

WORLD

What If the World's Soil Runs Out?

A broken food system is destroying the soil and fuelling health crises as well as conflicts, warns Professor John Crawford of the University of Sydney.

By World Economic Forum | Dec. 14, 2012

This is a “what if” interview from the World Economic Forum’s Risk Response Network. To view the rest of the series, click [here](#).

It’s a strange notion, but some experts fear the world, at its current pace of consumption, is running out of useable topsoil. The World Economic Forum, in collaboration with TIME, talked to University of Sydney professor John Crawford on the seismic implications soil erosion and degradation may have in the decades to come.



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Is soil really in danger of running out?

A rough calculation of current rates of soil degradation suggests we have about 60 years of topsoil left. Some 40% of soil used for agriculture around the world is classed as either degraded or seriously degraded – the latter means that 70% of the topsoil, the layer allowing plants to grow, is gone. Because of various farming methods that strip the soil of carbon and make it less robust as well as weaker in nutrients, soil is being lost at between 10 and 40 times the rate at which it can be naturally replenished. Even the well-maintained farming land in [Europe](#), which may look idyllic, is being lost at unsustainable rates.

Why haven't we heard more about this?

Probably because soil isn't sexy. People don't always think about how it's connected with so many other things: health, the environment, security, climate, water. For example, agriculture accounts for 70% of our fresh water

use: we pour most of our water straight onto the ground. If soil is not fit for purpose, that water will be wasted, because it washes right through degraded soil and past the root system. Given the enormous potential for conflict over water in the next 20-30 years, you don't want to exacerbate things by continuing to damage the soil, which is exactly what's happening now.

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How does soil erosion happen?

Soil is a living material: if you hold a handful of soil, there will be more microorganisms in there than the number of people who have ever lived on the planet. These microbes recycle organic material, which underpins the cycle of life on earth, and also engineer the soil on a tiny level to make it more resilient and better at holding onto water. Microbes need carbon for food, but carbon is being lost from the soil in a number of ways. Simply put, we take too much from the soil and don't put enough back. Whereas the classic approach would have been to leave stubble in the field after harvest, this is now often being burnt off, which can make it easier to grow the next crop, or it's being removed and used for animal feed. Second, carbon is lost by too much disturbance of the soil by over-ploughing and by the misuse of certain fertilizers. And the third problem is overgrazing. If there are too many [animals](#), they eat all the plant growth, and one of the most important ways of getting carbon into the soil is through photosynthesis.

What happens if this isn't addressed?

There are two key issues. One is the loss of soil productivity. Under a business as usual scenario, degraded soil will mean that we will produce 30% less food over the next 20-50 years. This is against a background of projected demand requiring us to grow 50% more food, as the population grows and wealthier people in countries like China and India eat more meat, which takes more land to produce weight-for-weight than, say, rice.

Second, water will reach a crisis point. This issue is already causing conflicts in India, China, Pakistan and the Middle East and before [climate change](#) and food security really hit, the next wars are likely to be fought over unsustainable irrigation. Even moderately degraded soil will hold less than half of the water than healthy soil in the same location. If you're irrigating a crop, you need water to stay in the soil close to the plant roots. However, a staggering paper was published recently indicating that nearly half of the sea level rise since 1960 is due to irrigation water flowing straight past the crops and washing out to sea.

Who will be impacted the most?

Soil erosion is most serious in China, Africa, India and parts of South America. If the food supply goes down, then obviously, the price goes up. The crisis points will hit the poorest countries hardest, in particular those which rely on imports: Egypt, for example, is almost entirely dependent on imports of wheat. The capacity of the planet to

produce food is already causing conflict. A lot of people argue that food price hikes caused the Arab spring, and may even have contributed to the recent violence following the release of an anti-Islam film.

(MORE: [Food Fight! Stores, Producers, Consumers Battle over High Food Prices](#))

What about richer countries?

They will have to deal with more refugees fleeing from truly desperate situations. Then there's the fact that this is happening at a time of economic difficulty in the West, with growing disparities across society and some people already having to resort to charity to feed themselves. The connection here with health is significant. Cheap food tends to be low in protein and high in carbohydrate, which is exactly the wrong balance for a healthy society. By reducing food to a mere commodity, we have created a system that is degrading the global capacity to continue to produce food, and is fuelling a global epidemic of diabetes and related chronic disease. Obesity in the US cost 150 billion dollars – 20% of the health budget – in 2008, the latest figures available, and this huge cost will rise as the broken food system takes its toll.

Why is the food system broken?

The big picture is that the amount of land per person has been shrinking over the last 100 years: we now have about a quarter of a hectare per person on the planet and we're using half of the total land area on the globe for agriculture. If you think of that little quarter hectare, we're asking more of it than ever before, largely because of population and the modern diet, which is totally inappropriate. Governments have not got this right. We're subsidising unsustainable food production systems at the cost of our health and our environment. Soil is not costed into food, which means that farmers don't have the financial capacity to invest in their soil to turn the situation around. Crop breeding is exacerbating this situation. Modern wheat varieties, for example, have half the micronutrients of older strains, and it's pretty much the same for fruit and vegetables. The focus has been on breeding high-yield crops which can survive on degraded soil, so it's hardly surprising that 60% of the world's population is deficient in nutrients like iron. If it's not in the soil, it's not in our food.

What should be done about this?

Significant progress is technically quite straightforward. There's a lot we can do, we just have to choose to do it and provide the right support where it is needed. First-off I'd focus on getting carbon back into the soil, by reversing bad farming practices like tillage, nutrient mismanagement, removing stubble and over-grazing. We can add manure and consider using human waste from cities as fertiliser, instead of just flushing it all out to sea.

In the longer term, breeding targets need to focus more on human nutrition as well as productivity, and on traits that improve the soil. We need to find new ways of bringing together scientists and farmers to harness the expertise of both. From a policy standpoint, probably the most important thing is to find pricing mechanisms that

take into account the environmental, health and other costs of a broken system. Farmers need to be appropriately rewarded for regenerating the environment and producing food that supports a healthier society.

Finally we need to recognise that this is a global problem that would benefit from a global approach. We don't need to reinvent the wheel in each country, and we don't have time to do so. It takes decades to regenerate soil. I find it quite ironic that while the Mars Curiosity Rover is poking around looking for life in Martian soil, we're in the process of extinguishing life in our own.

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