INTENSIVE CROPPING

A TROUBLED FUTURE FOR INDUSTRIAL FARMING

Less humus means lower fertility – something that no amount of fertilizer can solve. And new cultivation methods bring new problems.

Compared to other parts of the world, Europe has remarkably resilient soils. The mild climate puts few stresses on arable land. Farming is subject to numerous regulations that aim to protect the environment. Nevertheless, 35 percent of the agricultural land in the European Union shows signs of compaction, and 17 percent is degraded – with soils significantly damaged or even completely destroyed. Nearly 150 million hectares are subject to wind or water erosion: 42 million acres by wind, and 105 million by water.

Because of farming, 45 percent of Europe's soils have lost significant amounts of organic matter, including humus and soil organisms. The natural fertility of the fields has declined. In temperate climates their bad state can often be masked by mineral fertilizers and liming. But while crop yields are stable today, they may fail in the future.

What causes these problems? Decades of using "modern" techniques such as high-yielding seeds, fertilizers, pesticides, monoculture and irrigation have led to sharp rises in yields. This is the case in North and South America, Australia and northern China. Worldwide, farm production almost tripled in the last 50 years, while the area of agricultural land expanded by only 12 percent.

At the same time, precisely the same set of techniques, along with shorter rotations and fewer fallow periods, has caused the amount of humus – the organic matter – in the soil to decline. That removes the habitat of organisms that keep the soil loose and friable. The structure breaks down, and the soil becomes compacted. The range of soil functions is disrupted:

- Habitat (biodiversity, beneficial organisms)
- Regulation (water absorption, storage and purification; the breakdown of pesticides and other pollutants)
- Production (nutrient exchange and natural fertility).

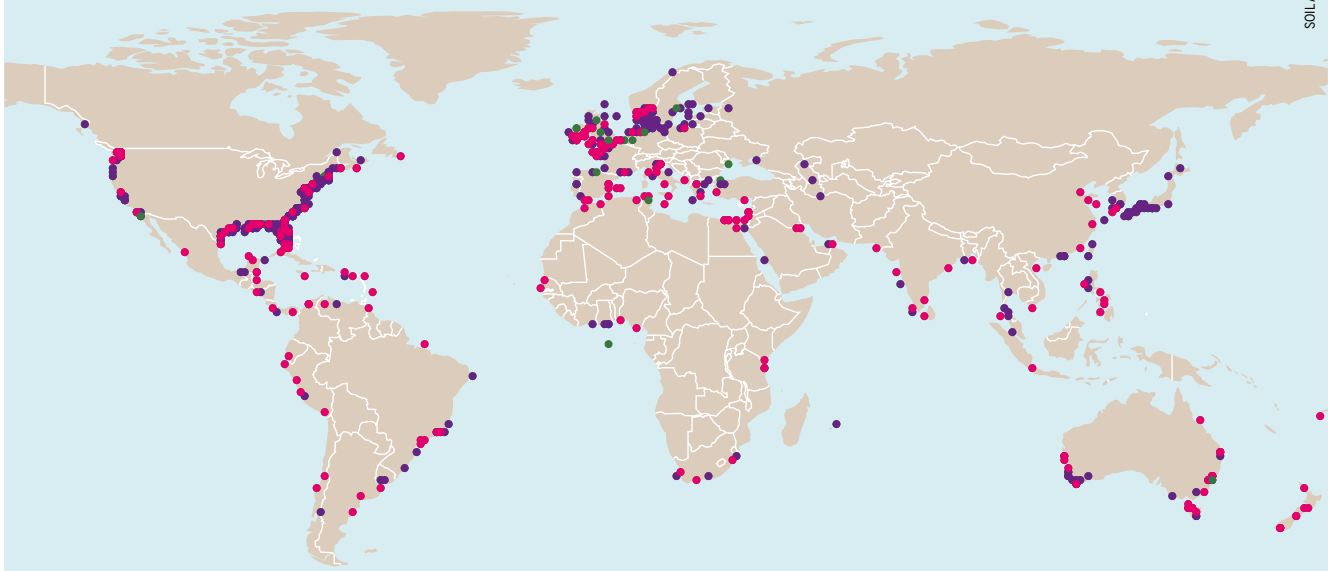
In the last two decades, no-till farming has been suggested as a means to combat soil erosion. This involves sowing seed

Excess fertilizer washes into rivers and is carried into the sea, where it causes algal blooms and destroys the ecological balance

COASTAL CRISIS

Regions polluted by an oversupply of nutrients and oxygen deficiency, 2010

SOIL ATLAS 2015 / UNEP



- Eutrophication (overfertilization, generally from agricultural nitrates and phosphates)
- Hypoxia (eutrophication as a result of oxygen deficiency; algal blooms, fish kill and dead zones)
- Recuperating

directly into the soil after the previous harvest, without first ploughing the land. Specialists call these methods "conservation agriculture" or "zero tillage". These methods are now widespread: in 2011, 125 million hectares were under "no-till", with 55 million in Latin America, 40 million in the United States and Canada, and 17 million in Australia.

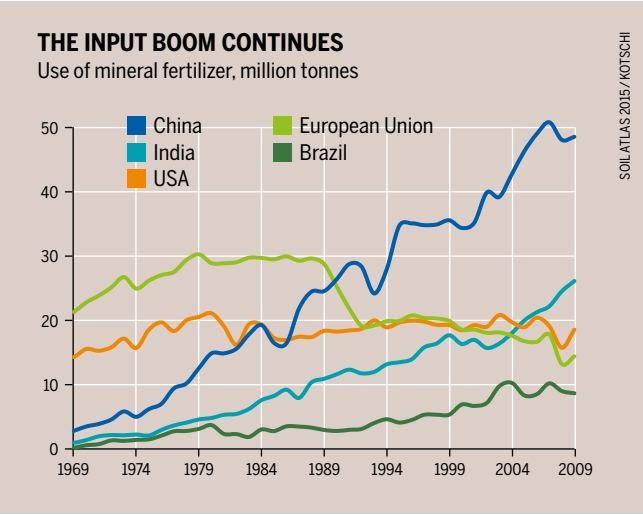
But merely throwing away the plough does not help overcome the problems of compaction and loss of humus. In general, direct seeding is not combined with rotating crops, which would loosen the soil by stimulating soil life and allowing roots to penetrate deeper. And many no-till farmers do not apply organic matter, which would build up the humus layer.

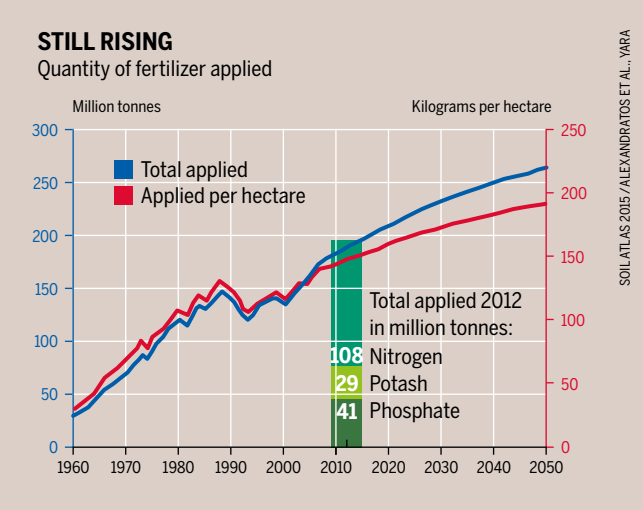
If the soil is not turned over by ploughing, weeds, pests and fungi can multiply quickly. So no-till farming often requires lots of herbicides and pesticides – an attractive market for the agrochemical industry and the producers of genetically modified seed. The chemicals kill all plants and animals that are not resistant to them. In Latin America, especially, vast no-till fields sown with soybeans are sprayed from planes. The surface and groundwater in these areas are contaminated with glyphosate, the world's best-selling herbicide.

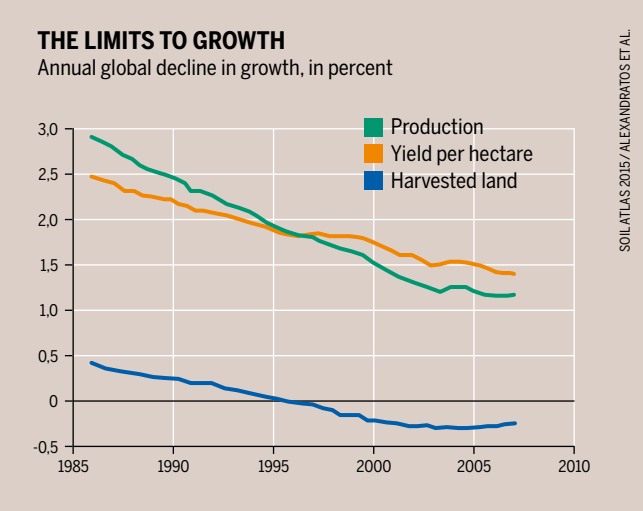
Phosphorus will also cause problems in the near future. This element is vital for plant growth, and is applied as a commercial fertilizer, just like nitrogen. But global phosphate supplies are being used up. Based on the current levels of demand, the world's known reserves will be exhausted in the next 50–100 years. Peak phosphorus output may be reached as early as 2030. Many experts believe that future consumption will have to come not from mines, but from recycling.

We currently waste phosphate. We must use it more efficiently and more sustainably. Phosphate prices are likely to rise, making new technologies more economic. But it will still be difficult to close the phosphate cycle.The main focus is on sewage sludge, which contains large amounts of phosphorus, as an adult human excretes 1.7 grams of this substance each day, 60 percent in the urine. But sewage sludge contains too many contaminants for direct use in farming. Furthermore, the large-scale extraction of phosphorus is expensive.

Mycorrhizal fungi offer another potential solution. These are symbiotic organisms that occur naturally in all soils. They colonize the roots of plants and provide them with considerably more water, nitrogen and phosphorus than the plants require. Little research has been done on the mechanisms that several thousand species of fungi use to extract phosphorus from the environment, or how these processes work in degraded soils and in various crop types. It is conceivable that these fungi could be used to convert sewage, human and agricultural waste into valuable fertilizer.







The ever-increasing use of synthetic fertilizers, especially in Asia, brings little: global yields are still rising, but at a slower pace