



Reducing risks and seizing opportunities: integrating biodiversity into food and agriculture investments



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Bioversity International is a global research-for-development organization.

We have a vision – that agricultural biodiversity nourishes people and sustains the planet.

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Rice field, The Philippines. Credit: IRR

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Foreword

Agricultural supply chains and global food brands are encountering serious operational risks from climate change, and are facing reputational risks from resource-intensive production and low-nutrition product lines. With rising global demand for agricultural commodities and limits on arable land, competition is pushing producers to grow more nutritious food on the same land base. To accomplish this in an environmentally and economically sustainable fashion, farming systems will need to capitalize on agricultural biodiversity, which can boost productivity, nutritional quality and resilience.

At the same time, loss of agrobiodiversity creates material risks for agricultural supply chains, including food production. The simplification of the world's farming and food systems leaves farmers with fewer options for dealing with risks of crop failure due to pests and diseases, declining soil fertility, or increasingly variable weather. We are already seeing rising risks and volatility in agricultural production and crisis scenarios loom on the horizon.¹

By mainstreaming agrobiodiversity in supply chains, food and agriculture businesses can reduce risks and seize opportunities. Investors in the agri-food sector can stabilize their portfolios by directing capital toward supply chains and food brands that promote and benefit from agrobiodiversity.

I'm proud to lead Bioversity International, a research centre with unique scientific expertise in agrobiodiversity, that is helping decision-makers leverage scientific knowledge to maximize productivity and profitability. With our private and public sector partners, we are developing the Agrobiodiversity Index. This flexible tool can be used to detect material agrobiodiversity-related risks and opportunities, and integrate them into financial instruments, and company and government decision-making. We invite other interested companies, governments and financial institutions to work with Bioversity International to test and refine the Agrobiodiversity Index.



M. Ann Tutwiler
Director General
Bioversity International

Agrobiodiversity is the fundament of a sustainable agricultural system. That is why Syngenta committed to help improve biodiversity on 5 million hectares by 2020. But we cannot manage what we cannot measure – it requires agreed metrics to assess agrobiodiversity in food systems.

The Agrobiodiversity Index provides for consistent, long-term monitoring and management of agrobiodiversity. At Syngenta, it will enhance our decision-making system when implementing sustainable business practices both by reducing risks in the supply chain and communicating the relevance of our solutions to value-chain partners and consumers.

Juan Gonzalez Valero, Head Public Policy and Sustainability, Syngenta

Given the risk associated with biodiversity loss and ensuring supply of agricultural raw materials, the agri-food sector must include biodiversity stewardship in its operations. Furthermore, as consumers' interest and consciousness grow continuously, biodiversity-inclusiveness becomes a significant competitive advantage.

Nestlé Creating Shared Value Commitment to Natural Capital 2016

What are the financial benefits of the Agrobiodiversity Index?

Using the Agrobiodiversity Index, companies and governments can reduce operational and reputational risks and seize opportunities by estimating and monitoring the agrobiodiversity impact of supply chain investments. The Agrobiodiversity Index can also help investors to screen their portfolios for companies and governments that promote agrobiodiversity, as a proxy for operational and reputational risks related to climate change and unsustainable production.

Capturing the value of environmental impact.

The positive correlation among a high corporate ESG² rating, strong market performance, and a lower cost of capital³ points to the benefits that accrue to companies capable of delivering on both financial and non-financial metrics. Businesses that can detect and respond to agrobiodiversity-related risks and opportunities will be better positioned in a context of increasing environmental volatility and expectations for risk disclosure.

Agri-food businesses depend on reliable agricultural production to consistently deliver high yield and quality despite an increasingly volatile climate. Companies can promote agrobiodiversity-friendly technologies and practices in agricultural supply chains through investments in seed systems, diversified sourcing,

producer support programmes and so on. They can also build demand for a broader diversity of agricultural commodities through their procurement policies and food brands. The Agrobiodiversity Index will help companies to compare multiple corporate strategies for investing in resilient and sustainable supply chains and product lines.

Clarifying risk-return. Investors in food and agriculture-related businesses target stability and profitability as well as sustainable practices. To do that more effectively, they need to be able to detect and navigate material risks related to agrobiodiversity degradation.

With appropriate information, investors, asset managers and corporate decision-makers can direct capital toward activities with demonstrated revenue streams (e.g. improved yield and quality) or avoided costs (e.g. lower insurance premiums) from enhanced agrobiodiversity. The Agrobiodiversity Index will support development of a pipeline of replicable, scalable agrobiodiversity-friendly investments with clearer risk-return profiles and affordable transaction costs.



Maize farmer with his crop, which has been destroyed by parrots, whose migration patterns have changed and now coincide with the end of the maize season. Credit: CIAT/N.Palmer



Different types of lettuce and cabbage grown in a field surrounded by trees and banana plants, India.
Credit: Bioversity International/C.Zanzanaini

The world is changing. Global warming, extreme weather and volatile prices are making it harder for farmers and growers to produce the foods our customers love. However, the scale of our business means Sainsbury's can play an important role in encouraging biodiversity and contributing to sustainable development. As a business with over 24.5 million customer transactions a week, we're committed to delivering quality and value to our customers, as well as helping them lead healthier lives by providing them with a wide range of product choices. Sainsbury's

customers care about where the products they buy come from, and how they are grown, and they put their trust in us to do the right thing on their behalf. Which is why we are committed to working with our suppliers, farmers and growers in the UK and around the world to optimize the health benefits, address the impact and biodiversity of these products and secure a sustainable supply. We believe that participating in the development of the Agrobiodiversity Index will help us achieve this goal.

Beth Hart, Head of Agriculture, Sainsbury's

Why is agrobiodiversity important?

Agriculture is under threat. Changing weather patterns are shifting the geographic range and intensity of agricultural diseases and pests (as well as their natural predators) and the pollinators required for crop production.⁴ The areas where major crops can viably be produced are also shifting as the climate changes. We are already seeing this with coffee and cocoa, among other crops. As the weather becomes more volatile and extreme, agricultural production will experience disruptions and price shocks, and some supply chains will face existential threats.

Left unchecked, degraded agrobiodiversity will cause direct production losses and, for some regions and commodities, these losses will be substantial, even catastrophic.⁵ At the same time, low-diversity diets are exacting a devastating toll on human health. The effects of agrobiodiversity degradation globally will diminish the overall value of the sector and its contribution to investor portfolios. This will be exacerbated by the macroeconomic effects of declining agricultural productivity and associated impacts on nutrition security and political instability.⁶

Agrobiodiversity is a source of resilience. Increasing the species and genetic diversity in agricultural production areas and food markets can help mitigate these threats. Greater agrobiodiversity means breeders and producers can pull from a deeper pool of crop and livestock characteristics. In doing so, they address different environmental conditions (e.g. poor soils), shifting consumer demand (e.g. urbanization) and changing weather conditions (e.g. frost, unpredictable rainfall). It also means more beneficial insects are present and more competitors and predators are on hand to counteract pest species. All of this translates into more stable farming and food systems that are better able to withstand stresses and shifting demand.

Agrobiodiversity is a cornerstone of nutrition and productivity. Agriculture and global diets have become heavily dependent on a very small number of species. Globally, more than 50% of daily plant-derived calories come from maize, wheat and rice.⁷ In addition, producers and consumers often lean heavily on just one or two varieties. This misses out on many benefits offered by multi-crop and combined crop–animal farming models, such as more efficient nutrient and

water use, better pollination, and pest and disease control. Diversification across agricultural supply chains and product lines can help food- and agribusinesses achieve reliable sourcing as well as respond to consumer trends by increasing the nutrition profile of regional and global brands.

Many people are familiar with the Irish potato blight, which decimated the two dominant potato varieties in the mid-1800s. This triggered a famine in which 1 million Irish people died.⁸ In the modern era, global trade mitigates – although does not eliminate – the risk of famine, yet the risk of catastrophic economic harm persists. In the 1970s, the US maize crop was severely threatened by corn blight, which destroyed almost US\$1 billion worth of maize and reduced yields by as much as 50% in 1978.⁹ Fortunately, plant breeders were able to address the crisis by breeding blight-resistant varieties using genes from wild types of Mexican maize.¹⁰ In the 1980s, Brazilian cacao producers were not so lucky when Witch-broom disease decimated 70% of their crop, with catastrophic economic consequences for some 2 million people.¹¹ Agricultural supply chains that are dominated by a single variety or species may gain process efficiencies and consistency, but are at greater risk from pest outbreaks, extreme weather and market fluctuations.

What strategies enhance agrobiodiversity and resilience?

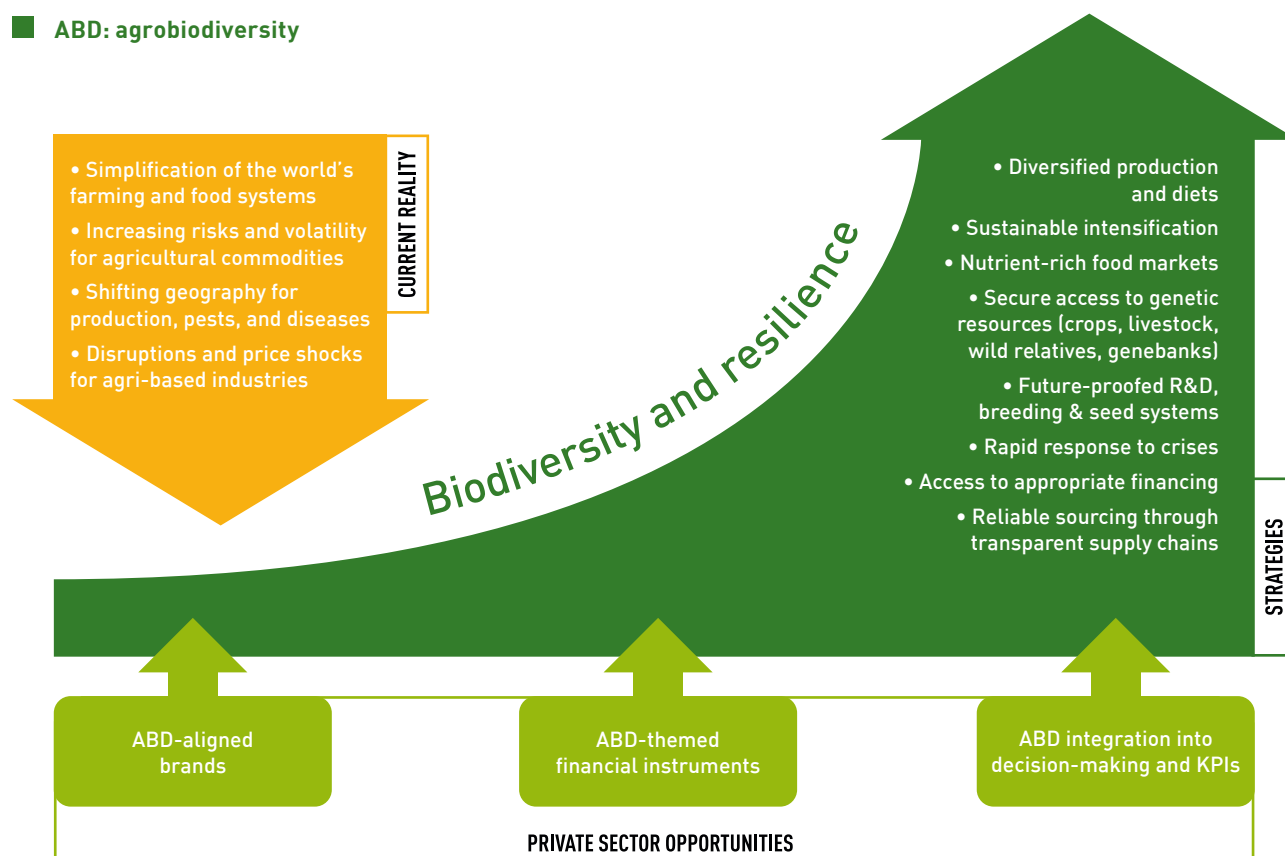
The strategies for enhancing agrobiodiversity are many, ranging from careful selection of species and varieties in diversified production systems to ensuring access to genetic resources that allow breeders and producers to respond to emerging threats such as climate shifts and pest outbreaks. Investments that support agrobiodiversity span lending programmes that provide working capital for diversified production, supply chain 'greening' initiatives, and R&D and procurement for differentiated food brands.

Conventional breeding has been used to improve the productivity and performance of domesticated plants and animals since the dawn of agriculture. Risks in many value chains can be reduced through investment in innovative breeding and seed systems designed for a broader set of species, varieties and production objectives (e.g. drought resistance, nutrition density). Breeding systems are fundamentally reliant on access to genetic material contained in crops, livestock, wild relatives and genebanks. For example, the wild relatives of crops and animals are valued at more than US\$120 billion per year

as a repository of genetic diversity and traits beneficial to crops and domesticated animals, such as pest or disease resistance and yield improvement or stability.

Protecting genetic resources is critical to future-proofing agriculture. 'Conservation in use' by farmers is particularly important in regions where many of our staple crops and livestock originated. Since the 1930s, some critical Middle Eastern areas of origin have seen a 70% decline in the number of wheat types. Now, a major effort to document, collect and conserve landraces of wheat grown by farmers is ensuring that the building blocks of resilient wheat varieties remain available to the region and the world.¹² Drawing on heat-tolerant traits found in wheat landraces stored in a CGIAR genebank, researchers have recently developed new wheat varieties capable of surviving temperatures 4°C higher than other wheat types.¹³ With global production hovering at 750 million tonnes annually and global trade exceeding US\$35 billion in 2016, wheat is a global commodity that relies on effective conservation and use of genetic resources.¹⁴

FIGURE 1 PRIVATE SECTOR OPPORTUNITIES FOR INCENTIVIZING AND BENEFITING FROM A RESILIENT, BIODIVERSE FOOD SYSTEM



What strategies can agribusinesses and financial institutions use?

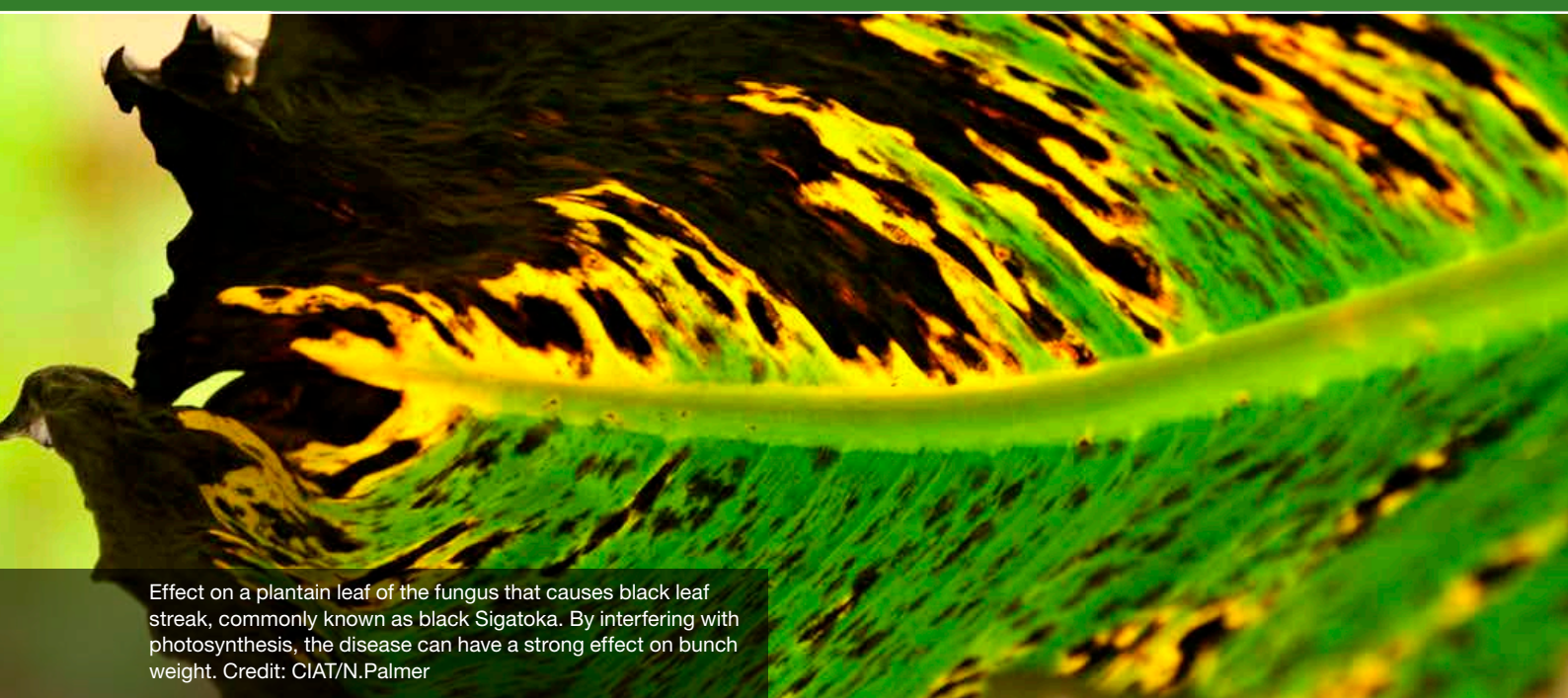
While the supply chains that deliver food and agricultural products into local and global markets vary greatly in size and structure, there are some general strategies that promote diversity.

Manufacturers and retailers can signal demand for and invest in a broader range of products. Whether directly to farmers (e.g. via purchasing programmes) or through traders, companies can indicate that agrobiodiversity is part of their supply chain ‘greening’ and sustainability efforts. Some companies may be able to differentiate their brands through consumer messaging or labeling that builds on agrobiodiversity enhancement and nutrition-rich product lines. They can also invest directly in input supply (e.g. diversified seeds), conservation of essential genetic resources (e.g. genebanks), development of new crop and livestock varieties and novel food products, and diversify their production base.

Financial institutions can incentivize agrobiodiversity enhancement by screening investments and actively driving capital to promote best practices. Institutional investors, such as pension funds and insurance companies, can apply positive or negative screens to their portfolios. Private and multilateral banks, for example, can apply lending criteria and also develop financial instruments that support agrobiodiversity-friendly technologies and practices.

Few examples illustrate the risks of over-reliance on a single variety more clearly than the Gros Michel – and now Cavendish – banana varieties. Generating US\$44 billion in economic value, 145 million tonnes of bananas are produced each year in over 130 countries.¹⁵ Nearly eradicated in the 1950s by a fungus, *Fusarium oxysporum* f.sp. *cubense*, the globally dominant Gros Michel banana variety was replaced by the Cavendish variety. Cavendish now represents 99% of bananas sold in Western supermarkets, but is also seriously threatened by a new strain of *Fusarium*.¹⁶ An array of pests and diseases threaten local banana varieties that are a critical part of the food and income security of millions of people in Africa. The need for applying specialized breeding approaches to develop resistant banana varieties is urgent if the global banana trade is to continue.

In addition to reducing climate-related risks, investments in genetic conservation can also deliver benefits for consumer-facing marketing. The supermarket tomato – which provides US\$2 billion in value annually, but is commonly maligned as flavorless – may regain some of the appetizing qualities that were lost in the drive to breed in sturdiness needed to long-distance shipping. Using heirloom and wild tomato varieties, researchers have identified genes that control flavour chemicals missing in modern varieties.¹⁷



Effect on a plantain leaf of the fungus that causes black leaf streak, commonly known as black Sigatoka. By interfering with photosynthesis, the disease can have a strong effect on bunch weight. Credit: CIAT/N.Palmer



A bee pollinating a flower, Vietnam.
Credit: Bioversity International/L.Sebastian

How can the Agrobiodiversity Index support risk assessment and reporting?

With widespread recognition of the risks to agriculture, environment and human health, there is growing momentum for risk management and reporting, and for more sustainable food and agricultural supply chains.

Current risk assessment and measurement are insufficient. Risks from climate change and agrobiodiversity loss in supply chains are poorly integrated into corporate analysis and investment decision-making.¹⁸ Most company-level reporting does not capture future risk preparedness or establish links among material climate risks, internal capital allocation strategies and company financials.¹⁹ Similarly, the greater resilience of high-diversity supply chains – and the non-correlated risk they offer to investor portfolios – are poorly quantified.

Expectations for risk reporting are changing. There is growing pressure on companies and investment managers to disclose a broader range of risks. For example, France recently adopted mandatory climate change risk reporting by asset owners and managers.²⁰ At the same time, many companies and institutional investors have made public commitments to ‘greening’ their supply chains and portfolios. Global sustainable reporting initiatives offer a foundation, but decision-scale tools are needed.

Companies and financial institutions can benefit from better agrobiodiversity-related risk assessment. As a tool for better measuring and reporting risks associated with low-diversity food and agricultural supply chains, the Agrobiodiversity Index can help decision-making and catalyze investments into more sustainable interventions.

With private capital investments in conservation exceeding US\$8 billion over the last decade²¹ and nearly US\$700 billion outstanding in bonds financing climate-smart infrastructure,²² it is clear that companies and financial institutions are getting serious about environmental impact.

Pollinator habitat protection is an important dimension of enhanced agrobiodiversity. The US Department of Agriculture has partnered with General Mills and the Xerces Society on a 5-year, US\$4 million programme that will plant more than 40,000 hectares of pollinator habitat and provide technical assistance to farmers to conserve native wildflower field edges, flowering hedgerows and other pollinator refuges.²³ Enhanced agrobiodiversity may also enable farmers to lower the costs and environmental burden of pesticides.²⁴ A recent study in France found that agricultural productivity and profitability would be stable even with over 40% reduction in total pesticide use.²⁵

How does the Agrobiodiversity Index work?

The Index can be applied to companies, countries or specific investments. The Agrobiodiversity Index methodology quantifies material agrobiodiversity-related risks and opportunities, with flexible components that can be adjusted to company and investor decision-making. Key design features include consistency, reliability over time and comparability as well as the capacity to integrate data at relevant scales and to accommodate different transparency norms.

The Index supports corporate decision-making and development of a range of financial products.

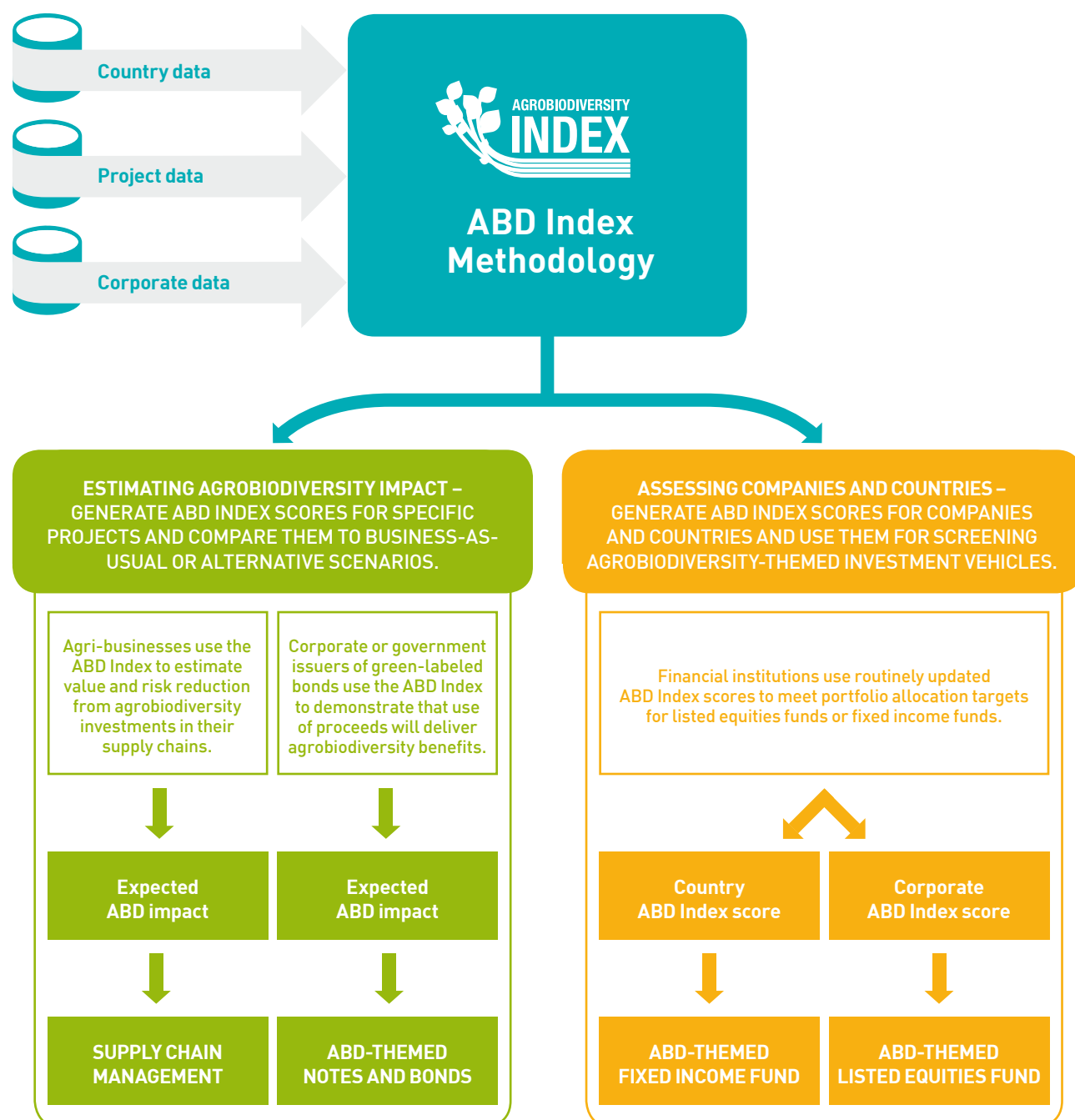
Food and agribusinesses seeking to mainstream agrobiodiversity will need an integrated assessment of the return on corporate investments and supply chain interventions. For agrobiodiversity-themed green bonds, corporate or government issuers will need to demonstrate that use of bond proceeds will result in positive improvement in agrobiodiversity status or reduction in agrobiodiversity-related risks. Financial institutions will need to screen investments according to selection criteria and allocation targets for agrobiodiversity-themed investment vehicles such as fixed income or listed equities funds.



A busy morning at a traditional floating market, Indonesia.
Credit: Rafly Rinaldy

FIGURE 2 APPLICATIONS OF THE AGROBIODIVERSITY INDEX METHODOLOGY

■ ABD: agrobiodiversity



Agri-food sector and financial institutions can advance the Agrobiodiversity Index

Years of scientific work have shown that future-proofing agricultural supply chains requires rebuilding biological diversity in production landscapes and food markets. Now, Bioversity International is converting that scientific knowledge into a tool that measures how enhancing agrobiodiversity reduces risks and improves yield and quality. Through its Agrobiodiversity Index, Bioversity International is helping companies to make operational, strategic and capital allocation decisions that integrate current and future agrobiodiversity-related risks.

The Agrobiodiversity Index will enable food and agribusinesses to reduce operational and reputational risks and seize opportunities by estimating and monitoring the impact of supply chain investments on agrobiodiversity. The Index will allow investors to stabilize their portfolios while steering capital toward supply chains that promote and benefit from agrobiodiversity by, for example, screening for bonds and listed equities with higher Index scores. It will also assist bond issuers, third-party verifiers and certification bodies to credibly label agrobiodiversity-themed green bonds.

Through innovative combinations of agrobiodiversity data, tailored to specific assets and geographies associated with food and agricultural supply chains, the Agrobiodiversity Index will enable novel insights and evidence-based decisions. The ability to make strategic corporate investments, signal market demand and redirect supply chain incentives will improve as agrobiodiversity-related risks become more visible and measurable to companies and investors. The Agrobiodiversity Index and its underlying methodology can support partner companies as they make internal decisions about capital allocation, R&D and procurement strategies, and operational investment.

Bioversity International is partnering with leading agri-food companies on pilot applications of the Agrobiodiversity Index. Through these pilots, the Index methodology will be refined so that it accurately represents the different scales and dimensions of agrobiodiversity in corporate footprints. The next set of pilots will go further by evaluating the integration of the Agrobiodiversity Index into investment decisions in concert with financial metrics for liquidity, volatility and performance relative to market benchmarks.

Bioversity International invites agri-food businesses and financial institutions to partner with them on the next phase of the Agrobiodiversity Index. Developing this science-based, fit-for-purpose risk-assessment tool will allow companies and financial institutions to shift global markets, while also incentivizing and benefiting from biodiversity in agricultural production.



Coffee cherries, Colombia.
Credit: CIAT/N.Palmer

Agrobiodiversity has promise for investors seeking better risk-adjusted returns. Investments in the agriculture sector are trending up based on the combined appeal of portfolio diversification, inflation protection and ESG impact. Screening investments based on agrobiodiversity can steer portfolios toward more resilient agricultural supply chains that support above-market performance. Smart investment relies on information, and the Agrobiodiversity Index will be an essential tool for companies and financial institutions.



Women sowing a field, Peru.
Credit: CIAT/N.Palmer



A girl holding a coffee plant, Colombia.
Credit: CIAT/N.Palmer

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