In 2019, we will continue to witness the negative effects of climate change on global food production. As temperatures rise, droughts will threaten crops and biodiversity loss will decrease yields and erode soil quality. The necessity of sustainable farming practices, which have less negative environmental effects and deal with climate change, will therefore increase. In the coming years, three shifts will transform agriculture: from an overuse of pesticides to precision farming, from traditional to intelligent farming, from high environmental costs to climate-smart solutions. These are the signs of the next Green Revolution.

Our observations

• According to a 2019 scenario article by Bloomberg, the coming year will bring more food insecurity, food shortages, food-fueled unrest, and migration due to hunger. These predictions are not unrealistic in light of the political environment and climate change related weather events that we have already seen in 2018.

• Many studies predict that yields will decline when temperatures rise. The MIT 2018 Food, Water, Energy and Climate Outlook predicts that negative climate change effects on yields and productivity are smaller for the developed world and larger for the rest of the world.

• The majority of farms worldwide are small (less than 2 hectares of agricultural area), of which 74% are in Asia, 9% in sub-Saharan Africa, and 7% in Central Europe and Central Asia. Only 4% of farms are in industrialized countries. Recently, a crowdsourcing citizen science project has shown that the proportion of smallholder farms may be much larger than previously thought. Contrary to most of today’s approaches, to be effective, improvements in agriculture will have to encompass larger numbers of smallholder farms in less developed countries.

• Though precision agriculture is very costly, its benefits outweigh the costs for most developing countries. And with the costs of sensors, other hardware and software steadily declining, the advantages that come with agricultural technology will be further democratized. Projections show that by 2024, the majority of small farms in the U.S. will leverage precision agriculture. In developing countries, precision metrics are already available to small farms in the form of ubiquitous data from satellite imagery, sent to farmers’ mobile phones. Mobile-enabled agricultural technology is key to the next Green Revolution, as it offers a way to reach farmers in remote areas with low-key technologies. Projects have already proven to be successful in many developing countries.

• As agricultural technology typically demands big investments, new ways to share costs and information are on the rise in developing areas. For instance, a free peer-to-peer service that enables farmers to share information via text messages, without an internet connection or having to leave their farm, offers a solution to farmers in African countries (e.g. Wefarm). The more elaborate FAO agricultural services apps provide farmers with real-time information on weather, livestock care, markets and nutrition.

• Sustainability is gaining traction among Western consumers, which is, for instance, visible in the growing popularity of vegan food. According to the Future 100: 2019 trend report by JWT Intelligence, Britain’s vegan population increased from 150,000 to 542,000 in just 10 years. In the U.S., sales of plant based food rose by 8.1% in 2017, topping $3.1 billion.
Connecting the dots

The Green Revolution of the mid-20th century brought an agricultural transformation which more than tripled the world food production in half a century. Food production per person grew sharply, despite the rapid growth of the global population. This success was most visible with rice growers in Asia and the fact that people across the globe were lifted out of poverty. Generally speaking, this was the result of the global introduction of inorganic pesticides, machinery and high-yield crop varieties that had previously only been used in some Western nations. However, as the effects of climate change and the environmental damage caused by farming take their toll, evidence shows that the productivity gains of the first Green Revolution will begin to plateau amid accumulated environmental problems. Because of this, a second Green Revolution is needed to intensify agricultural production in a sustainable manner. Three signs point to this next shift in agriculture.

First, there is a gradual shift from overuse of pesticides to precision farming. The Green Revolution resulted largely from increased use of inorganic fertilizers and manufactured pesticides. Over time, however, the excessive use of pesticides, herbicides, and fertilizers brought extensive collateral damage to the environment, leading to biodiversity loss, pesticide resistance, pollution of freshwater supplies, soil degradation and erosion, and harm to our health. Precision farming offers a means for farmers to minimize the use of these products. It employs aerial images from satellites or drones, weather forecasts, and soil sensors to manage crop growth in real time. Low-key precision farming solutions begin with satellite imagery. Ubiquitous data from satellites is then turned into agricultural advice, by indicating what is needed per plot of land and sending warnings for drought, flooding and diseases. It leads to higher crop yields and more efficient use of seeds, water and fertilizers. In developing countries, mobile phone-based services to provide this information are highly successful in empowering farmers. The success of these projects in China can also yield significant teachings for India, which also has many small land-holding farmers.

Second, climate-smart solutions will start spreading across the world. In a world of climate change, climate-smart agriculture can de-risk investments in agriculture and help food-insecure regions. During the Green Revolution, new crop varieties and livestock breeds led to sharp increases in food production worldwide. Again, new crops are necessary and readily available, such as plant varieties that are more efficient at converting nutrients to biomass, tolerate drought and/or increases in salinity, or with resistance to specific diseases. Other climate-smart solutions involve adjustments to the changing climate. Whereas the Green Revolution led to the industrialization of agriculture and strained fresh water resources, new saline agriculture techniques use salt water for irrigation, yielding plants that look and taste exactly like their freshwater counterparts. Another example of a climate-smart solution for protection against droughts while improving yield, is to unlock the potential of microbes by coating seeds with microbes, for instance, as is done by the start-up Indigo. Furthermore, 2019 will further prove its relevance in creating sustainable crops, as it offers the possibility to alter the genes of crops in a precise way, e.g. to make them more pest- or drought-resistant.

Third, climate-smart solutions will start spreading across the world. In a world of climate change, climate-smart agriculture can de-risk investments in agriculture and help food-insecure regions. During the Green Revolution, new crop varieties and livestock breeds led to sharp increases in food production worldwide. Again, new crops are necessary and readily available, such as plant varieties that are more efficient at converting nutrients to biomass, tolerate drought and/or increases in salinity, or with resistance to specific diseases. Other climate-smart solutions involve adjustments to the changing climate. Whereas the Green Revolution led to the industrialization of agriculture and strained fresh water resources, new saline agriculture techniques use salt water for irrigation, yielding plants that look and taste exactly like their freshwater counterparts. Another example of a climate-smart solution for protection against droughts while improving yield, is to unlock the potential of microbes by coating seeds with microbes, for instance, as is done by the start-up Indigo. Furthermore, 2019 will further prove its relevance in creating sustainable crops, as it offers the possibility to alter the genes of crops in a precise way, e.g. to make them more pest- or drought-resistant.

2019 will be a challenging year for food security, but the mentioned transitions point to the possibilities of a next Green Revolution, supporting not just big agriculture corporations but especially small farms in developing countries to increase food production in a sustainable way.

Implications

- China is taking many steps to increase the sustainability of agriculture by providing small land-holding farmers with technological support and scientific insights. This initiative already involves 209 million farmers and 377 million hectares. The success of these projects in China can also yield significant teachings for India, which also has many small land-holding farmers.
- Already existing and less advanced technology can contribute significantly to closing the yield gap in developing countries. However, the debate on how to empower farmers is polarized and figures such as Louise Fresco and international NGO Hivos, which is working with advanced technologies in order to support farmers, claim that especially these countries need high-tech solutions in order to emancipate sustainable farming practices.