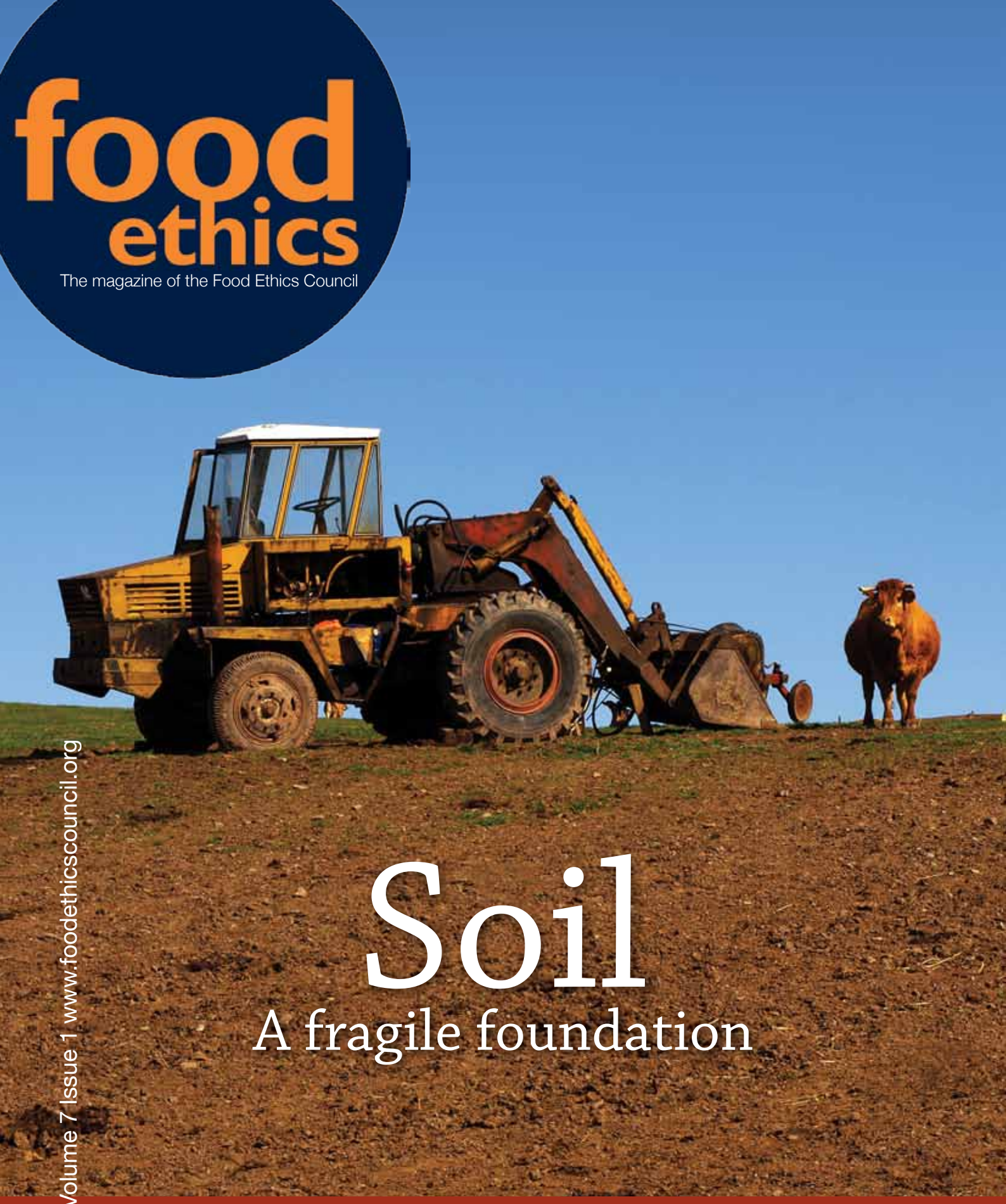
food ethics
The magazine of the Food Ethics Council



Soil

A fragile foundation

Spring 2012 Volume 7 Issue 1 www.foodethicscouncil.org

Ben Allen | Bruce Ball | Ellysar Baroudy | Martin Broadley | Joëlle Chassard
Charlie Clutterbuck | John Hammond | Emma Hockridge | Neeta Hooda | Peter Kendall
Mark Kibblewhite | Parviz Koohafkan | Martin Lane | David Montgomery | Patrick Noble
Janez Potočnik | Harjeet Singh | Geoff Tansey | Ronald Vargas | Bob Watson

FOOD ETHICS COUNCIL

Food Ethics, the magazine of the Food Ethics Council, seeks to challenge accepted opinion and spark fruitful debate about key issues and developments in food and farming. Distributed quarterly to subscribers, each issue features independent comment and analysis.

The Food Ethics Council challenges government, business and public to tackle ethical issues in food and farming, providing research, analysis and tools to help. The views of contributors to this magazine are not necessarily those of the Food Ethics Council or its members.

Edited by: Liz Barling
Design: James Adams
faojamesadams@gmail.com

Printed by: Newman Thomson Limited, Burgess Hill. Printed on 80% post-consumer recycled paper.
ISSN 1753-9056

Food Ethics Council
39-41 Surrey Street
Brighton BN1 3PB UK

T: 0845 345 8574
or +44 (0) 1273 766 654
F: +44 (0) 1273 766 653
info@foodethicscouncil.org
www.foodethicscouncil.org

The Food Ethics Council, registered charity number 1101885

Cover: Petr Kovar

Soil – don't treat it like dirt

Most contributors here seem to think that we treat the soil like dirt. Yet this thin living layer gives our planet its name special character of the 'Earth'. As Roosevelt observed - "The history of every Nation is eventually written in the way in which it cares for its soil".[1] How we change that perception and start treating soil like a living entity is an urgent question.

Many would take it as obvious that organic is better for soil, building up the biomass as Hockridge from the Soil Association says (p9). Others argue that it's not quite so simple. While the artificial nitrogen fertiliser from the Haber - Bosch process may be a major contributor to global warming, Kibblewhite (p7) notes that it not only delivers more food but also provides more carbon from plants to fuel the soil system and build up soil organic matter.

Clearly the role of the soil in carbon loss or capture is going to be vital. The World Bank authors (p17) see that encouraging and paying African farmers to conserve carbon must be all good. Others, including ActionAid (p19) challenge that position. They point out that there is currently no soil carbon market and if there were it would benefit traders more than farmers and count against smallholders who would have great difficulty is proving the methodology.

Noble (p22) has another issue with the whole process of sequestration: 'we may claim virtue (or money) in carbon credits when in truth we have stolen fertility from someone else's fields then sequestered it like money into our account.'

Broadley and Hammond (p15) pose a 'huge challenge facing soil scientists' – to describe and understand how the distribution of rarer elements in soils translate into crop and food quality. This raises an even bigger question: What is the best soil for the healthiest food? With much healthy fruit and vegetables now produced in massive hydroponics systems, what role does healthy soil play? Lane (p12) has – at least partially – some answers.

Contributors ask how we ensure that those with a duty of care for our soil treat it properly. One attempt – at least in Europe – is a 'Soil Directive', intended to force EU member states to look after their soils better. Kendall (p.15) considers it a restrictive barrier to soil care, and when the proposal for a Directive was made in 2006, as part of the soil Thematic Strategy, the UK government (along with Germany, France, the Netherlands, Austria and Malta) blocked its implementation.

But many, including, EU Environment Commissioner Potocnik (p14), Kibblewhite and Allen (p15) believe that this is the only way forward. In the meantime we must be strengthening soil monitoring and supporting research to fill knowledge gaps.

Just recently the Food and Agriculture Organisation launched a Global Soil Partnership to do just that. Koohafkan (p16) explains that its role is to 'improve global governance of the world's soil resources in order to guarantee healthy, productive soils for a food secure world... using the best science possible'. As one of a dwindling number of soil scientists in the UK, I welcome that commitment to putting robust science at the heart of soil policy. But whilst the initiative is welcome, it still leaves the question of who will take the lead in championing the protection of this precious resource?

In the end, all these questions boil down to land ownership. Tansey (p14) asks 'what is land for, in whose interests is it used?' Montgomery (p4) also links soil to the land question. 'The key to feeding the world's chronically hungry remains providing access to land where they can apply their singular asset – their labour – to feed themselves'. This reminds us that whatever plans we may have for the soil, somebody has to work it. Land and labour, soil and toil, go together. We need new skills and new science – But from where?

Despite the current UK administration's commitment to the previous government's soil strategy, and for all the talk of action plans, protection reviews and forums, there is little visible action, targets or indicators on soil policy. The impending drought will – I hope – focus minds on the key role soil could play in mitigating the effects of severe stresses on our food system, and raise its profile amongst Whitehall policymakers.

Now is the time to take soil seriously. It is a living entity that is vital for supporting all life on our planet. We have a duty – for now and for future generations – to respect, nurture and protect it.

Sixty years ago, Edward Hyams in *Soil and Civilisation* wrote: 'The pernicious vice of calculations of success in terms of money return per man-hour-energy-acre instead of food-value is still with us; and the lamentable social consequences are still being ignored.' There are big questions, with few answers, and even fewer people asking them.

1. Roosevelt signing Soil Conservation and Domestic Allotment ct 1936

Dr Charlie Clutterbuck is a Food Ethics Council Trustee, soil scientist and research fellow at the Centre for Food Policy at City University, London. www.soilanimals.com

Soil and civilisation

Time for a greener revolution

Civilizations from Babylon to Easter Island have proven only as durable as the fertility of their land, writes **David Montgomery**. What does the way we treat our soil say about our civilization?

Throughout history societies grew and prospered as long as there was new land to plow or the soil remained productive, and declined when neither remained true. Although archaeological studies around the world implicate soil erosion in the decline of ancient societies, the reasons behind the rise and fall of any particular civilization are complex. But the state of their soil set the stage upon which economics, climate extremes, and warfare shaped their fate.

In a broad sense, the history of many civilizations follows a common story line. Agriculture in fertile valley bottoms allowed populations to grow to the point where they came to rely on farming hillslope soils vulnerable to rapid erosion when tilling exposed bare earth to rainfall and runoff. While some societies developed agricultural practices that conserved or even improved their soils, time and again soil degradation pre-disposed whole civilizations to failure. The trigger for any particular societal collapse may have been a drought, natural disaster, or social conflict, but the resilience of societies in general lay in the state of the land – in the health of their soil. In small, isolated island societies and extensive empires soil erosion and degradation limited the longevity of civilizations that failed to safeguard the foundation of their health and prosperity, fertile soil.

Soil degradation is one of this century's most insidious and under-acknowledged challenges. Humanity has already degraded nearly one third of all agricultural land, much of it in the past half century. By some estimates, we continue losing about half a percent of farmland a year, a rate too slow to notice, but alarming nonetheless when one ponders how to feed a growing population. Two decades ago, a global assessment of soil degradation found that soil erosion and salinisation had already affected almost 2 billion hectares of agricultural land. Data from around the world shows that soil erosion under conventional agriculture exceeds rates of soil formation by at least ten fold.
In the coming century, we face the fundamental challenge of feeding a growing population while conserving both soil fertility and the soil itself. Although the experiences of past societies provide a sobering perspective on the long-term prospects for soil conservation, data compiled in recent studies indicate that low-till farming could dramatically reduce soil erosion with no loss in crop yields. Similarly, organic farming methods have been shown capable of improving soil fertility. Agricultural production need not come at the expense of either soil fertility or the soil.

If our modern global civilization continues the age-old pattern of soil loss and land degradation, we will repeat history as the maths of a growing population intersects with the reality of a shrinking supply of fertile farmland. Yet we can rebuild soil fertility even while using land. Centuries ago, the Dutch pioneered reclaiming land from the sea by returning organic wastes back to the fields to enrich their soil. Long before then, Amazonian Indians and the Inca in Peru improved their agricultural soils by adding organic matter back to the land. Agriculture has experienced several revolutions in historical times and, much like mechanisation did a century ago, changes in farming practices, particularly low-till and organic methods, could once again transform agriculture and farmers.

The typical arguments offered for why organic agriculture cannot feed the world have been challenged by studies showing that organic farming can produce both crop yields and profits comparable to conventional methods. Indeed, the highest per hectare crop yields typically come from small-scale, labour-intensive organic farms. A 2007 study from the University of Michigan analysed a global dataset of 293 examples of conventional and organic crop yields and concluded that organic agriculture could feed the world without expanding the agricultural land base. We need to prioritise transforming conventional agriculture no matter what technologies are pursued to increase yields in the future.

Soils are incredibly complex, reflecting the influences of climate, biology, and the underlying geology. Nonetheless, two simple guiding principles make sense for how to sustain soil


Photo: James Guppy

fertility over the long run – don't let erosion race ahead of soil formation and do feed the life in the soil that drives nutrient turnover and recycling. Conventional agriculture ignores both. During the 20th century, the Haber-Bosch process encouraged thinking that divorced agriculture from soil stewardship. Increased yields were propped up with intensive fertiliser inputs that had devastating effects on soil life. For example, mycorhizzae fungi, now known to play a fundamental role in delivering soil nutrients to nearly all plant species, experienced precipitous declines under chemical-intensive agriculture. The high-yield, fertiliser dependent crop varieties developed under the Green Revolution helped mask the effects of soil loss and declining soil fertility. A recent report sponsored by the UN and the World Bank concluded that industrial agriculture based on high external inputs is neither sustainable nor resilient. So how will we feed a growing population in the coming century? Despite the potential for advances in biotechnology, it seems foolish to leave native soil fertility at an all-time low as the energy required for producing chemical fertilisers becomes increasingly expensive. And although some insist there is no other way to feed the world, high-input agriculture is neither sustainable nor resilient. Crops grow best in fertile, life-filled soil.

Over the coming decades, as oil prices continue climbing, we must begin restoring life to the world's soils and rebuilding native soil fertility. When we see soils not as a substrate in which to grow plants but as an ecological system for feeding them so they can feed us, it becomes obvious that poisoning the foundation of our food web is a poor strategy. Yet this is what we are doing by relying on intensive use of pesticides, herbicides, and fertilisers.

At the same time, we must consider the differing needs of developed and developing nations. In the developed world the challenge lies in incorporating aspects of organic methods based on principles of agro-ecology into large farms. In the developing world, we face the challenge of how to feed the destitute. The answer to this problem does not lie in converting small subsistence farms to large farms with input-intensive methods, agro-technology, and proprietary crops for the simple reason that those with no money cannot afford to buy into those technologies. The key to feeding the world's chronically hungry remains providing access to land where they can apply their singular asset – their labour – to feed themselves. Small-scale organic farms rooted in agro-ecology offer a way to do this; large capital-intensive farms do not.

While the challenges remain daunting, promising approaches are beginning to frame potential solutions to the problem of soil degradation. The development of perennial grains, such as the pioneering efforts of Wes Jackson and colleagues at the Land Institute in Salina, Kansas, holds the potential to greatly reduce ploughing and hence soil erosion while enhancing carbon sequestration in agricultural soils. Experiments using biochar, charcoal produced through low-oxygen combustion,

as an agricultural soil amendment suggest that there is a tremendous potential to simultaneously store carbon in, and enhance the fertility of the world's agricultural soils. Over the coming decades, changes in agricultural practices, including adding biochar to soils, could potentially offset global carbon emissions by an estimated five to 30%. Efforts to build fertile soils for urban agriculture promise to bring food production closer to urban populations, especially those lacking access to fresh, healthy, affordable food.

What do all these efforts have in common? They are all based on improving soils even as we use them. Restoring health to soils can help produce better food, cleaner environments, and improve public health.

For all the attention focused on global warming, the end of cheap oil, and loss of biodiversity, there is a danger that society may neglect the most basic environmental change sweeping the planet – the erosion of the ground beneath our feet. Even though it is hard to notice in a single lifetime, Earth's continents are losing fertile soil in a process that, if it continues, will eventually undermine today's global civilization, just as it did with regional civilizations in the past.

A 2008 report developed by 400 scientists from 110 countries (the IAASTD) concluded that business as usual is not an option when it comes to soil, food, and people. While public investment in agricultural research remains dominantly directed at conventional methods and biotechnology, we need a crash programme on how to adapt agricultural methods to work with soil ecology rather than against it. Although we treat it like dirt, the thin layer of rotten rock, dead plants and animals, and living microorganisms blanketing the planet is every nation's most strategic resource.

Soil is the key to life on this planet – the foundation for all terrestrial ecosystems. It is foolish to think that we can sustain our own prosperity by degrading the foundation for it. At this pivotal point in history, we need to adopt agricultural practices that improve the health of the soil, and stop practices that harm soil. It's time for a greener revolution rooted in the mother of all life – fertile soil.

MacArthur Fellow David R. Montgomery is the author of Dirt: The Erosion of Civilizations and a professor of geomorphology at the University of Washington.

Photo: Thomas Levinson

Beyond peak soil

Sustaining global food supplies

As global availability of soil resources for growing crops declines, **Mark Kibblewhite** calls for a recognition amongst policy makers of our extraordinary soil system, and for soil management to be at the heart of a sustainable global food strategy.

I counted tractors last December, aboard the North East Frontier Express as it soldiered across the vast rice fields of West Bengal. I spotted just six small ones in five hours. Everywhere, mostly women worked small plots by hand. These timeless scenes of rural poverty are far away from the comfortable meetings about European and global soil policy, where obfuscation by Governments and straightforward opposition from farming lobbyists has prevailed.

However, unless the global governance of soil resources is sorted out urgently, and there is support for new innovations in soil management, the rural poor of South Asia and elsewhere will soon become even poorer and hunger will stalk their communities at an increasing rate.

Humankind is running out of land and the soil resources it needs for food production. The demand side problem is easier to grasp than the supply-side one; population growth means more mouths to feed and new demand for biofuels could transfer as much as a billion hectares out of food production.

The supply side is arguably more worrying; the global area of arable land increased by a quarter between 1920 and 1950, and by a further eighth up to 1980, but only by a twentieth in the next 25 years to 2005. Fortunately, this slowing of land extension during the last half of the twentieth century was offset by a simultaneous doubling of productivity through the application of science and engineering. However, this technological development has slowed dramatically in recent years and is unlikely to take off again in the short to medium term because of a lack of investment in agricultural research in recent decades.

Moreover, short-term over-exploitation of soil resources means that the quality of much arable land has been degraded so that, globally, around a quarter of it is threatened by soil erosion, salinity, loss of soil organic matter and contamination. Even in the UK, where the soils are more resilient than most, average rates of erosion are five times those of soil formation and there is good evidence of significant losses of soil organic carbon.

It is clear that at some point in the last two decades, the global availability of soil resources for crops peaked. Now the decline from the peak is accelerating because of global change. Anthropogenic climate change is shifting weather patterns so that land with productive soils is at increased risk of drought and salinity or flooding; rapid urban expansion is consuming fertile soils. Yet global governance of soil resources hardly exists and an awareness of the existential threat presented by their decline is absent from the mainstream of food and environmental policy-making.

Consumer interest in soil and the impact of food purchase decisions on soil resources could prove the most powerful means to develop more momentum for soil policy in government and business. Ultimately both markets and politicians have to reflect citizens' priorities.

Most people may be urban but a cultural affinity with soil endures from rural memories. Language is important and different words for soil have different connotations. Soil described as earth is both positively engaging and accurate because it emphasises that soil is alive. Dirt is a term that reflects a different and negative construct linked to waste and detritus. The strategic task is to share a sense of wonder as much as utility. Soil is a beautiful living system that does work for humans and the rest of life on the planet. Soil is good news!

Soil is a remarkable biological engine fuelled by carbon from above ground photosynthesis. Globally, the engine uses about 60 billion tonnes of carbon annually, to provide ecosystem services and goods on which all life depends. For plants, and

therefore for food production, the critical services provided are nutrient cycling, maintenance of a physical medium for roots, ecological control of pests and organic matter decomposition.

The soil engine is highly complex and elegant. It is made up of a vast array of organisms working in ecological concert, mainly at a microscopic scale unseen by above ground human giants. And it has a different timescale than our allotted span of three score and ten years. The soil system evolves very slowly – typically topsoil grows naturally at a rate of just 0.2mm a year, making it effectively a non-renewable resource.

Although we may see and be most aware of the mineral form of soil as sandy, clayey or loamy, it is the life in soil that is both amazing and its essential nature. Beneath the ground there is a myriad of species and a lot of biomass, equivalent to hundreds of sheep per hectare in arable fields and much more in grassland.

Over time, the organisms engineer the microstructure of the soil to optimise it as a habitat and in turn the ecological community in soil evolves to match this progression. To ensure its longevity through good times and bad, reserves of organic carbon are built up, some as working capital and others as recalcitrant reserves. Indeed the largest stocks of biogenic terrestrial carbon are in soil, so their loss to the atmosphere during soil degradation has profound implications for anthropogenic global warming. Soil is more than a paradigm for sustainability; it is a truly sustainable system.

Agriculture modifies soil and exploits it to maximise human food outputs from selected plants. There is no prospect of feeding the growing population without this exploitation and a further development of it. Global productivity of food would be much lower if we relied on soil with no external inputs. Even organic agriculture introduces significant inputs via animals and it manipulates the soil system through tillage, to increase outputs.

Much larger increases in outputs can be achieved in conventional agriculture by making stronger interventions and systematically augmenting the nutrients being cycled in the soil with inorganic nutrients. Of course the production of these nutrients as well as other inputs is currently dependent on using fossil carbon, so in effect the soil system is being driven harder by external energy sources.

Care is needed, however, when concluding that conventional systems are less sustainable than organic ones. The lower level of substitution and augmentation in organic agriculture may suggest it is more sustainable, but because conventional systems are more productive they not only deliver more food but also provide more carbon from plants to fuel the soil system and build up soil organic matter. As the American guru on soil management, Rattan Lal, points out: "plants cannot differentiate the nutrients supplied through organic and inorganic sources. It is a question of logistics and availability [with respect to food production and sustainable soil management]".

Indeed, if just 10% of conventional global agriculture was to shift to organic agriculture, the marginal loss of global food productivity, albeit just a few percent, would impact materially on global production and feed through in to higher food prices, making food less affordable at the margins of poverty and so increasing hunger.

So is it ethical to encourage organic agriculture? Well, answering this question is perhaps not that important. The critical task is not to debate the relative ethics of organic and conventional agriculture but to develop a wider awareness and understanding of the extraordinary soil system and of its strategic value, and to bring its management in to the heart of a sustainable global food strategy. This is the missing foundation for getting investment for essential research aimed at developing sustainable approaches to exploiting the life in soil, rapid innovation in soil management, and getting new know-how and tools to farmers worldwide.

The way forward requires action at all levels – by citizens, governments and, perhaps most of all, by the businesses that exploit soil resources and ultimately depend on continuing access to them. There are some encouraging signs of a growing awareness among decision-makers and the beginnings of effective strategy and action.

The soil engine is highly complex and elegant

A Global Soil Forum was formed by an international collective of scientists in 2011 and is being promoted as a formal initiative of the United Nations Food and Agriculture Organisation. Hopefully, the United Kingdom will support this initiative, although so far its officials have not participated, unlike those from another 80 countries. The European Union Council of Ministers has adopted the European Commission's far-sighted Thematic Strategy for the Protection of Soil, although a blocking minority (which includes the United Kingdom) has halted progress with the Soil Framework Directive.

However, while the National Farmers Union and its allies in Europe congratulate themselves on holding back soil legislation in Europe, some retailers and their suppliers have adopted more progressive strategies and are trying to understand the impact of their business value chain on soil resources and how to target investment in better soil management.

This makes sound business sense and implicitly recognises that running alongside land ownership and rights to exploit soil are duties to protect it and – where necessary – to restore it. Theirs is a logical response to emergent consumer concern that this most fundamental of resources is conserved while being fully exploited for food production.

Mark Kibblewhite is Professor of Applied Soil Science at Cranfield University, whose research is on soil resource policy and monitoring and understanding soil degradation processes

Healthy soil

Healthy people, healthy planet

The soil is vital; it quite literally shapes our world, writes **Emma Hockridge**. We rely on this thin layer of material for our very survival. We depend on it for our food supplies and many other vital functions including water management.

In recent years there has been an increased level of awareness about the importance of soil, but there is still too little general understanding of its importance for humanity, and relatively little action at a policy level is taken to preserve this vital substance.

Huge areas of land are suffering from soil degradation which can have a serious impact on our capacity to produce food, cause droughts and flooding, biodiversity loss and climate change. At a global level, the 2008 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)[1], conducted by over 400 scientists from across the world concluded that 1.9 billion hectares of soil is degraded around the world.

Soils under threat

In February 2012, a United Nations' Environment Programme (UNEP) report[2] stated that global warming will get worse as agricultural methods accelerate the rate of soil erosion, which depletes the amount of carbon the soil is able to store. It highlights assessments indicating that certain types of conventional and intensive agriculture are triggering soil erosion rates some 100 times greater than the rates at which nature can form soil in the first place.

Also in February 2012, the European Commission reported[3] that soil erosion by water is estimated to affect 1.3 million km^2 in Europe. The latest major UK soil study (conducted in 2009) found that food production is being jeopardised by the erosion of 2 million tonnes of topsoil each year.[4]

Such problems can impact directly on human health. Studies[5,6] reveal that the nutritional values in food have declined significantly over the past 70 years. These declines have been attributed to mineral depletion of the soil, loss of soil microorganisms and changes in plant varieties.

This critical situation for soil is in some ways an illustration of the broader problems affecting the planet. Many have outlined how the collapse of a number of civilisations has been attributed to their lack of care for the soil, most infamously, the Roman Empire. In his seminal work *Small is Beautiful*[7], E.F. Schumacher wrote:

"Among material resources, the greatest, unquestionably, is the land. Study how a society uses its land, and you can come to pretty reliable conclusions as to what its future will be."

A historic precedent

At the Soil Association, we believe that the importance of protecting and improving the health of our soil is even more important today than it ever has been, given the problems we are facing now, and the even greater challenges that climate change will bring in the future.

NGOs, academic institutions and prominent figures within the UN have all warned that threats to soil are jeopardising food security. The growing volume of their warnings is resulting in moves towards a better implementation of measures to protect soil resources. However, progress has been slow. We aim to do more to raise awareness of this vital issue in our future work.

As our name suggests, soil has been a key part of the work and foundation of the Soil Association. Perhaps surprisingly, we are often asked why we have the name. Given that we aim for healthy, humane and sustainable food, farming and land use, to us the link is obvious. One of the founders – and first president – of the Soil Association, Lady Eve Balfour first stated that: "The health of soil, plant, animal and man is one and indivisible."[8]


Photo: Organic Nation

The founders of the Soil 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.

In 1940 Sir Albert Howard published *An Agricultural Testament*[9], which explains the relationship between the health of the soil, the health of plants and the health of animals. This work inspired Lady Eve Balfour. In 1943, she published *The Living Soil*,[8] in which she summed up her subject as:

"... food, which concerns everyone; it is health, which concerns everyone; it is the soil, which concerns everyone- even if he does not realise it."

The publication of this book drew together a large meeting of like-minded people, including doctors, agricultural scientists and farmers in the summer of 1945. This formed the roots of the Soil Association, which was founded in 1946.

Since this formation, and the subsequent growth of organic agriculture, many studies have shown that it achieves much to protect and nurture the environment. For example, organically-managed soils and farmland can maintain soil fertility, enhance biodiversity and improve water retention capacity. It can even be part of the solution to mitigate the contemporary problem of climate change.

Our continuing aims and their inherent interdependence remains, as our strapline succinctly puts it: 'healthy soil, healthy people, healthy planet.' As our director, Helen Browning outlines in our new strategy:

"Our core message is that building healthy soil is the most reliable way to ensure we produce enough good food for everyone, while minimising non-renewable inputs and increasing resilience in the face of climate change and resource-constrained future."[10]

Soil carbon

According to Intergovernmental Panel on Climate Change (IPCC) scientific advisers, 89% of agriculture's GHG mitigation potential resides in improving soil carbon levels[11]. The Soil Association's 2009 review *Soil carbon and organic farming*[12] highlights the potential for organic farming to increase soil carbon levels. A report[13] of the Round Table on Organic Agriculture and Climate Change (RTOACC) also found that a quantitative evaluation of a comprehensive data set revealed strong scientific evidence for higher soil organic carbon levels in soils under organic farming.

Increasing evidence to show the importance of soil in mitigating climate change has meant that some moves are now being made to include these benefits in policy work to improve soils at a global and national level. Over 70 years ago, when promoting the first measures in the world to protect soil, President Franklin D Roosevelt said: "The nation that destroys its soil destroys itself."[14] In policy terms we haven't moved on a huge amount since then, though some attempts are being made to improve the situation at this level.

In 2011, Jacques Diouf, Director General of the UN Food and Agriculture Organisation, warned of the threat posed by

soil degradation and called for countries to speed up their implementation of the FAO's World Soil Charter.[15] In January 2012, Agriculture ministers from 64 countries discussed and agreed a number of issues relating to the future of agriculture, including to "underline the responsibility of each country to ensure that its soil is well utilised and protected to ensure that its soil can function properly."[16]

Most recently, on the 13th February 2012 the European Commission published scientific and policy reports on the state of the EU's soils.[17] They highlight the need for action to prevent the ongoing deterioration of Europe's soils, and the fact that opportunity for coordinated action on soil (via a directive) has not been exploited since it was initially proposed in 2006. At a UK level, *A Soil Strategy for England*[18] was published in 2009 and sets out the current policy context on soils and a number of core objectives for policy and research, though relatively little action has been taken on this.

At the Soil Association we hope to raise the profile of the fundamental nature of soil. Even though its importance underpins our philosophy, we need to be more vocal about it and ensure that it is an active part of our work in the future. We hope to continue and develop the vital work which the founders of the Soil Association began over 60 years ago, to ensure that there is recognition that 'the health of soil, plant, animal and man is one and indivisible' and that action is taken to ensure this health.

References

1. The International Assessment of Agricultural Knowledge, Science and Technology for Development (2008) Synthesis report
2. United Nations Environment Programme (UNEP) Year Book 2012, UN
3. European Commission (2012) Implementation of the Soil Thematic Strategy, European Commission
4. Soil Survey and Land Research Centre (2000) Soil Protection in the UK, SSLRC, Cranfield University
5. Anne-Marie Mayer, Historical Changes in the Mineral Content of Fruits and Vegetables, British Food Journal, Volume 99, Number 6, 1997
6. Donald Davis, Melvin Epp, and Hugh Riordan, Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999, Journal of the American College of Nutrition, Volume 23, Number 6, December 2005
7. E.F. Schumacher (1973) Small is Beautiful: A study of Economics as if people mattered, Blond & Briggs Ltd
8. Lady Eve Balfour (1943) The Living Soil, Faber and Faber
9. Sir Albert Howard (1940) An Agricultural Testament, London
10. Soil Association, (2012) The Road to 2020: Towards healthy, humane and sustainable food, farming and land use, Soil Association
11. Smith P et al, Greenhouse gas mitigation in agriculture. Philosophical Transactions of the Royal Society of London Series B Biological Sciences (2008) 363, 789-813. Published on-line 6 September 2007
12. Gundula Azeez (2009) Soil carbon and organic farming: A review of the evidence of agriculture's potential to combat climate change, Soil Association
13. RTOACC (2011) Organic Agriculture and Climate Change Mitigation, Food and Agriculture Organization of the United Nations (FAO) Natural Resources Management and Environment Department Rome
14. Franklin D. Roosevelt (26 February 1937) Letter to all State Governors on a Uniform Soil Conservation Law
15. In 1982 FAO adopted a World Soil Charter spelling out the basic principles and guidelines for sustainable soil management and soil protection to be followed by governments and international organizations
16. Final Communiqué 4th Berlin Agriculture Ministers' Summit on 21 January 2012 Food Security through Sustainable Growth - Farming with Limited Resources, Berlin
17. European Commission (2012) The state of soil in Europe, European Commission
18. Defra (2009) A Soil Strategy for England, Defra

Photo: Dieter Joel Jagnow

Damaged soils

Improving the quality of food

Documentary evidence shows that mineral content of UK-grown food crops has declined by an average of 60% since 1940. This decline has been matched by a commensurate fall in soil humus levels and in beneficial soil organisms, writes **Martin Lane**. In this article he explores the link between soil and human health.

If the Earth were represented by a football, then the thickness of our fragile soils on its surface would be one millionth of a micron. In the last century Man has created deserts, dustbowls and poisoned waterways, but has still failed to learn the lesson that the soil and the sea are the only two things on Earth supporting life. And yet we continue to abuse them both. In the European Union the Common Agricultural Policy and the Common Fisheries Policy are protectionist, fatally flawed and unsustainable.

Country dwellers are reminded daily that all is not well with our soils. Most pastures are now dotted with the ubiquitous plastic buckets containing mineral supplements, without which livestock now cannot thrive or reproduce. Despite this intervention, many animals display multiple symptoms of mineral deficiencies. The short life of the average modern dairy cow is an animal welfare disgrace. Modern arable farming systems are predicated solely on yield and margin. Cereal crops are sold on the commodity markets, graded by cleanliness, bushel weight, moisture content, mycotoxin levels and protein content. Meat, fruit and vegetables are rated on physical quality and quantity.

What is missing is any reference to nutritional quality. Some fruits such as apples are rated on taste, but that is very subjective. The old saying "An apple a day keeps the doctor away" only holds true if that apple contains all the correct nutrients. If a soil is denuded of its nutrient content, it is obvious that all crops grown in it will be deficient, unless they happen to be bio-accumulators of a specific mineral.

The human population relies on these same soils. We eat the livestock animals and the food crops, so are equally susceptible to deficiencies. The most common mineral deficiencies in man are well documented, but we are encouraged to look only for pharmaceutical solutions. This sticking plaster approach is used to treat diseases and conditions arising from symptoms of mineral deficiency, but does nothing to tackle the causes.

Six years ago my company Field Science conducted Brix tests and an assay of the mineral content of the best quality fruit and vegetables to be found in all major UK supermarkets. All but a handful of pears from southern Italy failed on a number of counts. The following are a few examples of common deficiencies:-

Magnesium

This crucial element is associated with over three hundred metabolic functions. Magnesium (Mg) deficient cattle are prone to "staggers" (hypomagnesaemia). In humans, Mg deficiency is beginning to be associated with celiac and Crohn's Disease. Long ago midwives knew that pregnant women with pre-eclampsia and eclampsia responded well to Epsom salts, both as a treatment and a prophylactic, so why do we not insist on adequate sources of magnesium in our diet? As magnesium is the principal element in chlorophyll, there can be no good reason not to ensure adequate presence in the soil.

Iodine

Iodine deficiency is the greatest worldwide cause of brain damage, goitre and other thyroid disorders, affecting 30% of the global population. Geologically older soils have lost most of their iodine content through leaching. The only parts of the UK with adequate soil iodine are the windward coastal strips, supplied by a combination of sea spray and the historical use of seaweed as fertiliser. Thirty-two countries in Europe alone are considered iodine deficient. The most effective initial action is to iodise table salt in affected countries, but iodine is also essential to livestock and we have seen improvements in crop quality resulting from its inclusion in fertilisers. This would indicate a strong case for bio-fortification. In the USA, where salt (even in iodised form) is now considered unhealthy, clinical symptoms of deficiency are beginning to reappear. A recent study showed that women in Okinawa, Japan, with a high, seafood-orientated diet, have 1/80th of the incidence of reproductive organ cancers suffered by their counterparts in Midwest USA.

Selenium

Field Science has been working on bio-fortification of selenium (Se) in livestock grass and forage crops for twelve years. For the past five we have also worked with a major retailer on the bio-


Photo: Rob Friesel

fortification of human food. We have shown that it is possible to raise Se to optimal tissue levels in cereals, fruit, vegetables and meat. The potential benefit to human and animal health is considerable. As with iodine, most of Europe is endemically deficient in selenium and these minerals are inter-dependent.

Bio-fortification should never be confused with mass medication. It represents a totally ethical way to provide optimal nutrition, both here and in developing countries where populations rely on a very few staple crops, grown on ancient, un-glaciated and degraded soils. Unlike the present form of GM food production, there are no associated risks to the environment. Nor is there any risk of it enabling large companies to achieve hegemony over world food production, or to endanger the bio-security of existing food crops.

In anticipation of a scaling-up of this technology we are in the process of identifying sources of desirable nutrient minerals derived from by-products, wastes and hitherto overlooked sources. The prospects are very encouraging, but as yet there is very little co-ordination between expert groups. For instance, the Food Standards Agency produced a highly unscientific report in 2008 concluding that there was no iodine deficiency in the UK, whereas the World Health Organisation reported that it is an ongoing health problem throughout Europe.

In 2011 a report from Hampstead NHS showed that one third of tested teenage girls were deficient. This prompted a recommendation from the British Dietetic Association that girls should drink more milk. Actually, the iodine content of our milk is serendipitous, deriving largely from the use in dairies of teat washes that contain iodine as a disinfectant. This iodine finds its way into the slurry pit, thence onto the land and into the forage crops. A few years ago the Veterinary Medicines Directorate was minded to ban its use, until we supplied the manufacturer with supportive data showing the extent of UK deficiency, of which they were obviously unaware.

Unlike in many areas of the developing world, the UK and Europe are blessed with relatively deep, resilient soils of glacial origin. It is not too late to change the way we produce food to a sustainable system that is not at the expense of production. All involved parties should work together to produce food of guaranteed quality and nutritional value. This could be of pivotal importance to the health of nations and save organisations such as the NHS a very large amount of money. The principle should be that the soil – and the food grown in it – provides the best medicine.

Martin Lane is the director of Field Science Ltd.

The big question

What price soil health?

Janez Potočnik is European Commissioner for the Environment

Soil is a key natural resource, fundamental to the quality and quantity of our food. But Europe's soils are under increasing pressure. Some 130 million hectares in Europe – an area more than twice the size of France – is affected by erosion. Organic matter is steadily decreasing in arable land, and there are now 250,000 contaminated soil sites in the EU.

Unless we take serious action, the damage may become irreversible. The EU currently loses more than 250 hectares of land every day, most of it converted from agriculture. Only 15 % of the Earth's landmass is suitable for food production, yet land-take for infrastructure and urbanisation carries on apace, aggravating global competition for agricultural surfaces and water resources. And land available for agriculture will need to expand by 13% by 2030 if we are to meet the needs of the growing world population.

If we want to preserve our soil's capacity to provide essential services, we should start by preventing land degradation and protecting soil biodiversity. We need to keep soils fertile, cut peatland conversion and maintain carbon stocks in forest soils. Most importantly, we must use this most precious resource more efficiently.

The Commission proposed to address this challenge through common EU legislation on soil. This has been on the table since 2006, and it's time to move towards action. In the meantime, we are strengthening soil monitoring, supporting research to fill knowledge gaps, and integrating soil protection into policies like agriculture, environment and climate. Soil is a precious resource – and it's vital we take the steps that are needed to value it more.

The European Commission recently published two reports on soil degradation: Report on the implementation of the Soil Thematic Strategy; and The State of Soil in Europe SOER 2010.

Professor Robert Watson is the Chief Scientific Adviser for Defra, and **Peter Costigan** is Science Co-odinator, Environment and Rural group, Defra.

The UK National Ecosystem Assessment (NEA) stressed the value of the natural environment, and the importance of natural assets such as soils in ensuring our well-being and economic prosperity. In the UK we have a large amount of information about our soils, including the detailed asset information provided by the Soil Survey and National Soil Inventory, supported by measurements of more ephemeral characteristics within the Countryside Survey soil work programme (http://www.countrysidesurvey.org.uk/outputs/soils-report-from-2007). One of the key aspects of the NEA has been to emphasise the importance of the many microbial functions (often in the soil environment) we rely upon for Ecosystem Services, especially Regulating and Supporting Services.

While it is important to recognize the potential for soils to sequester carbon, other services such as nutrient cycling, flood prevention, and acting as a support for crop production and as a basis for terrestrial habitats are also vitally important. The England Natural Environment White Paper (The Natural Choice), acknowledged that soil degradation costs at least £150 million – 250 million per year, and has a stated goal for all of England's soils to be managed sustainably by 2030.

This presents a challenge for government and for land managers and decision makers, but also for those who fund soils research to help clarify the role of soils in providing ecosystem services and the best ways to safeguard our soils for future generations. In addition to its funding of soils research, Defra is currently exploring the effectiveness of the Soil Protection Review to evaluate its implementation and explore current soil management trends in England. Protection of soil quality is included in the Integrated Advice Pilot which aims to develop a novel farmer-focused approach to the delivery of flexible, integrated advice to farmers.

Geoff Tansey is a Food Ethics Council Trustee, freelance writer and consultant on food, agriculture and related intellectual property issues

Understanding soil is not rocket science – it is far more complicated, as Mark Kibblethwaite likes to quip. He's a practising soil scientist. I am a lapsed one, who graduated 40 years ago. It was clear then, that using soil well was a matter not just of science but of culture – and of having the right kind of economic principles and incentives, and social values.

Our key challenge is to define the right principles to adopt when looking at how we use soils sustainably, and what we allow to happen to soils. Should we let the most fertile, productive soils be swallowed up for buildings or factories? Such soils are often the easiest and cheapest areas to develop, based on a flawed economics that discounts the future very rapidly over just a few years or a couple of decades at most. Should there, instead, be a presumption against taking these soils out of their most essential use for human kind – producing the food we need?

This means facing up to the question of what is land for, in whose interests is it used. Soils are complex living systems that must be maintained in a healthy, long-term way, not simply an input into an industrial, fossil-fuelled model of agricultural production.

Short-term economic considerations miss the point. Soil, unlike the fiction of money, is a reality that cannot be conjured up as and when we want, in they way that we can create credit or print more money. Soils are a key part of our life support system, which we do not own but of which we need to exercise stewardship.

Martin Broadley is a Reader in Plant Nutrition at the University of Nottingham.**John Hammond** is currently a Senior Research Fellow at University of Nottingham

When we define a healthy agricultural soil, we usually do so in terms of structure, texture, moisture and organic matter composition. We might also think about the soil's ability to supply crops with adequate mineral nutrients for growth, in particular nitrogen, phosphorus and potassium.

These macronutrients are typically supplied to UK agricultural soils as NPK fertilisers from inorganic or organic sources at rates of 10s-to-100s of kilograms per hectare, each year. However, in addition to these familiar nutrients, and others required in smaller quantities by all living organisms including sulphur, magnesium and zinc, the soil is also the primary reservoir of rarer elements that are equally essential to human life.

For example, selenium and iodine have variable, and sometimes very low, concentrations in UK soils. An adequate supply of these elements in our diets is essential for a healthy life and when this supply is lacking, our health suffers.

A huge challenge facing soil scientists is to describe and understand how the distribution of these rarer elements in soils translates into crop and food quality. Soil scientists must then collaborate with others to evaluate downstream health consequences and risk factors among populations, to determine if strategies such as food fortification or crop biofortification (such as is practised for selenium in Finland since 1984) might be needed.

A leading example of these approaches is at the British Geological Survey (BGS), where geochemical exploration techniques for mapping minerals of economic value using catchment and soil sampling are being adapted to study minerals which are priceless to health (http://www.bgs.ac.uk/gbase/home.html).

Peter Kendall farms in Eyeworth, Bedfordshire, in partnership with his brother Richard, and has been NFU President since 2006

The soil is the farmer's most important asset; an infinitely renewable resource which, managed well, will give back more than the farmer puts in with every year that passes.

Good soil management is also at the heart of 'sustainable intensification' which last year's Foresight report identified as being the only way in which the world's farmers can meet the challenge of producing 70% more food, while making fewer demands on non-renewable resources. As Defra's Chief Scientist, Professor Sir Bob Watson said at the Oxford Farming Conference, "Managing our soils and water is critical for increasing productivity in a sustainable manner".

Soils research has not received its rightful share of attention in the UK in recent years. That is one of the reasons why UK agricultural productivity has been falling behind many of our competitors. Good soils are essential to higher yields, and higher yields are what the farmer needs for his business and the nation needs for the security of its food supply. First class soil management is also enormously valuable as an eco-system service, reducing pollution and improving water quality.

Making the most of our soils does not require yet more prescriptive regulation in the shape of a Soils Directive. It does demand that we re-focus our efforts on funding for applied soils research, supporting new technologies and effective knowledge transfer.

The UK's farmers face a huge, but exciting challenge, of producing more, while impacting less. When it comes to meeting it, the answer really will lie in the soil.

Ben Allen is Policy Analyst, Agriculture and Land Management at the Institute for European Environment Policy.

Soil is one of the principle natural resources underpinning both the diverse range of terrestrial ecosystems within the EU as well as the functions and services that they support.

The ways in which soils are managed are critical for the future sustainability of land use in the EU and globally as it influences both the productivity of land and the extent to which different sectors, such as agriculture and forestry, can fulfil their role in contributing towards the EU's environmental targets.

Over 70% of EU land is managed as agriculture or forestry and developments in these sectors, such as the forthcoming reforms of the Common Agricultural Policy (CAP), provide significant opportunities to change the way soil resources are used and managed. In order for these opportunities to be fully realised there are two important developments that need to happen.

Unlike water or biodiversity there is no EU-wide directive that specifically addresses soil. The adoption of such a directive, if properly implemented, would provide a solid foundation on which to develop and adapt policies relating to soil management across different sectors within the EU. Implementing good soil management, with or without the support of such a directive relies on appropriately designed and evidence based policy measures.

Understanding the link between the way land is used and managed and the impacts on soil resources is therefore crucial. As such there is a need for ongoing investment to improve further the availability of data and information to support the development and adaptation of policies to ensure that EU soils remain a healthy, functioning natural resource in the future.

Bruce Ball is a soil scientist working at the Scottish Agricultural College.

Parviz Koohafkan is Director, Land and Water Division and coordinator of GIAHS at the Food and Agriculture Organisation in Rome

A healthy soil has a beauty in that it can feed us again and again, if we care for it. Farmers are key players in conserving soil quality. However while we, as scientists, know quite well how to conserve the soil and maintain crop productivity, the message often does not get across to farmers who face ever increasing pressure to increase productivity and remain profitable while coping with demanding environmental legislation.

I am surprised how often farmers are unaware of what their soils look like. At a series of farmer training events we at the Scottish Agricultural College have been helping to raise their awareness of how vulnerable soils are to degradation through compaction and erosion. I strongly believe that visual examination helps re-connect farmers to the soil and is essential in improving farmer awareness of soil problems and the action needed for improvement. This usually involves reduced compaction and increased incorporation of organic residues which not only helps to conserve our soils but also improve food quality.

We need a network of convenient knowledge exchange events about soils where the fruits of our research, investment and knowledge can increase farmers' wisdom. I believe that ultimately we need to move from agribusiness to husbandry and conservation, with increased linkage to consumers. This need will become more pressing as we reduce our dependency on oil by-products and capital injections and increase our dependency on good soil.

The views expressed in this article are the author's own, and do not necessarily reflect the views of the Scottish Agricultural College.

Often overlooked, soils are so important. They provide the basis for global food, feed, fuel and fibre production and are crucial for water availability, nutrient cycling, organic carbon stocks, and represent one-quarter of global biodiversity.

But soil is a limited natural resource, and the world's limited area of fertile soils are increasingly under pressure from competing land uses. Soil degradation threatens this vital resource, weakening efforts to increase food production for a growing population.

Soils are often perceived as a second-tier priority and no international governance body to support coordinated global action on their management exists. A unified and authoritative voice for soil management is needed to better coordinate efforts and pool limited resources.

For these reasons, FAO and a group of partners have launched the Global Soil Partnership (GSP) to improve global governance of the world's soil resources in order to guarantee healthy, productive soils for a food secure world – and to work together to sustain other essential ecosystem services on which our livelihoods and societies depend.

The Partnership aims to address soil issues from the field using the best science possible. Regional partnerships will implement the actions of the GSP, while addressing local needs with local stakeholders and fostering south-south cooperation. Technical guidance to the Global Soil Partnership will be provided by an Intergovernmental Technical Panel on Soils.

The Partnership's main initial areas of work include the promotion of sustainable soil management and investment; awareness and extension; facilitation of targeted soil research and development; enhancement of much-needed soil information; and harmonisation of methods and measurements.

FAO and its partners welcome join efforts in enhancing this global partnership and invites experts willing to pool their resources and experiences to safeguard global soil resources and ensure healthy ecosystems for future generations.

Sustainable land management and carbon finance

As farmers across Africa suffer from soil erosion and unpredictable weather, the decline of soil fertility can be so severe as to seriously threaten their livelihoods writes **Ellysar Baroudy** and **Neeta Hooda** of the World Bank's Carbon Finance Unit

The World Bank has supported agriculture in Africa for decades through a variety of means, including grants, loans and, most recently, the purchase of carbon credits. Through the pilot Kenya Agricultural Carbon Project, some 60,000 farmer households on 45,000 hectares of land will combat the erosion of their lands using sustainable land management practices to enrich degraded soil.

Reversing soil degradation enhances productivity and helps boost crop yields, directly increasing farmer revenues and resilience to climate change. It also, crucially, helps store more carbon in the soil, for which the farmers involved in the Kenya Agricultural Carbon Project are being rewarded with carbon credits.

Carbon Finance and Sustainable Land Management

The development of carbon finance to reward sustainable agricultural land management (SALM) practices, or 'soil carbon' as it is commonly referred to, is recent and cutting edge. The UNFCCC1 does not allow agriculture land management projects to be accounted for under the Clean Development Mechanism. In the land-use sector it allows for afforestation/reforestation (A/R) projects only. Consequently, in 2009 the World Bank's BioCarbon Fund took the initiative to develop a soil carbon methodology for the voluntary carbon market. It took two years, and numerous tweaks to the methodology, to complete the work but it was finally approved by the Verified Carbon Standard (VCS) in December 2011.

This methodology is a new approach for estimating changes in the soil carbon pool when sustainable land management practices that enhance soil carbon sequestration are adopted on farmlands. The methodology uses an approach where – instead of making direct soil carbon measurements – the emphasis is on robust monitoring of adopted agricultural practices which are known to have impacts on soil carbon (positive or negative), and then using the monitored parameters as inputs into models for estimating the soil carbon change. The World Bank is now identifying projects across Africa to test the application of this methodology to other farming environments and practices.

In western Kenya, the methodology enables each farmer to choose from a wide range of SALM practices and receive payments for changing his or her farming techniques as part of a carbon finance scheme. Working with farmers in Kitale and Kisumu is mainly about improving productivity in a changing climate. These farmers want – and need – to get more output from their land while making their yields more resilient. The use of farming techniques such as mulching, crop residue management, and soil and water conservation measures should increase farm productivity and incomes, and make agriculture more resilient to climate change, while also contributing to climate change mitigation. The revenue from carbon credits helps to trigger the actual implementation of sustainable land management practices by helping overcome the technical barriers and transfer of knowledge to the farmers that to ensure sustainability of the practices

The BioCarbon Fund

The BioCarbon Fund started working on agriculture in 2007 in close collaboration with the World Bank's Africa department. Two elements prompted it to expand to SALM: the natural progression to deal with all land-use issues in the fund beyond A/R, and the evolving debate in the international climate negotiations on agriculture.

The BioCarbon Fund's resources are directed to help the agriculture carbon sector as a whole, to support the development of an institutional framework around the net reduction of greenhouse gases from soil, and, in the case of Kenya, it covered the substantial cost of developing a new methodology, assessing the carbon baseline and investing in capacity-building and training for project developers and entities.

Taking on the Carbon Market Risk

Developing carbon projects in general, and land use projects such as soil carbon in particular, is challenging. The risks to buyers and sellers at such an early stage of the agricultural carbon market are significant. Most carbon transactions in the voluntary market have taken place in developed countries, mainly the United States and Canada, where agricultural emissions data are abundant, farms are often large and financial risks are lower than in developing nations. Very few transactions have been recorded from developing country projects.

What is needed to help SALM carbon take off?

Simplified procedures: Simpler accounting methods are needed for land use to become part of the climate solution and if there is to be a wide-scale contribution to sustainable development in degraded areas. The new soil carbon methodology is just one step.

Strong project champion: A key element in any carbon project is to have a dedicated project champion to manage the project and interact with the auditors and buyers of carbon credits. A dedicated champion is especially important for complex projects, or ones involving many farmers, and plays a significant intermediary role.

Adequate financing: For any carbon project to succeed, adequate financing needs to be secured. Two financing streams are required: the up-front financing needed to undertake the investment and the financing needed to develop the carbon asset. Carbon revenues only flow once a project is established and implemented. Raising resources for the initial financing of the project is a challenge for most carbon projects, and often an impediment to progress.

Strengthened rural financial institutions: Regional organisations such as rural development banks need help to understand and support agriculture and carbon programmes. National rural finance institutions can play an important role in bridging the gap towards upfront financing and should be strengthened.

Incentives to farmers: Farmers will primarily be driven to adopt new agricultural practices by the promise of increased yields or income. Better management practices that increase yields, add value along the production chain and result in carbon gains, are likely to be taken up more readily. The key question is: will there be enough incentives for farmers to adopt sustainable land management practices in their own best interests.

Capacity-building: The current mismatch between the complexity of procedures and the capacity to implement them on the ground can be tackled by enhancing the capacities both of beneficiaries and project implementers on the one hand and simplifying procedures on the other.

Economies of scale: An increase in project size can reduce transaction costs while a higher share of carbon revenues goes to the beneficiaries. But current capacity of project champions and difficulties in leveraging funds for up-front financing pose barriers to reaching economies of scale. Valuation of other environmental services such as biodiversity, soil conservation, improved water quality and water retention capacities also need to be realised, so the participating communities are compensated for primary and secondary benefits emanating from the project.

Sustainable land management fully integrated in agriculture policy: Sustainable land management practices and their use for greenhouse gas mitigation in most countries are not currently embedded in national legislation. Activities are undertaken at the initiative of project champions and thus remain localised. A more strategic approach would be to anchor carbon finance within agricultural policy discussions at national or sub-national levels.

Clear ownership rights: Carbon projects based on sustainable land management will require clear land tenure and emission reduction rights. Investors will not take the risk of working in environments where ownership of any asset, whether agricultural produce or carbon, are not clear. Carbon finance can help to increase land tenure security in project areas.

Solid management: A strong institutional and management framework is important for the success of these projects. Investing in and sustaining local capacities can ensure permanence of carbon initiatives, and successful projects rely on equitable benefit-sharing schemes that improve local livelihoods. Technical expertise is helpful within a project team, but this can be outsourced. What is critical and essential is solid management capacity.

SALM fully recognized by the carbon markets: Regulated markets have not been as favourable to forestry or SALM credits from developing countries as to other sectors. The regulations governing the Clean Development Mechanism and the EU Emissions Trading Scheme disadvantage many developing countries where better land use management could be incentivised through carbon revenues. It would be helpful for climate change regulators to assess how to make regulations friendlier to sustainable land management because of its importance for rural livelihoods in developing countries.

For a project developer in a developing country, entering these untested waters requires dedicating resources to a new area of expertise within their teams and for the transaction costs associated with project preparation and developing the carbon asset. In A/R projects, the cost of project development can range from $100,000 to $400,000 and can include delays incurred by lack of existing methodologies. SALM project development costs have been at the lower end of this range.

The willingness of carbon credit buyers to purchase agricultural carbon credits has so far been limited. The BioCarbon Fund tested the market with co-purchasers from outside the fund, but some buyers preferred to wait for developments in the sector and others did not want to invest in the development of the carbon methodology, which is fundamental to the transaction. Carbon methodologies can cost $100,000-150,000 to develop, and because they are ultimately a public good, private companies can be reluctant to invest in them. We also found that because SALM is so new, and the carbon risks were deemed too high, buyers were not willing to make advance payments for the carbon. However, we believe that this should change as the market develops in the coming years. If we learn and apply lessons from the more established sectors in the carbon market, such as A/R and REDD, funding and financing bottlenecks are likely to decrease in time as methodologies become available to use and carbon transactions increase.

The World Bank is committed to furthering work on sustainable land management as this should lead to a "triple-win" situation. It will increase productivity and improve farmers' livelihoods by generating additional incomes; contribute to climate change solutions through mitigation of greenhouse gases; and support the adaptation agenda by helping rural communities become more climate-resilient.

Our priority is to take this to scale and facilitate the adoption of these projects by poor farmers in least- developed countries across the world.

Ellysar Baroudy is BioCarbon Fund manager at the World Bank.
Neeta Hooda is a Senior Carbon Finance Specialist in the Carbon Finance Unit at the World Bank.

Soil carbon markets

False solutions for real problems

actionaid

The recent round of climate negotiations in Durban, referred to as the seventeenth Conference of Parties – COP 17 – is being hailed as a landmark success by a majority of countries, but **ActionAid** believes differently.

Rich countries claim that COP 17 has successfully broken the 'firewall' created by the Kyoto Protocol in 1997 between developed and developing countries in today's increasingly multi-polar world and changing economic geography.

It led to the creation of the "Durban Platform for Enhanced Action" which requires 'all' countries to act to accelerate the reduction of global greenhouse gas emissions, dumping the principles of 'equity' and 'common but differentiated responsibilities'

While Africa is suffering from the dire impacts of climate change, and smallholder farmers in particular are struggling to adapt, first world countries are attempting to evade their historical responsibilities and shift their mitigation burden onto developing countries without changing their consumption pattern back home.

Promoting soil carbon capture or sequestration as a "triple win", these first world countries, led by the World Bank, claim that it is a solution to the global warming crisis; a way for African farmers to adapt to climate change; and as a means to increase resources for African farmers.

ActionAid analysed these claims, and calls it as a 'false solution' for poor smallholders, particularly women, in Africa. This is because, apart from adapting to climate change, smallholder farmers would also have to bear the mitigation burden of the climate crisis caused by rich countries who are simply avoiding urgent decisions to reduce carbon emissions in their own countries. In addition, ActionAid believes that insecurity of land tenure of poor farmers will be exacerbated, as those with more money and power will try to control opportunities and acquire more land in anticipation of making money through the new markets.

Finally, smallholders may have to depend on an unpredictable and volatile source of funding through carbon markets, instead of receiving sustainable, adequate and compensatory public finance from rich countries for the costs of adapting to climate change.

Promoting soil carbon markets is therefore a major distraction from providing the public finance needed to help poor countries tackle climate change. There are six reasons why soil carbon markets won't work for smallholders:

There is currently no soil carbon market. The first rule of a market is that it needs buyers and sellers. A soil carbon market requires international rules that give incentives to polluters and investors to offset emissions through carbon credits. At the Durban conference, there was an agreement for the second commitment period of the Kyoto Protocol and creating a new market mechanism, but developed countries' extremely weak emission reduction commitments will contribute to the lack of global demand for carbon credits.

Added to the problem of sagging demand in general for carbon credits is the fact that the European Emissions Trading System (EU-ETS) – currently responsible for 98% of the compliance market – does not allow credits from soil carbon to be traded. These rules are in place until at least 2020.

If there were a market, it would not provide revenues to farmers. Soil carbon will be worth little. Investors want certainty when purchasing carbon credits – they need to be confident that the tonnes of carbon purchased are real, additional and permanent. The market price of carbon will reflect the value that investors see – or don't see. Soil carbon will not provide the certainty that investors need for several reasons.

Soil carbon sequestration is easily reversible. The loss of soil carbon can be caused by external occurrences such as fires, strong winds, droughts, pests, and human activities such as change in land management practices and deforestation.

Because soil carbon sequestration is reversible, the environmental integrity of the soil carbon sequestration projects cannot be guaranteed.

Soil carbon, like forest carbon, cannot be measured with the precision necessary for commodity investors. Farm soils cannot sequester much carbon in a year. Soil sequestration rates under ideal conditions are less than 1 tonne per hectare. Soil carbon prices on the voluntary market have hovered around $1.20 per tonne in past years.

Transactions costs are extremely high. Transaction costs associated with soil carbon schemes include negotiation, approval, administration, monitoring, enforcement, and insurance costs. The costs to implement many of the practices can also be significant. The FAO (Food and Agriculture Organisation) estimates the range of adoption costs to be from $12-$600/hectare, effectively preventing smallholders from participation without significant support.

Revenues principally go to intermediaries. Carbon credits, already in use with offset schemes like tree-planting, rarely deliver money to projects and communities on the ground. Because of high transactions costs, revenues largely go to intermediaries. Even though projects themselves are in developing countries, most of the money stays in rich countries. Those that stand to benefit most from carbon trading are project developers and financial speculators: just one more example of wealth transfer from South to North – where developing country farmers create a commodity – in this case soil carbon credits – that increases the wealth of traders, speculators, and middlemen, rather than the farmer.

The system will be biased against smallholders.
Larger landholdings and high quality land will be more attractive to project developers. Given the limited amount of carbon that can be sequestered per hectare, project developers will need to aggregate many hectares to make the project worthwhile. It will be easier to aggregate larger holdings than many small landholdings. Better quality land can sequester more carbon, so these lands will be preferred by project developers. As wealthier farmers are likely to be on better quality land, they will disproportionately benefit from a market in soil carbon, if it performs well.

Lands under secure legal title will be preferred by the market. Farmers holding secure and private title to land are much more likely to be included in sequestration projects, and the creation of a soil carbon market is likely to intensify pressures in some areas to favour formal or legal title over customary

tenure systems. Women farmers are rarely the holders to the title of the property they farm and so will be disproportionately disadvantaged by loss of the access and use rights they currently have under customary tenure systems. Moreover, if soil carbon prices rise as the overall price of carbon credits rises, land will become more valuable for its carbon sequestration potential, creating one more reason for dispossession of land of the poor and powerless.

An emphasis by the market on practices that generate and maintain carbon in soils will reduce farmers' ability to respond and adapt to climatic changes. Agriculture in the developing world is particularly vulnerable to climate change and the Intergovernmental Panel on Climate Change is predicting a drastic reduction in yields from rain-fed agriculture. Farmers are already reviewing and changing their agriculture practices to adapt to ever-changing weather patterns. Soil carbon sequestration requires long-term commitment and often binds farmers to certain type of agriculture practices and land management practices that can negatively affect the adaptive capacity of poor farmers, who may need to change their production systems to adapt to new climate conditions and economic needs.

To sustain finance from an offset market, developed countries need to keep emitting. "The 'sustainability' of finance from carbon trading is … structurally reliant on the failure to reduce emissions adequately in industrialized countries." (FERN et al. 2011)

The fundamental conundrum of soil carbon markets is revealed by the fact that to sustain financial returns from the market, developed countries need to keep emitting. Reliance by developed countries on an offset market means that real emission reductions don't happen: emissions are merely moved into trees and soils (maybe): but the structural changes needed at the economic level to move towards low- or zero-carbon economies are postponed.

Policymakers are distracted by the need to create market-friendly institutions

Instead of facing head-on the difficult task of reducing emissions domestically, developed countries are designing elaborate offsetting schemes that avoid reducing the own emissions, while reframing the conversation around the 'marvellous mitigation potential' that exists in developing country agriculture. Such schemes are a way of displacing the work and challenges of reducing carbon emissions away from those responsible for most of past, present and future emissions, and onto those least able to control the terms of their participation. This echoes economic and social patterns that have marginalised Africa and other regions for decades, indeed centuries. The end result is that developed countries continue to emit greenhouse gases and developing country agriculture remains significantly at risk – and may now have to bear the mitigation burden too.

Soil carbon markets are a distraction from addressing real adaptation needs and mobilising real funding to support adaptation. Adaptation and food security must be the central objectives of agricultural policies in a warming world. Unfortunately, the creation of a soil carbon market results in significant diversion and misallocation of resources for adaptation and agricultural development. Policymakers are distracted by the need to create market-friendly institutions. In order to effectively participate in the market, smallholders, researchers and development professionals must worry about measuring and maintaining the amount of carbon in the soil, rather than prioritising the many steps necessary to adapt effectively to a changing climate and enhance food security.

The World Bank and other soil market proponents argue that there are huge sums of money that could be mobilised for agricultural extension and development through the carbon market. However, the creation of a soil carbon market cannot be the driver of the adaptation agenda. Food security and systems resilience must be the guiding objectives of both adaptation efforts and means of their finance.

Soil carbon markets are a diversion from the real obligations of rich countries: to reduce emissions and to provide substantial, stable, predictable, new and additional public finance.
Developed countries have accepted obligations to provide new public funding to help tackle climate change, but soil carbon capture and offset schemes are diversions to evade these promises. Rich countries, which are responsible for historic and current emissions, including massive nitrous oxide and methane emissions from industrial agriculture, are trying to shift the burden of responsibility onto poor communities in developing countries, while focusing on 'private financing' as a means to evade their funding obligations. Investing resources in establishing a soil carbon market diverts attention from the central question of how to generate public finance that can be used to address food security threats posed by climate change.

Developed countries must immediately and rapidly reduce their emissions of greenhouse gases domestically. Only immediate and real reductions in emissions can prevent further humanitarian catastrophes such as the current drought and famine situation in the Horn of Africa. Every year that emissions continue at their current rate put the lives and livelihoods of millions of the world's poor increasingly at risk. Developed countries not only have the historical responsibility and the obligation to address the impacts of their emissions on the world's poor; they also have the means to do so.

This article, compiled by Harjeet Singh, International Climate Justice Coordinator at Actionaid, is drawn from a paper written by Doreen Stabinsky, Professor, College of the Atlantic, USA and Alex Wijeratna, independent consultant, with inputs from Celso Marcatto, Ilana Solomon, Harjeet Singh and Soren Ambrose of ActionAid.

Soil and humanity

Protecting the commons

Centuries ago, writes **Patrick Noble**, agricultural tenancy agreements would have clauses forbidding the sale of hay and straw. Selling them sold the farm's fertility for cash and in turn reduced the value of a farm. The purchasing farmer would increase both her farm's value and crop yields – or cash for fertility.

In the Mediterranean, communities control irrigation canals because water is central to their farms' productivity. In the same way, soil fertility, beyond a farmer's control yet essential for the farm's management, could come under civic control.

Civic boards, administering the distribution of wastes for agriculture could distribute an equivalent of waste to harvest back to the market gardens that feed our towns and cities. But in more widely dispersed arable land there is a serious question about how fertility can be maintained. Rotation of (leguminous) green manures and pastures are helpful, but insufficient for regular harvests. As fossil rocks, oil and gas diminish so systems for the return of fertility are to be our largest agricultural/social problems.

The commons is at the heart of social systems and all social systems cycle through soil. Soil is a common on which all people feed. Bio mass is a common on which both all people and all soils must feed. Climate is a common dependant on the respiration and photo synthetic powers of soil-fed bio mass.

In a challenge to the status quo, which would have us burn "wastes" and otherwise unused resources such as kelp or algae, I'd argue that the bio mass we hold as waste is also a common; one which cannot be burnt, because burning diminishes common soil.

Our combusted "wastes" (bio fuel) reduce fertility and gain energy. That burnt fertility does not follow laws of physics in which matter and energy always remain in some form or other. It does not re-appear in a neighbour's field, or on a neighbouring planet. Life is not finite, but variable. Earth can end in a lifeless state even though the physical components of life remain as matter and energy. If we burn life, the total mass of life will be reduced.

And so to sequestration. If we manage to sequester life (charcoal, silos, deep sea sumps, or embedded structures) then we will have removed some life (calling it carbon) from a life-cycle somewhere: so diminishing both the mass of life and the power of its atmospheric pump. We diminish the common. Furthermore we may claim virtue (or money) in carbon credits when in truth we have stolen fertility from someone else's fields then sequestered it like money into our account.

Of course, surplus fertility will mineralise in soil faster than plants can use it, so emitting gas and leaching nutrients to water courses. The answer is not to slow CO2 release in semi-sequestered charcoal (slowing cycles) - but to devise systems for equitable re-distribution of surplus wastes to where crops are hungry.

People have been curious about the high fertility of the Terra Preta soils of the Amazon Basin, which were achieved over generations by the systematic addition of charcoal. Hunting, foraging and fishing had provided a surplus of waste to that of the complementary agricultural production. Charcoal became a useful tool for the storage of that surplus fertility.

Such systems are no help to us today. We can only import bio mass by impoverishing that of a neighbour's, and we have no wilderness for foraging. On a planetary scale, charcoal (or sequestration sumps) reduces bio mass for both crop yields and the pumping capacity of Earth's lungs.

Anyone claiming carbon credits is similarly sequestering to themselves what should be another's. If we have surplus life to sequester we should give it up for another to grow

The carbon cycle is a delusion. Carbon cannot cycle. Living complex proteins cycle and can only do so by way of the very many elements of which they are composed. Isolating an element is isolating the convenience of a scapegoat and, usually, for labelling and marketing purposes – as in achieved carbon targets, footprints and maintained quotas – all of which legitimise and excuse over-consumption.

Sequestration is a convenient untruth. Life flows from life to life and through living rivers of sea and soil. The art of husbandry is the balancing by trial and error of optimum speeds. As with the flows of a river, increasing speed indicates increased mass. As I wrote in my recent book The Lost Coefficient of Time – "When economy and ecology are seamlessly enmeshed then both can run at optimum speeds – when not, friction between them will grind down bio mass and release wasted economic heat."

Patrick Noble farms Bryn Cocyn farm in North Wales, producing organic vegetables, fruit, cereal, beef and lamb.

Animals and public health: Why treating animals better is critical to human welfare
Aysha Akhtar| 2012 | Palgrave MacMillan | ISBN 9780230249738
In this groundbreaking work, Aysha Akhtar, Fellow of the Oxford Centre for Animal Ethics, links animal and human health and welfare. Focusing on violence to pets, animal experimentation and factory farming, she argues that treating animals without respect or dignity impacts on our own wellbeing. A compelling case for putting animal welfare at the heart of society. EB

Animal Welfare in Animal Agriculture: Husbandry, Stewardship, and Sustainability in Animal Production
Wilson G Pond, Fuller W Bazer and Bernard E Rollin Eds. | 2012 | CRC Press | ISBN 9781439848425
Our second book on animal health and wellbeing, this offers a wide range of views on what constitutes animal welfare from veterinarians, ethicists, scientists and producers. Taking the global importance of farm animals as its starting point, contributing authors offer insights into good practice which will be invaluable for agriculture students and agricultural specialists around the world. EB

Bees in the city: The urban beekeepers' handbook
Brian McCallum and Alison Benjamin| 2011 | Guardian Books | ISBN 9780852652312
A thought provoking collection of personal accounts of beekeeping in the middle of cities. Providing a very interesting and topical update on an amazing hobby, it raises key questions such as whether it's better to keep bees or plant bee-friendly flowers in the summer. If you're thinking of keeping bees it's well worth a read. JN

Food Movements Unite! Strategies to transform our food systems
Eric Holt-Giménez Ed. | 2011 | Food First Books| ISBN 9780935028386
Discussing diverse aspects of grassroots and social movement experiences of food system, some two dozen authors deal with issues including farmers, sustainability and food sovereignty; consumers, labour and food justice; and development, climate and rights. In his preface, Samir Amin argues that currently fragmented movements – including food sovereignty, justice and democracy – need some form of 'convergence in diversity' to transform food systems away from the "corporate food regime". GT

Food Systems Failure: The Global Food Crisis and the Future of Agriculture
Christopher Rosin, Paul Stock and Hugh Campbell Eds. | 2012 | Earthscan| ISBN 9781849712293
Using a variety of approaches in their critical assessment of the global food system, these authors all share the common perspective that it requires radical change. They argue that the recent food price crises are indicative of wider problems in the global food system as a whole, and provide evidence for the urgent need to shift away from business-as-usual to avoid an increasingly dire global food situation. LU

Let Them Eat Shrimp: The Tragic Disappearance of the Rainforests of the Sea
Kennedy Warne| 2011 | Shearwater by Island Press | ISBN 9781597266833
Written in the style of a passionate travelogue, the author explores the connections between the world's rapidly declining mangrove habitats, the organisms that inhabit them, the ecological processes they facilitate, and the people whose livelihoods depend on them. This book reminds us to be responsible consumers and mindful that our economic choices have global consequences. LU

Understanding the Common Agricultural Policy
Berkeley Hill | 2012 | Earthscan for Routledge| ISBN 9781844077786
This comprehensive and understandable analysis by Emeritus Professor of Policy Analysis at Imperial College London goes behind the Pillar I & II modulation and agri-environment schemes of current reform, to explain the problems that the CAP is intended to address. It looks at the conflicts, trade offs and unintended consequences involved, before putting the present policy in its historical perspective. SD

What to eat
Joanna Blythman | 2012 | Fourth Estate| ISBN 9780007341429
Joanna Blythman's informative, practical and inspiring book tackles head on the dilemmas facing the conscientious, or just hungry, food consumer. 'Should I eat red meat?', 'Is local always best?', 'Are pomegranates a green choice?' – What to Eat answers the questions we're all asking, through a combination of sound general advice ('The 20 principles of eating, made simple') and careful consideration of literally hundreds of particular food items. SR

Forthcoming events

13th Apr '12	Sociology in an age of austerity | The British Sociological Association http://www.britsoc.co.uk/events/conference/home.htm | Leeds, UK
23rd Apr - 25th Apr '12	Improving diet and nutrition | Wilton Park and the University of Exeter http://www.wiltonpark.org.uk/en/conferences/conference-calendar Sussex, UK
24th Apr - 25th Apr '12	Annual Conference; Healthy Food from Healthy Animals | British Society of Animal Science | http://www.bsas.org.uk/Meetings_&_Workshops/ Nottingham, UK
27th Apr - 30th Apr '12	World Nutrition Rio 2012: Knowledge Policy Action | World Public Health Nutrition Association | http://www.worldnutritionrio2012.com/ingles/
7th May - 12th May '12	6th World Fisheries Congress | The World Council of Fisheries Societies http://www.6thwfc2012.com/ | Edinburgh, UK
30th May - 2nd Jun '12	Climate Change and Sustainable Development | 10th Congress of the European Society for Agricultural and Food | www.eursafe2012.eu Tübingen, Germany
5th Jun '12	World Environment Day | United Nations Environment Programme www.unep.org
19th Jun - 20th Jun '12	Restoring Diverse Grassland conference | The Association of Applied Biology http://www.aab.org.uk/ Oxford Belfry, Thame
20th Jun - 22nd Jun '12	Rio +20 | UN Conference on Sustainable Development http://www.uncsd2012.org/rio20/index.php?menu=14 | Rio de Janiero, Brazil
22nd Jun '12	International Day for Biological Diversity | The United Nations http://www.cbd.int/idb/ | Worldwide
2nd July - 3rd July '12	Food and Society | BSA Food Study Group http://www.britsoc.co.uk/events/food.htm | London, UK
23rd July - 26th July '12	Royal Welsh Show | Royal Welsh Agricultural Society http://www.rwas.co.uk/society | Builth Wells
27th Aug - 31st Aug '12	EAAP Annual Meeting | European Federation of Animal Science http://www.eaap.org/Content/meetings.htm | Bratislava, Slovak Republic
16th Oct '12	World Food Day | FAO | http://www.fao.org/index_en.htm | Worldwide

The Food Ethics Council works towards a food system that is fair and healthy for people and the environment.

Our independent research, and advice to business, government and civil society helps find a way through controverisal issues and supports better choices in food and farming.

To keep up to date with our work, register at **www.foodethicscouncil.org** to receive our free monthly e-newsletter.