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Losing Ground

By [Gordon Weiss](#) October 6, 2012

If we want to keep eating, it's time to stop treating our soil like dirt.

This is a slow-emergency story. Very slow. Move your mind from Internet time to the geological clock. Glacial time. Dirt time. And let's talk soil security.

Unless you are a gardener, a farmer, or a worm, the topic of dirt — or, more particularly, topsoil — probably doesn't often cross your mind.

The following equation will give you a sense of how things are looking at ground level. The US Department of Agriculture [estimates](#) that the world produces one inch (2.54 cm) of topsoil every 500 years, and loses 2.54 cm every 1,000 years or so, to erosion. So until recently Mother Nature experienced a net soil gain of one inch per millennium.

However human activity, it seems, is now outstripping nature's ability to replenish the earth's thin skin. One estimate is that we are now losing 2.54 cm every 40 years or so.

Now, increase humankind by one-third, to make nine billion people by 2050. Add global warming, with its consequent droughts and floods, which increase erosion — and we're scraping to make a mud pie.

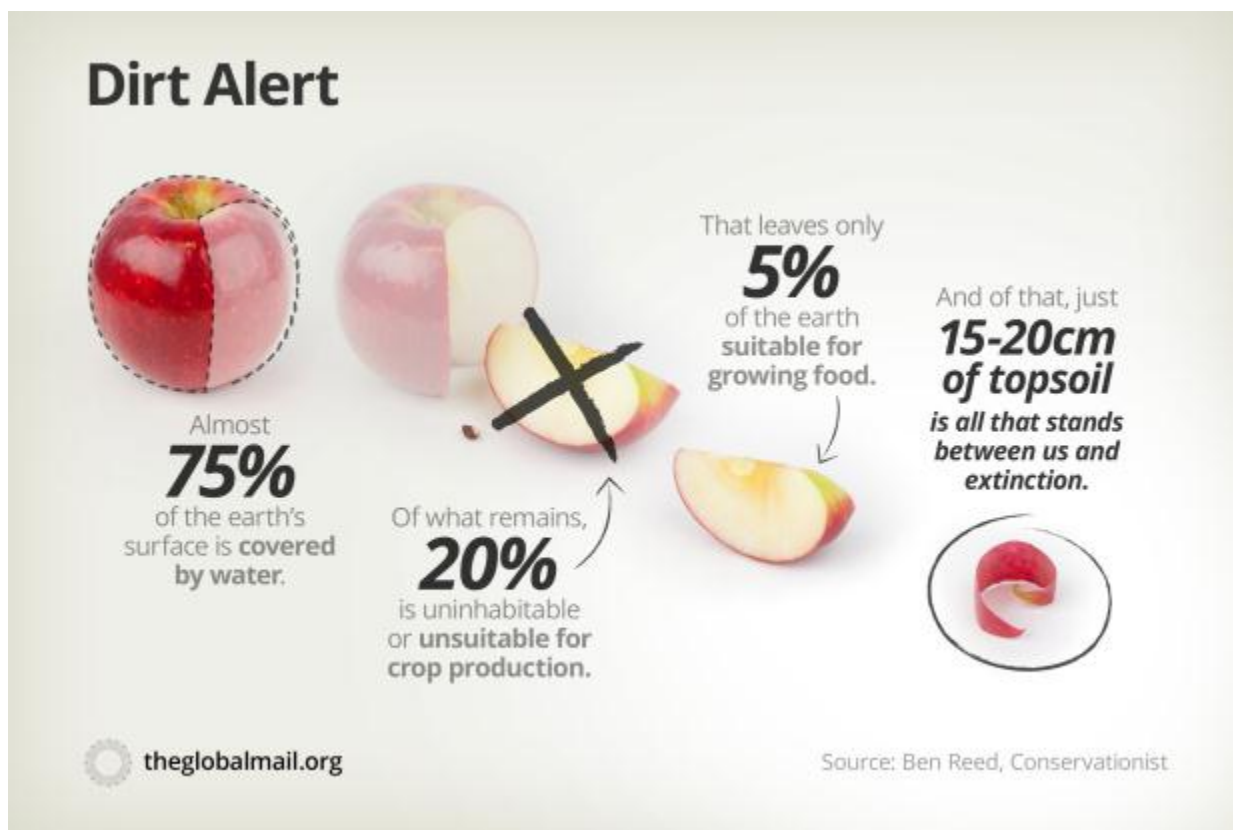
But the signs of hunger, of perpetual food crises, are already here.

“Like our clothes, white goods, and cars, food in Australia is relatively cheap, and we want it cheaper.”

IT'S BEEN SAID that the Arab Spring began “at the grocery store, not at a public meeting” — that was John Bradley, whose book *Inside Egypt: The Land of the Pharaohs on the Brink of a Revolution* predicted the fall of the Mubarak regime. And it's true that the protesters in Tahrir Square chanted, “Bread, dignity, and social justice”.

Similarly, Bradley believes that the [recent sudden rise](#) in maize and wheat prices — by 45 and 50 per cent, respectively — is the harbinger of global political unrest. The price jump is the result of a wheat-shrivelling drought in Russia in 2010, and the current drought gripping the United States — [the worst in that country's history](#).

Although food remains relatively cheap in the western world, hunger is biting in even the wealthiest of societies; both the [United Kingdom](#) and [Australia](#), for example, are experiencing growing demand for food charity. And, says Bradley, “The link between hunger and revolution is far stronger” than political analysts concede. Former Australian Prime Minister Kevin Rudd's [recent criticism](#) of the UN Food and Agriculture Organization is a reflection of global unease.



Jamie Ferguson/The Global Mail

The [G20 governments](#), the [United Nations](#), and the US government waited nervously until the recent September report from the US Department of Agriculture showed a [slight dip in prices](#). But a sense of teetering crisis still pervades.

What will almost certainly pass relatively unnoticed is that slow-moving crisis, depletion of the soil, that is so elemental to food security.

“Many scientists talk about ‘peak’ soil,” says Dr Alex McBratney, a soil scientist from the University of Sydney, and one of a small circle of scientists who spoke at a side event at the [Rio+20 Summit](#) at the UN in April this year, which was aimed at bringing the issue of soil degradation onto the UN agenda. McBratney, though, prefers “nadir” — a word that suggests an impending rock bottom, a soil-less earth.

Soil is renewed, literally, at a glacial pace. It is formed naturally from the erosions of rock, from living and dead vegetation, by microbes, and by the little creature Charles Darwin called “Nature's plough,” the earthworm. As water and tree roots break up nutrient-rich rocks pushing upwards from the earth's crust, worms munch leaves and nibble small rocks, then expel it all as mineral soil — a beautiful process. Darwin estimated that worms manufacture 10 to 20 tonnes of topsoil per acre (0.4 hectares) each year (about the thickness of an American dime).

“A single rainfall can wash away ... 20 years of worm work.”

Now, if you doubt our ability to destroy that which feeds us, a quick survey of history may jog your memory. To take you right back: in Mesopotamia, poor farming practices eroded much of that civilisation's lush landscape, and the Sumerian empire along with it, as food production slumped. The civilizations of the Mayans, Easter Island, and the Puebloan people of the southwestern United States are all thought to have collapsed, in part at least, because of the over-exploitation of soil, while the deserts, drylands, and stripped hills of Spain, Italy, Greece and much of the Mediterranean were caused by over-grazing.

Skip to the tractor-made dustbowl of the Midwest that emptied Oklahoma in the 1930s and the Australian dustbowl in New South Wales around the same time, which sprouted the world's second (after the US) soil-conservation authority.

When soil is most healthy, it not only smells good, but it's alive. There's more DNA in a handful of soil than in the human body. Soil generally contains a far greater biodiversity than the life it supports above it.

But not all soils are created equal. The soils of Britain, of European fields, of the American plains, and northern China are all rich and self-replenishing, and often many feet deep. Most Australian topsoil, in contrast to that of the world's great foodbaskets, is thin and poor. Australian farmers have traditionally used copious quantities of fertiliser and water to make it sustain crops, instead of the more difficult option of sustaining the soil itself.



This and other long-standing practices have wreaked havoc on the health of our soils, making life uncomfortable for worms, and ultimately for us.

Scientists consider that healthy soil can be measured by the relative abundance of carbon matter. When crops are harvested, the carbon so vital to make soil work goes with it, unless it is replaced. According to Alex McBratney, “The best Australian soil” — that of the West Australian wheat belt, the wheat and sheep belt which stretches across South Australia and Victoria, and the black-soil plains of northern NSW and Queensland — “holds about half the carbon it held before European settlement.” Until recently, Australian farmers didn't spare much of a thought for carbon replacement. But organisations like the Australian not-for-profit group [Soils for Life](#) are quietly showing that with balanced and nuanced management, Australia can have an [agricultural industry supported by sustainable soil](#).

The reason Australian scientists are necessarily at the forefront of efforts to conserve global topsoil stocks, which we are milking of carbon or ushering to the bottom of the ocean, is because of a history of corrosive farming practices on a paucity of topsoil. Just like the Mediterranean region, over-stocking with cattle has destroyed the vegetation to a point where it cannot maintain growth, and thereby hold on to and replenish the soil.

“Too often farmers take a cookie-cutter approach to farming on soils that are astonishingly diverse. The US Department of Agriculture counts 70,000 varieties of soil.”

The US Department of Agriculture counts 70,000 varieties of soil. A single rainfall can wash away 13 tonnes of topsoil from a hectare of land where soil has been unanchored by poor farming practices — or 20 years of worm work. A [Cornell University study](#) estimated that global soil stocks are being eroded 10 to 40 times faster than it can be replaced, and that 10 million hectares of cropland are being lost to erosion each year.

Over the 20th century, as the world's population tripled, outpacing our food-production capabilities, millions of Chinese, Indians and Africans starved to death. This was despite the fact that in the first half of the century, farming methods had been vastly improved and much more land had been dedicated to food production. In the second half of the century, food production doubled again thanks to a seven-fold increase in the application of nitrogen-based fertilisers, a three-fold increase in phosphorous fertilisation, huge irrigation schemes and the “green revolution” — which refers to the introduction of high-yield wheat, rice and maize varieties.

Hunter-gatherers require 20-100 hectares of land each for food, whereas these days an urban population can get by on as little as 0.2 hectares per person. While food production has been stagnant in Africa since the 1960s, rice production in Asia is now dropping, and wheat yields are generally static, when not dropping dramatically because of drought. And by 2050, available cropland is estimated to fall to just 0.1 hectare per person.



REMY GABALDA/AFP/Getty Images

The industrialisation of food production has, according to Montgomery, exhausted our capacity to extract any more from the one and a half billion hectares of land now being farmed globally. In his book he foresees that, “The lifespan of a civilisation is limited by the time needed for agricultural production to occupy the arable land and then erode through the topsoil.”

Our soil eco system credit card is maxed out, but we still want more.

Food in Australia is relatively cheap, and we want it cheaper. The combat between Australia’s two largest food chains, Coles and Woolworths, is wonderful for [citizens who think that their cost of living is skyrocketing \(it's not for most\)](#). But it forces farmers to make poor choices that exact a price on the holistic health of farm environments. Under such pressures, conventional industrial farming that corrupts soil quality is used for short-term gains that allow the farmer to service debts and purchase more fertilisers, pesticides and so on. It’s a death spiral.

In such a situation, says McBratney, increasing yields might seem counterproductive. But, as he points out, it’s growing things, whether crops or indigenous flora, which produces “root biomass, which increases the carbon content” of the soil.

When soil is most healthy, it not only smells good, but it’s alive. There’s more DNA in a handful of soil than in the human body.

And returning carbon is key to maintaining healthy soils. A great deal of Australian agriculture takes place on fragile land that is inherently carbon-poor. Outside the West Australian wheat belt, there is no tougher farming country than the poor sands of WA’s West Midlands region, 400 km north of Perth. Bob Wilson’s cattle graze on the poorest. “Soil carbon is the guts in the soil,” says Wilson, who has farmed there for 35 years. “If we can build that up, then we can move that ahead.”

So McBratney prescribes growing more plant life as a way of managing and renewing our topsoils. But you can put the fertiliser back in the shed. The kind of crop management McBratney advocates is called carbon

farming. For a start, it involves *not* ploughing in between harvests, and also resting pasture by rotating the grazing of livestock over a number of fields. He also recommends not tilling the soil, because, he says, not exposing damp sod to the sun can preserve as much as 50 to 75 mls of water annually in dry areas, and leaving crop stubble or deep-rooted native grasses undisturbed further helps to stop drying and erosion by wind.

Stubble, grass roots, and purpose-grown vegetation also re-carbonise the soil, encouraging soil biota (a hectare of land might contain 10 to 20 tonnes of the insects and microbe biota that populate your average patch) which in turn produce the nitrogen, phosphate, and sulphur necessary for plant life. In this way, chemicals and fertilisers are minimised, and a diversity of flora and fauna is encouraged.

Carbon farming not only protects land and water, but in turn protects peripheral ecosystems such as hedges or swamps that provide “eco-services” like water filtration or shelter for birds and fish, which add to the general health of the environment. These farms can become giant carbon sinks, producing soil organic carbon, an additional potential revenue stream for farmers in a stable carbon-trading system.

Much of Western Australian farming and grazing country was cleared after World War II. The fragile ecosystem was razed using de-commissioned army tanks. “Put a plough into this country,” says Wilson, “and the soil just blows away.” And that's what happened.

But for the past 20 years, Wilson's cattle have grazed on tagasaste, a perennial deep-rooted legume shrub, which has been planted like hedgerows 10 metres apart, with local flora and weeds allowed to flourish in between, which maintains biodiversity. Over the past decade, as carbon farming-consciousness has increased, 100,000 hectares of tagasaste has been planted, and around 95 per cent of WA farmers now use no-till farming. “Our farmers are the leaders in these practices, because our soil is so fragile,” says Wilson, who believes that his year-round evergreens are actually building an active fertile base of humus that meets the Kyoto standards for carbon-neutral grazing.

Australia's poor soil and damaging agricultural practices were singled out in Jared Diamond's 2005 book *Collapse*, which gave a gloomy diagnosis for Australia's agricultural future. For Australia to maintain the kind of food security now being sought abroad by China, let alone to play a part in the estimated 75 per cent boost in food production required to feed the world's projected mid-century population, it will take more than just holding our ground. By actively boosting soil-carbon sequestration to at least match carbon loss, improving productivity, and building the health of the soil, Australia can have a secure, long-term agricultural industry. Underfoot, under-appreciated, and still misunderstood, the humble clod and his mate the humble worm, sit at the heart of that ambition.