

## Can we create the "perfect" farm? – Brent Loken

About 10,000 years ago, humans began to **farm**. This **agricultural revolution** was a **turning point** in our history that enabled people to **settle, build and create**. In short, **agriculture enabled the existence of civilization**.

Today, **approximately 40 percent** of our planet is **farmland**. Spread all over the world, these **agricultural lands** are the pieces to a **global puzzle** we are all facing: in the future, **how can we feed every member of a growing population a healthy diet?** Meeting this goal will require nothing short of a **second agricultural revolution**.

The **first agricultural revolution** was **characterized by expansion and exploitation, feeding people at the expense of forests, wildlife, and water and destabilizing the climate** in the process. That's not an **option** the next time around.

Agriculture **depends on a stable climate with predictable seasons and weather patterns**. This means we can't keep **expanding** our agricultural lands, because doing so will **undermine the environmental conditions that make agriculture possible** in the first place.

Instead, the next agricultural revolution will have to **increase the output of our existing farmland for the long term while protecting biodiversity, conserving water, and reducing pollution and greenhouse gas emissions**. So what will the future farms look like?

This drone is part of a **fleet that monitors the crops** below. The farm may look **haphazard** but it is a **delicately engineered** use of the land that intertwines **crops and livestock with wild habitats**. **Conventional farming methods cleared large swathes of land and planted them with a single crop, eradicating wildlife and emitting huge amounts of greenhouse gases** in the process. This **approach aims to correct that damage**.

Meanwhile, moving among the crops, teams of field robots **apply fertilizer in targeted doses**. Inside the soil, hundreds of **sensors gather data on nutrients and water levels**. This information **reduces unnecessary water use** and tells farmers where they should apply **more and less fertilizer** instead of causing pollution by **showering it across the whole farm**.

But the farms of the future won't be all **sensors and robots**. These technologies are **designed to help us produce food in a way that works with the environment rather than against it, taking into account the nuances of local ecosystems**. Lower-cost **agricultural practices** can also **serve those same goals** and are much more **accessible to many farmers**.

In fact, many such **practices** are already **in use today** and stand to have an **increasingly large impact** as more farmers **adopt them**. In Costa Rica, farmers have **intertwined farmland with tropical habitats** so successfully that they have significantly **contributed to doubling the country's forest**

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cover. This provides food and habitat for wildlife as well as natural pollination and pest control from the birds and insects these farms attract, producing food while restoring the planet. In the United States, ranchers are raising cattle on grasslands composed of native species, generating a valuable protein source using production methods that store carbon and protect biodiversity. In Bangladesh, Cambodia, and Nepal, new approaches to rice production may dramatically decrease greenhouse gas emissions in the future. Rice is a staple food for three billion people and the main source of livelihood for millions of households. More than 90 percent of rice is grown in flooded paddies, which uses a lot of water and releases 11 percent of annual methane emissions, which accounts for one to two percent of total annual greenhouse gas emissions globally.

By experimenting with new strains of rice, irrigating less, and adopting less labor-intensive ways of planting seeds, farmers in these countries have already increased their incomes and crop yields while cutting down on greenhouse gas emissions. In Zambia, numerous organizations are investing in locally specific methods to improve crop production, reduce forest loss and improve livelihoods for local farmers. These efforts are projected to increase crop yield by almost a quarter over the next few decades. If combined with methods to combat deforestation in the region, they could move the country toward a resilient, climate-focused agricultural sector. And in India, where up to 40 percent of post-harvest food is lost or wasted due to poor infrastructure, farmers have already started to implement solar-powered cold storage capsules that help thousands of rural farmers preserve their produce and become a viable part of the supply chain. It will take all of these methods, from the most high-tech to the lowest-cost, to revolutionize farming.

High-tech interventions stand to amplify climate- and conservation-oriented approaches to farming, and large producers will need to invest in implementing these technologies. Meanwhile, we'll have to expand access to lower-cost methods for smaller-scale farmers. This vision of future farming will also require a global shift toward more plant-based diets and huge reductions in food loss and waste, both of which will reduce pressure on the land and allow farmers to do more with what they have available.

If we optimize food production, both on land and at sea, we can feed humanity within the environmental limits of the earth, but there's a very small margin of error, and it will take unprecedented global cooperation and coordination of the agricultural lands we have today.