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**

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.