

## Biodiversity and agriculture: A review of the evidence

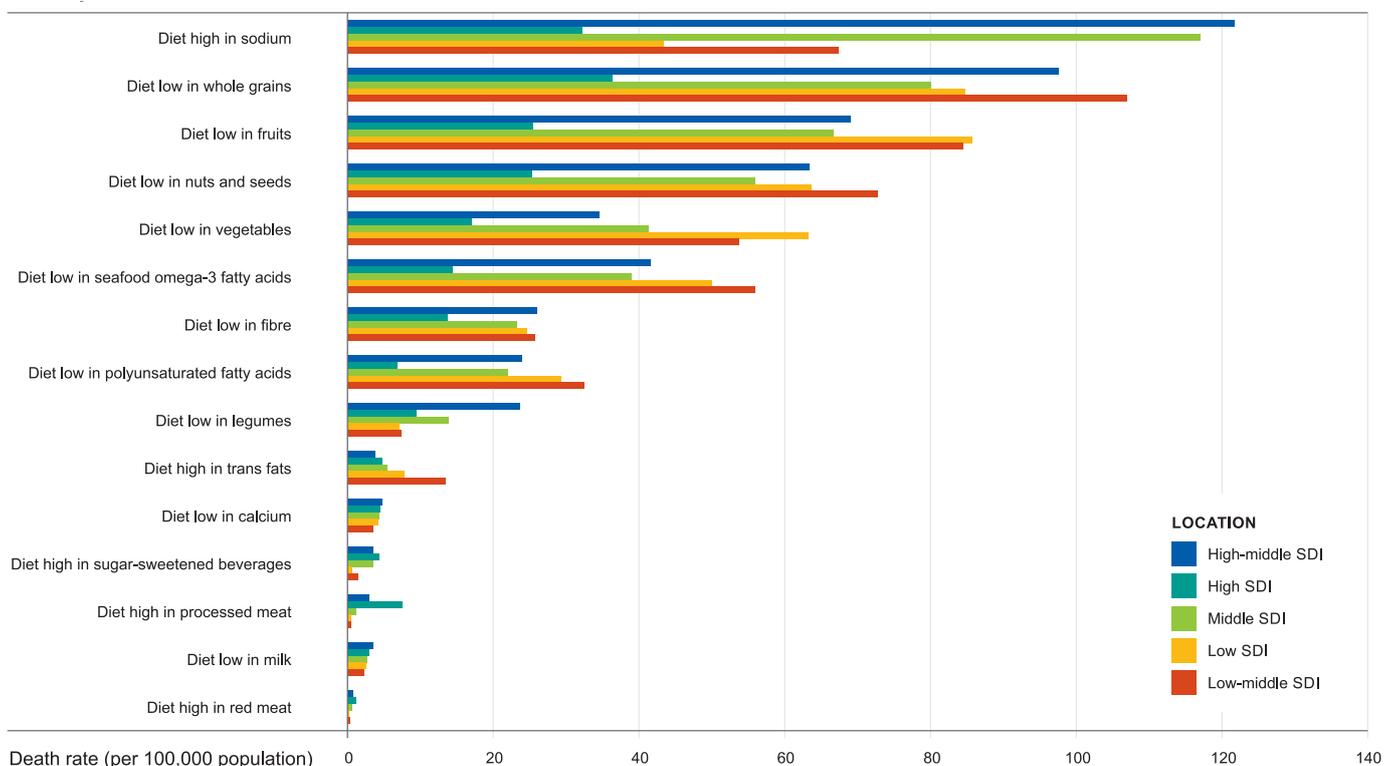
While agri-food systems today provide enough food globally, they have been unable to provide the basis for sufficiently diverse and healthy diets, with a persistent underproduction of a range of nutritious foods like fruits, nuts, vegetables, beans and pulses. Meanwhile, agriculture is also the single largest driver of environmental degradation. These two challenges are linked through the common solution space of biodiversity.

To map out the connections between these challenges and recommend

concrete policy responses, the CGIAR Research Program on Water, Land and Ecosystems (WLE) has conducted a review of the best available evidence on biodiversity in agriculture. The review spans many dimensions including the shortfall in dietary diversity, the dependence of agriculture on biodiversity in and around fields, and the other roles of ecosystem services in critical Earth systems such as climate and hydrological regulation. This review, commissioned by the Foreign, Commonwealth and

Development Office (FCDO) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), is a component of the COP26 Transforming Agricultural Innovation campaign. It is part of a series that covers agroecology as well as finance and innovations that showcase the complementary solutions that exist and should be leveraged, or need to be developed, to unlock solutions that further support biodiversity-based approaches to agriculture, bringing us closer to planetary health goals.

### LOW CONSUMPTION OF A DIVERSITY OF FOODS IS THE LEADING CAUSE OF MORTALITY ATTRIBUTABLE TO DIET



Number of deaths attributable to individual dietary risks by food group and by Social Demographic Index (SDI).

Source: Global Burden of Disease Collaborative (GBD 2017 Diet Collaborators 2019)

## DIETARY SHORTFALLS AND ENVIRONMENTAL COSTS

Poor dietary diversity results in poor health, contributing to 11 million premature deaths annually. While too many people still struggle from acute hunger, a growing number, including in low and middle-income countries (LMICs), have enough to eat but are unable to access a healthy range of foods.

Agricultural systems are also responsible for more than 30% of global greenhouse gas emissions, 70% of freshwater use and 80% of land conversion, and are the primary driver of biodiversity loss. Agricultural lands should share their space with biodiversity, devoting at least 10–20% of their area to semi-natural habitats to guarantee services vital to agricultural productivity such as pollination and biological pest control and to prevent soil erosion, nutrient loss and water contamination. Nevertheless, one fifth of agricultural lands currently lack the biodiversity to provide those services – an unacceptable risk for food security.

## BIODIVERSITY IN AND AROUND FIELDS

Greater consideration for, and integration of, biodiversity in agriculture is a key solution space for achieving food security, health and nature-positive development objectives together. It is possible to produce healthy diets for 10 billion people and halt the loss of biodiversity, securing its contribution to climate regulation and the maintenance of other planetary boundaries – despite significant challenges and trade-offs in several regions of the world, especially in developing economies.

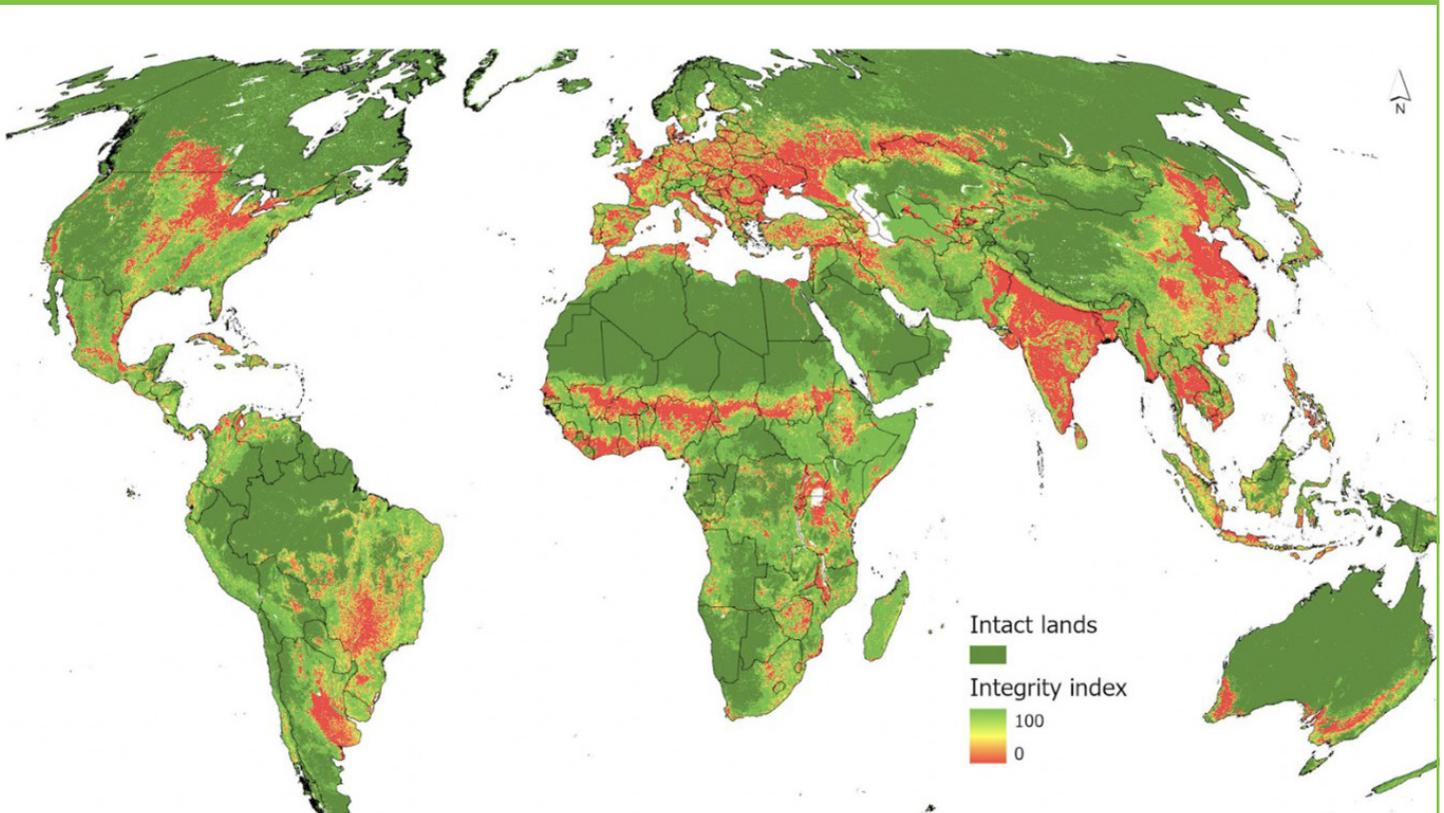
Agriculture thus needs a multi-pronged approach, notably through a shift towards practices that aim to regenerate ecological processes in agricultural production systems that deliver more diversified diets, coupled with conservation of intact habitats. Diversification strategies within fields, between fields and across landscapes are often regenerative, synergistic and multipurpose, and can bolster ecosystem functions within resilient agricultural production systems.

At scale, these practices offer the potential to sequester 4.3–6.9 billion tons of carbon dioxide equivalent per year, retain more than 30% of environmental flows in water to basins, create 12–17 million km<sup>3</sup> of habitat for biodiversity, and increase connectivity of habitats. There is no evidence that diversified production systems compromise food security – many agricultural diversification practices provide multiple complementary benefits.

## A UNION OF INCENTIVES, POLICIES AND POLITICAL WILL

We need to reorient incentives towards production systems that produce healthy foods and environmental goods, coupled with less food loss and waste. Whole-of-plate approaches will make space for a diversity of foods within caloric needs; such diets will also have significantly smaller footprints and harness biodiversity in food, in fields and around farms. This shift is a powerful win-win solution, as it could reduce per capita emissions from food production between

### GLOBAL DISTRIBUTION OF BIODIVERSITY INTACTNESS AND INTEGRITY

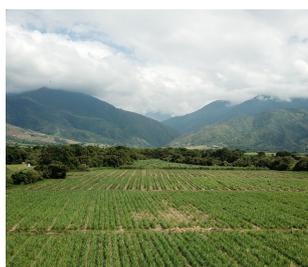


Global distribution of biodiversity intactness (dark green) and ecological integrity. Regions in red are below proposed thresholds for biodiversity in agriculture.

Source: Data from DeClerck et al. 2021

## SNAPSHOTS OF AGRICULTURAL LANDSCAPES

## COLOMBIA



## FRANCE



## GHANA



## INDIA



Examples (single snapshots) of agricultural landscapes without integrity (top), and with integrity (bottom), where ecosystem services are potentially being regenerated.

Photos (top to bottom, left to right): Jose F. Donneys / Shutterstock; GATO / Shutterstock; CSLD / Shutterstock; Philippe Montigny / Shutterstock; Albert Smith Junior / Shutterstock; Dr. Kofi Boa / Conflict & Development at Texas A&M; Tukaram.Karve / Shutterstock; G. M. Devagiri / World Agroforestry

30% to 50% while also accounting for a 20% reduction in freshwater consumption and a 20% decrease in the land needed to meet consumption demand (in line with the Convention on Biological Diversity's goal of no net loss of nature by 2050). But it will require the commitment and engagement of all actors, from policymakers to small and large landholders and all along supply chains from production to consumption. All need to act in concert to demand and deliver food that enhances nutrition and biodiversity.

Real leadership and political will are required to develop such a global agenda for transforming our food systems. It has to be grounded in the best available science and economic analysis, yet guided by established, universal norms while harnessing the power of agricultural and financial innovations. Such an agenda is already emerging through a global collaborative effort.

## KEY RECOMMENDATIONS

1. Agriculture needs to be more strongly integrated into global environmental policies and agreements, as well as global health policies.
2. Protection of remaining natural ecosystems from agricultural expansion and other extractive activities needs to be tightened.
3. A transition to managing agricultural systems as ecological systems (agroecosystems) is needed through the systematic adjustment of agricultural, land use and fisheries policies and practices guided by science-based targets and true cost accounting to incentivize regenerative, carbon-sequestering and nature-positive production systems.
4. This should be accompanied with critical investments in performance analysis across multiple dimensions and synergies of production systems: increasing production, diversifying crop composition, above or below ground carbon capture, soil health and measures of the ecological integrity of production systems. Global support and alignment for nature-positive production by scaling a diversity of context-specific diversification practices will increase the resilience of food systems.
5. A coordinated, transformational adjustment of policies, incentives, regulations and other public sector instruments and public funds is needed to make healthy and sustainable food affordable and available for all, and enable farmers and farming communities to gain greater recognition and reward for actions that produce healthy foods as well as biodiversity and climate benefits.
6. Investment is needed to close the production gap of crops contributing to healthy diets at local, regional and global scales in line with Sustainable Development Goals 2 and 3, including urgent investments in undervalued and underproduced crops vital to dietary health and integrating sustainable livestock production into cropping systems.
7. Investment is needed in research to fill knowledge gaps on agricultural systems of LMICs, including on building the capacity of scientists and institutions in the Global South, increasing their capacities to engage with regional food system actors, and increasing the access and participation of LMIC scientists in global science-policy interfaces.
8. Food loss and waste should be halved, using strong incentives, regulations and financial innovation along the entire value chain, creating a truly circular food economy.

9. Policy makers need to make the required policy shifts on both the supply and the demand side. In the Global South, policies are needed to allow greater access to sustainably produced protein-rich foods.
10. Financial markets need to shift investment flows away from unsustainable, unhealthy and socially unjust practices into investments in tools, innovations, technologies and enabling environments that drive transformative change; food companies should integrate environmental, social and health risks into company disclosures.
11. International trade should be reimagined so that higher-income countries take account of the adverse impacts of their consumption on ecosystems and biodiversity through trade in commodities, goods and services with lower-income countries. Sustainability in trade can be supported through due diligence requirements, tracing mechanisms and border tariffs.
12. People everywhere need access to the knowledge and tools required to demand change from policy makers and business, and to enable better informed, satisfying everyday food choices.

## SOURCE

This brief is based on the following rapid evidence review: DeClerck, F. A. J.; Koziell, I.; Sidhu, A.; Wirths, J.; Benton, T.; Garibaldi, L. A.; Kremen, C.; Maron, M.; Rumbaitis del Rio, C.; Clark, M.; Dickens, C.; Estrada-Carmona, N.; Fremier, A. K.; Jones, S. K.; Khoury, C. K.; Lal, R.; Obersteiner, M.; Remans, R.; Rusch, A.; Schulte, L. A.; Simmonds, J.; Stringer, L. C.; Weber, C.; Winowiecki, L. 2021. *Biodiversity and agriculture: rapid evidence review*. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE). 70p. doi: <https://doi.org/10.5337/2021.215>

## ACKNOWLEDGMENTS

This research was carried out as part of the CGIAR Research Program on Water, Land and Ecosystems (WLE) and supported by Funders contributing to the CGIAR Trust Fund (<https://www.cgiar.org/funders/>). CGIAR is a global research partnership for a food-secure future. The views expressed in this document cannot be taken to reflect the official opinions of CGIAR or WLE.

## CONTACT

Dr Fabrice DeClerck, CGIAR Research Program on Water, Land and Ecosystems (WLE), Montpellier, France, and EAT Foundation, Oslo, Norway ([f.declerck@cgiar.org](mailto:f.declerck@cgiar.org))

## THE BRIEFING NOTE SERIES

The WLE briefing note series presents WLE research outputs in an accessible format to different users (policy makers, development practitioners, investors and others). The purpose of repackaging research down to its essential points is to appeal to the needs and interests of specific groups of decision-makers. Each brief offers evidence and gives the minimum required background for concrete recommendations on what can be done and is actionable.

## CGIAR RESEARCH PROGRAM ON WATER, LAND AND ECOSYSTEMS

The CGIAR Research Program on Water, Land and Ecosystems (WLE) is a global research-for-development program connecting partners to deliver sustainable agriculture solutions that enhance our natural resources – and the lives of people that rely on them. WLE brings together 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO), the RUAF Global Partnership, and national, regional and international partners to deliver solutions that change agriculture from a driver of environmental degradation to part of the solution. WLE is led by the International Water Management Institute (IWMI) and partners as part of CGIAR, a global research partnership for a food-secure future.

IN PARTNERSHIP WITH:

