

# Future of Food and Farming

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**"Progress made in reducing poverty and hunger has been lost."**

**Beth Bechdol**, Deputy Director - General, Food and Agriculture Organization of the United Nations (FAO)

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**"Livestock farming plays a crucial role in sustainable development."**

**Arianna Giullodori**, Secretary General, World Farmers' Organisation

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**FAO project beneficiaries harvesting onions on the Fadjé site.** The project, funded by ECHO, has been improving the anticipatory action and emergency response system in Cameroon to help thousands mitigate the impact of floods. 17 March 2023 (Makary, Cameroon).



Future of Farming  
**Regenerative  
Agriculture**



## Power to the microbe: how agriculture's nitrogen fix can protect crops

The 760 million tonnes of wheat, 515 million tonnes of rice and 1.2 billion tonnes of corn we grow each year rely on nitrogen fertiliser: without it, we'd struggle to grow half that volume.

Unfortunately, synthetic nitrogen production contributes 5% to greenhouse gas emissions (GHGs). Then there's nitrous oxide: 235 times more damaging than carbon dioxide; emitted when fertiliser's applied. Moreover, nitrates trickle into watercourses. Technological solutions, such as encapsulation to allow controlled release, often involve plastics — substituting one harm with another.

### Nature's nitrogen fix

Industrial fertilisers incorporate atmospheric nitrogen. That same nitrogen is tapped by legumes, the plant family that includes peas and beans. They strike up a beneficial relationship with nitrogen-fixing bacteria.

"Agriculture would be transformed by enabling this mechanism for every crop," enthuses Tom Tregunno, Global Market Manager at Azotic Technologies. The British agtech startup hopes to commercialise 30 years of research into *Gluconocetobacter diazotrophicus* (Gd), a nitrogen-fixing bacteria that unlike *Rhizobium* — the legumes' friend — isn't fussy about which species it teams up with.

"Gd was discovered in sugar cane. It colonises every cell throughout the plant, creating a mini nitrogen-fixing unit in each one," Tregunno explains. "Rather than the roots absorbing nitrogen, each cell produces its own." Sprayed onto crops' leaves, Gd reduces synthetic nitrogen applications without compromising crop yield. This has held true across four years of commercial usage in North America.

### Protecting crop production

Gd, trade name Encera, is one of a handful of similar 'biological nitrogen fixation' products. "These products aren't a substitute for fertiliser," Tregunno admits. "Nevertheless, Encera can cut a crop's demand by around one-quarter."

"Gd can protect crop production in a changing climate, too," reveals Tregunno. "Crops struggle with nitrogen when there's little soil moisture, but Gd-treated crops better manage heat and drought stress."



**Tom Tregunno**  
Global Market  
Manager, Azotic  
Technologies

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Find out more at  
[azotic.com](http://azotic.com)



# To feed more people during a food crisis — make a timely plan



**Zacharey Carmichael**  
Economist,  
The World Bank

To avoid the worst of food and nutrition crises, preparing and planning are key ingredients.

According to the 2023 Global Report on Food Crises, 258 million people across 58 countries/territories are facing acute food insecurity, marking the fourth consecutive year this figure has increased. The goal of achieving zero hunger by 2030 seems more distant every year, and people around the world face a litany of challenges that threaten their food and nutrition security and drastically impact their quality of life.

### Responding earlier to food and nutrition security crises

To promote greater preparedness for food and nutrition security crises, The World Bank — in collaboration with the Global Alliance for Food Security and its partners — is supporting countries in developing and operationalising Food Security Crisis Preparedness Plans (FSCPPs).

These are nationally led plans that define what constitutes a major food and nutrition security crisis. They explain how crisis risks are monitored and identified, and detail step-by-step protocols for mobilising additional funding and scaling up early action among government, humanitarian and development partners.

The plans are guided by seven key principles: (1) Government-owned and led; (2) Focused on major food and nutrition security crises; (3) Evidence-based; (4) Pre-arranged operations and timely; (5) Holistic (government, humanitarian and development); (6) Do no harm; (7) A living document, which is updated regularly.

### Collaboration at country-level in Somalia

Plans are being rolled out in 26 countries including Somalia, which has faced one of its worst droughts in a decade, causing widespread crop failures and livestock deaths. Building on past lessons and recognising the importance of more proactive and early responses that can save lives, livelihoods, and resources, the Somalia plan is expected to be completed by the end of 2023.

### Tailored plans suited to each country

The Food Security Crisis Preparedness Plans will be tailored to individual country needs and regularly updated. This includes incorporating lessons learned; strengthening collaboration among humanitarian and development partners; improving the capacity of government agencies.

These plans enable emerging crises to be identified and linked with earlier and more predictable action to prevent further setbacks to a country's development. Such efforts complement longer-term investments that tackle the root causes and can get us back on track to achieving a world without hunger.

The goal of  
achieving zero  
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# How farmers can help recover biodiversity and restore natural capital

Radically changing approaches to agriculture is essential in preserving the 'natural capital' of global biodiversity.



**C**hairman of Environment Bank, Professor David Hill, believes farmers and landowners must help rebuild and conserve the natural capital of biodiversity, pollinators, soils, landscapes, habitats and air and water quality.

**Encouraging farmers to restore nature** Environment Bank was set up in 2006 to lobby government to require developers to provide gains for nature — and was successful. The Environment Act in 2021, requires developers to comply with the Biodiversity Net Gain (BNG) mandate and adhere to nutrient neutrality compliance from housing schemes.

In support, the organisation offers alternative revenue streams to help landowners diversify their businesses and restore nature.

With an initial £220 million to fund farmers to create large-scale habitat banks and transition land to places of high biodiversity, Environment Bank then sells the uplift as biodiversity net gain units to developers enabling them to comply with the law.

**Reliance on natural capital** As former Deputy Chair of Natural England, Hill underlines the benefits of natural capital — largely in the control of landowners and the farming sector — highlighting that as recently as 2019, the World Economic Forum calculated that 55% of global GDP relies on what nature provides.

“Biodiversity loss and the climate crisis are recognised as the two main existential threats to us, yet extractive and unsustainable food production systems have

caused 70% of the decline of global biodiversity,” he adds.

## Shifting towards regenerative agriculture

We must massively change how food is grown, relying more on regenerative agriculture and soil management. The farming industry must reverse years of damage through nature recovery and regenerating natural capital. Its reliance on insecticides, fungicides, herbicides and artificial fertilisers has to change because 52% of UK farms are failing to recover the costs of these inputs.

## Using old methods to recover

As pests also build resistance to chemicals, he advocates new ways of growing food and returning to more historic methods such as building nitrogen in soils by using legumes; using rotational cropping; deploying smaller machinery (controlled now by robotics); embracing vertical farming.

“It is about using systems from many years ago but in a more effective and efficient way,” says Hill. Optimistic about delivering on the Government’s nature recovery plan, he believes farmers should see natural capital as a revenue generator as they work with developers on BNG and corporate businesses transitioning to a nature-positive ambition to secure future investment.



INTERVIEW WITH  
**Professor David Hill CBE**  
Chairman  
and Founder,  
Environment Bank

WRITTEN BY  
**Mark Nicholls**

Paid for by  
**Environment Bank**



Find out more at  
[environmentbank.com](http://environmentbank.com)

27 November 2017 (Nyahururu, Kenya)  
– Miriam Mbuki Koigu (L) and son Joel Koigu (R), farmers and beneficiaries of FAO’s Mechanization Programme for Conservation Agriculture, pose for a portrait at their piece of land near Nyahururu, Laikipia County, Kenya.



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# How **investing in agriculture** resilience can help feed the world

Progress made in reducing poverty and hunger has been lost, and many of the Sustainable Development Goals are unlikely to be achieved by the 2030 target date.



**Beth Bechdol**  
Deputy Director-General, Food and Agriculture Organization of the United Nations (FAO)

**T**he frequency and intensity of emergencies, disasters and conflicts worldwide are rising and contributing to growing numbers of people facing hunger. Around 828 million people go to bed hungry; shockingly, two-thirds of them are farmers — the very people expected to feed us cannot afford to feed themselves.

### Helping farmers tackle hunger by investing in agriculture

We must invest differently. The current reactive approach — dealing with one crisis at a time — fails to address the causes of vulnerabilities.

We prioritise the immediate needs of affected people for food aid, water and shelter but then neglect to address long-term impacts on people — such as farmers — and their livelihoods. When farmers lose crops and livestock due to droughts or floods, they may lack the means to replant their fields or purchase animals, hindering their ability to make a living and produce food.

We must make more meaningful investments in agriculture. Today, only 8% of global humanitarian financing goes to agricultural investments. The rest is for direct food assistance. We need a better balance, and we need to put resources (seeds, tools, veterinary

assistance) in farmers' hands. Farmers need access to the knowledge and tools to be equipped before disaster strikes. Why wait until an emergency — when it's too late?

### Global agrifood systems transformation can end hunger

Investing in agriculture is almost 10 times more cost-effective than traditional, direct food assistance. In Mozambique, with just \$5, the Food and Agriculture Organization (FAO) can vaccinate a farmer's goat. This can save the animal (worth \$75) and provide a child with two glasses of milk daily.

We must pivot to resilience strategies and commit to agrifood systems transformation — from production to consumption. FAO's expertise is unique in the United Nations system. We lead

international efforts to end hunger and malnutrition and leverage science and innovation to tailor interventions to countries' specific needs.

We also believe that creating impact at scale requires commitment from all stakeholders and meaningful private sector engagement. We are working closely with partners to build a better food future for all.

**Today, only 8% of global humanitarian financing goes to agricultural investments.**

*The views expressed in this publication are those of the author(s) and do not necessarily reflect the views or policies of FAO.*

## How top food brands can transform our **agricultural land**

Food brands and supermarkets have the power to make nature-positive food the norm. Rather than bending nature to produce food, food can be designed for nature to thrive.



**Reniera O'Donnell**  
Food Initiative Lead, Ellen MacArthur Foundation

**E**verything we eat has been designed by brands and supermarkets. They decide and design how our food looks and tastes, its nutritional value and impact on nature. Many of these players are part of a problem that sees almost a third of all food production wasted and nearly 10% of the world's population go hungry.

However, their size, influence and the opportunities presented by a circular economy means food businesses can become part of the solution and redesign food that is not only nutritious but allows nature to thrive.

### Benefits of a circular economy

We are currently locked into a system that is destroying our environment and cannot work in the long term. Industrial farming has turned agriculture into a leading source of greenhouse gas emissions and pollution, and it's driving the extinction of many species.

In stark contrast, the circular economy is driven by design to eliminate waste and pollution, circulate products and materials, and regenerate nature. This presents leading brands and supermarkets with the massive opportunity to create a circular design-led approach that ensures we work with nature, not against it.

By rethinking the ingredients they use and how they're

produced, food designers can provide choices that are better for customers, farmers and the environment.

Circular design for food allows us to unlock substantial environmental, economic, and yield benefits by combining regenerative production with three other sourcing opportunities, leveraging ingredients that are diverse, upcycled, and lower impact. While each opportunity brings its own benefits for people and nature, these are maximised when the opportunities are combined.

**By rethinking the ingredients they use and how they're produced, food designers can provide choices that are better for customers, farmers and the environment.**

### Rethinking product design

Redesigning their product portfolios in this way and applying circular economy principles across all aspects of food design — including product concept, ingredient selection and sourcing and packaging — will allow brands and supermarkets to not only create but

meet growing consumer demand for more products that have a positive impact.

People are calling for meaningful solutions to global challenges. Shifting our food system to be circular by design is one of the most powerful things we can do to tackle climate change, build biodiversity and eliminate food waste.

**i** Join the Big Food Redesign Challenge or learn more at [ellenmacarthurfoundation.org](http://ellenmacarthurfoundation.org)

# How regenerative agriculture drives growth for farmers and lowers environmental impacts



The future of farming is regenerative. Regenerative agriculture practices can reshape global agriculture and farming systems as we face the challenges of climate change and food security.



**Jessica Christiansen**  
Head of Sustainability and Business Stewardship, Crop Science, Bayer

**R**egenerative agriculture, put simply, is about 'producing more with less while restoring more.' It will play an increasingly important role in supporting food security and sustainable food production. This is because, unlike conventional farming, regenerative practices offer a way to deliver long-term gains for nature while at the same time allowing for improvements in farm productivity and incomes.



**Axel Trautwein**  
Head of Regulatory Science, R&D, Crop Science, Bayer

**Taking regenerative agriculture practices to farmers**  
If adopted widely, regenerative farming - with its focus on soil health - has the potential to boost harvests with less land, fewer resources and a lower climate and environmental footprint. This, in turn, can deliver positive outcomes for species and habitats, help restore ecosystems and improve soil conditions.

Scientific innovations may be created in the lab and the greenhouse, but they are always developed with the farmer's needs in mind and deployed taking into

account the specific conditions of each farm, whether large or small. Such a farmer-centred approach will help enable regenerative agriculture practices on a wider scale.

Bayer has the facilities to provide farmers with an entire system of agriculture solutions. Solutions were previously seen as falling into three separate categories: (1) Seeds and traits; (2) Crop protection; and (3) Digital technology. Now, we increasingly look at them as one holistic offering.

**Matching solutions to the conditions of each farm**

Resilience is a key focus of Bayer's system approach. By treating each farm as an ecosystem itself and using digital tools to tailor solutions to the conditions on the ground, our systems can help farmers meet future expectations and adapt to uncertainty and change.

Farmers can then make informed decisions on what to plant at which density and when to apply nutrients, crop protection and water on their land. This means they can grow more crops

with fewer resources and less environmental impact while improving the profitability of each acre.

**Modern, sustainable crop protection chemistry**

Innovations in crop protection are one of the key building blocks of our system approach to regenerative agriculture. Crop protection directly supports farmers in feeding the world because it safeguards around 30% of yields worldwide — equivalent to feeding over 2 billion people.

Our tailored solutions help growers maximise the land and crops that feed, fuel and clothe the population — sustainably. They will also be able to adapt to changing climate or weather conditions more efficiently. We aim to provide growers with digitally enabled solutions for the precise application of modern crop protection — with the right input, in the right place, at the right time and in the right amount.

**How biologicals can advance regenerative agriculture**

Nitrogen-containing fertiliser is commonly used in agriculture today. But simply creating synthetic nitrogen fertiliser requires huge amounts of energy and accounts for about 3% of global greenhouse gas emissions. That's why regenerative farming uses sustainable alternatives where available.

Biologicals can reduce the amounts of synthetic nitrogen fertilisers with nitrogen-fixing microbes. They also complement chemical crop protection for pest and disease control. Biological products, therefore, allow farmers to effectively protect their crops while limiting environmental impacts.

**Shaping the regenerative future of agriculture**

Agriculture solutions such as these give back to nature by prioritising soil health, removing carbon from the atmosphere, conserving water and maintaining or potentially restoring biodiversity. By attending to each farm's needs, we can unlock the potential of regenerative farming practices.

Partnerships across the agriculture value chain will play a crucial role in bringing regenerative agriculture solutions to scale. That's why it's time to work together to make them more widely available while always being mindful of farmers' specific needs and challenges.

Paid for by Bayer

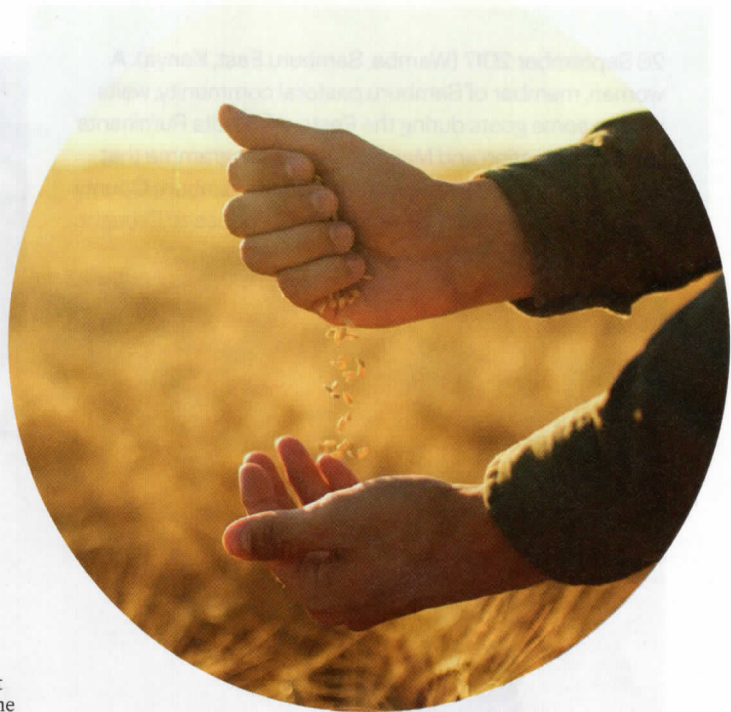


Scan the QR code to find out more



# Finance is the key to unlocking regenerative agriculture

When managed in the right way, agriculture offers a huge opportunity for us to reach global net zero targets through carbon sequestration.



**Richard Zaltzman**  
Chief Impact Officer,  
EIT Food

**W**hile our current food system contributes to one-third of GHG emissions, evidence shows that it has huge potential to be part of the climate solution. Sustainable and regenerative farming has a key role to play, encompassing a broad range of context-specific farming practices that work in harmony with biodiversity to improve soil health and boost resilience.

#### Shifting to sustainable farming practices

As it stands, shifting to regenerative methods takes time and carries risk, which is currently shouldered entirely by farmers who are often already working on extremely tight margins. Food producers understand their land and are more invested in its health and quality than anyone. However, they lack the financial support to transition to sustainable farming practices. Innovative financial mechanisms are key to helping alleviate these risks and to plug finance gaps including training costs, inputs such as new seeds and mitigating yield loss.

#### A sector ripe for impact investment

Consumer demand for sustainable food alternatives is rapidly increasing, bringing a host of exciting new investment opportunities across supply chains. Our research shows that over half of Europeans take sustainability into account when making food choices. But during a time when food products are becoming more expensive, consumers should not be expected to bear the costs of the regenerative agriculture transition either.

Analysis from the Food and Land Use Coalition shows that an annual investment of \$35-40 billion is required to shift procurement from buying commodities to investing in sustainable supply chains and deploying innovative finance to reach currently underfinanced areas. Impact investors can also support the shift away from high-carbon inputs across complex and global value chains towards more localised production.

The pay-off is significant: by 2030, this investment could unlock an annual opportunity worth \$530 billion for businesses associated with the transition to sustainable food production.

Regenerative agriculture practices can also draw CO<sub>2</sub> from the atmosphere and lock it into soils, providing high-quality carbon sequestration – a key component of the EU's net zero strategy.

#### Scaling the opportunities through innovation

Startups such as Fyteko, which is developing next-generation bio crop inputs including bio-herbicides and Paltech, which has designed a mechanical weeding robot to support weed control on organic farms are evidence of the growth and scaling that are possible when investment reaches regenerative agriculture innovation.

Significant benefits can be realised by bringing new technologies directly to farmers. EIT Food's Test Farms programme links agritech startups with farmers and testing land, enabling entrepreneurs to validate and test their products and services, showcase their business to customers and investors and, in the longer term, support the regenerative transition.

#### Investing in sustainable food supply chains

Impact investors have an exciting opportunity to deploy innovative financing at the root of food supply chains to support climate resilience and biodiversity restoration. Regenerative agriculture overlaps with many of the other shifts that are needed to transform our food system, including healthy diets, food loss and waste. This means that regenerative agriculture will become an increasingly critical area for investment and innovation over the next decade.

There is a strong case for impact investors to work together to create a 'Coalition of Capital', building on the foundation of organisations like EIT Food which seed the first critical stage and de-risk later investments. We invite you to join us, to invest in sustainable agriculture and the future of food production.

**Regenerative agriculture will become an increasingly critical area for investment and innovation over the next decade.**

Paid for by **EIT Food**



Co-funded by the European Union



**i** If you'd like to know more about EIT Food's innovative work supporting regenerative agriculture and to get involved, contact us: [info@eitfood.eu](mailto:info@eitfood.eu)

28 September 2017 (Wamba, Samburu East, Kenya). A woman, member of Samburu pastoral community, waits next to some goats during the Peste des Petits Ruminants (PPR) vaccination and Mass treatment programme that FAO and Red Cross Kenya carried out in Samburu County – as part of the Central Emergency Response to Drought.



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