

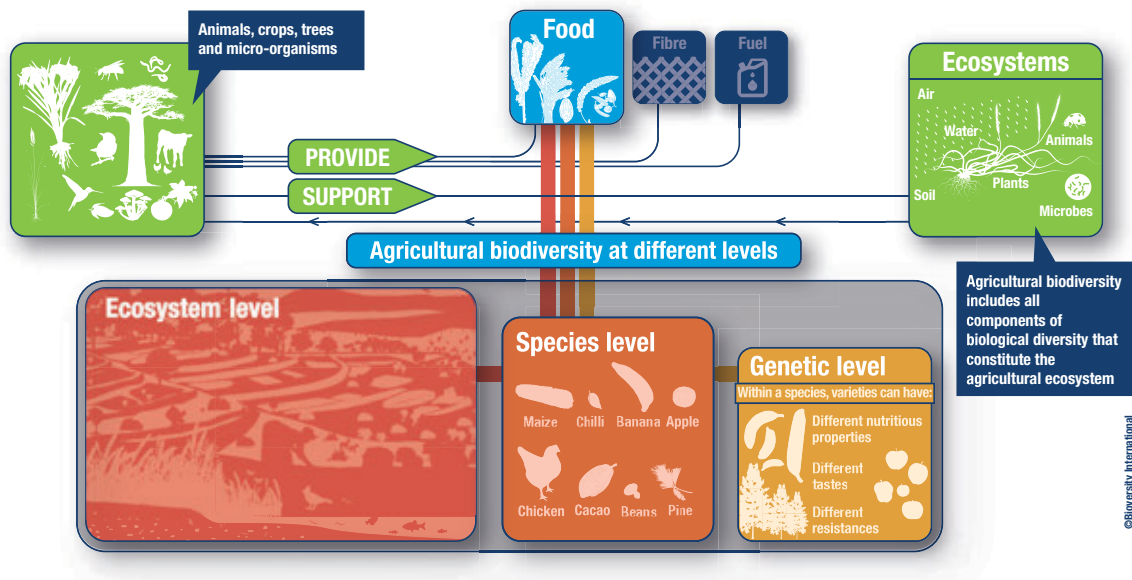


ALL YOU NEED TO KNOW ABOUT
MAINSTREAMING
AGROBIODIVERSITY
IN SUSTAINABLE FOOD SYSTEMS



What is agricultural biodiversity?

Agricultural biodiversity is a critical component of a sustainable food system. Without agricultural biodiversity, a food system cannot be sustainable.



Agricultural biodiversity represents the **variety and variability of animals, plants and micro-organisms** that are used directly or indirectly for food and agriculture.

The loss of agricultural biodiversity in our global food production systems is an issue of increasing concern, recognized by the Rio Convention on Biological Diversity and the Sustainable Development Goals of the United Nations.

When we lose agricultural biodiversity, we also lose the options to make our diets healthier and our food systems more resilient and sustainable.

How agricultural biodiversity can contribute to sustainable food systems

Sustaining people

The world relies on just three crops – rice, wheat and maize – for more than 50% of its plant-derived calories. Yield of these crops has plateaued.

- *Tens of thousands of alternative crops can substitute and complement these staples. Sorghum, millets and quinoa are examples of cereals that can grow in difficult environments, have high nutrient content and have potential to increase their yields.*

One in three people in the world suffers from micronutrient deficiencies and almost 2 billion people are overweight or obese.

- *Food biodiversity is a source of high-nutrient species and varieties.*

The production of fruit and vegetables, nuts and seeds falls about 22% short of population need according to nutrition recommendations.

- *Many nutritious fruit, vegetables, nuts and seeds available in the wild or in traditional farming systems are not well known and could be used to improve nutrition.*

Sustaining the planet

Agriculture contributes around 24% of global greenhouse gas emissions and is the single largest user of fresh water on the planet.

- *Biodiversity-based solutions are at the heart of agroecological practices, which intensify production while reducing pressures on the environment.*

Agricultural lands cover about 38% of global land area.

- *Using biodiversity-based approaches on this vast area of land can reduce emissions and runoff, decrease the need for synthetic inputs, improve soil quality, encourage pollinators and conserve varieties and species.*

Every decade until 2050, agricultural production will reduce by 2% while demand will increase by 14%.

- *Agricultural biodiversity is a source of species and varieties that are tolerant to different climate extremes – from drought to flooding and extreme temperatures. Using biodiversity-based solutions on farms can also decrease emissions that contribute to climate change.*

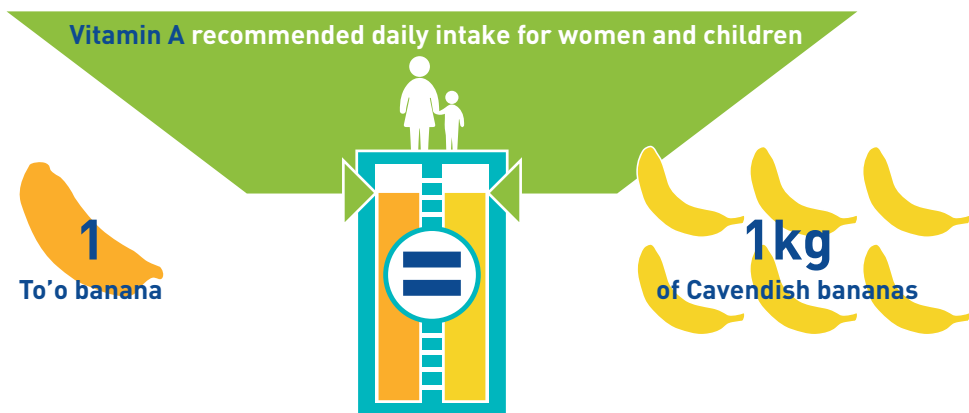
While agricultural biodiversity is by no means the only component needed in a sustainable food system, a sustainable food system cannot exist without agricultural biodiversity.

FOOD

Food biodiversity can improve diets and nutrition.

- **Thousands of species** exist on farms and in the wild. Within these species are millions of varieties that have potential to spice up diets, improve nutrition and have a lower environmental impact. In India alone, there are more than 1,000 different varieties of mango.
- Fruit trees, pulses, vegetables, cereals, poultry and other small livestock, and fish can be combined in **portfolios** to provide year-round harvest of healthy, nutrient-dense foods, which fill hunger gaps and specific nutrient gaps.
- **Nutrient content** between different species, or different varieties, can vary even a thousandfold:
 - › Eating one To'o banana meets the daily recommended intake of vitamin A for women and children. They would need to eat 1kg of Cavendish bananas, the variety that dominates supermarket shelves, to consume the same level.
 - › Some indigenous fish species, like mola and darkina in Bangladesh, have much higher levels of much-needed micronutrients than commonly produced fish, like tilapia.
- **Wild and indigenous plants**, fruit trees and animal species are often more nutritious than their better known exotic counterparts. In Brazil the fruit of Amazonian fruit trees buriti, pupunha and tucuma have high levels of beta-carotene. Brazil nut, caburi, assai and uxi also offer an impressive array of minerals and phytonutrients.
- Healthy diets need to be **available, accessible, affordable and acceptable**. Quinoa, one of the world's favourite grains, was once shunned by urban dwellers in the Andes. Now this highly nutritious traditional cereal, which grows well on stony mountain lands, has become prestigious.

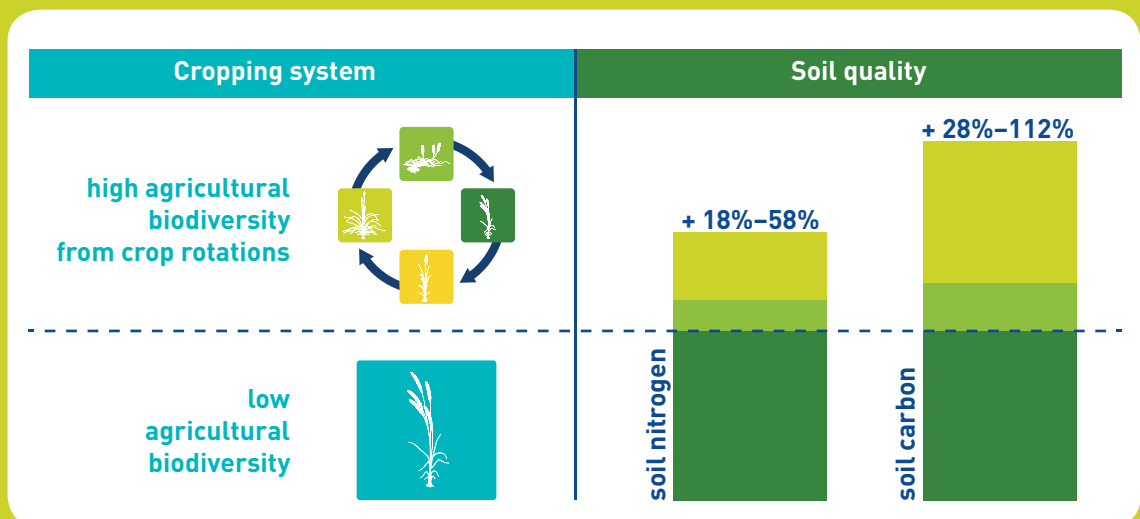
Nutrient content between different species



SUSTAINABILITY

Using agricultural practices based on biodiversity – genetic, varieties, species, soil and landscapes – can increase yields, and reduce waste and dependencies on external inputs.

- **Soil erosion** can be reduced by using agricultural biodiversity practices, such as hedgerows, cover crops, agroforestry or intercropping. In Indonesia, intercropping coffee trees with vegetables in hilly areas led to a 64% reduction in soil erosion, and no decrease in coffee yield.
- **Pest and diseases** can be controlled by selecting plants that increase the number of pest predators, or by using pest or disease-resistant varieties. Research in Uganda on common bean found that mixing 50% traditional resistant varieties into a plot made them more resistant to common diseases.
- Greater diversity in landscapes – with patches of trees, wild vegetation, floral strips – leads to more diverse **pollinators**. Organic fields worldwide have been found to host about 70% more bees and 50% more kinds of bees than conventional fields.
- **Crop diversity**, increased vegetation diversity and certain agroecological practices enhance **wild biodiversity conservation**. In Costa Rica, twice as many birds and kinds of birds were found in complex coffee and cacao agroforests than in simpler pastures and sugarcane fields.
- **Soil quality**. Cropping systems with high agricultural biodiversity from crop rotations, displayed increased soil carbon by 28%–112% and nitrogen by 18%–58% compared with those with low agricultural biodiversity.
- **Yield**. Diversifying corn and soybean systems by adding crop rotations while reducing tillage increased yield by 7% and 22% respectively. A study on barley in Ethiopia found that for each increase in a measure of diversity, yields increased between 415kg/ha and 1,338kg/ha.
- Diversity among and within species increases **resilience** to environmental fluctuations because they respond differently to change or create beneficial synergies. Diversified farm systems in Nicaragua recovered better and faster than simplified systems after Hurricane Mitch in 1998.



SEEDS

Seed systems need to increase crop and variety diversity in food and agricultural systems.

- **Crop improvement** programmes released more than 8,000 new crop varieties between the 1960s and the 2000s, but they represented only 11 species. Many highly nutritious crops were left out, especially fruit, vegetables and pulses.
- For all farmers to be able to **access seeds** means supporting informal as well as formal sources of seed. The formal sector provides less than 5% of seeds of traditional crops in West Africa, less than 10% of rice in Nepal, and less than 20% of wheat in Ethiopia and Syria.
- **Breeding** tends to decrease the overall genetic diversity in modern varieties, which can be risky. In the 1970s, US maize was severely threatened by corn blight, which destroyed almost US\$1 billion of maize and halved yields. The disease was contained by identifying maize germplasm that was not affected and using it to breed resistant varieties.
- **Innovation** is not just about formal breeding. Some farmer-bred crop varieties can be more productive than modern varieties. In Ethiopia, one farmer variety yielded 60% more than the best commercial variety. Two farmer varieties have been approved by the Ethiopian government for distribution.
- Focusing only on yield can mean losing **beneficial traits** like taste and nutrition. Protein, minerals and vitamins of 43 crops declined between 1950 and 1999. With tomato, a focus on transportability and shelf life led to loss of flavour.
- Working with farmers can strengthen **production and distribution** of local crops. In Kenya, introducing traditional leafy vegetables to the formal market, making seed available and training farmers led to an increase of 23% in farmers planting at least one species of traditional leafy vegetable.
- Overcomplex **regulations** can stifle farmer innovation. Some countries, like Costa Rica and Nepal, have adopted simpler farmer-led procedures to control and release seeds. This can bring diversity back to farming systems.

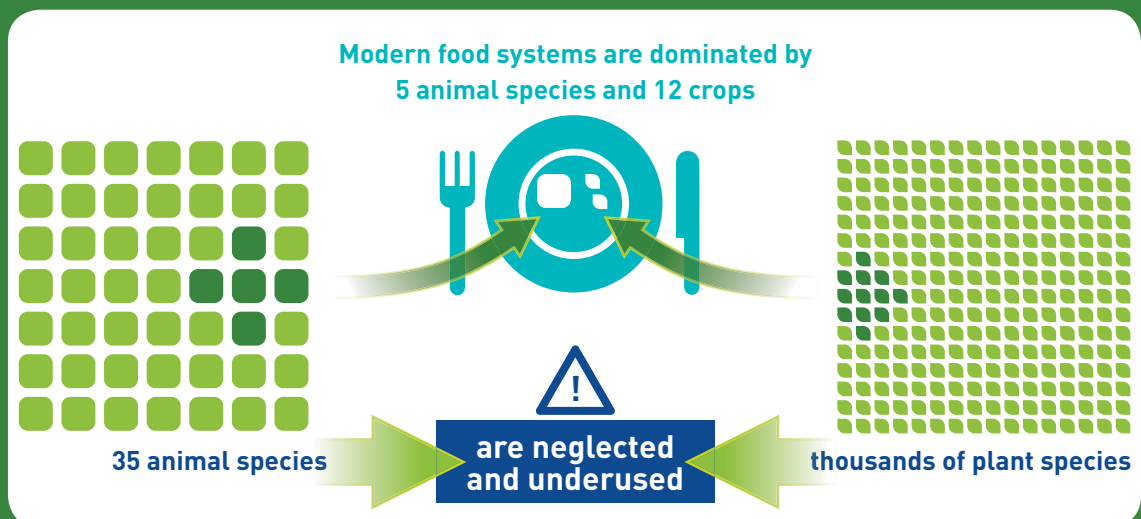
Access to seeds – formal sources of seeds provide less than:



CONSERVATION

Conserving the widest possible genetic diversity keeps options open for future generations and maintains the evolutionary potential of agricultural biodiversity.

- Much biodiversity useful for food and agriculture is **neglected and underused**. At least 40 animal species and many thousands of plant species contribute to human diets. However, 5 animal species and 12 crops dominate modern food systems.
- Diversity conserved **on farm** can be remarkable. Some households in Benin grow and gather 65 different plant species. Home gardens around the world often harbour 20 to 50 different plants and several small animal species.
- Farmers manage different varieties of the same crop in **livelihood strategies**. Farmers in Mexico, to manage drought risk may cultivate one maize variety that ripens early before drought sets in and another one which is drought-resistant. This way they have two strategies to beat drought.
- A huge repository of plants and animals occurs **in situ** in natural habitats, where it continues to evolve in response to natural pressures. The value to food production of the diversity found in wild relatives of food crops has been estimated at US\$115–120 billion per year worldwide.
- **Ex situ conservation** protects threatened crops by conserving genetic resources outside their natural habitat in off-site facilities. Over 7 million samples are conserved in 1,750 genebanks worldwide.
- From a **sustainable food system perspective**, the diversity held in genebanks is only the tip of the iceberg. Genebanks have largely focused on the conservation of major staple crops, while non-staple crops represent only 2% of materials stored and crop wild relatives are also poorly represented.



Mainstreaming Agrobiodiversity in Sustainable Food Systems

Scientific Foundations for an Agrobiodiversity Index

Mainstreaming Agrobiodiversity in Sustainable Food Systems: Scientific Foundations for an Agrobiodiversity Index is a new book, which summarizes the most recent evidence on **how to use agricultural biodiversity to provide nutritious foods through harnessing natural processes**. The evidence described provides the foundations for identifying indicators for an Agrobiodiversity Index.

“Mainstreaming Agrobiodiversity breaks out of the mould of the predictable. Thoughtful, refreshingly clear and at time provocatively counter-intuitive, this is a serious and commendable effort. It deserves considered engagement and reflection.”

Cary Fowler, former Executive Director of the Crop Trust

Mainstreaming Agrobiodiversity in Sustainable Food Systems is available at:
www.biodiversityinternational.org/mainstreaming-agrobiodiversity

The Agrobiodiversity Index

The Agrobiodiversity Index is comprised of a simple set of measures to:

- Apply across three interconnected dimensions of diets, production and genetic resources
- Use in different locations by different actors to provide insights into agricultural biodiversity trends
- Provide key data for allocation of financial resources
- Measure progress towards relevant targets in the Sustainable Development Goals and relevant UN Conventions.

The Agrobiodiversity Index is critical for decision-makers to measure and manage actions towards developing sustainable food systems:

- **Companies** implementing sustainable business practices that increase long-term shareholder value both by reducing risks in the supply chain and enhancing attractiveness to consumers
- **Governments** pursuing sustainable development by investing in progressive food, agriculture and conservation actions and monitoring country progress towards global goals
- **Investors** in green bonds contributing capital to sustainable environmental and climate-focused development projects
- **Farmers, consumer groups and local organizations** wanting evidence to inform their decisions about sustainable practices and purchases.

To know more about the Agrobiodiversity Index: www.biodiversityinternational.org/abd-index