



Why civilisation depends on the protection of topsoil



UNDER THE MICROSCOPE

WE TAKE topsoil completely for granted, but our civilisation depends on it and we are losing our precious topsoil at an alarming rate. We produce most of our food in topsoil, but we are losing about 1 per cent of our topsoil every year to erosion, mostly caused by **agriculture**. Conventional farming, based on ploughing, leaves soil vulnerable to erosion by wind and water, but a new sustainable approach, known as “no-till”, is being adopted in some parts of the world. The new approach is described by Dr Huggins and JR Reganold in *Scientific American* (July 2008).

Ploughing is the traditional method of preparing the land for sowing crops, used since about 1500 BC. This turning of the soil buries crop residues, animal manure and weeds, and also warms and aerates the soil. But, ploughing also leaves the soil susceptible to erosion by wind and water and leads to degradation of **agricultural** land, posing a global threat to food production and to rural livelihoods, particularly in densely populated developing counties.

Agriculture expanded enormously over the course of the 20th century in order to feed the growing world population, and it consequently has a growing impact on the environment and on human health. But producing enough food is not enough – it must be done in a sustainable manner, leaving the soil capable of continuing high-volume

food-production. One approach to achieve this is no-till farming.

No-till minimises soil disruption. Crop residues are left on the fields after harvesting and this acts as a mulch protecting the soil from erosion and maintaining soil productivity. Seeds are sown using special machines that penetrate through the mulch to the undisturbed soil below, depositing the seeds there, where they germinate and surface as the new crop.

A down-side to the no-till method is that the necessary machinery is initially quite expensive and the method also calls for increased use of expensive pesticides and herbicides to deal with weeds and pests that ploughing would have minimised.

Earth is covered by a thin layer of topsoil, on average only about one metre deep. Healthy topsoil is a living matrix that houses a fantastically diverse community of biological organisms – bacteria, nitrogen-fixing fungi and earthworms. The earthworms tunnel through the soil, creating channels that provide aeration and their digestive tracts transform fine grains of sterile rock and plant detritus into fertile excrement.

Topsoil forms naturally, but at a very slow rate. It grows at a rate of three to six centimetres over several hundred years, but is being eroded globally at a much faster rate. Cropland topsoil in the US is being eroded at least 10 times faster than it is being replaced. Worldwide, more than 25 million acres of cropland are degraded or lost annually as rain and wind sweep away topsoil.

No-till farming, on the other hand, can reduce soil erosion rates down close to soil production rates. It also stabilises soil structure and encourages high numbers of earthworms.

Civilisations depend on their topsoils. Simple calculations show that the rate at which the plough-based **agriculture** erosion of topsoil exceeds the natural replenishment of this vital resource neatly accounts for the life spans of many past civilisations – 800 to 2000

years.

No-till **agriculture** is currently practised on only 7 per cent of **agricultural** land worldwide. Eighty five percent of this no-till land is located in North and South America. Adoption rates of no-till methods are very low of Europe, Africa and Asia.

It is particularly difficult to establish this technique in developing countries because of the expensive equipment needed initially and because farmers there usually use crop residues for fuel, animal feed and other purposes. In Europe, governments do not encourage no-till (unlike in the US) and there are many restrictions on herbicide and pesticide use.

When the Earth had a small population, people could move from place to place and give depleted soil a chance to regenerate. But, with more than six billion people on the planet presently, that option no longer exists. We simply must now learn to farm without losing soil.

Progress is slow in establishing no-till **agriculture** on a global basis. But there is no doubt that measures must be established to conserve topsoil. At the moment we are “mining” this effectively non-renewable resource.

Soil erosion is as big a problem as **global warming** in the opinion of many experts, but it doesn't get the same publicity. It is time to give it serious attention.

A popular book, *Dirt – The Erosion of Civilisations*, by David Montgomery (University of California Press, 2007) is a very good exposition of the importance of topsoil and the problem we face today. Montgomery is a geomorphologist who studies how landscapes change with time.

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