions or cost shocks for maintaining plant and property. But companies appear to be confident about deploying technology for biodiversity—only one in four consider it a barrier. More than 91% of companies think digital technologies will become important in the next three years for managing nature- and biodiversity-related risks and opportunities.

The catch is that these technologies are data-dependent, while the extent, quality, aggregation, use and measurement of nature and biodiversity data vary enormously between and within organizations. Executives are increasingly facing practical questions such as: *How can we get better quality data for sensing our environment? How can we aggregate data from multiple sources—sensors, satellite, drones—for quick analysis? How can we better package insights for key decision-makers? How can we measure the impact of conservation decisions?*

Generating value with nature (and technology)

More than ever, companies are using AI to advance their biodiversity initiatives. AI is useful not only for **monitoring and conserving ecosystems** but also for making more informed and specific business decisions. For example, AI-based tools are currently used to map ecosystem changes or to integrate data across different business units (see **Figure 1**).

Figure 1. AI for biodiversity

51%

Analyzing size and scale of organizations impact on biodiversity

45%

Developing and evaluating scenarios on impact of biodiversity loss on business operations

45%

Aggregating data across business units to meet reporting and compliance requirements

44%

Avoiding and reducing negative impact of business activities on biodiversity

43%

Mapping ecosystem level changes due to business activities

Source: Accenture survey, "Power business growth by protecting biodiversity", April-May 2023.

Potential use cases of advances in AI, such as generative AI, are still waiting to be explored. For example, generative AI can produce **synthetic data** based on small biodiversity datasets. This synthetic data can then potentially be used to create traditional AI platforms or sophisticated digital twins for biodiversity preservation and restoration. The **BioDT** project, funded by the European Union, is currently developing a digital twin prototype for advanced modelling, simulations and predictions for evidence-based biodiversity restoration. And this is only the beginning.

Companies using analytic tools and technologies to fulfill bold commitments for preserving nature and biodiversity are seeing clear benefits. For instance, Dow, in pursuit of its Valuing Nature Goal, collaborated with The Nature Conservancy (TNC) and the EcoMetrix Solutions Group to develop and deploy financial modeling tools to accurately put a value on nature.

The Valuing Nature Goal is based on the premise that real business benefits come from fully informed decisions about how its operations rely on and impact nature. The company aims to achieve **US$1 billion** in net present value through projects that benefit both ecosystems and business as a part of its 2025 sustainability goals.

The first big breakthrough of the collaboration was the Ecosystem Services Identification and Inventory (ESII) tool, a free app that allows users to quickly generate information on the ecosystem services performed by a specified landscape. TNC also helped Dow integrate consistent data on the environmental conditions on all of their global sites and then **condense the data into a "Nature Scorecard."**

The scorecard, combined with the ESII tool, allows Dow to compare the financial and environmental performance of potential nature-based interventions. For example, it helped Dow understand that if it restored forest, prairie and wetlands, it could save $2 million over 10 years by reducing mowing, fencing and stormwater management. Dow will use its analytic tools to identify cost-effective, nature-positive solutions to address coastal climate risk and water reliability issues around its most water-stressed sites. The ESII Tool and Nature Scorecard stand alongside traditional financial metrics in evaluating project performance. Now that Dow can value nature, it can generate value with nature.

Towards intelligent biodiversity preservation

While the value of biodiversity preservation and the return on investment can be high, companies still need to overcome challenges in their journey towards being nature-positive and biodiversity-positive. We suggest three AI-infused actions to strengthen their biodiversity initiatives.

1. Generate dependable data

Companies can use a variety of data sources to monitor and gain insights into ecosystems and biodiversity, such as IoT, drones, satellite imagery and computer vision or acoustics. However, the validity and certifiability of this data is often a concern.

For example, data from IoT sensors—such as temperature, humidity, soil quality, animal movements and plant growth—can be useful for biodiversity conservation, but is not always reliable. Sensors deployed in wild or harsh environments are prone to component failure and interference. **Verified Telemetry** is overcoming these challenges through automated monitoring of electrical properties of sensors and providing alerts for action.

Jaljeevika, a non-profit that aims to improve the livelihood of small-scale fish farmers, is using dependable IoT technology in partnership with Microsoft and Accenture to ensure decisions are based on reliable data. It uses a range of IoT devices that monitor temperature, total dissolved solids and pH of water bodies. Farmers rely on these sensors deployed in remote locations for reliable data and advice. Microsoft Research's **dependable IoT technology** was employed to rigorously test the advisory framework's reliability, as well as data integrity and accuracy. Using Microsoft Azure IoT Hub and PowerApps, the solution incorporates heuristic models to accurately calculate ammonia levels in ponds, eliminating the need for ammonia sensors. This enables aqua farmers to optimize feed and enhance fish yield, while predictive insights and expert advisory bulletins simultaneously reduce operational costs.

2. Create analysis-ready datasets

Effective use of biodiversity data requires **integration of diverse data sources**, including asset, supply chain, observation and financial data, which often comes in different formats and lacks standardization. One in three business leaders says that aggregating data, metrics and reporting at the organization level is one of the biggest challenges in biodiversity technology investments.

The lack of data infrastructure, ownership, interoperability and data security further complicates the process of deriving actionable insights. For instance, despite recent advances, the full potential of Earth observation data for biodiversity assessment, monitoring and conservation remains largely **untapped**. To overcome these challenges, companies need to invest in robust data infrastructure, establish data governance policies and leverage advanced technologies to automate data processing and create analysis-ready data sets.

But while companies are building analysis-ready datasets, the **data-centric AI** movement allows companies to use limited datasets effectively and achieve AI business value and full-scale production of AI projects.

Landing AI's **LandingLens** visual inspection platform, which can potentially be used in various nature and biodiversity projects, applies computer vision to create models for image classification, object detection and image segmentation. Image segmentation can distinguish between different objects or classes based on pixel similarities. For example, it can distinguish between soil and mulch when companies need to remotely monitor and verify if suppliers are complying with regenerative agriculture practices. The neural network model is trained with satellite and unmanned aerial vehicle images that have labels for the objects of interest. It can be trained with visual prompts from end-users—as few as dozens of images —to achieve reasonable precision and recall for enterprise applications.

3. Put data into action

AI, analytics and visualization tools can bring to life data aggregated from multiple sources, helping companies capture the nuances of species interactions, ecosystem dynamics and conservation challenges for informed decisions and targeted strategies.

Intelligent platforms such as **Microsoft Premonition** can identify and monitor both invertebrate and vertebrate species using genomic signatures. Premonition metagenomics AI helps researchers analyze genomic data and find potential new pathogens in the environment, animals and in clinical settings. It can also help take targeted action to protect and restore local ecosystems. Its design enables it to combine different types of data (such as real-time sensor data and genomic data) into a knowledge graph that can be tracked and updated for large-scale analysis in the cloud.

Powerful innovation is often combinatorial. When paired with advances in synthetic biology, AI has the power to open entirely new revenue streams for forward-thinking businesses. Take the case of Basecamp Research, a biodiversity geospatial intelligence company that has built a vast protein code database by collecting samples from over **40**

global expeditions. Using this data, it is applying AI to discover novel proteins that provide R&D teams with more starting points and test the candidates most likely to succeed. Basecamp funnels part of its profits into preserving biodiversity.

Chemix, a California based start-up, has fine-tuned a deep learning model to discover and develop materials that can replace nickel, cobalt or lithium, metals that are mined, for manufacturing sustainable and efficient electric-vehicle batteries. **Meta AI** has created a generative AI model that predicts protein structures that may help restore ecosystems, produce cleaner energy and cure diseases. It trained a large language model to learn evolutionary patterns and generate accurate protein structure predictions that companies can incorporate into entirely new raw materials, products and services.

Conclusion

The exponential improvement in intelligent technologies has the potential to significantly bridge the gap between awareness and action to prevent biodiversity loss. However, it is crucial that companies prepare themselves to embrace these technologies, even as they continue to evolve. The very first step in this journey is to automate data collection and aggregation, followed by putting in place intelligent systems that can help plan and execute actions. The preservation of our precious ecosystems and life itself warrants the use of technology. The rewards far outweigh the challenges and risks.

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