Soils and the Modern Pagan

Dai Llewellyn Davies, 2010 – Brindabella.id.au

Published in DEBATE, August-October 2010

> *... we must awaken to the necessity of putting down our roots deeply, of drawing strength from our isolation while overcoming its disadvantages and opening our minds to the knowledge and wisdom of other lands. Without allowing ourselves profoundly to belong to the land, we will be as nothing - "a wind that passeth away and cometh not again.*

The Australian writer Elyne Mitchell, who wrote these words in the 1940s, lived in the high country of the upper Murray valley. She travelled through it on foot, horseback and ski and came to understand the delicate balance that exists between the stability of the thin mountain soils and the health of the river system below.

She described the process of past civilisations, with most of their urban populations isolated from the productive land, expanding through imports of food by trade then conquest of other lands but, when the tide of conquest turns, finding that they have lost the fertility of their home soils. They withered into oblivion or lingered on in small enclaves as a reminder of former glory.

As she wrote, dust clouds were blowing in from the plains and she describes the snowfields darkened by the Mallee soils. The book is a short poetical work that makes effective use of her ability to capture the essences of the Australian bush. It is hard to resist quoting more. Emphasising just what we are putting at risk she describes the colours:

> *Greys and greens, blending and separating - mixing with brown, intimately growing with cream and white, with lemon and the faint stain of dusty red - eucalypt barks fuse and twine the colours. Their leaves, ephemeral against the sky, are pointed and olive green, or blue laid over by an oily dust, and the bronze and burnished copper of the young leaves find their counterpart in the underwing of the kingfisher.*

And a contrast:

> *The dead snowgum bleached to silver, standing above a mountain stream - moonlight on dried grass that is moving like a crop in the south wind - these are the colours of history past; but the stream and the wind are the past and future too.*

A more conventional scholarly treatment of the topic is provided by Carter and Dale - as dry as the dust that blows through gritty pages and heralds the collapse of civilisations. They present a seemingly endless list of culture after culture, civilisation after civilisation, continent after continent and, with a terrible inevitability, collapse after collapse. It is hard, reading this, to escape the conclusion that humans are incapable of learning from the past or planning for the future - but this is wrong.

They make it clear that some people in the past have well understood what was needed to maintain their soils and the importance of doing so. Before the start of

recorded history, ancient engineers in Mesopotamia and elsewhere built extensive systems of irrigation canals that they probably thought would last forever.

These systems and the soil they fed might still have been productive today were it not for the deforestation and erosion of the hills in their upper catchments dumping more silt in the canals than their slaves could remove. Coastlines that have been extended up to fifty kilometres beyond ancient ports are a silent reminder that earth moves.

On the other hand, the fertile Nile valley has been plundered for food by almost every colonial power from ancient times to modern but it has been blessed with soils that have had their fertility replenished annually with silt from the flooding Nile - not too little, not too much. Where soils have survived, regions have lived to foster a new culture.

Where the soils have been destroyed - most of the Middle East, North Africa and across the north of the Mediterranean, parts of India and China - there sometimes remained what Carter and Dale refer to as rained-on deserts - regions that have water but not the soils that can capture and hold it.

For the Mayan civilisation of Central America a reversion to jungle followed collapse in a region where the destruction wreaked by a non-industrial culture could not hold back the fecundity of nature for long. Modern tools powered by fossil fuels rather than slave labour may yet lay waste to the Amazon basin.

Many factors, both social and natural, have been put forward to explain the rise and fall of civilisations. Whether it was war, tyranny and deliberately destructive barbarism, or a socialistic lethargy of cultured but decaying states, social factors were certainly important but ultimately it has been soils that have had the final say.

Two partial exceptions to this have been India and China. Both have had the advantage of vast tracts of fertile land to draw on without colonial expansion and both have been able to sustain a cultural momentum that has eventually engulfed invaders. Their sustained cultural integrity has maintained traditions that emphasise the importance of the land and the concept of living with, rather than battling against, the forces of nature.

Christianity took root in a decaying empire and an irrelevant paganism - irrelevant in the sense that it had degenerated to the point of having no practical value in dealing with the land and maintaining food supplies. Paganism simply meant country values. These were centred on maintaining the productivity of the land, but even in Virgil's day the fresh perspective of a country lad had little more than entertainment value.

By the time of Constantine's rule even the bloody spectacles of the stadium had little impact on jaded and numbed spirits. So Christianity attempted to repress everything pagan despite the fact that its founder spoke of seeds flourishing in fertile soils and the beauty of lilies in the fields.

In rural Europe Christianity eventually fostered a fresh view of nature based on careful observation. Gilbert White strolled through the English countryside observing, noting, and talking with the locals. Charles Darwin sailed to foreign lands, observed their diversity and returned to spend decades carefully considering the implications. Gregor Mendel kept detailed records of plants in the monastery gardens and his insight laid the foundations of modern genetics.

If Christianity is to be more than a source of individual spiritual strength in the modern world, and play a meaningful role in confronting the practical problems of the twenty-first century, it needs to recognise the historical origins of its difficulties in dealing with natural phenomenon as more than arbitrary or punitive 'acts of God'. It needs to grow beyond its largely ineffectual rejection of early scientific, materialism and develop a working relationship with an emerging scientific world-view that itself rejects this early, naive reductionism.

This emerging view, based on an increasing understanding of the mathematics of complex systems, has put the ghost back into the machine with its recognition of the existence of new levels and systems of order within apparent chaos. There is a growing recognition in the natural sciences that this abstract mathematics is reflected in the behaviour of natural systems.

It is a rejection of Just Science - the reductionist science that claims that atoms are just particles, chemicals are just atoms, soils and food are just chemicals and so on. This is a we-know-it-all view of science that inhibits enthusiasm and creativity. The emerging science recognises that we still have a very long way to go. It recognises that higher levels of order have a dynamic and 'life' of their own that goes far beyond a collection of components. It is encouraging a renewed zest for discovery in a younger generation.

It is not really a new idea because traditional views have always recognised the complexity of nature and the existence of higher laws. It is, however, regaining strength and moving from the realms of religious custom and philosophy to measurable reality. As theoreticians toy with simple definitions of intelligence to describe the behaviour of complex systems they may be agreeing with Virgil: that '*an inner spirit nourishes the heavens, the lands, the liquid fields'*.

It is said that over half the biological diversity of the planet lies in its soils. I suspect that the validity of this statement rather depends on the definition of diversity but putting aside Virgil's liquid fields, the seas that store the vast bulk of all biologically available carbon, soils hold most of the remainder, and most of that is biologically active.

At the smallest scale we have bacteria. These were once assumed to act independently but we now know more about how they form co-operative colonies with complex exploratory and defensive behaviour. They are small but not simple. They are skilled artisans and capable of creating, or living in, environments that don't support other life forms.

At the next level of structural complexity we have protozoa, such as the amoeba, that farm the bacteria and have been breeding them for a billion years or more to tame them and to develop co-operative arrangements. Amoeba normally live singly but are also capable of forming aggregates that exhibit behaviour mirroring that of multi-cellular organisms such as molds, with visible fruiting bodies producing spores.

Then there are the real fungi. They form a network of filaments, or mycelium, through the soil on scales that range from metres to kilometres. They develop mycorrhizal connections with plant roots for nutrient exchange. Fungi are the traders. They co-operate with plants to gain access to solar energy in the form of simple carbohydrates. In return they provide plants with nutrients that they are able to harvest

more effectively than plant roots can alone.

Their networks can form a trading system between plants of differing species but where you have traders you also have pirates. Some fungi don't play fair and act parasitically. Others are innocent vectors for viral diseases. Stable, healthy soils tend toward a balance between co-operation and destructive parasitism.

Healthy soils capture and store water far more effectively than dead dirt and they reduce nutrient leaching and so improve river quality. They are also easier to till so can reduce costs and save energy. They provide a stable, vital foundation for everything that grows above their surface.

We know that Australia had poor soils before the arrival of Europeans and it is difficult to imagine how any particular area has changed since then, but I was once given an insight that has stuck quite vividly in my mind. A friend and I were called out one day to help a neighbour rescue a cow that had become stuck in the broad ring of boggy mud surrounding a near-empty dam. In the hour or so that we struggled to free the cow the old farmer said little and as it eventually stumbled away he looked silently after it.

I watched the cow and wondered if it was going to fall over somewhere else and die. I wondered if the old man was thinking the same, and whether it might end up being the first of many. Would he be forced to make the decision to sell off stock and take a known, and perhaps tolerable, loss against the possibility of losing the lot if he left it too late?

Eventually he turned to us and became quite talkative. He described the changes that had taken place in the area since he was a young man. The land had been rich, fertile loam that had supported large dairy herds and thriving towns. What remained was a poor and fragile soil that supported a few beef cattle.

I had previously noticed one area that he mentioned. Along one side of a nearby creek the soil was a barren clay, with patches of sand in places, that barely supported a feeble eucalypt re-growth. A few metres away across the creek the soil was, if not great, in dramatically better shape.

The difference was a drought or two, and failed hopes. Hope is an essential characteristic of farmers anywhere but particularly so in Australia. Through floods, storms, disease and mild drought it is essential for survival, but in an extended drought too much hope and wishful thinking leads to disaster, not just for the stock and the farmer but for the land.

Australia loses around five billion tons of soil each year. This figure means little to me - just a long string of zeros. I could contrast it with the figure of 1.7 billion tons said to be lost from USA soils but I doubt that either figure is accurate enough for a comparison. We don't know. Fifty kilometres of land pushed into the Persian Gulf is within my mental grasp.

We are losing soil both through direct physical erosion and also through the reduction in its living content or biomass. It is clear that to reverse this we need to act on a grander scale than we are at the moment. We need to act on two fronts - reducing erosion and increasing fertility.

We have many thousands of farmers who have struggled for generations to adapt to our harsh, erratic climate and poor soils. From among their number have come

some exceptional innovators whose ideas are slowly being taken seriously. We have a strong track record in agricultural sciences with a diverse and innovative contemporary community. We have government sponsored community programmes such as Landcare. We are still losing ground.

We are failing in both vision and discipline. It is a test for democracy to show that it can match the achievements of past benevolent autocracies. If we ignore problems then autocratic forces will intervene as they are attempting to do in the global warming arena. History tells us that benevolence rarely lasts long in an autocracy.

Those ancient engineers, from Chaldea to China, who built canal systems that served people for millennia, helped to create a distinction between civilisation and barbarism. They set standards for what it means to be civilised. They expanded food production within the world as they knew it using the energy of slave labour to extend their irrigation canals and keep them free of silt.

As the amount of silt increased, the cost in food of maintaining the slaves outstripped the productivity of the land. Now we have machines and fossil fuels. Any use we make of these to improve soils will pay long term dividends, not just in money but in redressing our impact on the carbon cycle.

For millennia, until very recently, soil degradation has been the main source of atmospheric carbon dioxide generated by human activities. In the USA, fossil fuels surpassed soil at some time around the 1950s. If we are having an impact on climate, and my best guess is that we are and have been for a long time, then putting carbon - life - back into the planet's soils is the obvious first option for a corrective response.

We need a significant shift in resources from urban to rural - but how? For a moment there I glimpsed a hazy mirage. I though I saw a pasteurised, homogenised consensus of climate scientists. Beyond the herd were traders with their heavy-laden camel train. Far off in the heat shimmering distance was an oasis with tall stands of cedar breaking the barren line of the horizon. But a storm blew in from the west and the oasis disappeared in a flurry of dust.

Complete consensus is an unnatural state. We need to sustain a healthy competition in the sciences. We need good old-fashioned competition stripped of the new-speak of 'natural selection' and the tautological 'survival of the fittest'. We need to fund diversity and reward those that poke holes in scientific orthodoxies.

We should borrow from the Romans and create new digital arenas for public tournaments. We could also adopt another ancient tradition and have the contestants compete naked, or at least their data should be fully, and freely, exposed to public scrutiny. We could give the contestants a choice there.

Tycho Brahe laid the foundations of modern astronomy with pains-taking records of the positions of stars and planets that provided accurate data for Kepler's orbital models. We need better models of soils, their growth, decay and erosion. We need to prepare the ground for future generations of natural scientists by creating extensive reference data on the current condition of our soils. Even a one-off, but substantial, effort would greatly benefit future modellers and good data grows in value over time.

The models of climate science are seriously flawed by the lack of reliable data extending over significant periods of time. Better soil models would also help climate models. Reliable data will also be necessary if soil carbon is to be included in any

future carbon-trading scheme. In a mature scheme, certainty and reliability will attract a financial premium.

Although it is heretical to say so at present, it seems to me that the problem of soil degradation is fundamentally more significant than climate change. The planet's terrestrial ecosystems have survived extremes of climate but they don't survive soil loss.

Of course the processes are not disconnected. Hot dry conditions degrade soils. Heavy rains wash them away. The breakdown of soil life adds carbon dioxide to the atmosphere. The specifics depend on local conditions. The overall dynamics are currently beyond our understanding.

The twentieth century saw a major transformation of agricultural practice in the green revolution. All revolutions have unintended casualties - collateral damage in new-speak. With the green revolution it was the soils of the world that suffered most. Machines and fossil fuels led to over-tilling of soils combined with compaction from their wheels during tilling and harvest - and machines don't produce manure. The carbon dioxide they produce is a plant nutrient, not a pollutant, but it is dispersed to the winds and mostly ends up in the oceans.

The industrial production of nitrogenous fertilisers and the enhanced transport and processing of others led to the neglect of soil life. It led to a view of dirt as just a physical matrix that supported a semi-hydroponic view of agriculture - a clean and simple view freed from the complexities of soil life. This was naive reductionism at its worst - a failure that some people still refuse to contemplate. The green revolution is deeply embedded in the modern mythology of science as saviour and to question it is a threat to the faithful.

Provided with water, soils and the fecundity of nature fight back. Particularly in Australia, water is the key to fertility. We have long known the advantages of contour plowing in holding water, slowing run-off and reducing erosion. Australian innovators such as Ken Yeomans (Keyline Farming) and Peter Andrews (Natural Sequence Farming) have extended this basic principle.

They, and others, have shown that we should reverse a common attitude to flooding. Rather than building drains and freeing natural watercourses of obstructions, so increasing erosion and exacerbating flooding downstream, we should hold back the water at the earliest possible stage. We should give it time to seep deep into the soils and, importantly, we should develop soils that assist this process.

Rising fuel prices have hastened the uptake of low or zero-till regimes that leave soil life relatively intact and reduce the loss of soil carbon to the atmosphere. A more sophisticated view of soils is now well established in the agricultural sciences.

We have the means to rapidly expand our understanding of soil ecologies - an understanding that could lead to a second green revolution. We need to develop new herbicides (a necessary adjunct to most zero-till regimes) and develop ones that have a reduced impact on soil life.

We need to develop a much deeper understanding of the role and consequences of modern genetic engineering and base decisions on fact rather than faith. Those that totally oppose genetic engineering should at least recognise the advances that have been made since the days of blasting seeds with radiation and hoping that something

useful would emerge in the mess of mutations that was produced.

Geneticists should publicly recognise that the simplistic view of genes that we had fifty years ago was flawed. The study of epigenetics will continue to surprise us for a long time to come. Traditional breeding programs had the advantage of time to observe and evaluate.

There is a newly expanding source of funding that is promoting the development of healthy soils. It doesn't yet amount to a camel load of gravy trains but it is significant. A growing number of prosperous city dwellers, encouraged by a new generation of celebrity chefs, are looking for taste and nutritional quality rather than price. Science is slowly clarifying the link between healthy soils, healthy plants and healthy people but we are a long way from a full understanding.

Our definition of organic produce needs revision. Poor soils produce poor plants, organic or otherwise. Few soils can sustain production without some added mineral fertiliser but good soils can, with intelligent cultivation, produce thriving crops without pesticides. We need to better understand what constitutes good human nutrition and evaluate produce directly rather than making assumptions based on broad generalisations. We are still a long way from achieving this.

I once spent some lazy hours chatting and watching a crop of broccoli fend off moths that hovered above the plants but seemed unable to approach them. Come picking time, most of this organically grown crop had completely escaped damage except for the plants in the corners of the plot where the tractor couldn't reach. Here the soil preparation had been deficient and caterpillars had savaged the plants. The arc of the tractor's turning circle clearly delimited two regimes. Some simple arithmetic suggested that the difference was highly significant.

We are using most of the arable land of the planet. There are no new continents to expand to but there is a new frontier. We have the know-how and energy to restore old, tired land. Gill and Dale made a claim that startled me. I have no idea whether it might be feasible, but they suggested that if arrangements could be negotiated with Turkey and Syria to control erosion, much of the former fertility of Mesopotamia could be restored in modern Iraq.

References:

Elyne Mitchell, *Soil and Civilization*, Halstead Press, Sydney, 1946.
Vernon Gill Carter & Tom Dale, *Topsoil and Civilization*, University of Oklahoma Press, 1955, 1974.