Peak Soil

Industrial Civilization
On The Verge of Eating Itself

Dr. Sahadeva dasa

Peak Soil

Industrial Civilization
On The Verge of Eating Itself

By
Dr. Sahadeva dasa

B.com., FCA., AICWA., PhD
Chartered Accountant

Soul Science University Press
www.soilchange.com

Readers interested in the subject matter of this
book are invited to correspond with the publisher at:
SoulScienceUniversity@gmail.com +91 98490 95990
or visit DrDasa.com

First Edition: February 2016

Soul Science University Press expresses its gratitude to the Bhaktivedanta Book Trust International (BBT), for the use of quotes by
His Divine Grace A.C.Bhaktivedanta Swami Prabhupada.

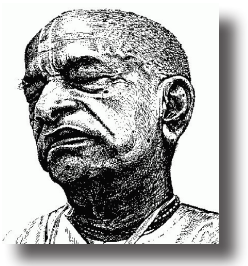
ISBN 978-93-82947-44-8

Published by:
Dr. Sahadeva dasa for Soul Science University Press

Printed by:
Ranjit Print Services, Hyderabad

Dedicated to....

His Divine Grace A.C.Bhaktivedanta Swami Prabhupada



On the earth we can see so many living entities are coming out, beginning from the grass, then so many insects, reptiles, big trees, then animals, birds, beasts, then human beings. They are all coming from the earth, and they are living at the expense of earth. The earth is supplying food to everyone. As the mother gives life or maintains the child by the milk of her breast, similarly, the earth mother is maintaining all different types of living entities. There are 8,400,000 different forms of life, and the earth, mother earth is supplying food.

~ Srila Prabhupada (Lecture, Ratha-yatra -- New York, July 18, 1976)

By The Same Author

Oil-Final Countdown To A Global Crisis And Its Solutions
End of Modern Civilization And Alternative Future
To Kill Cow Means To End Human Civilization
Cow And Humanity - Made For Each Other
Cows Are Cool - Love 'Em!
Let's Be Friends - A Curious, Calm Cow
Wondrous Glories of Vraja
We Feel Just Like You Do
Tsunami Of Diseases Headed Our Way - Know Your Food Before Time Runs Out
Cow Killing And Beef Export - The Master Plan To Turn India Into A Desert
Capitalism Communism And Cowism - A New Economics For The 21st ` Century
Noble Cow - Munching Grass, Looking Curious And Just Hanging Around
World - Through The Eyes Of Scriptures
To Save Time Is To Lengthen Life
Life Is Nothing But Time - Time Is Life, Life Is Time
Lost Time Is Never Found Again
Spare Us Some Carcasses - An Appeal From The Vultures
An Inch of Time Can Not Be Bought With A Mile of Gold
Cow Dung For Food Security And Survival of Human Race
Cow Dung – A Down To Earth Solution To Global Warming And Climate Change
Career Women - The Violence of Modern Jobs And The Lost Art of Home Making
Working Moms And Rise of A Lost Generation
Glories of Thy Wondrous Name
India A World Leader in Cow Killing And Beef Export - An Italian Did It In 10 Years
As Long As There Are Slaughterhouses, There Will Be Wars
Peak Soil – Industrial Civilization, On The Verge of Eating Itself
Corporatocracy : The New Gods – Greedy, Ruthless And Reckless
(More information on availability on DrDasa.com)

Contents

Preface

The foundation of any civilization is adequate availability of food and water. So anyone with common sense would think the top priority of nations throughout history would be taking good care of the land.

Apparently not — the decline of most civilizations is due in large part to soil degradation and erosion. Common sense is very uncommon. In his book, Dirt: The Erosion of Civilizations, David R. Montgomery discusses past civilizations around the globe, which typically last a few centuries before ruining their soil.

Our present-day civilization is following in the footsteps of it's predecessors. Only difference is here everything is global. All the previous calamities were local in nature. The world today shares a common fate, thanks to interdependence and interconnectivity. Earlier we suffered in isolation and now we go down, all together.

Soil is a finite and non-renewable resource, meaning its loss and degradation is not recoverable within a human lifespan.

Despite the fact that soil can be formed by weathering it is considered a non-renewable resource because the process of formation of soil is a very slow process. The estimated global average rate of soil formation is about 400 years for each centimeter of soil. But for us, it takes only a couple of decades to ruin a landscape completely.

UN FAO estimates that 'today, 33 percent of land is moderately to highly degraded due to the erosion, salinization, compaction, acidification and chemical pollution of soils.'

Foundation of our civilization is eroding while we are caught-up in the non-essentials. The leaders are also too busy putting out proverbial fires, to see the point.

Dr. Sahadeva dasa
3rd January 2016
Secunderabad, India

1.

We've Forgotten That Land Is The Foundation Of Life

Peak Water, Peak Oil…Now, Peak Soil?

Peak Soil refers to the declining production capacity or the life sustaining capability of the world's soil. Our usage or exploitation of Soil has 'peaked' and now onwards, all the graphs or vital signs will be pointing downwards.

Soil is becoming endangered. This reality needs to be part of our collective awareness in order to feed the a growing human and animal population.

And a big part of reversing soil decline is carbon, the same element that is overheating the planet.

"Keeping and putting carbon in its rightful place" needs to be the mantra for humanity if we want to continue to eat, drink and combat global warming, concluded 200 researchers from more than 30 countries who had assembled in Reykjavík, Iceland, in May 2013.

"There is no life without soil," said Anne Glover, chief scientific advisor to the European Commission.

"While soil is invisible to most people it provides an estimated 1.5 to 13 trillion dollars in ecosystem services

annually," Glover said at this conference on Soil Carbon Sequestration.

The dirt beneath our feet is a nearly magical world filled with tiny, wondrous creatures. A mere handful of soil might contain a half million different species including ants, earthworms, fungi, bacteria and other microorganisms. Soil provides nearly all of our food – only one percent of our calories come from the oceans.

Soil also gives life to all of the world's plants that supply us with much of our oxygen, another important ecosystem service. Soil cleans water, keeps contaminants out of streams and lakes, and prevents flooding. Soil can also absorb huge amounts of carbon, second only to the oceans.

It takes half a millennia to build two centimetres of living soil and only seconds to destroy it.

Each year, 12 million hectares of land, where 20 million tonnes of grain could have been grown, are lost to land degradation. In the past 40 years, 30 percent of the planet's arable (food-producing) land has become unproductive due to erosion. Unless this trend is reversed soon, feeding the world's growing population will be impossible.

The world will likely need "60 percent more food calories in 2050 than in 2006, according to a new paper released May 30 by the World Resources Institute. Reaching this goal while maintaining economic growth and environmental sustainability is one of the most important global challenges of our time, it concludes.

Urban development is a growing factor in loss of arable lands. One million city dwellers occupy 40,000 hectares of land on average, says Rattan Lal of Ohio State University.

Plowing, removal of crop residues after harvest, and overgrazing all leave soil naked and vulnerable to wind and

rain, resulting in gradual, often unnoticed erosion of soil. This is like tire wear on your car – unless given the attention and respect it deserves, catastrophe is only a matter of time.

Erosion also puts carbon into the air where it contributes to climate change. But with good agricultural practices planting cover crops and leaving crop residues, soils can go from a carbon source to a carbon solution.

Soil can be a safe place where huge amounts of carbon from the atmosphere could be sequestered.

When a plant grows it takes CO2 out the atmosphere and releases oxygen. The more of a crop – maize, soy or vegetable – that remains after harvest, the more carbon is returned to the soil. This carbon is mainly found in humus – the rich organic material from decay of plant material. Soil needs to contain just 1.5 percent carbon to be healthy and resilient – more capable of withstanding drought and other harsh conditions.

Healthy soils equals healthy crops, healthy livestock and healthy people.

However, most soils suffer from 30 to 60 percent loss in soil carbon. Soils are like a bank account. You should only draw out what you put in. Soils are badly overdrawn in most places.

Farmers and pastoralists (ranchers) could do "miracles" in keeping carbon in the soil and helping to pull carbon out of the atmosphere and feed the world if they followed healthy agricultural practices.

The world's 3.4 billion ha of rangeland and pastures has the potential to sequester or absorb up to 10 percent of the annual carbon emissions from burning fossil fuels and cement production, estimates Ólafur Arnalds, a soil scientist at the Agricultural University of Iceland.

Eliminating overgrazing and using other pasture management techniques will reduce the number of animals

on the land in the short term but it is better for the long term health of grazing lands. While these practises can help with climate change, there many other good reasons to adopt them.

That view is echoed by many since determining exactly how much carbon a farm field or pasture can absorb from the atmosphere is highly variable and difficult to determine.

Proper land management can help with climate change but in no way does it reduce the need to make major reductions in fossil fuel use, said Guðmundur Halldórsson, a research co-ordinator at the Soil Conservation Service of Iceland, co-host of the conference.

The real key is adopt practices that enhance soil health to improve food productivity.

That approach is much more likely to help in improve local livelihoods, protect water resources, improve biodiversity, reduce erosion and help put carbon back into the ground where it belongs.

We are overexploiting our lands, trying to squeeze more out of the land than it can handle. We can call it 'killing the milk cow'. We can no longer live off the land as we once did.

Take the example of Iceland. Situated in the North Atlantic, the windy island was once mostly covered by forests, lush meadows and wetlands when the first settlers arrived nearly 1,000 years ago. By the late 1800s, 96 percent of the forest was gone and half the grasslands destroyed by overgrazing. Iceland became one the world's poorest countries, its people starved and its landscape remains Europe's largest desert.

Of necessity, Iceland pioneered techniques to halt land degradation and in restoration. And for more than 100 years the Soil Conservation Service has struggled but the gains are small and very slow in coming. Today at least half of the

former forests and grasslands are mostly bare and subject to severe erosion by the strong winds.

Iceland relies far less on agriculture now and the harsh lessons of poor land management of the past are irrelevant to the 90 percent of Icelanders who now live in urban areas.

The public is not much concerned with land restoration because they've forgotten that land is the foundation of life.

Source

By Stephen Leahy, Inter Press Services (IPS) News Agency, May 31, 2013

Reference

Skeptical Science, 16 June 2013 by John Hartz

Al-Kaisi, Mahdi. July 24, 2000. Soil Erosion: An agricultural production challenge. Integrated Crop Management. Iowa State University.

Benton, M. 2003. When Life Nearly Died. The greatest mass extinction of all time. Thames & Hudson.

Bibliography on soil erosion and soil and water conservation. (Washington, U. S. Govt. print. off., 1938), by Stanley Harry Gaines

2.

Peak soil

World Is Not Having Enough Dirt To Go Round

In a world plagued with worries about depleting resources, having enough dirt to go round seems like the least of our problems.

Oil is what most of us think of as a strategic resource, yet in the long run it is soil which is the more important. Even so, people's eyes tend to glaze over when talk turns to soil conservation, maybe because it's so much easier to see the immediate relevance of rising gas prices and climate change in these days of peak oil. So while public attitudes on climate change have shifted dramatically over the past few years, a crisis in global agriculture remains hidden: we are, and have long been, using up the supply of topsoil we rely on to grow our food.

Those of us living in modern cities can easily forget that without fertile soil we could not survive. Yet modern agricultural techniques are eroding the very soil on which food production depends. This ongoing soil loss means we face the problem of feeding a growing population from a shrinking land base. This should be troubling because even a casual

reading of history shows that, under the right circumstances, climatic extremes, political turmoil or resource abuse can bring down a society. And in the century ahead we face all three, as shifting climate patterns and depleted oil supplies coincide with progressive loss of farmland.

We have, in effect, been 'mining' soil for much of human history. Indeed, the decline in fertility and loss of agricultural lands through wind and water erosion is a problem as old as agriculture itself. *Civilizations from Babylon to Easter Island have proven only as durable as the fertility of their land.* The Roman Empire left Eastern Mediterranean agriculture in a state from which it has yet to recover. But the problem of soil loss is not just ancient history. Exacerbated by modern industrial farming, global agricultural soil loss of about a millimetre per year outpaces soil formation by at least tenfold.

Over the past century, the effects of long-term soil erosion were masked by bringing new land under cultivation and by developing fertilizers, pesticides and crop varieties to compensate for declining soil productivity. However, such 'agrotech' fixes become progressively more difficult to maintain because crop yields decline exponentially as soil thins. While fertilizers can temporarily offset the effects of soil erosion, the long-term productivity of the land cannot be maintained in the face of the reduced organic matter and thinning of soil that characterize industrial agriculture. Replacing soil fertility with chemical fertilizers and genetically engineered crops can boost productivity in the short run, but a world stripped of its soil cannot, in the end, feed itself.

Feeding an increasing human population without further increasing crop yields would require doubling the area presently under cultivation. Such vast tracts of land could only be found in tropical forests and subtropical grasslands – like

the Amazon and the Sahel. Experience shows that farming such marginal lands produces an initial return, but the land quickly becomes degraded and has to be abandoned – if the population has somewhere to go. With the land best suited for agriculture already under cultivation, expansion into marginal areas is not a long-term strategy.

Small And Soil Friendly

In contrast to the amount of arable land, which has varied widely through time and across civilizations, the amount of land needed to feed a person has systematically declined. Hunting and gathering societies used from 20 to 100 hectares per person; our current use of 1.5 billion hectares of cultivated land to feed roughly 6 billion people equates to about 0.25 hectares of cropland per person. And by 2050 the amount of available cropland is projected to drop to less than 0.1 hectare per person. So, simply keeping up will require major increases in crop yields.

Before 1950, increases in global food production came by either enlarging the area under cultivation or improved husbandry. Since 1950 most of the increase has come from mechanization and intensified use of chemical fertilizers. The 'green revolution' doubled food production and averted a food crisis through increased use of chemical fertilizers, massive investments in irrigation infrastructure in developing nations and the introduction of high-yield varieties of wheat and rice capable of producing two or three harvests a year. Subsequently, however, growth in crop yields has slowed and achieving further substantial increases through conventional means seems unlikely – since crops don't take up half the nitrogen in the fertilizers farmers apply today, adding even more won't help.

So far, the promise of greatly increased crop yields from genetic engineering remains unfulfilled. And it could prove catastrophic, should genetically modified genes that convey sterility cross to non-proprietary crops. Does it even make sense to design crops that can't reproduce?

So how do we move to sustainable agriculture and still feed the world? The answer lies in better adapting what we do to where we do it. To do this we need to restructure agricultural subsidies to favour small-scale organic farms, encourage soil-friendly farming methods, and develop urban agriculture.

Among soil scientists, concern over the world's fast-depleting soil is almost universal.

Public dialogue and media portrayals of organic farming tend to the simplistic, pitting those who consider modern industrial farming unsustainable against those who argue that organic methods are unethical when hunger plagues so many people. Representatives of agribusiness like to question the relevance of organic agriculture in feeding a 10-billion-person planet and instead promote agrochemicals and genetically modified crops as keys to food security. Yet many studies over the past decades have shown that crop yields under organic methods are comparable to those achieved through conventional methods. Indeed, some of the highest crop yields come from small-scale, labour-intensive organic farms.

Many currently profitable industrial farming methods would become uneconomic if their true costs were incorporated into market pricing. Direct financial subsidies and failure to include the costs of depleting soil fertility encourage practices that degrade the land. In the US, for example, the top 10 per cent of agricultural producers now receive 66 per cent of the more than $10 billion handed out in annual subsidies, and they use it to support large farms

growing single crops, particularly wheat, corn and cotton. We need to curb the $300 billion in global agricultural subsidies – more than six times the world's annual development assistance budget – that encourage unsustainable industrial farming. Shifting public support to make organic agriculture more competitive is part of the answer.

Industrial agriculture will never provide a way out of hunger for the third of humanity that lives on less than two dollars a day. More innovative thinking is necessary, and on a global scale. If we are to feed those too poor to buy food, the naïve idea that all we need to do is produce cheap food must go. While food was still cheap there were still far too many hungry people on the planet. A different approach – one that might actually work – would be to promote the prosperity of small farms in the Global South so that subsistence farmers can feed themselves, generate an income and become stewards of the land. To do this they need access to enough land to grow a marketable surplus, and an agricultural support system that builds on indigenous agricultural knowledge and provides appropriate tools.

Finally, as oil and the cost of shipping food around the world become more expensive, it will become increasingly attractive to take food production to the people – into the cities. With 800 million people already involved, urban farming is not restricted to developing countries; by the late 1990s two-thirds of Moscow's families were engaged in urban agriculture. City agriculturalist Will Allen has been pioneering urban farming in Milwaukee, Wisconsin, as a way to provide healthy, affordable diets to low-income urban populations. He has come to realize that urban farms not only deliver fresh produce to city dwellers at a lower cost of transportation, but that they typically use far less

water, fertilizer and oil, and can reduce urban waste disposal problems and costs.

Among soil scientists, concern over the world's fast-depleting soil is almost universal. Unfortunately, saving dirt just isn't a very sexy issue. However, time grows short and industrial agriculture is proving an expensive and increasingly risky dead end. We are left with a fundamental challenge: how do we merge traditional agricultural knowledge with modern understanding of soil ecology to promote and sustain intensive agriculture? Herein lies our real hope for feeding a hungry world.

Source

David R Montgomery, Dirt: The Erosion of Civilizations and professor of geomorphology at the University of Washington.

Published on December 1, 2008 by David R. Montgomery

Reference

David R Montgomery, New Internationalist, Issue 418

Foth, Henry D. (1984). Fundamentals of soil science. New York: Wiley. ISBN 0-471-88926-1.

Merrington, Graham (2002). "Soil erosion". Agricultural Pollution: Environmental Problems and Practical Solutions. Taylor & Francis. ISBN 978-0-419-21390-1.

3.

Peak Soil Is No Joke

Civilization's Foundation Is Eroding

The thin layer of topsoil that covers the planet's land surface is the foundation of civilization. This soil, typically 6 inches or so deep, was formed over long stretches of geological time as new soil formation exceeded the natural rate of erosion. But sometime within the last century, as human and livestock populations encroached new areas, soil erosion began to exceed new soil formation over large areas.

This is not new. In 1938, Walter Lowdermilk, a senior official in the Soil Conservation Service of the USDA, traveled abroad to look at lands that had been cultivated for thousands of years, seeking to learn how these older civilizations had coped with soil erosion. He found that some had managed their land well, maintaining its fertility over long stretches of history, and were thriving. Others had failed to do so and left only remnants of their illustrious pasts.

In a section of his report titled "The Hundred Dead Cities," he described a site in northern Syria, near Aleppo, where ancient buildings were still standing in stark isolated relief, but they were on bare rock. During the seventh century,

the thriving region had been invaded, initially by a Persian army and later by nomads out of the Arabian Desert. In the process, soil and water conservation practices used for centuries were abandoned. Lowdermilk noted, "Here erosion had done its worst … if the soils had remained, even though the cities were destroyed and the populations dispersed, the area might be re-peopled again and the cities rebuilt, but now that the soils are gone, all is gone."

Wind and water erosion take a toll. The latter can be seen in the silting of reservoirs and in satellite photographs of muddy, silt-laden rivers flowing into the sea. Pakistan's two large reservoirs, Mangla and Tarbela, which store Indus River water for the country's vast irrigation network, are losing roughly 1 percent of their storage capacity each year as they fill with silt from deforested watersheds.

Ethiopia, a mountainous country with highly erodible soils, is losing close to 2 billion tons of topsoil a year, washed away by rain. This is one reason Ethiopia always seems to be on the verge of famine, never able to accumulate enough grain reserves to provide meaningful food security.

Soil erosion from the deterioration of grasslands is widespread. The world's steadily growing herds of cattle and flocks of sheep and goats forage on the two-fifths of the earth's land surface that is too dry, too steeply sloping, or not fertile enough to sustain crop production. This area supports most of the world's 3.3 billion cattle, sheep, and goats, all ruminants with complex digestive systems that enable them to digest roughage, converting it into beef, mutton, and milk.

An estimated 200 million people make their living as pastoralists, tending cattle, sheep, and goats. Since most land is held in common in pastoral societies, overgrazing is difficult to control. As a result, half of the world's grasslands

are degraded. The problem is highly visible throughout Africa, the Middle East, Central Asia, and northwest China, where the growth in livestock numbers tracks that in human numbers.

Nigeria, Africa's most populous country, is losing 351,000 hectares (867,000 acres) of rangeland and cropland to desertification each year.

Iran, with 73 million people, illustrates the pressures facing the Middle East. With 8 million cattle and 79 million sheep and goats — the source of wool for its fabled rug-making industry — Iran's rangelands are deteriorating from overstocking. In the southeastern province of Sistan-Balochistan, sand storms have buried 124 villages, forcing their abandonment. Drifting sands have covered grazing areas — starving livestock and depriving villagers of their livelihood.

Neighboring Afghanistan is faced with a similar situation. The Registan Desert is migrating westward, encroaching on agricultural areas. A U.N. Environment Programme (UNEP) team reports that "up to 100 villages have been submerged by windblown dust and sand." In the country's northwest, sand dunes are moving onto agricultural land in the upper reaches of the Amu Darya basin, their path cleared by the loss of stabilizing vegetation from firewood gathering and overgrazing. The UNEP team observed sand dunes 15 meters high blocking roads, forcing residents to establish new routes.

China faces similarly difficult challenges. After the economic reforms in 1978 that shifted the responsibility for farming from large state-organized production teams to farm families, China's cattle, sheep, and goat populations spiraled upward. While the United States, a country with comparable grazing capacity, has 97 million cattle, China has

a slightly smaller herd of 82 million. But while the United States has only 9 million sheep and goats, China has 284 million. Concentrated in China's western and northern provinces, sheep and goats are destroying the land's protective vegetation. The wind then does the rest, removing the soil and converting productive rangeland into desert.

China's desertification may be the worst in the world. Wang Tao, one of the world's leading desert scholars, reports that from 1950 to 1975 an average of 600 square miles turned to desert each year. By century's end, nearly 1,400 square miles (3,600 square kilometers) were going to desert annually. Over the last half-century, some 24,000 villages in northern and western China have been entirely or partly abandoned as a result of being overrun by drifting sand.

China is now at war. It is not invading armies that are claiming its territory, but expanding deserts. Old deserts are advancing and new ones are forming like guerrilla forces striking unexpectedly, forcing Beijing to fight on several fronts.

Soil erosion often results from the demand-driven expansion of cultivation onto marginal land. Over the last century or so there were massive cropland expansions in two countries — the United States and the Soviet Union — and both ended in disaster.

During the late 19th century, millions of Americans pushed westward, homesteading on the Great Plains, plowing vast areas of grassland to produce wheat. Much of this land — highly erodible when plowed — should have remained in grass. This overexpansion culminated in the 1930s Dust Bowl, a traumatic period chronicled in John Steinbeck's novel The Grapes of Wrath. In a crash program to save its soils, the United States returned large areas of eroded cropland

to grass, adopted strip-cropping, and planted thousands of miles of tree shelterbelts.

The second major expansion came in the Soviet Union beginning in the mid-1950s. In an all-out effort to expand grain production, the Soviets plowed an area of grassland larger than the wheat area of Australia and Canada combined. The result, as Soviet agronomists had predicted, was an ecological disaster — another Dust Bowl. Kazakhstan, where the plowing was concentrated, has abandoned 40 percent of its grainland since 1980. On the remaining cultivated land, the wheat yield per acre is one-sixth of that in France, Western Europe's leading wheat producer.

A third massive cropland expansion is now taking place in the Brazilian Amazon Basin and in the cerrado, a savannah-like region bordering the basin on its south side. Land in the cerrado, like that in the U.S. and Soviet expansion, is vulnerable to soil erosion. This cropland expansion is pushing cattle ranchers into the Amazon forests, where ecologists are convinced that continuing to clear the area of trees will end in disaster. Reporter Geoffrey Lean, summarizing the findings of a 2006 Brazilian scientific symposium in London's Independent, notes that the alternative to a rainforest in the Amazon would be "dry savannah at best, desert at worst."

Civilization depends on fertile soils. Ultimately, the health of the people cannot be separated from the health of the land. Conserving and rebuilding soils should be the number one priority but unfortunately it is not, at least at the moment.

Soils are like a bank account. You should only draw out what you put in." -- Rattan Lal, Ohio State University

Source

Lester Brown, 29 September 2010

Adapted from Chapter 2, "Population Pressure: Land and Water" in Lester R. Brown, Plan B 4.0: Mobilizing to Save Civilization.

Reference

Eswaran, H.; R. Lal; P.F. Reich (2001). "Land degradation: an overview". Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification. New Delhi, India: Oxford Press.

Stockings, Mike; Murnaghan, Niamh. (2000), Land Degradation - Guidelines for Field Assessment, Norwich, UK.

4.

Peak Soil

Are We Taking More Than the Earth Can Give?

Modern humans are aware of contemporary global menaces: a changing climate, peak oil, a dodgy economy that could collapse at any moment, and the extinction of honey bees, but relatively few of us know that the world's productive soils are also under threat. What has been most noticeable is that the price of food and fuel has increased markedly over the past decade, during when we have also experienced an economic crash. We fear another such shock, even amid whispers of "growth", which can only be expected to be of a slow stuttering kind, since we cannot significantly grow our rate of production of resources. Thus, the price of a barrel of crude oil has more than trebled since 2004 (though there is a temporary slump in prices right now), while global production has practically flat-lined at around 75 million barrels a day over that same period, leading to the view that we have reached the ceiling of our oil supply.

Given that all components of human civilization are inextricably linked to petroleum, either as a chemical

feedstock or a fuel, if we cannot elevate our production rate of oil, nor can we grow the global economy. The troubles of the human condition, however, are more fundamental, since we are steadily using-up Mother Earth's bestowal to us of fertile soil. This has been dubbed "peak soil" in analogy with "peak oil", and while the two phenomena are not of the same kind, they are connected, as indeed are all the elements like soil, land, water, climate (change), honeybees, oil and food.

Alice Friedmann wrote, in the context of the unsustainable nature of growing land-based crops and producing biofuels from them: "Iowa has some of the best topsoil in the world, yet in the past century it's eroded from an average of 18 inches to less than 10 inches (Pate 2004, Klee 1991). When topsoil reaches 6 inches or less (the average depth of the root zone in crops), productivity drops off sharply (Sundquist 2005). Soil erodes geologically at a rate of about 400 pounds of soil per acre per year (Troeh 2005). But on over half of America's best crop land, the erosion rate is 11,000 pounds per acre, 27 times the natural rate, and double that on the worst 7% of cropland (NCRS 2006), partly because farmers aren't paid to conserve their land, and partly because hired farmers wrench every penny of profit they can on behalf of short-sighted owners."

This is deeply disturbing, all the more so because rates of erosion that are in excess of the natural rate of soil formation are not restricted to Iowa, but are a global feature. According to a report by the World Resources Institute (WRI) some 20% of the world's cultivated areas are afflicted by land degradation, and in order to feed Humankind over the next 40 years, food production must be increased by 60%. This conclusion is drawn, in part, from the expectation that another 2.5 billion people will be added to the current number of just over 7 billion of us, and that a rising middle

class will have greater expectations of their diet, particularly in wanting to eat more meat. The amount of food that is wasted is another consideration, and combining this factor with population increase suggests a daily gap between the demand for food and what is likely to be available by 2050 of 900 calories (kilocalories) per capita.

Many of the limitations to meeting such a testing challenge are those of the modern industrialised agricultural system per se. The factors involved are complex and inseparable, in short providing a nexus. The impact of climate change adds further weight to the problem, and seven clear courses of action have been identified, by which we might adapt to ensure food security into the future. 24% of anthropogenic greenhouse gas emissions are from agricultural activities, including methane from livestock, nitrous oxide from fertilizers, carbon dioxide from running tractors and combine harvesters etc. and from changes in land use. Furthermore, 70% of all human water consumption is claimed by agriculture. In the last 40 years, 20 million square kilometers of land have suffered degradation, which accounts for around 15% of the total land area of the Earth, while 30% of the originally available cropland is now unproductive. As noted for Iowa, the degradation of topsoil is occurring many times faster than the rate at which soil is generated by Nature, which can take longer than 500 years to form just an inch of it.

There is an increasing pressure on water supplies too, which may begin to struggle in meeting demand in the food basket regions of the Americas, west and east Africa, central and eastern Europe, Russia, the Middle East and south and south-east Asia, within only 12 years. As alluded earlier, the costs of both fuel and food have risen markedly over the past decade: food prices follow oil prices because oil and gas are involved

at all principal stages in the food production and distribution chain. The World Bank has proposed restricting oil prices as a means to mitigating food price increases. Indeed, were the price of oil not high, no one would bother to produce it in the first place. There is also the critical question of how high an oil price the economy can bear, before it falls into recession and finally collapses.

According to the U.S. National Agriculture Statistics there has been a decline from about 6 million bee-hives in 1947 to 2.4 million in 2008, representing a reduction by 60%. Over the past 10 years, beekeepers in both the U.S. and Europe have reported annual hive losses of 30%, and last winter losses of 50% in the U.S. were not uncommon, with worst case examples of 80-90%. Since one third of all food crops rely on bees to pollinate them, if this "bee-collapse" continues, the effect on world food production could be calamitous. Various causes have been brought culpable for killing the bees, including pesticides, parasitic mites, intensive monoculture farming methods and urban development. The nexus of components that we have identified is totally at odds with providing sufficient food for a growing population, with a growing appetite for meat.

The various ills we have described are outcomes of the industrial nature of monoculture farming, which frets the ecology and does not restore it, including the soil itself. Alternatively, methods of regenerative agriculture and permaculture have been advanced. These help to rebuild the soil, making it more fertile through increasing its soil organic matter content (SOM), including establishing a healthy network of microbes and other creatures to live in it (the soil food web), thus securing fertility and crop productivity. Such methods of ecological food production can be done on a more

local scale, and the food consumed closer to where it is grown, largely obviating the necessity for an extensive transportation/distribution system powered by oil-refined fuels. They are further less intensive in their demand for other inputs, such as water, fertilizers, pesticides and herbicides. By keeping the soil covered throughout the year, it is protected from erosion, and the SOM improves its structure so that it can absorb water more effectively and allow aquifers to recharge, thus mitigating both water shortages and flooding. It is likely that a reduced use of pesticides, through reintroducing biodiversity, might help to bring the bees back too.

Source

Professor Chris Rhodes, 15 April 2014

Reference

Brabant Pierre, 2010. A land degradation assessment and mapping method. A standard guideline proposal.

Powlson, David (20 January 2005). "Climatology: Will soil amplify climate change?". Nature 433 (433): 204–205.

Montgomery, David (October 2, 2008). "Islands in time". Dirt: The Erosion of Civilizations (1st ed.). University of California Press. ISBN 978-0-520-25806-8.

5.

Peak Soil

Act Now Or The Very Ground Beneath Us Will Die

By Helen Browning

As a farmer, my foremost responsibility is to protect and enhance the soil in my care. It can take more than 500 years to generate an inch of soil, yet our farming activity can erode or degrade it in a decade or two if we are not careful.

Even as an organic farmer, where the system is designed to protect and build soils, I'm aware that the move to bigger machinery, the need to cultivate and plough to control weeds, and our seemingly ever more volatile weather can put soils at risk.

At agricultural college, we were taught much more about the chemistry and physics of soils than we were about the biology, and given scientists have recently admitted that they know about maybe only around 20% of the soil's microbial population, that's probably still true today.

But soil always fascinated me, and as a research student on the first Government funded project on organic farming in 1984, it quickly became clear to me that the yield and health

of plants was determined by soil biological factors as much or more than by theoretical nutrient availability.

I remember one field, same soil type, rotation and variety of wheat, where there was a distinct line across the field, one side of which the crop was thriving and yields were much higher than the other.

The only difference was that at the time of conversion to organic, a number of years earlier, a light dose of composted manure had been applied to the higher yielding side. In my view, that 'inoculation' of beneficial microorganisms must have kick started soil activity that was allowing plants to be better fed and possibly protected from disease years later.

As I converted my own farm, I always ensured that as a field started its move from chemical dependency to a biological, organic life, we helped it recover its vitality with some well-rotted manure. A few small applications are often better than one big one, as a 'dead' soil cannot digest manure and organic matter easily.

For me, one of the signs that our soils are in good heart are that cow pats, or applied manures, vanish quickly, as the earthworms, beetles and microbes gobble it up, incorporating it rapidly into the body of the soil. Just like a well-functioning human or animal digestive system, which, like the soil, and equally often ignored, is primarily a vat of micro-organisms upon which we and our health depends.

The first president of the Soil Association, Lady Eve Balfour first stated that: "The health of soil, plant, animal and man is one and indivisible." The founders of the Soil

"The top 20cm of soil is all that stands between us and extinction."
~ Luc Gnacadja, executive secretary of the UNCCD

Association recognised the potential and actual problems facing soil over sixty years ago. Their response was to develop what was then, and still is now, a radical, yet practical and workable method of farming which protects and nurtures the soil and the life within it by putting it at the centre of the farming system.

The need for us farmers and growers to understand and protect our soils has never been greater. We are destroying soils worldwide ten times faster than nature can restore them, and in the last 40 years, human activity has degraded 2 billion hectares of soil -over 15% of our land.

Given that only 15% of land globally is suitable for growing food, which must be most of it. Even in the UK, where our temperate climate reduces erosion risk, it's estimated that we lose 2 million tonnes of soil a year, valued at £150 to £250 million. And across Europe, we lose 250ha/day to development.

How we put a value on this is not clear to me; our soils are invaluable. They store 10 times more carbon than the forests do; they are the fundamental resource on which human life depends. If we want to have more healthy people on the planet, then we need more healthy soil to sustain them.

So, as farmers, what should we do? Here are some personal thoughts on the kind of things we need to get moving on, here and worldwide:

1. Trees are incredibly important when it comes to protecting soil, which means that we need to stop clear felling old growth forest. Instead, develop more agroforestry systems (mixtures of productive trees or shrubs and crops), so we have the yield, biodiversity and soil protection benefits of many more trees in our landscape.

2. Learn from one another's experiences when it comes to building up organic matter - and act on it - quickly! A project in Sekem, Egypt, has shown how even desert can be turned into productive farmland, and 'mob stocking' (where a large herd of livestock is confined to an area to intensively graze it) has also been shown to build organic matter very fast.

3. More research needs to go into how different chemicals and fertilisers affect soil biology. All farmers need to know whether and how severely their inputs are hampering soil health, so they can choose less damaging ones.

4. We need to stop doing certain things, like using big tractors over vast areas of land, building houses on precious grade 1 and 2 agricultural land, sending our straw away for power generation, and farming maize to such a huge extent as it can leave soil at risk of erosion.

5. We also need to start doing more of other things, such as experimenting with growing perennial crops and trees, and recycling sewage sludge safely back to soils. We are not allowed to do this as organic farmers due to EU regulations, but we should be as long as it is uncontaminated, and in some parts of the country that may mean separating industrial from household waste systems. The phosphate in sewage is invaluable - another precious resource the world is running out of too.

6. Think long term solutions: we might put most of our land into restorative grassland for the next 20 years, and get our soils into the best possible condition to face the challenges ahead and in doing so, sequester a whole load of carbon in the meantime. (If that seems too extreme for some, at least encourage mixed and organic farming!)

'Peak soil' may be upon us, yet we know enough to start reversing the damage. With the right research and the further

development of ecological farming systems, we could rebuild our soils, lock up carbon, protect our water courses, and improve our resilience to drought and flood.

In the process we would create a more beautiful and biodiverse countryside, with more jobs, improved access for people to walk and play, more trees and more grazing animals.

Climate change will dramatically alter how we live and is already affecting the lives of the world's most vulnerable people. In Soil Not Oil, bestselling author Vandana Shiva connects the food crisis, peak oil, and climate change to show that a world beyond dependence on fossil fuel and globalization is both possible and necessary. Bold and visionary, Shiva reveals how three crises are inherently linked and that any attempt to solve one without addressing the others will get us nowhere. Condemning industrial agriculture and industrial biofuels as recipes for ecological and economic disaster, Shiva's champion is the small, independent farm. What we need most in a time of changing climates and millions hungry, she argues, are sustainable, biologically diverse farms that are more resistant to disease, drought, and flood. Calling for a return to local economies and small-scale food production Shiva outlines our remaining options: a market-centred short-term escape for the privileged, which will deepen the crisis for the poor and marginalized, or a people-centric fossil-fuel-free future, which will offer a decent living for all.

Soil Not Oil: Climate Change, Peak Oil and Food Insecurity Paperback – 8 Jan 2009

by Vandana Shiva (Author)

Source

Helen Browning, Soil Association, 8th November, 2013

Reference

Voroney, R. P. (2006). "The Soil Habitat". In Paul, Eldor A. Soil Microbiology, Ecology and Biochemistry. ISBN 0-12-546807-5.

Donahue, Miller & Shickluna 1977

Brady, Nyle (1984). The Nature and Properties of Soils (9th ed.). USA: Macmillan Publishing Co.

Michael E. Ritter. Factors Affecting Soil Development, Soil Systems, The Physical Environment: an Introduction to Physical Geography, University of Wisconsin, Stevens Point, 1 October 2009.

6.

Peak Soil

Does civilization have a future?

We are no longer hunter-gatherers. Cultivating the soil is the basis of the human food supply, and the very foundation of civilized society. Without it, civilization could not survive.

Agriculture is contingent on natural geological goods, such as soil, and services, including water, weathering and nutrient cycles. These cycles, together with the cycle of erosion, are responsible for the origin and development of soil in the first place. Paradoxically, they are also responsible for soil's ultimate degradation and destruction. Unfortunately for farmers, agriculture has a tendency to reinforce the destructive aspects, especially erosion.

The inherent fertility of soil used to be an important factor in food production. Now it's more or less irrelevant. Modern industrial agriculture now depends on the use of high inputs of nonrenewable resources, particularly oil, gas and fertilizer raw materials, to keep crops growing. Our future is so heavily mortgaged to the exploitation of such agricultural inputs that we have overshot the ability of the planet to support

us in a sustainable way. The World Wildlife Fund estimates the overshoot at about 25 percent. In other words, modern society is living off global principal. Anybody with a bank account knows that living off principal rather than just the interest is an unsustainable option.

Modern industrial agriculture acts like an army waging war on the soil. In the 21st century we continue to slide down the nether slope of Peak Soil.

Obviously, if we are to sustain the type of human society we call civilized, a sustainable agriculture not dependent on fossil fuels would be required.

Ecologist William Rees, inventor of the concept of the ecological footprint, has said that "sustainability is the greatest collective exercise the human race will ever have to undertake." I'd say that it's either the greatest collective exercise or the last forlorn hope.

Source

Ward Chesworth

Thursday, April 15, 2010

Reference

"Soils". Natural Resource Conservation Service. United States Department of Agriculture.

Donahue, Miller & Shickluna 1977

FAO, WFP, and IFAD (2012). The State of Food Insecurity in the World 2012. Rome: FAO.

Using current standard practices, current producing agricultural land will yield approximately 30% less by 2050. At this rate, 70% of the earth's surface will have to be converted to agricultural purposes by 2050– up from the current 40% in order to meet the demand for food.

7.

More Nutritious Food? Feed The World?

Agroecology Is The Answer

Food is less nutritious than it used to be. Compared to values from 1950 (the first year for which there are data), nutrients in crops have declined up to 40%. For example, a serving of broccoli eaten in 1950 had significantly more vitamin C, B vitamins, calcium, and other nutrients than the same size serving of broccoli eaten today. In other words, to get the same nutrients today, you'd have to eat up to 40% more food.

The Organic Center report that describes this degradation notes that although organic produce is more nutrient dense than industrial produce, nevertheless organic nutrient density has also declined. Productivity is the cause cited in the report: growers are driven to increase the yield of crops from each acre. But as plants grow faster and bigger, plant metabolism limits the rate of nutrient uptake.

Increasing yields is driven by economics: get the biggest bang for a buck. In this case, the bang is a head of cauliflower or other food crop.

The culprit is remineralization: cook up nutrients in industrial labs and add them to dirt. Unfortunately, those nutrients are finite resources themselves: at some point, we'd run out of them. Another solution is genetically engineered crops that are more efficient at extracting nutrients from soil. Aside from the fantasy that GMO will feed the world with little more than PR for scientific evidence, it does nothing for the health of the soil itself.

The sane answer is what's referred to as agroecology: the design and management of food systems based on ecological integration. A lot's packed into that, but practically what it says is that agroecology is a technology used to grow and distribute nutrient dense food, integrates the farm into the local culture, political economy, and ecology, and improves and maintains the health of the soil.

This isn't a fringe idea. The UN Special Rapporteur on the Right to Food says that the new Green Revolution is agroecology.

But that's not the direction in which feeding the world is headed. For example, there's an organization called Peak Soil Indexes that is creating what it calls "investment opportunities" for the purchase of farmland as a commodity. Since the financial crisis of 2009, investment capital has flooded the Third World, especially Africa, to buy up farmland from small farmers. As a consequence, farm productivity has dropped.

Why Is That?

Because investment capital isn't interested in tending the land and growing food. It's interested in growing money. Farmland has become one of the latest speculative bubbles. Productivity drops either because land is taken out of production or because any farming that takes place is

industrial farming—you know, the kind that's hell on wheels for degrading the nutrient value of crops and the soil from which they grow.

It turns out that worldwide, small farmers produce 70% of food on 25% of the land. That is, of all the land in the world being farmed, one quarter (25%) is cultivated by small farmers. Those small farms produce over two-thirds of the food people actually eat.

Many of those small farms use traditional methods that approximate agroecological practices.

So although nutrient degradation and peak soil appear as technical problems, as being about agricultural practices, as being about the adoption of ecologically sane technologies by farmers, in fact nutrient degradation and peak soil are problems of political economy. What I mean is that the politics are not about encouraging the right kind of technology but about making sure we have the right kind of land ownership.

And if you think this is exclusively a Third World problem, think again. The speculator's friend Peak Soil Indexes is all about finding farmland investments in the United States, a speculative bubble that is expected to make half of all small farms disappear over the next decade.

More nutritious food? Feed the world? Sure thing. Shop agroecology. Grow your own agroecologically. Organize against industrial agriculture.

Source

Jeffry Fawcett, PhD, June 10, 2014

Reference

Wezel, A., Bellon, S., Doré, T., Francis, C., Vallod, D., David, C. (2009). Agroecology as a science, a movement or a practice. A review. Agronomy for Sustainable Development.

Conway, Gordon R. 1985. Agroecosystem analysis. Agricultural Administration.

Wibblemann et al. (2013) Mainstreaming Agroecology: Implications for Global Food and Farming Systems.

Sample, Ian (August 30, 2007). "Global food crisis looms as climate change and population growth strip fertile land". The Guardian.

8.

Peak Water

Down the Drain

Peak water is the latest realization that our resources may fall shallow of our needs. This one is often the hardest one for many of us, who have ample access to water, to recognize. But the truth is that, globally, a child dies because of lack of access to water almost every ten seconds.

Most of the world's drinkable and usable water resides in underground lakes and aquifers, a finite supply to say the least. Not only is the planet simply becoming drier as it becomes hotter and water sources such as glaciers melt away, but the world is particularly guilty of contaminating water supplies with chemicals. That may mean you. Every time you empty a skin care product or unused medication into your skin, it enters the water supply.

In many cases, particularly in the western world, the realities of resource diminishment haven't been felt yet. However, they are very, very real. And it only takes small actions by individuals to add years of viability to each of these resources. Shorter showers, turned off taps and responsible

disposal methods can all add up to more "miles per gallon" for our remaining soil and water.

Industrial Agriculture Is Water Intensive

Industrial agriculture is incredibly water intensive. In his essay 'Agriculture's Big Thirst', Wenonah Hauter writes, "You know things are bad when reservoirs are converted into cornfields. On a 2008 trip from Beijing, I searched in vain for a glimpse of the Miyun reservoir that once provided drinking water for Beijing's 17 million residents. Instead of lapping waves, there was an ocean of corn. The water was gone."

This sight may become more common as water-intensive agricultural practices collide with water scarcity. Agriculture is the single largest user of water worldwide, dwarfing everything else. Drinking, cooking, and washing by six billion people combined with all industrial water consumption pale in comparison to watering crops and livestock. Global agriculture uses nearly two quadrillion gallons of rainwater and irrigation water annually—enough to cover the entire United States with 2 feet of water.

Obviously, crops and animals need water to thrive and sustain a hungry and growing population, but intensive agricultural practices exert more stress on watersheds than rainfed cultivation of ecologically appropriate crops. Even

According to the UN's Global Environment Outlook:
By 2025, about 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under conditions of water stress – the threshold for meeting the water requirements for agriculture, industry, domestic purposes, energy and the environment (UN Water 2007). This will have major impacts on activities such as farming.

irrigation can sustainably maintain fields during periods of drought. But the worldwide expansion of industrial-scale cultivation of water-intensive crops and feedlots on more marginal land magnifies the pressure on already overstretched water resources. In America, recent high crop prices spurred increased corn cultivation in more arid regions of the high plains and the Rockies. In Central Asia, irrigation of cotton has almost completely eliminated the Aral Sea, once the fourth largest freshwater lake in the world.

The scale of water withdrawal from rivers, reservoirs, and groundwater for agriculture taxes available water resources. In the developing world, 85 percent of water withdrawals go toward agriculture; rich countries funnel 40 percent of water to agriculture.

Industrial agriculture's use of water is a cycle of overuse, waste and pollution. Unfortunately, most of us are a part of that cycle, too. What we eat and how we grow our food is key to our global water crisis. Your hamburger, cup of coffee, and cotton shirt have a water footprint that is determined by

Himalayan glaciers that are the principal dry-season water sources of Asia's biggest rivers - Ganges, Indus, Brahmaputra, Yangtze, Mekong, Salween and Yellow - could disappear. An international conferrence in Kathmandu recently heard a UN report that, if temperatures continue to rise "there will be no snow and ice in the Himalayas in 50 years." Under the headline Vanishing Himalayan Glaciers Threaten a Billion, we read of the unimaginably vast scope of climate change:

Thousands of glaciers in the Himalayas are the source of water for nine major

Asian rivers whose basins are home to 1.3 billion people from Pakistan to Myanmar, including parts of India and China.

the industrial agriculture model. (Check out the infographic in the Image Gallery to see how much water is in different foods and products.) But we have the power to change this model, if we can harness the political will of a new generation of consumers, farmers, and activists.

Source

Postconsumers Content Team, May 13, 2013.

Reference

Meena Palaniappan and Peter H. Gleick (2008). "The World's Water 2008-2009." Pacific Institute.

Brown, Lester R. "Peak Water: What Happens When the Wells Go Dry?", Earth Policy Institute, July 9, 2013.

"World's largest aquifer going dry". US Water News. February 2006.

Lester R. Brown (2006). Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble. W. W. Norton & Company.

Matthew Power (2008-04-21). "Peak Water: Aquifers and Rivers Are Running Dry. How Three Regions Are Coping". Wired Magazine.

9.

Peak Soil Desertification

Between Us and Extinction

By Richard_Mills

Desertification is a phenomenon that ranks among the greatest environmental challenges of our time, unfortunately most people haven't heard of it or simply don't understand it. Desertification and land degradation is a global issue with desertification already affecting one quarter of the total land surface of the globe today.

Today the pace of arable land degradation is estimated at 30 to 35 times the historical rate. Land degradation is costing US$490 billion per annum and desertification is degrading more than 12m hectares of arable land every year - the equivalent of losing the total arable area of France every 18 months.

One third of the earth's surface is covered with grasslands that are facing the threat of desertification. According to a study by the United Nations, 20 percent of our farmland, 30 percent of our forest and 10 percent of world's grassland are degrading worldwide. Over the past four decades, 15 percent of the Earth's land area - an area larger than the United

States and Mexico combined - have been degraded through human activities.

Severe land degradation is now affecting 168 countries across the world, up from just a 110 a few short years ago.

Desertification doesn't refer to the advance of deserts which can and do expand naturally. Desertification is a different process where land in arid or semi-dry areas becomes degraded - the soil loses its productivity and the cover vegetation disappears or is degraded to the point where wind and water erosion can carry away the topsoil leaving behind a highly infertile mix of dust and sand.

Land degradation, and the eventual resulting desertification of dry land ecosystems is most often caused by human activities such as:

1) Unsustainable farming - intensive farming depletes the nutrients in the soil

2) Overgrazing - animals eat away grasses and erode topsoil with their hooves

3) Deforestation or clear-cutting of land - the tree and plant cover that binds the soil is removed

4) Misuse of water resources

5) Industrial activities

6) Climate change can accelerate and intensify the degradation process.

The issue of desertification is not new, it has constantly played a significant role in human history, even contributing to the collapse of the one of the world's earliest known empires, the Akkadians of Mesopotamia.

One of the most basic, fundamental problems (other than the rapid depletion of our fresh water resources) we've created for ourselves is the impact of human activities on the land we need to cultivate for our very survival.

It takes 100 years to generate a single millimeter of topsoil - 24 billion tons of fertile soil disappear annually.

Conclusion

We obviously reached peak soil a long time ago, soil can be considered a non-renewable and rapidly depleting resource.

Given fears over the world's present ability to feed our growing population - it's surprising desertification and land degradation is so absent on most people's radar screens.

According to the UN, global demand for food is projected to increase by 50 percent by 2030. It is projected there will be nine billion people to feed by 2050, that's a needed increase of one billion tonnes of cereal and 200 million tonnes of meat.

It's obvious the world needs a new farm - one the size of South Africa.

Unfortunately the UN also says that by 2030 an area twice the size of South Africa will become unproductive due to desertification, land degradation and drought.

Adding to our troubles is production gains from the Green Revolution are diminishing. Is the security of your food supply on your radar screen?

If not, maybe one should be.

Source

Richard Mills, The Market Oracle, June 22, 2013

Reference

Arnalds, Ólafur & Archer, Steve (2000). Rangeland Desertification. Springer.

Geist, Helmut (2005). The causes and progression of desertification. Ashgate Publishing. ISBN 978-0-7546-4323-4.

Hartman, Ingrid (2008). "Desertification". In Philander, S. George. Encyclopedia of global warming and climate change, Volume 1.

10.

Peak Soil

Competition For Land Becoming Fiercer

The demand for arable land is on its way towards exceeding supplies. This places great pressure on existing arable land which should suffice for the production of food, feed, fibres and fuels.

The competition for arable land is putting the world at risk of being led towards new conflicts and greater division.

This is what the researcher and author Kennet Hermele claims in his recently published disseration "Land Matters" on the subject of human ecology at the University of Lund. He also believes that the shift from a fossil-dependent world to a world built upon renewable resources threatens to repeat colonial conflicts and patterns.

This development, where the supply of land is decreasing, has been called Peak Soil in the international environmental debate.

Peak Soil is reflected in the greatly increasing food prices from the beginning of the 21st century and onwards. This

is a trend break, and I believe we are entering a new phase with steadily increasing conflicts over land-based resources.

Another effect of the decreased land supply is deforestation. Of the cultivation which took place globally during 1980-2000, 83 per cent of this was cultivated on what earlier was forested land. And this trend will most likely continue.

Colonial Patterns

Land has become a geopolitical resource. Countries with a high rate of economic growth and large populations want more, for example Saudi Arabia, China and South Korea.

It is in this situation that colonial patterns emerge once again, in the form of so called "land grabbing". This means that either private or public parties gain access to land in other countries either by leasing or buying the right to utilise arable land.

Rich countries also take over land by disposing their waste in poorer countries and by outsourcing polluting industries. For example, ship demolition, which has highly negative consequences for humans and the environment, now occurs in Bangladesh.

This can also be seen in trade patterns: northern countries import ecological resources from southern countries.

The earth can support a larger population if we organise our societies in a better way. On the individual level, becoming accustomed to less meat on the menu is a key factor.

Source

Johan Granath, Sustainability Journal, Swedish Research Council Formas

Reference

Kenneth Hermele's dissertation "Land Matters", http://www.lu.se/o.o.i.s?id=12588&postid=2969351

Nikhil Aziz, The Neo-Colonial Land Grab in Africa, On The Commons, April 15, 2011

John Vidal, Fears for the world's poor countries as the rich grab land to grow food, The Guardian, 3 July 2009

Interview with Carlo Petrini, Land Rush: Neo-Colonialism in Africa, Mother Earth News, May 2014

11.

Are We Heading Toward Peak Fertilizer?

We've heard of peak oil, peak coal, peak water, peak demographics, peak soil etc. But what about peak phosphorus and potassium? These elements form two-thirds of the holy agricultural triumvirate of nitrogen, phosphorus, and potassium (also known as NPK). These nutrients, which are essential for plants to grow, are extracted from soil every time we harvest crops, and have to be replaced if farmland is to remain productive.

For most of agricultural history, successful farming has been about figuring out how to recycle these elements (although no one had identified them until the 19th century). That meant returning food waste, animal waste, and in some cases, human waste to the soil. Early in the 20th century, we learned to mass produce N, P, and K—giving rise to the modern concept of fertilizer, and what's now known as industrial agriculture.

The N in NPK, nitrogen, can literally be synthesized from thin air, through a process developed in the early 20th

century by the German chemist Fritz Haber. Our reliance on synthetic nitrogen fertilizer (as its known) carries its own vast array of problems—not least of which that making it requires an enormous amount of fossil energy. But phosphorus and potassium cannot be synthesized—they're found in significant amounts only in a few large deposits scattered across the planet, in the form, respectively, of phosphate rock and potash. After less than a century of industrial agriculture, we're starting to burn through them. In a column in the November 14 Nature, the legendary investor Jeremy Grantham lays out why that's a problem:

"These two elements cannot be made, cannot be substituted, are necessary to grow all life forms, and are mined and depleted. It's a scary set of statements. Former Soviet states and Canada have more than 70% of the potash. Morocco has 85% of all high-grade phosphates. It is the most important quasi-monopoly in economic history."

Phosphate, when used as fertilizer, is the irreplaceable engine powering modern agriculture, and its reserves are in decline almost everywhere except Morocco. Most phosphate mines, including those in the U.S., which produces 17 percent of the global supply, have been in a downward spiral for the last decade, running out of quality rock and hindered by environmental regulation. That has forced companies to look farther afield for additional supplies. Earlier this year, Mosaic spent $385 million for a 35 percent stake in a Peruvian mine to supply rock to its phosphate operations in the U.S. and South America. Meanwhile, Australia's mining giant BHP Billiton (BHP) has been threatening to take over Canada's PotashCorp (POT), a major supplier of both potash and phosphate.

~ Phosphate: Morocco's White Gold, Bloomberg Business, November 04, 2010

What happens when these fertilizers run out is a question. There seems to be only one conclusion: their use must be drastically reduced in the next 20-40 years or we will begin to starve.

Phosphate: Morocco's White Gold

Of the two key fertilizers, phosphorus is the more urgent. Canada sits on a vast potash stash. But phosphate rock is largely concentrated in Morocco—and not just anywhere in Morocco. It's in the country's Western Sahara region, on highly disputed land. In a superb 2011 piece in Yale

Western Sahara is a disputed territory. It's also where Morocco's best phosphate lies. The region known to the King as "Moroccan Sahara" begins just south of the fishing village of Tarfaya on the Atlantic coast. The U.N. calls it "the non-self-governing territory of Western Sahara" and deems it "occupied." It's a place where phosphate rumbles to the coast on the world's longest conveyor belt, while tanks and soldiers roam alongside, defending the shipments from Sahrawi separatists.

When Spain withdrew from Morocco in 1975, some 350,000 Moroccans marched into Western Sahara with tents on their backs. The native Sahrawi fought back for 16 years under the leadership of the Algerian-backed Polisario rebels, signing a cease-fire in 1991. The U.N. continues to monitor the agreement with 215 uniformed peacekeepers, but a planned vote on self-determination has been repeatedly delayed. Today, approximately 90,000 Sahrawi live in refugee camps in Algeria, separated from their families in Moroccan-controlled territory by a 1,400-mile-long berm dotted with land mines.

~ Phosphate: Morocco's White Gold, Bloomberg Business, November 04, 2010

Environment 360, the environmental writer Fred Pearce explained:

"The Western Sahara is an occupied territory. In 1976, when Spanish colonialists left, its neighbor Morocco invaded, and has held it ever since. Most observers believe the vast phosphate deposits were the major reason that Morocco took an interest. Whatever the truth, the Polisario Front, a rebel movement the UN recognizes as the rightful representatives of the territory, would like it back."

Given that a savvy investor like Grantham calls Morocco's phosphate holdings "the most important quasi-monopoly in economic history," you can bet that the Polisario Front isn't going to let the Moroccan government control it without a fight. In other words, a scarce mineral key to the future of industrial agriculture is concentrated on geopolitically fraught territory. As Pearce puts it, "If the people of Western Sahara ever resume their war to get their country back—or if the Arab Spring spreads and Morocco goes the way of Libya—then we may be adding phosphate fertilizer to the list of finite resources, such as water and land, that are constraining world food supplies sooner than we think."

Our agricultural system is lurching toward collapse if we let peak phosphorus continue to be an obscure topic.

The phosphate extracted from the rock, used in fertilizer, detergent, food additives, and more recently lithium-ion batteries, sold for decades in its raw state for less than $40 per metric ton. Those days are gone. It's currently trading at about $130.

"God just put the phosphate there, it is our only resource, and it is our responsibility."

~ Jamal Bensari, a member of OCP's delegation

This is good news for King Mohammed VI, 47, who owns all these phosphate reserves. James Prokopanko, chief executive officer of Plymouth (Minn.)-based fertilizer giant Mosaic (MOS), has called Morocco the Saudi Arabia of phosphate, with all that implies about the King's power to influence prices and economies. Mohammed's strategy, by most accounts, is to drive the commodity's price higher yet—which means the cost of making everything from corn syrup to iPads will be going up as well.

Even a temporary phosphate shortage could affect a range of industries. Phosphate fertilizer is used on just about every crop, though most in the U.S. goes to the 13 billion bushels of corn grown each year to make everything from corn syrup to cattle feed to ethanol. When prices climbed tenfold in 2007 and 2008, retailers and farmers scrambled to build local fertilizer warehouses as a buffer. Now, according to Dirk Lohry, owner of Nutra-Flo, a crop and animal nutrient manufacturer in Sioux City, Iowa, many of those warehouses stand empty as supplies are being used too quickly to build inventory. The prospect of a shortage has become serious enough that the Office of Intelligence and Counterintelligence at the U.S. Energy Dept. recently assigned an analyst to study the issue; she was not permitted to speak publicly because of "geopolitical sensitivities."

One could look at the 2007-08 food crisis for clues to how a shortage might play out. At that time, rising food prices led to riots across Africa and Asia—the Pakistani Army even stepped in to defend warehouses and farms. Before the crisis was over, China had levied a 135 percent export tariff on its phosphate to protect its domestic food supply; phosphate there is still taxed at 110 percent at the height of the buying season.

~ Phosphate: Morocco's White Gold, Bloomberg Business, November 04, 2010

Mohammed VI is the unofficial overseer of the state-owned phosphate monopoly, Office Chérifien des Phosphates (OCP), Morocco's largest industrial company.

We've haven't really begun to face the problem of climate change; our reliance on mined phosphorus doesn't register at all. It's easy to ignore crises whose most dire consequences loom decades away.

But the next time someone facilely insists that the "industrial farms are the future," ask what the plan is regarding phosphorus. Developing an agriculture that's ready for a phosphorus shortage means a massive focus on recycling the nutrients we take from the soil back into the soil—in other words, composting, not on a backyard level but rather on a society-wide scale. It also requires policies that give farmers incentives to build up organic matter in soil, so it holds in nutrients instead of letting them leach away (another massive problem stemming from our reliance on abundant NPK). Both of these solutions, of course, are specialties of organic agriculture.

Source

Tom Philpott, Mother Jones, Nov. 28, 2012

Reference

Cordell, Dana; Drangert, Jan-Olof; White, Stuart (2009). "The story of phosphorus: Global food security and food for thought". Global Environmental Change.

Rosemarin, A. (2010). Peak Phosphorus, The Next Inconvenient Truth? - 2nd International Lecture Series on Sustainable Sanitation, World Bank, Manila, October 15, 2010.

Neset, Tina-Simone S.; Cordell, Dana (2011). "Global phosphorus scarcity: identifying synergies for a sustainable future". Journal of the Science of Food and Agriculture.

Gilbert, Natasha (8 October 2009). "The disappearing nutrient". Nature 461: 716–718.

Van Vuuren, D.P.; Bouwman, A.F.; Beusen, A.H.W. (2010). "Phosphorus demand for the 1970–2100 period: A scenario analysis of resource depletion". Global Environmental Change.

Heckenmüller, M.; Narita, D.; Klepper, G. (2014). "Global availability of phosphorus and its implications for global food supply: An economic overview". Kiel Working Paper, No. 1897.

12.

Treating Our Earth Like Dirt

Not all dirt/soil is created equal. For the sake of clarification, let's make a couple of distinctions.

Dirt – mainly mineral based; pebbles and finely ground rock.

Soil – mineral, plant, fungi and animal based.

It's easy to tell dirt and soil apart. Soil will usually be darkish in color and have a rich earthy smell. Dirt just tends to smell like dust.

There's a lot of dirt around the world, it's in plentiful supply – no worries there. The problem with dirt is that it's a filler and has very little nutrient content as it's primarily composed of basic minerals – calcium, iron etc. While these are required to some degree by plants, the real life giving properties are in the soil.

Soil is a smorgasbord of nutrients; animal droppings and decaying plants and creatures add to its fertility. It contains a multitude of life forms including insects, fungi and bacteria – it's an ecosystem unto itself.

Because there's so much dirt around, we can tend to see it as a limitless resource; but so much of the dirt on this planet isn't really capable of sustaining life.

The Soil/Worm Connection

I began to understand how much matter it takes to make soil when starting a worm farm. In that scenario, the worms break down the organic material leaving what is basically a very rich soil – worms are a crucial part of the soil ecosystem.

We put hundreds of pounds of waste into our worm farm during the first year and at the end of it still weren't able to fill the worm bin up with castings (worm poo). All that organic waste breaks down so much as it primarily consists of water.

Soil Horizons

Soil layers are called horizons. The very top layer is called the O horizon, it's made of new and decomposing organic materials and basically acts as a mulch. The "A" horizon below it is a mixture of rock particles and decomposed organic materials – the fertile soil. This can be a few inches to a foot thick. The B horizon is almost entirely rock material, plus some nutrients that have washed out of the A horizon. The C horizon is mainly bedrock in various states of weathering and extends to a depth of thousands of feet.

The Fragile Nature Of Soil

Only a very small percentage of our planet has soil suitable for sustaining high levels of plant life and the silly thing is we tend to build our houses in areas where this rich soil is. When our house was being built, I remember all the topsoil being scraped off the top of the subdivision and dumped in big piles – which the wind then went to work on, causing

localized dust storms so thick that at times we could hardly see across the road.

We lose millions, perhaps billions of tons of top soil across the world each year that winds up in our oceans. Good quality soil tends to extend downwards just inches rather than feet – and that's what sustains us; so it's crucial that we preserve what we have.

Threats To Soil:

Acidification – Usually happens through intensive watering and harvesting when certain nutrients and minerals are removed that alter the acid/alkali balance, or by using too much nitrogen-rich fertilizer.

Soil Contamination – Often contaminated by industrial chemicals. It can sometimes take many years for oils etc. to wash out of soil to the degree that plant life can grow again.

Desertification – This can sometimes be caused by drought, but also by general abuse where too much is taken out of the land without anything being put back into it. The land becomes infertile.

Soil Erosion – Once plant cover is removed, such as in the case of deforestation, the soil is no longer replenished with nutrients and is easily blown away or carried by rainwater runoff.

Salinity – Where saline ground water comes to the surface, evaporates and leaves salts behind. This commonly occurs where deep rooted trees are cleared.

Things You Can Do To Help Save Our Soil

Even if you don't have a yard, we can all do our bit to go towards conserving our precious soil.

- Start a worm farm and return the casting to the earth

- Start up a compost pile

- Mulch; this not only saves water in your garden but protects the soil and adds to it

- Use natural fertilizers

- Plant more trees and deep rooted vegetation

- If you're moving soil from one area to another, try to do it on a calm day or cover up the pile

- Don't pour hazardous waste and toxic substances onto the ground e.g. gas and oil.

While "Peak Oil" has been getting increased media attention lately, a matter just as urgent is Peak Soil. While a life without oil is a disturbing concept, life without adequate fertile soil is downright frightening.

Source

Michael Bloch, Green Living Tips, July 4th, 2011

Reference

Raloff, Janet (17 July 2008). "Dirt Is Not Soil". ScienceNews.

Millennium Ecosystem Assessment (2005) Desertification Synthesis Report.

Blanco, Humberto & Lal, Rattan (2010). "Soil and water conservation". Principles of Soil Conservation and Management. Springer.

Nyle C. Brady & Ray R. Weil (2009). Elements of the Nature and Properties of Soils. Prentice Hall.

Amber Dance (2008). "Soil ecology: What lies beneath". Nature 455 (7214): 724–5.

What is lent by earth has been used by countless generations of plants and animals now dead and will be required by countless others in the future. In the case of an element such as phosphorus, so limited is the supply that if it were not constantly being returned to the soil, a single century would be sufficient to produce a disastrous reduction in the amount of life.

~Sears

13.

How Close Is Our Civilization To Collapse From Soil Erosion?

The bedrock of any civilization is food and water. So you'd think the top priority of nations throughout history would be ensuring farmers were taking good care of the land.

Apparently not — the decline of most civilizations is due in large part to soil degradation and erosion. Montgomery discusses past civilizations around the globe, which typically last 800 to 2,000 years before ruining their soil. The usual pattern is: first, only valley bottomland farmed, second, the slopes are farmed, but the soil washes away into the valley. Finally, the bottom land is even more intensely cultivated, which uses the soil up as it grows thinner and becomes depleted of nutrition from continuous farming. Finally civilization declines and collapses.

We are on track to destroy our soil faster than any previous civilization thanks to a history of not caring, large monoculture crops, absentee ownership, and mechanization. You can do a lot more harm to soil with a tractor than a

horse (compression, deeper tilling leading to more soil that can blow or wash away, greater pollution with pesticides and insecticides that kill off soil biota which help plants fight off pests, etc). These days there are tractors the equivalent of 1,000 horses or more!

Both George Washington and Thomas Jefferson commented on how poorly American farmers treated their land. Washington attributed it to ignorance, Jefferson to greed. Since the principles of good land management were known for hundreds of years previously in Europe, Jefferson's harsher view is no doubt the correct one.

Tobacco is partly to blame for the very early loss of topsoil in America. It was a very lucrative crop, worth about 6 times more than any other crop, plus it could survive the long journey to Europe. But tobacco crops expose the soil, which washes or blows away in storms. If storms don't ruin the soil, tobacco will — it uses 10 times more nitrogen and 30 times more phosphorous than the average food crop.

Tobacco exhausted the land after about five years, so to some extent it was responsible for the continual migration of settlers westward. Slavery magnified this trend. Running a farm with multiple, rotating crops requires a great deal of fine-tuned attention. Slaves worked reluctantly, just hard enough to not get beaten, so it was easiest to train slaves to work in huge mono-culture tobacco (and soil-depleting cotton) fields.

Role of Topsoil In American Civil War

Montgomery makes an interesting case for topsoil being the reason the South started the Civil War. President Lincoln took the middle ground of allowing slavery where it already existed, rather than banning it as so many wanted, but would not allow slavery to expand to new states. The largest slave

owners made more money selling slaves than growing crops. If Texas became a slave state, they could double their money, and so the wealthiest slave owners started the Civil war to protect as well as increase their wealth by fighting for the expansion of slavery into new states so they could sell slaves for more money.

To this day, much of the land in the South is still ruined. Instead of the thick black topsoil described by early settlers, the soil is thin and clayey, and sometimes missing entirely.

Absentee ownership has played a large role in soil exhaustion from the Roman Empire to the present day. Tenants being paid with a percentage of crops or money are far more concerned with maximizing the harvest than protecting soil fertility.

Mechanization And Absentee Ownership

Mechanization worsen matters. Like slavery, mechanization requires single crops. When farms became mechanized, the need for profits to finance the machines becomes more important than the soil. Increasing debt to pay for machines led to 4 out of 10 farms disappearing between 1933 and 1968.

Large corporate farms are a type of absentee ownership that is particularly likely to foster erosion. Huge debts need to be paid off on large pieces of farm machinery. The financial pressure to produce as much as possible to earn money to pay off the debt trumps soil conservation.

Mechanized farms are less efficient and profitable than smaller traditional farms because they spend a lot more on equipment, fertilizer, and pesticides. Larger farms do not bring economies of scale to food production. Small farms grow 2 to 10 times as much per acre as do large farms. And because small farms use far less agrichemicals, antibiotics, and

fertilizer, they don't pollute the air, water, and soil as much as large farms do.

Yet the trend continues toward large farms, in US we've gone from 7 million to 2 million farms, with 20% of farms producing almost 90% of food grown in America.

This is because the $10 billion a year in farm subsidies goes mainly go to the largest ten percent of farms, which receive two-thirds of the subsidies. Farm subsidies were meant to support struggling family farms, but now they're used to actively encourage large farms.

Montgomery points out that "Good public policy would use public funds to encourage soil stewardship—and family farms—instead of encouraging large-scale monoculture".

Half the fertilizer we dump on the soil is used to replace the soil nutrients lost from topsoil erosion. "This puts us in the odd position of consuming fossil fuels—geologically one of the rarest and most useful resources ever discovered—to provide a substitute for dirt—the cheapest and most widely available agricultural input imaginable".

"Enough American farms disappeared beneath concrete to cover Nebraska in the three decades from 1945 to 1975. Each year between 1967 and 1977, urbanization converted almost a million acres of U.S. farmland to nonagricultural uses".

Within 200 years, America has lost one-third of its topsoil. At the rate soil was being lost in the 1970's, it would only take a century to lose the rest of the country's remaining topsoil. Yet despite congress being aware of this, the government cut support for agricultural conservation by over half in the 1970's. Congress doesn't get it —they think "why spend taxpayer money to save soil when grain bins are bursting?"

It's hard to imagine anything worse than allowing the land to lose its topsoil, but there is. Montgomery writes about

how eight major U. S. Companies sold industrial toxic wastes as fertilizer to make money and avoid spending millions to dispose of it properly. Heavy metals stay in the soil for thousands of years, preventing or stunting plant growth.

In the last chapter, "Life Span of Civilizations", Montgomery discusses what needs to be done to protect the remaining soil for future generations. Today, agriculture is the most ecologically destructive force on the planet.

Anyone who's read this far is probably devoted to many causes, but unless your cause is to return to hunting and gathering, I urge you to make preservation of topsoil and reforming agriculture your main cause!

Source

Alice September 4, 2011

David R. Montgomery. 2007. Dirt: The Erosion of Civilizations. Univ. of California Press.

Further reading:

Johnson, Douglas; Lewis, Lawrence. (2007), Land Degradation; Creation and Destruction, Maryland, USA

Friedemann, Alice. 2011. Peak Soil: Why Cellulosic and other Biofuels are Not Sustainable and a Threat to America's National Security.

Toy, Terrence J. et al. (2002). Soil Erosion: Processes, Prediction, Measurement, and Control. John Wiley & Sons. ISBN 978-0-471-38369-7.

Imeson, Anton (2012). "Human impact on degradation processes". Desertification, Land Degradation and Sustainability. John Wiley & Sons.

Eswaran, H.; R. Lal; P.F. Reich (2001). "Land degradation: an overview". Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification. Oxford Press.

14.

Peak Soil

The Silent Global Crisis

By Stephen Leahy

A harsh winter wind blew last night, and this morning the thin snow cover has turned into a rich chocolate brown. The dirt covering the snow comes from cornfields near my home that were ploughed following the harvest, a common practice in southern Ontario and in the corn-growing regions of the US Midwest.

A handful of this dirty snow melts quickly, leaving a thin, fine-grained wet mess. It doesn't look like much, but the mucky sludge in my hand is the prerequisite for life on the planet.

"We are overlooking soil as the foundation of all life on Earth," says Andres Arnalds, assistant director of the Icelandic Soil Conservation Service. Arnalds is an eloquent spokesperson for the unheralded emergency of soil erosion, a problem that is reducing global food production and water availability, and is responsible for an estimated 30 percent of the greenhouse gases emissions. "Land degradation and desertification may be regarded as the silent crisis of the world, a genuine threat to the future of humankind."

Arnalds is dead serious when he calls soil erosion a crisis. Each year, some 38,000 square miles of land become severely degraded or turn into desert. About five billion acres of arable land have been stripped of their precious layer of topsoil and been abandoned since the first wheat and barley fields were planted 10,000 years ago. In the past 40 years alone, 30 percent of the planet's arable land has become unproductive due to erosion, mainly in Asia and Africa. At current erosion rates, soils are being depleted faster than they are replenished, and nearly all of the remaining 11 billion acres of cropland and grazing land suffer from some degree of erosion.

Most of this erosion is simply due to plowing, removal of crop residues after harvest, and overgrazing, which leaves soil naked and vulnerable to wind and rain. It is akin to tire wear on your car — a gradual, unobserved process that has potentially catastrophic consequences if ignored for too long.

Arnalds has seen our perilous future crisis by looking into the past. Eleven hundred years ago, the first Icelandic settlers came to a cold island mostly covered by forests and lush meadows, and blessed with deep volcanic soils. In a pattern repeated around the world, settlers cleared the forests and put too many animals on the meadows, until 96 percent of the forest was gone and half the grasslands destroyed. By the 1800s, Iceland had become Europe's largest desert; the people starved, and the once prosperous country became one of the world's poorest. "Once soil is gone, you can't get it back," Arnalds says. "It's a non-renewable resource."

Nickel And Dimed To Death

Food production per acre of land is starting to decline, primarily due to loss of productive land and water shortages. The latter is often the result of soil erosion because soil and

vegetation act as a sponge that holds and gradually releases water. And that soil erosion, in turn, is exacerbated by chemical farming practices that over time break down soil structure.

Add to these challenges climate change's impact on soil erosion and the competition between growing food and producing biofuels, and it's frightening to consider the challenge of feeding nine billion people when nearly one billion go hungry right now. Arnalds summarizes the challenge: More food will have to be produced within the next 50 years than during the last 10,000 years combined. "Securing food in many places will become a crisis of rapidly growing proportions."

Erosion largely goes unnoticed by farmers as it "nickels and dimes you to death," says David Pimentel, an ecologist at Cornell University who has conducted extensive research on the subject. Even if there were no humans on the planet, soils would still erode. The soil formation from the weathering of rock and the breakdown of plants, however, would be faster than the erosion rate; it takes roughly 500 years to create one inch of soil. Once humans remove natural vegetation, soil is exposed to raindrops that easily dislodge it, washing soil particles into creeks, streams, rivers, and eventually into the ocean. One rainstorm will wash away .04 inches of soil. This may not seem like much, but over one acre of land that fraction of an inch adds up to tons of topsoil.

Wind also disrupts soil, and can transport dust huge distances. Dry and windy conditions blew nearly two inches of topsoil off Kansas farmlands during the winter of 1995–96. Contrary to common belief, the topsoil loss in Kansas didn't end up being neatly deposited on farms in neighboring states. More than 60 percent ended up clogging ditches,

streams, rivers, and lakes. That makes waterways more prone to flooding (further exacerbating erosion) and contaminates them with fertilizer and pesticide residues, Pimentel says.

Every rainy day or windy night steals a thin layer of soil from any exposed piece of ground until there is little left but sand and rock. "Iowa has some of the best and deepest soils in the world," Pimentel says, "and they've lost nearly 50 percent in the last hundred years."

'The International Year of Land Care'

Erosion's potential threat to humanity remains largely ignored by the world community. When soil experts from around the world met in Selfoss, Iceland in August 2007, they concluded that an international treaty is needed to spur countries into taking action to protect their soils. The soil scientists proposed that, at the very least, soil ought to have its own year — "The International Year of Land Care" — to focus the world's attention on soil stewardship.

But hold on a second. While politicians, CEOs, and autoworkers might not think much about soil, surely farmers, whose very existence depends on soil, don't need a bunch of international lawyers and bureaucrats at the United Nations to tell them to protect their lands. After all, controlling erosion isn't rocket science. By now it's well known that agricultural practices such as protecting soil with cover crops when the land is not growing edible crops, keeping post-harvest plant residues on the land, and reducing overgrazing and forest clearance are some of the ways to protect soils.

"Farmers know their success depends on the soil, but they often have more immediate needs, such as feeding their families, paying school fees, or fleeing corrupt governments," says Michael Stocking of the University of East Anglia in

Britain, and one of the leading experts on agriculture in tropical countries. Most farmers face so many short-term challenges that it is difficult to invest in the long-term protection of the soil. Social and economic pressures force many farmers to "mine the soil" until the land is completely denuded and is turned into "badlands," Stocking says.

Such badlands can be found in every country in the world, and are easy to spot. A more worrisome trend is the hidden danger of losing soil fertility on lands that appear healthy. "Fertility loss on good soils has a much bigger impact than further degradation of badlands," Stocking says.

Healthy topsoil is a complex mixture of minerals, bacteria, fungi, microscopic invertebrates, and larger invertebrates such as ants and earthworms that break down nutrients and transfer them to the roots of plants. Degradation of soils diminishes this incredible below-ground biodiversity, reducing crop yield as well as soils' ability to store and filter water and to regulate the global cycles of carbon, nitrogen, and phosphorus.

While some American farmers control erosion using low- or no-till techniques for planting, the majority are mining the soil, according to Craig Cox, executive director of the Soil and Water Conservation Society, headquartered in Iowa. "Soil conservation has taken a back seat to maximizing production," Cox says.

As Cox drives the rural roads of Iowa, he sees fresh signs of erosion on the world's best farmland. "It's amazing to see the extent of erosion here, mainly because of the absence of basic soil conservation techniques," he says. Those techniques — such as planting grasses along the edges of waterways and leaving crop residues on the soil — are some of the hard lessons learned during the dust bowl years of the 1930s. But

those lessons have been forgotten — or ignored. Driven by the high costs of fertilizer and fuel, and currently lucrative crop prices, farmers are planting rows of corn right to the edge of stream banks, and sometimes in the streams themselves. "It's amazing and discouraging to see," Cox says.

Bad News Biofuels

It's all the more discouraging because American farmers had reduced soil erosion by about 40 percent between 1985 and 1995, largely due to government policies like the Conservation Reserve Program (CRP). But CRP programs are now taking a back seat to the desire to cash in on the biofuel bonanza. Erosion is ignored while the US government provides billions of dollars in subsidies for biofuels. "Biofuels and climate change are real threats to America's soil health," Cox says.

Mortgaging The Future For Short-Term Profits

Farmers are eagerly plowing up CRP lands, pastures, and highly erodible land to grow corn — 12 million additional acres of corn in 2007 alone — so they can profit from the ethanol boom. Ethanol is mainly made from corn, and the federal government hopes the US will be producing 35 billion gallons of the stuff by 2017. Reaching that goal would turn much of the US into a giant cornfield and has already doubled the price of corn in the past two years. Corn is particularly hard on the soil, requiring plenty of fertilizer, water, and pesticides. Cox says ethanol has sparked a "gold-rush mentality" among farmers who are mortgaging the future health of their soils for short-term profits. "There's no question that the ethanol boom is increasing erosion."

Not surprisingly, land prices and rents in the corn belt have jumped upward, creating additional pressure to "mine the soil

to pay the mortage." Farmland has been a popular investment for many years, and in some states, half of all farmland is rented. This reduces the incentives for soil conservation, since the farmer who works the field is not the permanent caretaker of the land. Ethanol-driven land degradation will not disappear even if the much-touted cellulosic ethanol technology is commercialized. The cellulosic process uses crop residues like corn stalks and wheat straw (rather than grains like corn or soy) to make ethanol. While cellulosic ethanol won't directly use food as fuel, the loss of crop residues would further expose soils to erosion. And it would also reduce organic matter in soils, greatly diminishing their fertility, Cox says. "I'm very concerned there will be serious consequences for soils if cellulosic ethanol goes forward."

Hard Rains of Climate Change

Strange new weather patterns linked to global climate change could further harm vulnerable soils. Increasing corn and soy production could expose soils to the hard rains that climate change is producing.

A number of studies have documented increased rainfall intensity in the US since 1970. In many regions, the amount of overall rainfall hasn't changed, but the rain comes in shorter, more intense bursts, doubling the normal rates of erosion. This is particularly noticeable in the southern US, Cox says. A brand new computer climate model that uses data collected over the last decade reveals that soil scientists have substantially underestimated the amount of erosion from climate change's hard rains. "It could be four times higher than we thought," Cox says. And that rate appears to be accelerating as hard rains wash soil off the land, ruining streams and destroying aquatic habitat. The soil conservation

techniques of yesterday may not be enough to keep soil healthy with climate change, he says. "There has been very little attention paid to the impact of climate change on soil conservation."

There are some 2,300 billion tons of carbon locked in the world's soils, far more than the 790 billion tons currently in the atmosphere. Land degradation, including deforestation of farmland and desertification, may account for as much as 30 percent of the world's greenhouse gas releases, according to studies by Rattan Lal of Ohio State University. Aside from removing the natural vegetation, plowing the soil releases organic carbon into the atmosphere as carbon dioxide. Conventional agriculture methods have already reduced soil carbon by 30 and 60 percent in much of the US, says Don Reicosky, a research soil scientist with the US Department of Agriculture who is based in Morris, Minnesota. Carbon is a key ingredient for plant growth and crucial for soil fertility. For Reicosky, carbon is the primary driver of the entire living soil ecosystem: "Carbon does great things for the soil but it takes a generation to see the impacts."

Farmers have only been able to escape the impacts of this massive loss of organic carbon thanks to cheap chemical fertilizers made from fossil fuels. But that short-term solution is just making matters worse, according to a new study out of the University of Illinois. In examining crop records and

"Soil is the connection to ourselves. … To be at home with the soil is truly the only way to be at home with ourselves, and therefore the only way we can be at peace with the environment and all of the earth species that are part of it. It is, literally, the common ground on which we all stand."

~ Fred Kirschenmann

soil samples from the Illinois Morrow Plots dating back 100 years, soil scientists were surprised to see corn yields falling on plots that had received the most chemical nitrogen fertilizers and crop residues. It turns out that even with additional crop residues, fertilized soils have much less soil carbon, likely resulting in higher releases of carbon into the atmosphere.

Keeping carbon in the soil may be one of the quickest ways to reduce global carbon emissions. And if that's not enough reason to substitute carbon storage for crop yield as the ultimate goal of farming, then the improvements in soil fertility and declines in erosion that will give us a chance at feeding a crowded world ought to.

"Blaming the farmer for these problems is futile, since we've created the economic system they operate in," says Fred Kirschenmann, a North Dakota organic farmer who works at Iowa State University's Leopold Center for Sustainable Agriculture. That system forces farmers to produce as much as possible no matter what the cost, Kirschenmann says.

A Different Way of Farming

The Kirschenmann family broke out of that system in the late 1960s when Fred learned of organic farming around the same time that his father, a veteran grower, saw their farm's soil quality deteriorating despite best efforts to protect it. Their primary objective was to rebuild the soil, and after years of trial and error, their 3,500 acres were certified as organic in 1976; they have never looked back. Today, about 1,000 acres are in native prairie and used for grazing livestock, and the rest is managed in a diversified operation with eight to nine crops each year in three different rotations. Being debt-free — a rare privilege in farming country — enabled the

Kirschenmanns to take the economic risk of finding a way to farm that was environmentally sustainable.

While organic farmers eschew chemical fertilizers, they often use intensive tilling to eliminate weeds, which can break up soils. But most organic farmers are careful to maintain cover crops and add manures to keep the soil covered and well fed with organic matter. As a result, erosion is many times less than on conventional farms. And because organic soils are more fertile, they absorb more water deeper, further reducing erosion and allowing them to better withstand droughts. A USDA study using data collected between 1994 and 2005 confirmed that organic fields have much more living soil matter than those farmed by conventional methods that did not till the soil. Corn on the organic plots also produced 18 percent higher yields.

Farm As Nature Does In The Forest

"Agriculture's biggest problem is the health of soil; erosion is just a symptom," Kirschenmann says. Overcoming that problem means fundamentally re-thinking our food production systems so that the first priority is to preserve the fertility and ecological health of the land. As to how this can be done, Kirschenmann refers to the writings of Sir Albert Howard, a British botanist who wrote in 1940 that farmers ought to farm as nature does in the forest. There should always be livestock and a multitude of plant varieties; all "wastes" should be returned to the soil so that growth and decay balance each other; great pains need to be taken to store rainfall. In such a system, Howard wrote, plants and animals protect themselves from disease.

That approach may seem quaint in our technology-driven industrial culture, but Kirschenmann points out that the

cows on his farm no longer need visits from the vet. Soil considerations aside, Kirschenmann wonders why — if conventional agriculture is so effective — 62 percent of Iowa farm families have off-farm jobs.

"Our system is clearly dysfunctional, and in destroying soil, we are putting enormous burdens on future generations," he says. "We need to start to behave as members of the land community instead of continuing to act like conquerors."

Source

Stephen Leahy, Earth Island Journal

Reference

Kirschenmann: Rethinking soil, economics and health, Leopold Center

Ian Sample (2007-08-31). "Global food crisis looms as climate change and population growth strip fertile land". The Guardian.

Aldo Leopold, "Erosion and Prosperity" ms. 1921, Included in The Essential Aldo Leopold Quotations and Commentaries, Edited by Curt Meine & Richard Knight.

B.K. Gugino, et. al. 2009, "Cornell Soil Health Assessment Training Manual" (Second Edition) A third edition will become available shortly.

David R. Montgomery and Anne Bikle, 2015. The Hidden Half of Nature; The Microbial Roots of Life and Health. New York: W.W. Norton & Company.

Sir Albert Howard, 1947. The Soil and Health. Lexington: The University of Kentucky Press.

Daphne Miller, 2013. Farmacology: What Innovative Family Farming Can Teach us About Health and Healing. New York: Harper Collins.

15.

Peak Soil: Why Nutrition Is Disappearing From Our Food?

The Secret To Good Health May Start With Dirt

By Monica Nickelsburg

The fountain of youth may be made of dirt! So supposes Steve Solomon in *The Intelligent Gardner: Growing Nutrient-Dense Food*. He asserts that most people could "live past age 100, die with all their original teeth, up to their final weeks, and this could all happen if only we fertilize all our food crops differently." It's a bold statement, but mounting evidence suggests that remineralization could be the definitive solution to our nutrient-light diet.

Concerns about the quality of our food tend to focus on the many evils of modern industrial farming, but 10,000 years of agriculture have created a more insidious problem. The minerals and phytonutrients historically derived from rich soil are diminishing in our produce and meat. It takes 500 years for nature to build two centimeters of living soil and only seconds for us to destroy it. While pesticides, chemical-rich fertilizers, and agro-tech exacerbate the problem, even natural gardening can leach soil of vital minerals. When the

same land is constantly re-cultivated *without replenishing phytonutrients* it yields more disappointing and nutrient-deficient crops.

Jo Robinson of The New York Times writes:

"Studies published within the past 15 years show that much of our produce is relatively low in phytonutrients, which are the compounds with the potential to reduce the risk of four of our modern scourges: cancer, cardiovascular disease, diabetes and dementia." [New York Times]

This is the same reason new gardeners often see generous harvests in their first few years, followed by diminishing results. The natural ecosystem is based on wild and diverse plant life, which creates more balanced and healthy soil. Agriculture, by nature, is designed to reap the maximum yield of crops, a process that has been honed and perfected over the centuries. It's quantity at the expense of quality, in other words.

As Nafeez Ahmed, executive director of the Institute for Policy Research & Development, notes:

"Over the past 40 years, about two billion hectares of soil — equivalent to 15 percent of the Earth's land area (an area larger than the United States and Mexico combined) — have been degraded through human activities, and about 30 percent of the world's cropland have become unproductive. But it takes on average a whole century just to generate a single millimetre of topsoil lost to erosion. Soil is therefore, effectively, a non-renewable but rapidly depleting resource". [The Guardian]

Many experts believe the depletion of nutrients in our soil is responsible for many of the degenerative diseases that are more prevalent now than they were in our ancestors. Research

indicates that even those who lived into their seventies were far less likely than we are to die from degenerative diseases.

Solomon offers a solution: Remineralization. The process is relatively simple in concept. Through soil-testing, farmers can determine which minerals are deficient and regularly reintroduce them into their farmland. But the economics of it are quite challenging. At current food prices, artificially reduced by government subsides, the cost of remineralization could put many commercial farmers out of business.

Take phosphorus, for example. Vegetables and fruits grown in phosphorus-abundant soil have less starch and sugar, and feature higher concentrations of other important minerals and nutrients. Yet, the nutrient-rich produce looks the same as if it had been grown in phosphorus-deficient soil, making it difficult for consumers to rally behind the cause. Getting a critical mass of consumers is especially important because the cost of reintroducing a healthy supply of phosporus into just an acre of soil is about $10,000.

That's the crux of the problem for remineralization. While reintroducing phytonutrients and minerals into our soil would require a widespread commitment to invest more in our food, rallying the masses to get behind soil enhancement poses some unsurprising challenges. As David Montgomery, author of Dirt: The Erosion of Civilizations says, "Unfortunately, saving dirt just isn't a very sexy issue."

Source

Monica Nickelsburg, October 8, 2013, The Week

Reference

Steve Solomon in The Intelligent Gardner: Growing Nutrient-Dense Food.

"Provide for your garden's basic needs ... and the plants will take it from there". USA Weekend. March 2011.

Nafeez Blog on Peak soil : Wind causing soil erosion in fields, Suffolk Sandlings

Nafeez Ahmed, The Guardian, 7 June 2013

Jo Robinson, Breeding the Nutrition Out of Our Food, The New York Times, Sunday Review, May 25, 2013.

16.

Britain Has Only 100 Harvests Left In Its Farm Soil

As Scientists Warn Of Growing 'Agricultural Crisis'

By Adam Withnall

Study shows soil in urban areas is actually much more fertile on average than the intensively over-farmed UK countryside.

Intense over-farming means there are only 100 harvests left in the soil of the UK's countryside, a study has found.

With a growing population and the declining standard of British farmland, scientists warned that we are on course for an "agricultural crisis" unless dramatic action is taken.

Despite the traditional perception that there is a green and pleasant land outside the grey, barren landscape of our cities, researchers from the University of Sheffield found that on average urban plots of soil were richer in nutrients than many farms.

Sampling local parks, allotments and gardens in urban areas, Dr Jill Edmondson showed that the ground was significantly healthier than that of arable fields. Allotment soil had 32% more organic carbon, 36% higher carbon to nitrogen ratios, 25% higher nitrogen and was significantly less compacted.

Professor Nigel Dunnett, also of the University of Sheffield, said that in order to ensure we can produce food for future generations we must start to see towns and cities as the future of farming.

He has established a scheme in the centre of Sheffield to transform a piece of wasteland into an "eco-park", and is among five projects shortlisted to win a grant from the Big Lottery Fund through the Grow Wild initiative, led by the Royal Botanic Gardens in Kew.

"With a growing population to feed, and the nutrients in our soil in sharp decline, we may soon see an agricultural crisis," Professor Dunnett said.

"Meanwhile we are also seeing a sharp decrease in biodiversity in the UK which has a disastrous knock-on effect on our wildlife Lack of pollinators means reduction in food.

"We need to dramatically rethink our approach to urban growing and use the little space we have as efficiently as possible. Cities must become places of food production."

Source

Adam Withnall, 21 October 2014, The Independent

Reference

John Vidal, 24 September 2009, The Guardian.

Tom Bawden, Independent, Soil erosion a major threat to Britain's food supply, says Government advisory group, 30 June 2015.

R. C. Palmer1 & R. P. Smith, Soil structural degradation in SW England and its impact on surface-water runoff generation, Soil Use and Management, December 2013, 29, 567–575 doi: 10.1111.

17.

The Role Of Soil Moisture on

Our Climate, Weather And Global Warming

By Keith Bellingham

Global warming is a topic that has received much attention in the media, especially during the hot days of summer. The process by which carbon dioxide (CO2) in the atmosphere prevents the escape of thermal energy into outer space is known as the green house effect. The higher the carbon dioxide levels in the atmosphere the less thermal energy that can escape thus an increasing global temperature.

Environmental scientists for several decades now have been establishing trends between anthropogenic (human induced) and natural emissions and the global thermal budget by examining carbon cycles and sources and sinks (removal) of atmospheric carbon dioxide.

Within the framework of the Kyoto Protocol, soil management represents a substantial mitigating factor reducing the atmospheric concentrations of CO2. Countries adopting the Kyoto Protocol can fulfill the carbon budget criteria by creating soil CO2 sinks on agricultural and forested lands.

The global carbon cycle, weather and climate are all heavily influenced by soil moisture. Soil can be both a major source of atmospheric CO2 and a major storage reservoir for carbon with soil moisture being a driving force. In fact, the amount of CO2 emissions from soil is ten times greater than that of human fossil fuel emissions. The CO2 emission from soil is called soil carbon flux or soil respiration and it is the result of bacteria and microorganism in the soil. The consumption of organic material or decaying plant matter in soil by bacteria generates small amounts of humus, and large concentrations of CO2 in the subsurface. Much of the CO2 that is generated diffuses from the soil into the atmosphere while some of the CO2 partitions into groundwater affecting the carbonate chemistry and as a result lowering the pH. The CO2 saturated groundwater will eventually resurface through a stream bed or discharge into some surface water body. When the CO2 saturated groundwater comes in contact with water that is exposed to the atmosphere, the CO2 will equilibrate and out gas into the atmosphere just like opening a can of a carbonated soft drink.

Soil moisture, along with temperature, and organic matter concentrations is a major player in the rate of soil respiration and the fate and transport of carbon in the environment. In arid desert regions for example where the soil is very dry, microbial activity in soil decreases, conversely in bogs and swamps where the soil remains saturated with water, anaerobic (without oxygen) conditions occur which also affects soil respiration. Soil temperature is also important as microbial activity slows with decreasing temperature.

While soil respiration is a major contributor of greenhouse gasses, soil can also be a major reservoir or sink for CO2 by a process called carbon sequestration. Agricultural carbon

sequestration is one of the most effective strategies in mitigating the CO2 emissions from fossil fuel combustion. Not only does soil carbon sequestration provide a net sink for atmospheric concentrations of CO2 but it can increase crop yields, minimize erosion, and save in fuel costs associated with farming.

Large amounts of carbon can be stored in the soil on agricultural land by a practice called conservation tilling. Conservation tilling is a strategy that makes the soil more fertile and includes strategic crop rotations, incorporation of organic liter in the soil, and minimizing the tillage of the fields. Tillage increases the rate of soil respiration by increasing the availability of oxygen to microorganisms and it disperses aggregates making the organic material more bioavailable to these organisms. If tillage is minimized, there will be less of a dependence on fertilizers.

In addition to fertilization, increases in the organic component of soil will increases the porosity allowing the plant roots to have easier access to water. In other words, with conservation tillage, it is possible to take CO2 out of the atmosphere and put in the soil to increase crop yields.

One can not discuss the global carbon cycle and sinks of atmospheric CO2 without making mention of the of the worlds oceans. The oceans represent the biggest sink for atmospheric CO2; more than forest, soil carbon sequestration and agriculture combined. Aquatic plants such as phytoplankton, consume CO2 out of the water in conjunction with their photosynthesis. The CO2 in ocean water is constantly being replenished from the atmospheric CO2 because CO2 is soluble in water and it will equilibrate with the ocean water to maintain a constant concentration that is indicative of the air pressure. In other words, oceans

inhale CO2 while soils ingest carbon and exhale CO2. Phytoplankton will build their cells with the carbon they receive from the CO2. Once the aquatic plants begin to grow, they will be consumed by other aquatic creatures and the carbon becomes part the food chain.

The global carbon cycle is indeed one of the most interesting and complex phenomenons that effects the climate, the geology and the food chain on Earth and soil moisture is an important player in this process. But how does soil moisture affect the weather?

Soil moisture is important for forecasting both temperature and precipitation. As the temperature rises the evaporation rate of soil moisture increases. The increased soil moisture evaporation helps cool the ground.

In physics, when things expand they cool their surroundings. Just like human perspiration cools human skin, when water evaporates out of the ground, it expands both in pressure and going from a liquid to a vapor, cooling the day-time temperatures. At night, the opposite holds true. The increased humidity produced by the evaporation of soil moisture increases the dewpoint (temperature where condensation occurs at constant pressure).

If the temperature drops below the dew point, condensation or dew will occur and this limits the over night low temperatures. When water goes from a vapor to a liquid, it goes to a lower energy state thus releasing thermal energy to its surroundings. In other words, things warm up as they condense. Take for example, the daytime and nighttime temperatures of Arizona and Alabama. Both states are at the same latitude but there is a big difference in daytime highs and nighttime lows and soil moisture is the reason why.

There is also a strong correlation between precipitation and soil moisture. If moisture is in the air due to soil moisture evaporation, low pressure systems will condense the moisture and precipitation will occur. If the soil is very dry, there will be less available moisture in the air and it is less likely for precipitation to occur if a low pressure system moves in.

In order to better understand our climate and weather, scientists are studying soil and how it fits in with the ocean in determining global climate changes. In situ measurements of soil moisture are invaluable for countless environmental models, and for many years, soil moisture data was unavailable to environmental researchers because of the cost and reliability of commercially available sensors soil sensors. The Stevens Hydra Probe has become an important tool for many environmental scientist the world over because of number of measurable soil parameters, reliability, and accuracy.

Source

Keith Bellingham, Opposing Views.

Reference

Powlson, David (20 January 2005). "Climatology: Will soil amplify climate change?". Nature 433 (433): 204–205.

Robert Brinkman And Wim G. Sombroek, The effects of global change on soil conditions in relation to plant growth and food production, FAO Corporate Document Repository.

Emanuel, W.R., Shugart, H.H. and Stevenson, M.P. 1985. Climatic change and the broad-scale distribution of terrestrial ecosystem complexes. Climatic Change 7: 29-43.

Sombroek, W.G. 1990. Soils on a warmer earth: the tropical regions. In: Scharpenseel et al. (eds.). 1990.

Feddema, Johannes J. Freire, Sergio Carneiro, Soil degradation, global warming and climate impacts, Inter Research, 2001.

18.

A Sense of Humus

The Environmental Benefits Of Good Soil

By Environmental Commissioner of Ontario

Most people have some sense of "humus" — the rich, dark, earthy-smelling material found in most top soils and in all well-aged compost piles. Few of us, however, have a real appreciation of its full range of environmental benefits. Even the people whose job it is to find solutions to climate change and other environmental problems often overlook the potentially huge role of soil in general, and soil organic matter (SOM) in particular, in addressing these issues. Soil scientists have had to fight hard to get decision-makers to even consider creating a major role for soil solutions in on-going climate negotiations.

In fact, soils are enormous carbon "sinks"; that is, they are capable of holding large amounts of carbon indefinitely (most of it as humus), reducing atmospheric carbon and mitigating climate change. There is more carbon held in soils worldwide than there is in either the vegetation above ground or in the atmosphere. Furthermore, most agricultural and pasture soils have lost about half of their SOM over the past few decades,

so there is ample scope for improvement. Another benefit conferred by organic matter is an increased capacity for holding water, reducing the need for irrigation and preventing flooding and erosion. In fact, the more carbon sequestered in soil, the more water it can hold – a win-win-win scenario for agriculture, the environment, and the economy.

To get an idea of the potential benefits of raising the levels of soil organic matter, let's consider two close-to-home examples: a football field; and an average urban lawn.

A typical CFL football field has an area of about 4645 m2, which is just a bit less than half of one hectare. Assuming a topsoil depth of 30 cm, there are about 1400 cubic meters of topsoil, which weigh about 1700 tonnes. If the folks who manage the field were to add just 17 tonnes of well-made compost (about one large truck load) as a top-dressing to the surface of the football field each year (preferably right after aerating), they would increase the carbon level of the soil by 1% (total dry weight of soil) over a period of 10 years. What does this mean for the environment?

First of all, it means that each year the field would sequester about 6 tonnes of CO2 (enough to offset the annual CO2 emissions produced by four average passenger cars). Secondly, each year the field's soil will have increased its water-holding capacity by about 7 cubic meters, or the amount held by 42 barrels (the big ones they use to ship oil). This is water that does not have to be added to the field via irrigation to keep the turf healthy and green in dry periods. After ten years, when the extra 1% of organic matter has been sequestered, the amount of water-holding capacity will have increased by about 70 cubic meters (imagine a very large tractor-trailer full of water sitting in the middle of the field!). In addition, about 60 tonnes of CO2 will have been

permanently sequestered. These benefits could be realized for at least 50 years for most agricultural fields, parks, recreational fields, and gardens, before maximum organic-matter content would be attained (after which, of course, the benefits can be retained, but not increased).

To accomplish the equivalent soil-carbon increase on your 90 m2 (1000 ft2) lawn, you would need to add only 1/50 of 17 tonnes, or 340 kgs (a pick-up truck load). Your lawn would then be able to hold about 4/5 of a barrel more water in its upper 30 cm than it did before. You would also be off-setting about 1/12 of the CO2 produced by your vehicle, if it is a standard one and you drive as much as the average North American. Since this is so easy to do, you might want to increase your soil's C-content by twice that rate, so that the percentage goes up 1 point over five years and two points over 10 years. With this simple act, you would be offsetting 1/6 of your car's emissions (or somebody else, if you don't drive) and increasing the water-holding capacity by 1 and 3/5 barrels each year.

The benefits don't stop there. If the turf (football field or lawn) is managed properly, the addition of the compost will preclude the need for commercial fertilizer and pesticides, further reducing the turf's carbon footprint and eliminating the potential risks associated with pesticide use. Moreover, by supporting the composting industry, you will be helping to create local jobs, boost the economy, and provide stable, long-term markets for the compost produced from your own organic residuals.

All of these benefits, simply by developing a better sense of humus.

Source

Relevant ECO reporting:

Soil: Our Eroding Asset (2009-10)

Posted on January 11, 2010 by Environmental Commissioner of Ontario

Further Reading:

Whitehead, D. C.; Tinsley, J. (1963). "The biochemistry of humus formation". Journal of the Science of Food and Agriculture 14 (12): 849–857.

Hargitai, L (1993). "The soil of organic matter content and humus quality in the maintenance of soil fertility and in environmental protection". Landscape and Urban Planning 27 (2–4): 161–167.

Whitehead, D. C.; Tinsley, J. (1963). "The biochemistry of humus formation". Journal of the Science of Food and Agriculture 14 (12): 849–857.

THE AUTHOR

Dr. Sahadeva dasa (Sanjay Shah) is a monk in vaisnava tradition. His areas of work include research in Vedic and contemporary thought, Corporate and educational training, social work and counselling, travelling, writing books and of course, practicing spiritual life and spreading awareness about the same.

He is also an accomplished musician, composer, singer, instruments player and sound engineer. He has more than a dozen albums to his credit so far. (SoulMelodies.com) His varied interests include alternative holistic living, Vedic studies, social criticism, environment, linguistics, history, art & crafts, nature studies, web technologies etc.

Many of his books have been acclaimed internationally and translated in other languages.

By The Same Author

Oil-Final Countdown To A Global Crisis And Its Solutions
End of Modern Civilization And Alternative Future
To Kill Cow Means To End Human Civilization
Cow And Humanity - Made For Each Other
Cows Are Cool - Love 'Em!
Let's Be Friends - A Curious, Calm Cow
Wondrous Glories of Vraja
We Feel Just Like You Do
Tsunami Of Diseases Headed Our Way - Know Your Food Before Time Runs Out
Cow Killing And Beef Export - The Master Plan To Turn India Into A Desert
Capitalism Communism And Cowism - A New Economics For The 21st ` Century
Noble Cow - Munching Grass, Looking Curious And Just Hanging Around
World - Through The Eyes Of Scriptures
To Save Time Is To Lengthen Life
Life Is Nothing But Time - Time Is Life, Life Is Time
Lost Time Is Never Found Again
Spare Us Some Carcasses - An Appeal From The Vultures
An Inch of Time Can Not Be Bought With A Mile of Gold
Cow Dung For Food Security And Survival of Human Race
Cow Dung – A Down To Earth Solution To Global Warming And Climate Change
Career Women - The Violence of Modern Jobs And The Lost Art of Home Making
Working Moms And Rise of A Lost Generation
Glories of Thy Wondrous Name
India A World Leader in Cow Killing And Beef Export - An Italian Did It In 10 Years
As Long As There Are Slaughterhouses, There Will Be Wars
Peak Soil – Industrial Civilization, On The Verge of Eating Itself
Corporatocracy : The New Gods – Greedy, Ruthless And Reckless
(More information on availability on DrDasa.com)

The foundation of any civilization is adequate availability of food and water. So anyone with common sense would think the top priority of nations throughout history would be taking good care of the land.

Apparently not — the decline of most civilizations is due in large part to soil degradation and erosion. As they say, 'common sense is very uncommon'. In his book, Dirt: The Erosion of Civilizations, David R. Montgomery discusses past civilizations around the globe, which typically last a few centuries before ruining their soil.

Our present-day civilization is following in the footsteps of it's predecessors. Only difference is here everything is global. All the previous calamities were local in nature. The world today shares a common fate, thanks to interdependence and interconnectivity. Earlier we suffered in isolation and now we go down, all together.

Soil is a finite and non-renewable resource, meaning its loss and degradation is not recoverable within a human lifespan. Despite the fact that soil can be formed by weathering it is considered a non-renewable resource because the process of formation of soil is a very slow process. The estimated global average rate of soil formation is about 400 years for each centimeter of soil. But for us, it takes only a couple of decades to ruin a landscape completely.

UN FAO estimates that 'today, 33 percent of land is moderately to highly degraded due to the erosion, salinization, compaction, acidification and chemical pollution of soils.'

Foundation of our civilization is eroding while we are caught-up in the non-essentials. The leaders are also too busy putting out proverbial fires, to see the point.

Dr. Sahadeva dasa

www.soilchange.com

Soul Science University Press

9 789382 947448 >