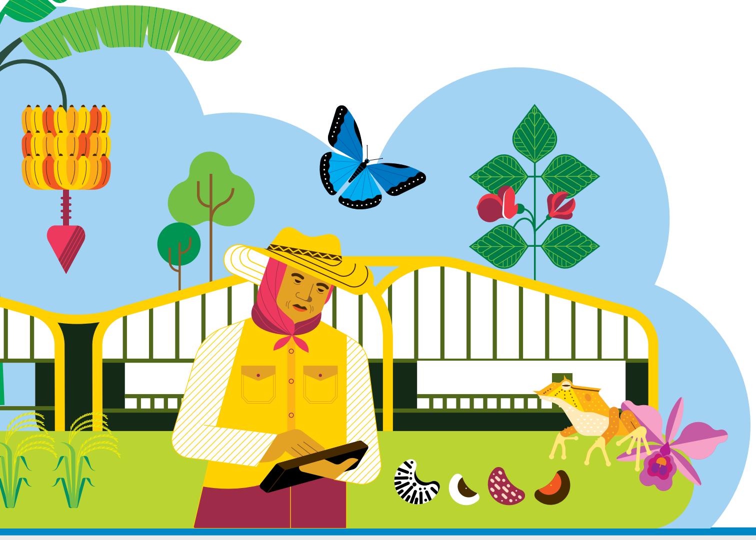


ACCELERATING PROGRESS
towards global biodiversity targets through agroecology

Key Highlights

- Food and biodiversity challenges are deeply interconnected, requiring systems approaches that address these and other interconnected socio-ecological challenges simultaneously.
- Systems approaches recognize synergies and trade-offs across multiple objectives and stakeholders and focus on finding solutions that enable progress in multiple areas.
- Agroecology forms part of this solution space, encompassing interventions at field, farm, landscape and food system level that build ecological resilience, deliver nutritious diets, and lead to economically prosperous and fairer societies.
- Agroecology is embodied in Target 10 of the Kunming-Montreal Global Biodiversity Framework (GBF) yet contributes directly or indirectly to all of the GBF targets.
- We call on Parties to the Convention on Biological Diversity (CBD) to facilitate an agroecological transition by creating a supportive policy, regulatory, and financial environment, and investing in agrobiodiversity conservation from farm to plate.
- We call on researchers, practitioners, and Parties to the CBD to break down sectoral silos and tackle complex food and biodiversity challenges using inter- and trans-disciplinary methods that equitably integrate diverse local concerns, preferences and needs.

Halting biodiversity loss requires transforming food systems

Land use change, direct exploitation, and pollution are major drivers of worldwide biodiversity loss,[1] with each of these strongly affected by agricultural expansion and unsustainable production system management. At the same time, biodiversity loss is eroding the resilience of food systems and their capacity to sustainably provide nutritious food to people everywhere.[2,3] Efforts to achieve both food security and biodiversity conservation are hindered by climate change[4], making achieving food-biodiversity-climate goals an interconnected triple challenge.

Agricultural activities that drive biodiversity loss are influenced by many different actors and segments of the food system often geographically displaced from the site experiencing biodiversity loss. For example, the conversion of natural habitats to agricultural land is a primary driver of biodiversity loss.[5,6] Such land use change is indirectly driven by over-consumption of food, timber, and biofuels, resource-intensive diets, and lack of or inadequate regulations and incentives to spare species and natural habitats.[7] Agrochemical pollution is another major driver of biodiversity loss, exacerbated by surplus fertilizer and pesticide use and inefficient application methods.[8] This agrochemical misuse is enabled by a lack of regulatory safeguards on fertilizer and pesticide use,[8] business interest in maximizing agrochemical demand irrespective of environmental damage,[9] and market factors favouring economies of scale and a shift to larger farms and simplified production methods.[10] Simplification of agricultural fields, farms and landscapes leads to direct loss of cultivated varieties and livestock breeds together with species (e.g., insect pollinators) that support agricultural production –referred to as agrobiodiversity –[11] and declines in the diversity of other plants, animals and micro-organisms.[12–16] Fragmentation of land, particularly driven by the proliferation of extensive monocultures, has an especially negative effect on biodiversity. It reduces ecological connectivity and habitat diversity making it harder for non-mobile species to propagate and for mobile species to access the resources they need and move between the remaining relatively intact habitats.[17,18]

Biodiversity loss has strong negative consequences for food systems, undermining system resilience and increasing production costs. Loss of biodiversity and associated ecosystem services, such as pollination, biocontrol, soil nutrient cycling, and water regulation, erode agroecosystem health, productivity and resilience,[3,19] and create dependencies on synthetic or manual inputs and technological solutions. Loss of indigenous crop varieties and livestock breeds from farmlands and diets accelerates the genetic erosion of agrobiodiversity, removing options for adapting to future climate change and diseases.[2,11] In contrast, diversified fields, farms and landscapes, which incorporate local varieties and breeds and functionally diverse plants, enhance nutrition,[20] profitability,[21] agronomic,[22] and ecological performance,[23,24] boosting food security, resilience, and optionality – increasing the capacity to evolve positively into new states after disturbance –[25] at local levels and along supply lines.

There is increased awareness that current food systems are poorly equipped to handle climate and economic shocks, opening up a search for more resilient alternatives.[26–30] **Biodiversity is at the core of these solutions.** Agrobiodiversity and the benefits it brings to food systems can be largely restored by applying agroecological principles at field, farm and landscape level backed by supportive supply chains, policies and institutions.

Agroecology provides a set of principles for transforming food systems to a sustainable trajectory, grounded in restoring ecological functionality, fairness and social equity, and farmer and consumer agency in food system governance.[31] Agroecology calls for the empowerment of marginalized stakeholders, and the largest number of agroecological principles (8-13) put forth by the High Level Panel of Experts (HLPE) on food security and nutrition relate to agroecology's third organizational principle: "secure social equity/ responsibility" (HLPE, 2019, Table 1). Agroecology is embodied in GBF Target 10, and the Global Alliance for the Future of Food has demonstrated the cross-cutting value of agroecology to 13 GBF targets.[32]

Agroecology faces criticism, including from within the biodiversity conservation community, related to concerns that agroecological approaches reduce agricultural productivity (leading to agricultural land expansion)[33,34] require unfeasible organic fertilizer inputs,[35] and are too labor intensive to be profitable.[36] **Fact-checking these claims suggests they are mostly false** (see Table 1). While joined up actions are needed from within and beyond the food system to bend the curve on biodiversity loss,[37,38] agroecology presents an evidence-based approach to shifting food systems into a safe space for nature and people.[30,39]

Farmers in Andhra Pradesh preparing soil inoculants using locally available organic products. 📷 Bioversity International / Sarah Jones

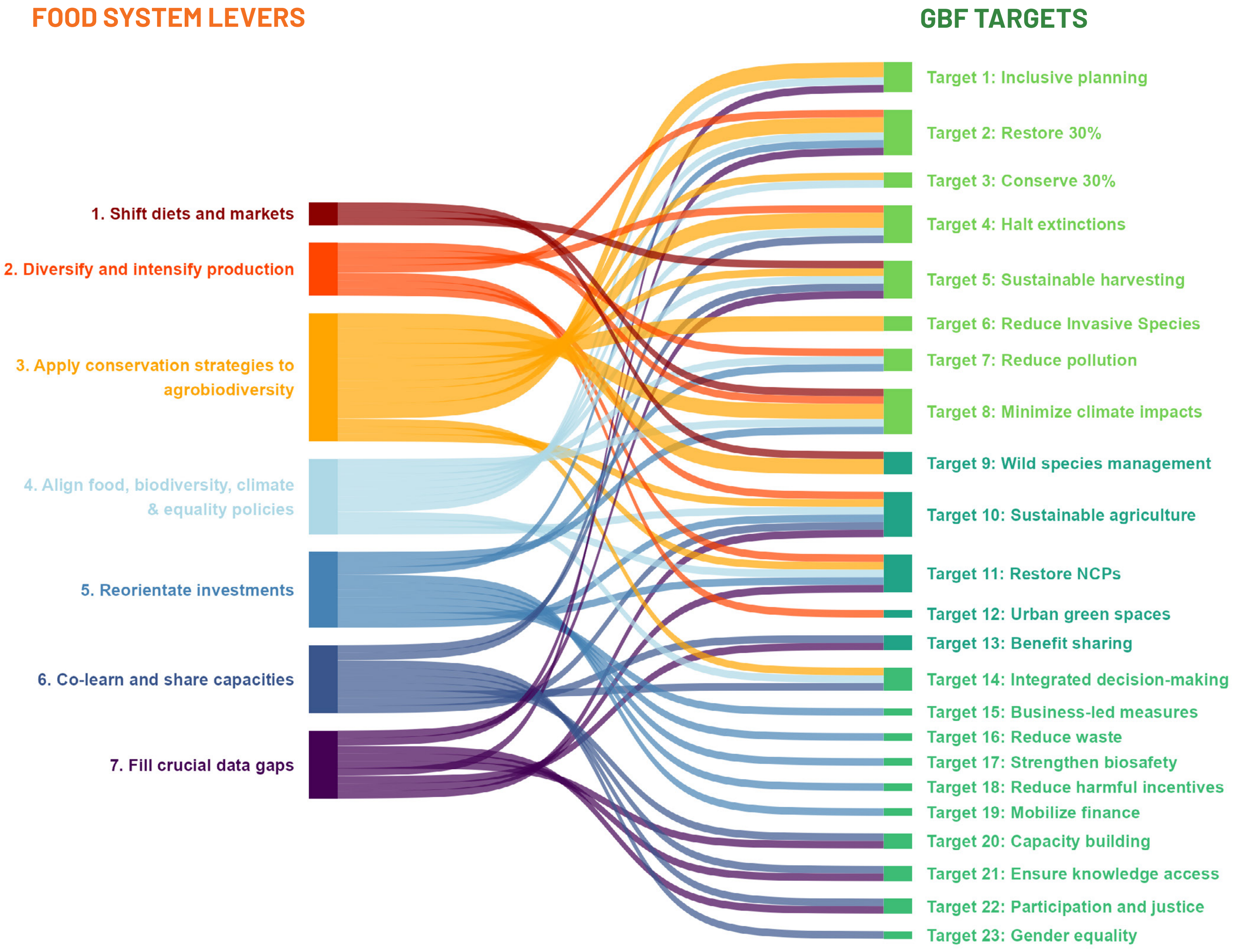
Table 1. Myth-busting agroecology's contributions to food security and biodiversity conservation

CLAIM	TRUE OR FALSE	EVIDENCE
Agroecological approaches reduce agricultural productivity.	**FALSE**	While agroecological approaches can lower productivity in certain contexts relative to intensively managed monocultures, they frequently lead to increases in whole system yields and cumulative yields through time.[20, 22, 40] Agroecological farming is not the same as organic farming, which is consistently found to lower productivity relative to intensively managed monocultures[41] and is often at the root of misconceptions about agroecology's effect on yields.
Agroecological approaches require zero chemical fertilizer inputs.	**FALSE**	Agroecology does not call for the elimination of chemical fertilizers. It advocates that dependency on purchased fertilizers is minimized or eliminated, and that fertilizer inputs are carefully managed to maximize efficiency, minimize waste, and avoid environmental harm.[31] Minimizing purchased fertilizers requires the use of organic fertilizers, but chemical fertilizers should be used where organic alternatives are limited or insufficient to restore soil nutrients, notably in sub-Saharan Africa.[35] Applications of fertilizers should follow the agroecological aims to close nutrient cycles (minimize waste and environmental harm) and maintain soil health (enhance soil organic matter and biodiversity).
Agroecological approaches are too labor intensive to be profitable.	**FALSE**	While agroecological approaches frequently demand higher labor inputs than intensively managed monocultures, profits are comparable[21] likely because of higher market prices or government subsidies, lower agrochemical and fuel costs, and more stable production levels. Demand for labor provides employment opportunities, which can lower unemployment rates and out-migration in rural areas.
Land needs to be spared not shared for biodiversity to thrive.	**FALSE**	Both land sparing and sharing are essential for biodiversity conservation.[42] Proponents of land sparing argue that replacing conventional intensive agricultural management with less intensive practices lowers yields, driving agricultural land expansion.[33, 43] Yet conventional intensification of agricultural production systems drives biodiversity loss and degrades soils, with strong negative feedback on agricultural yields,[14, 44] which can also lead to agricultural land expansion. This swings the pendulum in favor of agroecological intensification approaches, which may result in small yield losses but often boosts yields, while substantially boosting biodiversity on farmlands. However, yield responses to biodiversity loss are variable across crops and geographies; for example, cereal productivity appears unaffected by biodiversity loss in certain landscapes.[44] The best strategy for safeguarding biodiversity is context-dependent and requires inclusive, integrated landscape planning to identify and manage trade-offs with food production and other priorities.[7, 45]
Food systems can halt agricultural-driven biodiversity loss solely by changing production practices.	**FALSE**	Food systems depend on interconnected production, consumption, and conservation components, and changing food system trajectories requires interventions that recognize and use this interconnectedness to effectively reorientate the whole system.[46] This is why agroecology is not only about implementing ecological practices; it is also about prioritizing social well-being and fairness over efficiency[47, 48] and shifting the power in food systems away from corporate oligarchies that lock farmers and consumers into practices that are detrimental to the environment and human health, in pursuit of profit.[9, 10]

Leverage points

The ripple effects on biodiversity of decisions all along food supply chains means there are **multiple leverage points for change from farm to plate.** We present seven promising levers to accelerate progress towards GBF targets through transforming food systems grounded in agroecology science and practice. The figure 1 shows the numerous and complementary pathways through which these levers can contribute to halting biodiversity loss (Targets 1-8), meeting peoples' needs (Targets 9-13) and providing tools and solutions (Targets 14-23).

Figure 1. *Seven levers of change within food systems to accelerate progress towards Global Biodiversity Framework (GBF) targets, grounded in agroecology science and practice.*



Source: *the authors.*

LEVER 1

Shift diets and markets

Models show that shifting diets can reduce pressure on land, making it easier to preserve remaining habitats and restore degraded ones, while simultaneously improving human health.[49] Globally, this means eating less meat, dairy and sugar and more whole grains, fruits, nuts and vegetables.[50] Yet, locally, it means addressing population nutrient shortages (including increasing access to animal-based foods in contexts with protein-deficiencies) and over consumption, through dietary shifts that are culturally, environmentally, and economically viable. Diets for meeting human nutrition and environmental goals in tandem are shaped and constrained by cultural preferences (for certain foods and food-sources), population nutritional needs and deficiencies, local environmental pressures (e.g. water stress limiting vegetable and nut production), and political and economic contexts determining food affordability and trade flows. Therefore the dietary shifts that are needed and desirable depend on the starting point and context, which varies significantly across countries[29] and communities.

At a simpler level, what people consume and prioritize in their food purchases drives which plants are grown and which animals kept on-farm. Currently we consume only a tiny proportion of the 70[39] known edible plants,[51] with only 9 plants accounting for 66% of global crop production.[52] Many traditional cultivars and local livestock breeds are on the brink of extinction and are unavailable or disregarded by consumers, producers and companies, though some of these neglected foods are making a comeback.[53, 54] Incorporating more diversity into fields and onto plates would help to safeguard more edible species, varieties and breeds in-situ, rejuvenate local food markets, and close nutritional gaps.[53] Simple targets can help focus efforts. For example, a US study found that consuming 30 plants per week led to significantly healthier gut microbiome.[55] A review of national dietary guidelines found that over 50% of countries recommend prioritizing consumption of five food groups, commonly listed as starchy staples, fruits, vegetables, dairy, and other proteins.[56] Information on food composition and diversity (e.g. in terms of number of species, varieties, breeds, or food groups) is improving, but full traceability remains a challenge.[57, 58] Company and government efforts to shift to fully digital supply chains is a promising route to providing consumer driven support for agroecological farms and raising awareness of the cultural, environmental, nutritional, and culinary value of many neglected and underutilized foods.

Recommendation

In national dietary guidelines, public procurement schemes, and institutional (schools, hospitals, ministries) meal plans, favor indigenous varieties and local breeds sourced from local, agroecological farms, ideally supported by digital food supply chain traceability tools, with weekly meal plans that promote nutrition and diversity (e.g., target individual weekly consumption of at least 30 plant species).

LEVER 2

Diversify and intensify production systems

While diversification and ecological intensification of production systems can boost biodiversity, how interventions are designed greatly influences whether biodiversity benefits or not, and whether there are trade-offs or synergies with food, profitability, land degradation neutrality, and climate goals. Evidence from comprehensive, global meta-analyses shows that certain diversification practices are effective at boosting agronomic and environmental outcomes in tandem,[14,23,24] contesting the claim that achieving high yields depends on simplified farming systems. Since diversification can deliver on yields while additionally safeguarding crop and livestock species in-situ and leading to significantly better outcomes for wild biodiversity and multiple ecosystem services, this is a strong basis for promoting such systems worldwide.

The most effective and feasible diversification practice depends on the cropping system and both local (e.g. soil type, labour availability), landscape (e.g. surrounding land uses) and institutional (e.g. insurance access, land tenure security, technology access) context. The latest information on expected biodiversity, food and other outcomes of implementing specific practices can be retrieved from online repositories such as iMAP,[59] to help guide practice selection. Promising practices should be implemented by farmers and practitioners on-ground, with continuous monitoring and adaptation to improve agronomic, environmental, economic and social outcomes. Continued scientific efforts are needed to close performance knowledge gaps, by including a wider range of diversified systems in experimental testing sites and documenting their holistic performance, including effects on yield, biodiversity, climate, soil health and pollution.

Understanding what enables and prevents farms and landscapes from adopting and maintaining diversification strategies is key to scaling these systems. A review of factors influencing the implementation and performance of integrated landscape approaches – which inherently seek to reconcile development and conservation objectives - found that a portfolio of interventions, inclusive stakeholder dialogues, and long-term engagement were key to success.[60] Learning from these insights can help design effective scaling mechanisms for diversifying and intensifying production fields, farms and landscapes.

Recommendation

On existing agricultural land, support farmers to improve productivity through socially and economically viable ecological intensification based on locally validated evidence, facilitated by technology transfer, training, and financial support, and implemented as part of integrated landscape planning strategies.

LEVER 3

Apply wild biodiversity conservation strategies to agrobiodiversity

Which plants are safeguarded in seed banks or in-situ determines the availability of genetic resources for use by farmers and researchers to find and breed locally adapted and climate-proofed varieties capable of thriving and meeting future needs. Yet the need to maintain functionally diverse genetic resources for food and agriculture was largely neglected in previous National Biodiversity Strategies and Action Plans (NBSAPs). “Of 119 reviewed NBSAPs only 30% include details of concrete actions for agrobiodiversity conservation and sustainable use. Very few of the reviewed NBSAPs include explicit plans to use genetic resources for food and agriculture (GRFA) for climate change adaptation or for diversified diets and improved nutrition”.[61] As Parties update their NBSAPs, there is an opportunity to address this gap and incorporate explicit conservation strategies for agrobiodiversity.

These could include targets and actions to create and safeguard agrobiodiversity-rich zones, following in the footsteps of Peru and its 10 Agrobiodiversity Zones. Peru has long-since recognised the conservation value of its Agrobiodiversity Zones for preserving thousands of indigenous plant varieties that would otherwise likely be extinct. Peru is seeking to have these biodiverse areas designated as Other Effective Conservation Management (OECMs) zones, contributing to GBF Target 3: Conserve 30% of Land, Waters and Seas. Applying such conservation strategies to agrobiodiversity is essential to halt the erosion of this biodiversity.[11]

Recommendation

Recognize that edible plants, livestock breeds, and fish, and the plants, animals, and microorganisms that support their production, are a crucial part of biodiversity and include targets and actions to conserve and sustainably use this agrobiodiversity in NBSAPs, in-field, in gene banks, and in conservation areas.

LEVER 4

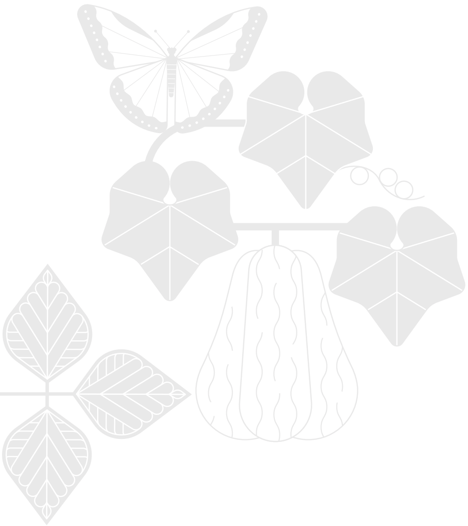
Align biodiversity, food, climate and equality policies

Governments should seek to set ambitious, well-aligned biodiversity, food, climate, and equality policies, conducive to a just and sustainable food system transition. There is an urgent need to move beyond single-sector planning, to identify and implement holistic approaches that address root causes of biodiversity loss and misuse, climate change, and malnutrition in tandem, including those stemming from actions (or inaction) across the whole food system. Halting biodiversity decline requires food system transformation.[38] This is acknowledged by GBF Target 10, yet transforming food systems is valuable for multiple GBF targets (see Figure 1).

Initiatives such as the Food, Agriculture, Biodiversity, Land-Use and Energy (FABLE) consortium can support the development of inclusive, integrated food and land use pathways for achieving cross-sector objectives. FABLE includes local teams from 24 countries, who use models to develop, in consultation with multisector stakeholders, alternative food and land use system futures and estimate their effects on food, biodiversity, climate, water, social and economic targets.[29] The goal is to support and enable cross-sector dialogue and facilitate integrated policy development.

Recommendation

Through science-policy and multistakeholder collaboration, identify a national food and land use system pathway that supports the simultaneous achievement of NBSAPs, Nationally Determined Contributions (NDCs), Land Degradation Neutrality (LDN), and national and regional development plans, and mobilize strong inter-agency cooperation to collectively transition to this pathway.



LEVER 5

Reorientate public and private investments

Many farmers and agrifood value chain actors face financial lock-in, coupled with knowledge and technology gaps, hindering attempts to shift to more sustainable agricultural production patterns.[28] There is a particular need to manage risk and consider financial support to farmers and businesses during transition periods towards agroecology. Financial mechanisms, such as providing insurance against crop losses, or long-term procurement contracts, can help reduce risks, and enable farmers to safely explore alternatives, and enable private sector support of sustainability transitions. Alongside, research and technical investments are needed to develop and make accessible farm machinery compatible with diverse cropping systems, precision fertilizer application to reduce or halt polluting losses, and integrated pest management strategies that halt the prophylactic use of and reduce dependencies on toxic biocides.

Donors can help fill these gaps by redirecting funds towards innovative, agroecological research and development as part of GBF Target 18.[62] This includes investment in research on effective agroecological production practices, and market development of currently under-consumed high-value crops, notably fruits, nuts, vegetables, and legumes. It includes investment in identifying and supporting farmer transitions to practices that enhance pollination, pest regulation, soil carbon sequestration, and water quality over the funding of replacement technologies that undermine biodiversity's contribution to stable and productive environmental systems. In turn, governments and companies can help translate research into practice by providing financial, institutional, and regulatory support to agroecological approaches. For example, the EU ban on import of goods linked to deforestation triggered widespread company investment in improving deforestation monitoring and reporting systems in order to maintain access to the European market.[63]

Recommendation

Redirect and significantly boost funding for agroecological research, development, and scaling, including funding research on how to effectively design, adopt and maintain agroecological practices, providing financial support to farmers during agroecological transitions, and creating financial incentives for companies and consumers to support agroecologically produced foods.

LEVER 6

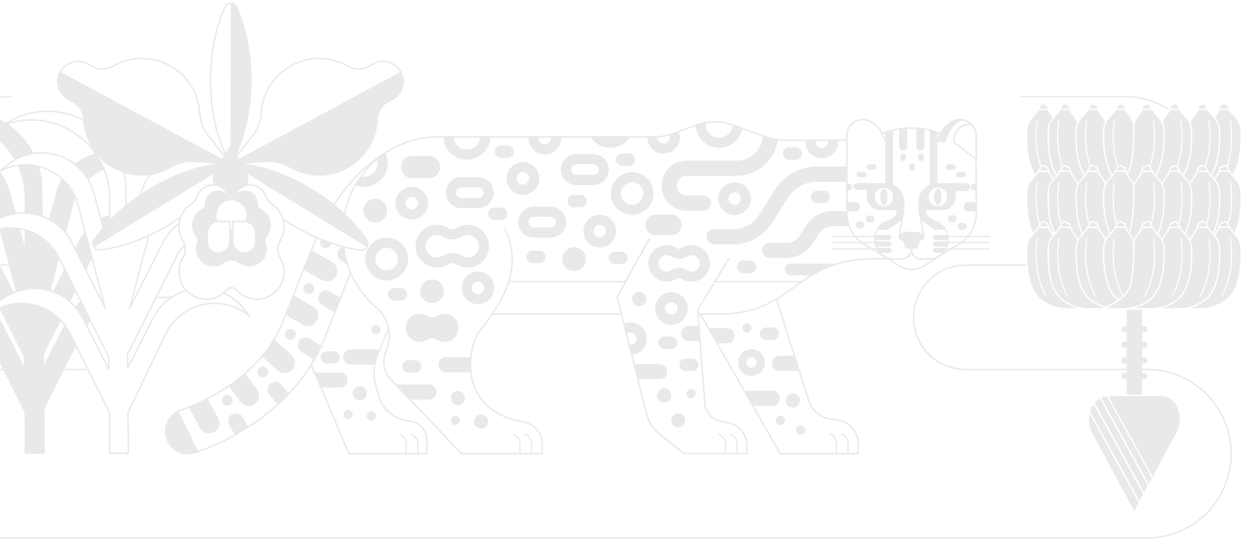
Co-learn and share capacities

Agroecology calls for co-development and co-learning with rural extension services, farmers, communities, national/local governments and related institutions to incorporate and respond to local rural development needs. For example, farmers often know which crop combinations, input sourcing strategies, and market arrangements enable them to practice agroecology, but may not have spaces for exchanging and receiving knowledge and sustained technical support to increase chances of success.

To overcome these barriers, NBSAP activity plans could include holding peer-to-peer exchange days with innovative farmers already practicing biodiversity-friendly farming. To strengthen extension service support to farmers, NBSAP activity plans should include mainstreaming agroecology into agricultural training colleges and state recommendations on best practices.

Recommendation

Mainstream agroecology into agricultural training colleges and state recommendations on best practices, and provide farmer-to-farmer and cross-value chain capacity sharing opportunities.



LEVER 7

Fill crucial data gaps

Few countries have data on agroecological practices: where they are being used, how, and with what costs and benefits. NBSAPs and accompanying financial support for implementation should include investment and regulations to improve the monitoring of agroecological practices and agrobiodiversity in alignment with the GBF Target 10 monitoring requirements.

FAO-collated data on the proportion of agricultural area under productive and sustainable agriculture is the headline indicator.[64] Several component and complementary indicators can also provide useful insights, such as the Agrobiodiversity Index.[65] Yet all of these indicators are constrained by limited data availability. Trend data are needed on the land area under different agroecological practices, such as agroforestry, use of flower strips, zero chemical pesticides, use of local crop varieties and livestock breeds; and on the performance of such practices in relation to biodiversity and several human well-being and other environmental objectives. These data could be collected by Parties through regional administrators, such as extension workers, or as part of existing national household surveys, and reported to FAO to improve the headline indicator and fill gaps in knowledge on agrobiodiversity in production systems. Such data could also be collected by companies as part of their supply chain monitoring, enabled by national legislation passed to make this a requirement. Farmers could also be incentivized and supported to generate their own data with mechanisms to link such data to national monitoring systems.

Recommendation

Parties should implement mechanisms for collecting trend data on the area of land under specific agroecological practices, and ideally the agronomic, environmental and social performance of these practices, setting clear and collectively designed rules and respecting the principle of free, prior and informed consent of Indigenous Peoples and local communities for sharing, using, and collecting local or traditional knowledge on local varieties/breeds and agroecological practices.

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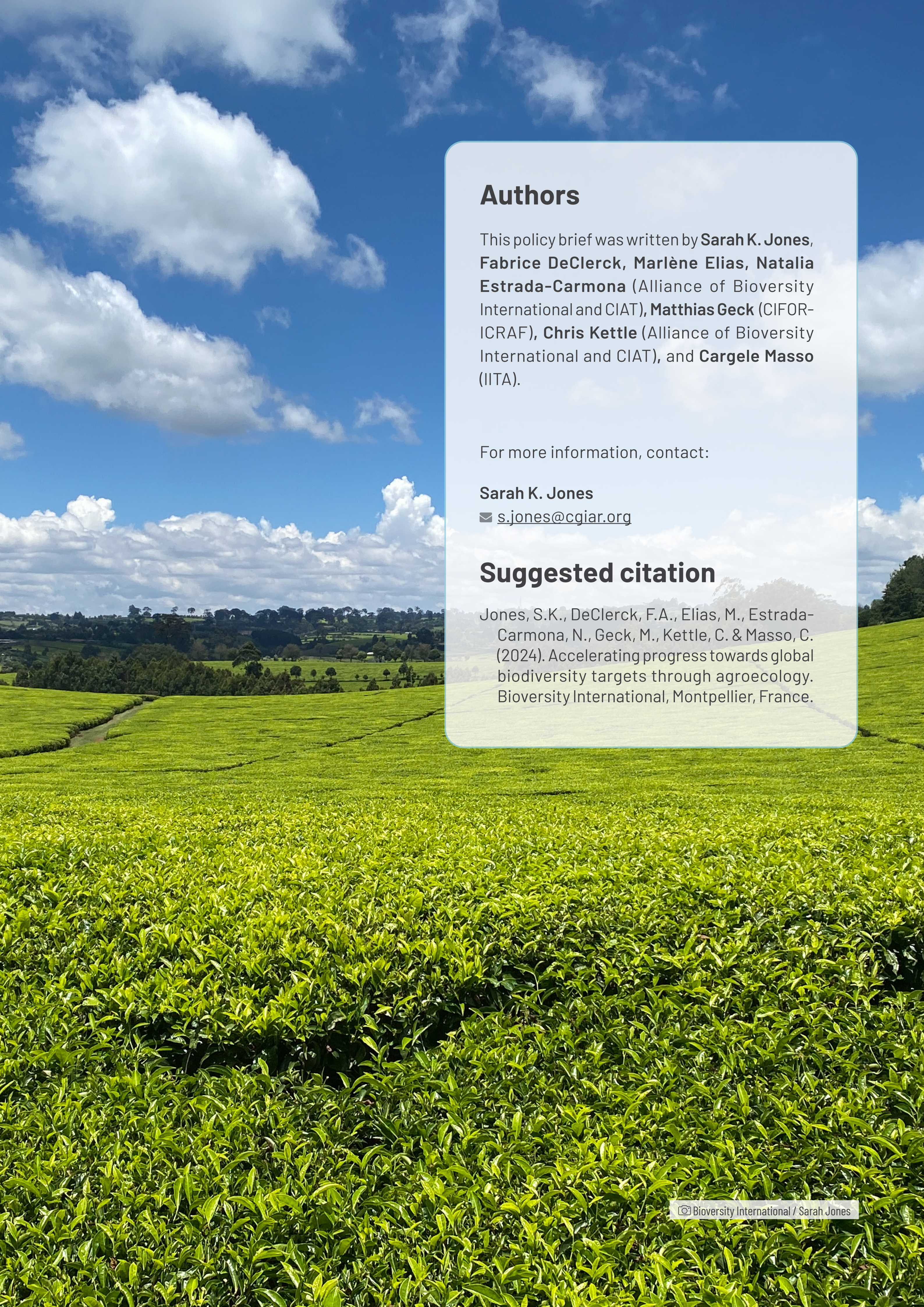

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