Preserve soil's riches

The International Year of Soils draws attention to our vital dependence on the fertile crumb beneath our feet. Soil is renewable, but it takes careful stewardship to keep it healthy and plentiful.

Soil is sometimes described as the Earth's skin — a thin living membrane stretching across landscapes. It is, in many ways, one of the vital organs that support life on the planet. Soils contain three times as much carbon as plants, and twice the amount found in the Earth's atmosphere. We rely on it for the vast majority of our agricultural production. It provides nutrients and water for the world's forests, grasslands and deserts. It filters and retains water. It's a locus for the cycling of nutrients and heavy metals, and both a source and sink of greenhouse gases. In short, soil is a physical and biogeochemical wonderland.

In recognition of the importance and vulnerability of this critical natural resource, the 68th United Nations General Assembly declared 2015 the International Year of Soils. At the Nature journals we celebrate this designation with a collection of articles and opinion pieces (www.nature.com/soils). The International Year of Soils is intended to highlight just how central soil is to the sustainability of the human endeavour, and to promote the importance of soil research.

Arguably, soil is a natural resource of far more fundamental value to humanity and to the planet than oil or platinum; without it, there would be little for humans, or animals, to eat. And like many natural resources, soil is increasingly being commoditized. For example, widespread media reports highlight the rise in controversial acquisitions of agricultural land in Africa by investors in food-importing countries such as China and Saudi Arabia — despite the fact that food security remains a perennial challenge in Africa itself. Individuals can buy into farms and forests through publicly traded real estate investment trusts and agricultural mortgage-backed securities.

Soil is a renewable resource, but it is not inexhaustible: care must be taken in maintaining and preserving soils and their fertility if they are to retain their value. That lesson hasn't always been easy. In the Dust Bowl of the 1930s, that thin skin of productive earth was stripped away from the Great Plains of North America. As wheat production expanded across the plains in the early twentieth century, farmers removed native grasses, which held soil together, even during drought conditions. With the arrival of drought in 1931, the wheat crops failed and the tilled soil quickly began eroding in the wind. As the drought continued through the decade, millions of acres of soil were lost.

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Soils are also under pressure today. Sub-Saharan Africa is experiencing a degradation of soils that is much slower than in the American Dust Bowl, but no less disastrous. In this slow-motion calamity, farmers across much of the region have used little or no fertilizers over decades of farming. Each year, soils become increasingly depleted of nutrients, as the nutrients extracted by the crops are harvested, but not replaced. As discussed in a Perspective by Christopher B. Barrett and Leah E. M. Bevis on page 907 of this issue, farming on low-fertility soils can create self-reinforcing poverty traps: low-productivity soils prevent farmers from accumulating the capital necessary to make their soils more productive. And soils depleted of essential micronutrients such as iodine or zinc have led to negative health outcomes around the world.

Where mineral fertilizers are readily available, on the other hand, their excessive use is leading to the eutrophication of inland waters, acidification of soils, and increased soil emissions of greenhouse gases. Future changes in climate are likely to add stress to our soils. Shifts in climate towards fewer but more intense precipitation events can increase rates of runoff and soil erosion, while more intense drought stress can reduce protective vegetative biomass.

Because of the massive volumes of carbon stored in soils, they can represent an important feedback to global climate. Arctic and peat soils represent some of the largest pools of soil carbon, and are particularly vulnerable to changes in climate and land use. Increased soil temperatures may accelerate soil carbon mineralization and emissions of carbon dioxide and methane, but they can also increase nutrient availability and productivity. The ongoing expansion of agricultural systems into forested areas can result in substantial losses of soil carbon.

The International Year of Soils arrives in the midst of ambitious efforts to advance our knowledge of soil science. These range widely in scope, from efforts to digitally map the soils of the world to the development of inexpensive, low-tech solutions that can provide farmers in the developing world with access to the kinds of information farmers in the developed world rely on to ensure their soils remain healthy and productive.

With recognition of the universal and essential value of soils to humanity and the biosphere, and with investment in research, conservation and sustainable development, we can ensure that the Earth's skin can maintain a healthy and productive glow. ❐