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John Thackara

HOW TO THRIVE IN THE NEXT ECONOMY

DESIGNING TOMORROW'S WORLD TODAY

Thames & Hudson

2 GROUNDING: FROM HEAL THE SOIL, TO THINK LIKE A FOREST

On a hot day in the foothills of the Cevennes, the mountainous area in France where I live, I'm spreading a mixture of bonemeal, dried blood, crushed oyster shells, and wood-fire ash, onto a growing mound of wood, twigs, leaves, and straw. Each layer is seasoned, as if with salt and pepper, by this powdery mix of minerals and biological activators. The preparation stimulates root growth, soil micro-organism production, and humus formation. Although it takes six of us a day to build one Cevenol mound, our teacher Robert Morez assures us it will supply nutrients to plants, and retain water effectively, for at least four years – maybe more.[1] The invitation had said I would learn 'how to construct a bio-intensive planting mound' – but in my mind I'm making soil, rather than depleting it, for the first time in my life.

During breaks to replenish ourselves, too, with nutrients, I learn that healthy soil is itself a living system – the most dense and diverse medium of interdependent organisms on Earth. There are about 50 billion microbes in one tablespoon of soil; a single shovel can contain more living things than all the human beings ever born.[2] There's a world of connected intelligence down there, too. Mind-bogglingly complex interactions support the flora and food webs upon which we all rely for our existence. In an old-growth forest, millions of super-delicate mycorrhizal fungi are linked together with the roots of plants; these form vast subsoil neurological networks. These interlacing mosaics of mycelium infuse habitats with information-sharing membranes that are aware, react to change, and collectively have the long-term health of the host environment in mind. This vast, invisible web does not just ferry water and nutrients, it also spreads information, and over long distances; a typical mycorrhizal fungal filament can be hundreds or thousands of times the length of a tree root. This chemical communication between plants stimulates their defence against parasites; plants that are not under attack themselves have shown an increased resistance to insects attacking other plants a good distance away. The mycologist Paul Stamets, who describes these networks as 'nature's internet', speculates that fungi may participate in some form of planetary interspecies communication in which we, too, may one day learn to take part.[3] Left to itself, this immense but invisible network is not only self-sustaining, it also determines the metabolic health of all terrestrial ecosystems, including our own. Ninety-nine per cent of all food comes from our soils.[4] As James Merryweather so memorably explains it, all living creatures – animals and plants, bacteria, fungi, and others – are involved in this worldwide, multilayered web of cooperation.[5]

I knew nothing of all this – not a single thing – until that day on the mountain. Remorseful at my own ignorance, but intrigued, I set off to learn more. It turns out that ten thousand years ago, when we discovered that using the plough made farming easier, my predecessors did not realize that intensive tillage fragments these vast but delicate underground networks. They were unaware that fungi and plants depend on each other for survival, and that chopping up the soil disrupts food-producing processes that had evolved over millions of years. In blissful ignorance, we ploughed on regardless – only to discover, over time, that escalating amounts of money, transport, energy, and imported raw materials would soon be needed to feed ourselves. The more food we produced industrially, the greater the damage we caused to soils as a living system. Our use of heavy machinery accelerated the damage; it so compacted soils that plant

roots found it ever harder to penetrate – and the soil's capacity to store and conduct water was degraded. As our production increased, ever vaster swathes of land were affected by water and wind erosion. Irrigation with bad water, the escalating use of synthetic fertilizers, and a build-up of salt have made the situation worse. Two hundred years of industrial production have added to the damage in the form of soil contamination: three million major sites around the world have been poisoned by heavy metals and mineral oils. And of course, large areas of healthy land are simply paved over each year as buildings, roads, and airports spread.[6]

The notion that high-tech farming is feeding the world is therefore misleading. The truer story is that industrial agriculture is an extractive industry: it mines the soils for nutrients that are not replaced. We've ruined an area the size of India since the Second World War[7] and, right now, we're losing 3.4 tons of healthy soil a year for every person on the planet.[8] When the first Norwegians came to Goodhue County, Minnesota, the black topsoil was 2 m (7 ft) deep in some places; now, it is only 30–90 cm (1–3 ft) deep.[9] In the UK, scientists have warned that Britain has only 100 harvests left in its farm soil as a result of intense over-farming.[10]

HEALING THE SOIL

What will it take to heal the soil? On its own, soil formation is an extremely slow process – sometimes taking thousands of years – but a growing band of visionaries have discovered that the process can be speeded up dramatically if the right approach is followed. One such pioneer, the Australian soil scientist Dr Christine Jones, has demonstrated that new topsoil will form rapidly, and naturally, with the right combination of biomass and turnover of plant roots. In what she calls her 'Rules of the Kitchen', Jones lists six essential ingredients for soil formation: minerals; air; water; living things in the soil – such as plants and animals, and their by-products; living things on the soil, ditto; and what she describes as 'intermittent and patchy disturbance regimes'. 'In order for new soil to form, it must be living,' Jones explains; 'life in the soil provides the structure for more life, and the formation of more soil. That's why healthy groundcover, high root biomass, and high levels of associated microbial activity, are fundamental to building new topsoil.' Farmers using cover crops as green manure can produce 1 cm (½ in.) of topsoil in three to four years. Even better: when the value of the crops used in this approach is factored in, the net cost of restoring soil is negative.[11]

These principles have been shown to work on a large scale in a project in Zimbabwe called Operation Hope.[12] More than 2,600 hectares (6,500 acres) of parched and degraded grasslands have been transformed into lush pastures replete with ponds and flowing streams – even during periods of drought. Surprisingly, this was accomplished through a dramatic *increase* in the number of herd animals on the land. Behind Operation Hope is an approach called holistic management, applied to rangeland practice, that has been developed over fifty years by Allan Savory, a former wildlife biologist, farmer, and politician. Savory's method is based on a singular insight: grasses can't graze themselves. Before man came along, herbivores co-evolved with perennial grasses. When a large herd moved around freely – accompanied, that is, only by pack-hunting predators – they dunged and urinated with very high concentration on the grass. No animals like to feed on their own faeces, so they had to move off of their own faeces within one to three days and they could not return until the dung had weathered and was clean again.

Moving across the land in large herds, the herbivores trample and compact soils while also fertilizing the soil with concentrated levels of nutrient-rich animal wastes. This approach aligns itself with nature in a comprehensive way; it increases plant growth and also re-establishes livelihoods through additional livestock, while increasing wildlife populations through holistic management. Grasses depend on herbivores to help them with their decay process. When large herbivores such as kudu and Cape buffalo disappear, grasses begin to decay far more slowly through oxidation. When millions of tons of vegetation are left standing, dying upright, light cannot reach growth buds; the next year, the entire plant dies. The death of grass leads to bare ground, and the desert spreads.

Savory was not alone in understanding the importance of compacting on the health of vegetation. In the early 1970s, agricultural institutes in Texas and Arizona designed machines to simulate the physical effects of once prevalent vast herbivore herds such as the millions of bison that roamed North America. Machines with names like the Dixon Imprinter were used on thousands of acres of the western US to break soil crusts and cause indentations and irregularities, while laying down plant material as soil-covering litter vital to soil health. Imprinting, as the technique is called, is still practised; agriculture labs in various countries have developed rollers that imitate the hoofprints of passing buffalo and trample green manures and old stalks into the ground.[13] Trouble is, these approaches do not heal the soil. Their machines are too heavy. Although a big buffalo weighed about a metric ton (2,200 lbs), the monster tractors used in mega-agriculture can weigh 45 metric tons (over 100,000 lbs). Machines this large do terrible damage to the soil underground in a single pass.

For Allan Savory, the hooves, mouths, and digestive systems of real animals do this same task more effectively. The process consumes no fossil fuels, and can be repeated continuously at no cost. Large herbivores break soil crusts, but without damaging the subsoil, and the broken crust allows soil to absorb water and to breathe; this enables more plants to germinate and establish. The effect is more pronounced when animals are concentrated in large herds – which is how they behave when under threat from pack-hunting predators. Operation Hope therefore runs livestock in what Savory calls a 'predator-friendly manner. We don't kill the lions, leopards, hyenas, wild dogs or cheetah because their presence is crucial to keeping wildlife moving and thus the land healthy.' Livestock are held every night in portable lion-proof corrals (known as kraals in southern Africa). Large animals also compact the soil under their hooves – 'anyone who has had a horse stand on their boot understands this', jests Savory – but it's the right amount of compaction for good seed-to soil-contact, which increases germination. The need for compaction is why gardeners tamp down the soil around seedlings or seeds.

Ruminants also return standing grass-plant material to the soil surface earlier than the same plant material would have returned to the soil had the animals not been there. One has only to watch a cow or buffalo trample or dung to know this. In short, the conversion of plant material to litter or dung is essential to maintain biological decay. Machines designed to imitate animals cannot do this.

TIME, NOT NUMBERS

Grasslands where rainfall is seasonal require periodic disturbance for overall health – but not too much, and not too little. Overgrazing is a function of time, not of animal numbers alone. Trampling for too long turns the soil into powder, which increases erosion by wind and water; and dung and urine, like most things in excess, become pollutants when animals are there too long – a lesson industrial-scale 'feedlot' cattle farmers soon learn. Whether there is one cow or a thousand, Savory explains, is not so important; the important variable is *time*. Moments of high physical impact – trampling, dunging, and urinating – are choreographed in short periods between much longer periods for plants and soil life to recover. As a guide, three or fewer days of grazing are followed by three to nine months of recovery – but, because they manage holistically, Operation Hope's herders do not follow abstract time regimes. Each piece of land, and each moment in time, is unique.

Savory's use of increased livestock to reverse desertification is a profound challenge to mainstream approaches to land use and agricultural development. For although the Green Revolution increased global food production tremendously, its reliance on fertilizers, intense watering, and heavy machinery degraded its ecological base, and its associated social systems, in the process. In the pursuit of efficiency and increased output, so-called production agriculture relied on massive inputs of petrochemicals and herbicides, focused on just one crop at a time, and confined large numbers of animal into grim 'feedlots'. The good news, according to Savory, is that this damage can all be reversed by what he calls a 'Brown Revolution' based on the regeneration of covered, organically rich, biologically

thriving soil, and brought to fruition via millions of human beings returning to the land and the production of food. 'Viewed holistically biodiversity loss, desertification, and climate change, are not three issues, they are one,' Savory says. 'Without reversing desertification, climate change cannot adequately be addressed.' The more humid and biologically productive regions of the world need to develop agricultural models based on small, biodiverse farms that imitate the natural, multi-tiered vegetation structures of those environments. This is where most of tomorrow's grain, fruits, nuts, and vegetables will be produced, as well as most of the dairy products, and some of the meat. Savory's approach has big social benefits, too. Globally, small-scale livestock production employs 1.3 billion people and sustains livelihoods for about 900 million of the world's poorest people – many of them women. They will have a vital role to play in the restoration of degraded soils.

Although Savory describes these insights as common sense, he has spent fifty years battling to make the scientific case for his approach. For most of his life, he has had to contend with intense opposition from agricultural researchers intent on 'proving' it does not work. Savory's belated acceptance by the mainstream is one sign of a profound shift in scientific understanding of energy and nutrient transfers in ecosystem ecology. What Savory learned on the range is confirmed by biological studies of plants, animals, terrestrial, aquatic, and marine ecosystems and how they interact with each other. Systems can have properties as a whole, it turns out, that are not explicable in terms of the sum of parts that scientists once studied in isolation. The drive to scale up food production was a powerful incentive to bypass complexity, but a management approach that works well in car factories or software has turned out to be self-defeating when applied to the land.

THINKING LIKE A FOREST

If maintaining the fertility of the soil is a core principle of ecological agriculture, so, too, is a commitment to think in longer timeframes than markets – or even than individual human lifespans. We need

to think less like a machine and more like a forest. At Windhorse Farm in Nova Scotia, James W. Drescher is the latest custodian of an experiment called 'enrichment forestry' that has been in progress for four generations – just a blink of the eye in the life of a forest. 'Windhorse is on the leading edge of something very old,' says Drescher; 'wealth, from the forest's point of view, is biological material.' Because a healthy forest is rich in biodiversity and heavy with stored carbon, the key to its long-term health is the retention of wealth after it has been created. Conserving that wealth, Drescher has learned, is dependent on the very slow decomposition of huge volumes of dead wood. Dead wood is the life of the forest, Drescher explains; almost half the animals in an old-growth forest live in or on or from it. Foresters who act as land stewards, rather than like factory managers, are therefore selective in deciding which trees to harvest and remove. Most dead trees, or trees that have fallen naturally, are left where they are. By harvesting only the slowest-growing trees in a stand, the forest's overall vitality is increased. In a similar spirit, the tallest trees are never cut; this increases canopy height. Species of tree that are under-represented in a particular stand are left alone to conserve species diversity. Pathways in the forest are lined with sawdust and bark, not with concrete; animals and plants travel and disperse along these corridors of connectivity. Remarkably, this 'forest health first' approach is economically viable – more so, in fact, than the clear-cutting approach of mainstream commercial forestry. If a 40-hectare (100-acre) lot in the Acadian Forest had been clear-cut in 1840, and again in 1890, 1940, and 1990, Drescher explains, the total harvest would have been much lower than the wood harvested by the annual selection methods; and, of course, there would be no standing merchantable timber at all today.

In today's culture of short-term profits, the wisdom and skills needed to maximize the yield from a forest over a period of a century or more are rare. But looking forwards, the Windhorse Farm experiment is proof that it's possible to make a living in ways that respect, and not harm, other life forms that are also trying to make a living there. The forest itself – not the timber that's sold – is

the primary product. In that sense Windhorse forestry is a set of principles rather than a model to be replicated at will. It's a practice that demands diligent study, keen observation, insightful analysis, and resourceful generosity. Drescher describes as 'deep stillness' the everyday practice in which foresters, woodlot owners, and other workers simply hang out in the forest a lot more: studying, observing, reflecting, working, and, as Drescher puts it, 'investing lots of time doing as close to nothing as possible'.[14]

If holistic rangeland management and do-little forestry sound fringe – well, they are, for now. But in a growing number of real-world contexts, the respectful interdependence of people and living systems is coming back to life. I'll tell you about more examples later in the book, but my purpose here is to suggest that reconnecting with the land and proactive soil restoration are set to become mainstream. At the Stockholm Resilience Centre in Sweden, Per Olsson and his colleagues are amassing a growing number of stories in which groups of interested parties inhabit their land in healthy ways.[15] Olsson describes these examples as 'social-ecological systems' in which often diverse communities are finding ways to share rights, responsibilities, and power in ways that put the interests of the land and its soils first.

BIOREGIONS

What researchers describe opaquely as 'adaptive ecosystem-based management' is at heart a social and cultural process, not a technical one. A sense of belonging, and shared responsibility for the land, is the social glue that binds diverse groups together. A new political and geographical concept – the bioregion – is beginning to strengthen these shared ties.

National boundaries are an outdated way to inhabit the land. In the Global South, where lines were often drawn literally in the sand by former colonial powers, the relationship between city and countryside is especially distorted; nearly half of the 250 biggest cities in the Global South were founded by European colonial administrations. In the United States, too, most state and county boundaries were drawn as straight lines on a map by people who did not know the land. What's emerging now is an approach to the governance of cities and their region, based on place, that enables the regeneration of soils, watersheds, and biodiversity. A bioregion is literally and etymologically a 'life-place', in Robert Thayer's words, that is definable by natural rather than political or economic boundaries. Its geographic, climatic, hydrological, and ecological qualities – its metabolism – are complex, and unique.[16] A bioregional approach reimagines the man-made world as being one element among a complex of interacting, codependent ecologies: energy, water, food, production, information. It attends to flows, biocorridors, and interactions. It thinks about metabolic cycles and the 'capillarity' of the metropolis wherein rivers and biocorridors are given pride of place.[17]

A growing worldwide movement is looking at cities through this fresh lens – but the lens is not a rose-tinted one. Modern bioregionalism does not seek a return to pristine nature or an unspoiled 'before' – as if ecological change could be reversed. The sense, instead, is our wellbeing is intimately connected to the vitality of living systems; we should make them – and the interactions between them – the focus of our efforts. Bioregions are not a form of wildlife park; they embrace the urban landscape itself as an ecology with the potential to support us.[18]

STEWARDSHIP

Changes in policy are responding to a powerful cultural shift in which the concept of land use is giving way to land *stewardship*. The word 'steward' (from the Anglo-Saxon *stigweard*) originally meant 'keeping in trust for the absent king'. It evolved to include managing an estate on behalf of an absent owner, but is most commonly used today in connection with stewardship of the environment. Organizations such as the Forest Stewardship Council promote responsible management of forests; the Marine Stewardship Council promotes sustainable fisheries and the long-term interests of people who depend on fishing for livelihood or food; the Countryside Stewardship Scheme in England sustains landscape beauty and diversity, protects and extends wildlife habitats, conserves historic features, restores neglected land,

and improves opportunities for people to enjoy the countryside. A growing number of educational projects link nature and culture and promote learning about the intimate linkages between them. A recent EU programme called LandLife, for example, promoted land stewardship as a means for national governments to meet to agreed biodiversity goals.[19] And in Turkey, hundreds of teachers across the country are being certified as ecoliteracy instructors in a programme that spans subjects from soil erosion to ethical forestry. Their classroom is an arboretum.[20]

In mainstream land management, stewardship is creeping in literally from the edge with the development of habitat networks in productively marginal areas. Edge habitats such as hedges, ditches, and banks, waterways, abandoned fields, and forest sites, are all havens for biodiversity; they provide forage plants at the start and end of the nesting season when flower-rich grassland areas are otherwise being grazed or have been cut. Edge habitats are also nesting and hibernation sites; they provide relatively sheltered and undisturbed conditions with plenty of tussocky areas and abandoned rodent holes. They also play a vital role in connecting up larger areas of habitat in the landscape. In the UK, an organization called Hedgelink involves farmers, planners, environmentalists, and local communities in a nationwide Hedgerow Biodiversity Action Plan. Volunteer groups collect data on a wide variety of variables – from the age of a hedgerow, or the presence of ditches, to the types of soil in a hedge or the location of gaps.[21] Other landscape niches for biodiversity include schoolyards, sacred groves, parks, areas around roadways, industrial and hospital sites. The Danish government is promoting the expansion of natural 'field margin ecotones' – buffer zones between highly cultivated fields that are kept pesticide and additive free. Just how wide these buffer zones should be is of course a contested issue, but one government report advocated a minimum width of 6 m (20 ft). Such zones also increase the supply of food for game birds and hence enable extra income for landowners.[22]

In Scotland, where a Centre for Stewardship has been established on the Falkland Estate, Ninian Stewart is convinced that the time is ripe for a new model of stewardship that, in his words, 'draws from the past and seizes our day to leave a sustainable legacy for the future'. Stewart's approach widens what he calls the 'circle of consideration' further into the future and away from self-interest than is typical in today's stewardship regimes. We need, he says, to 'restrain our present-day kings from headlong exploitation, depletion and destruction of our social and biological capital'.[23] 'The world is calling out for more responsible long-term thinking,' Stewart told me when we corresponded; 'in an age when speed, profit-taking and consumption are undermining the sustainability of the world as we know it, we would be wise to adopt more of the mindfulness, long-term ethical investment and care for the wider community that are the hallmarks of stewardship.'

A bioregion makes sense at many levels: practical, cultural, and ecological. By putting the health of the land, and the people who live on it, at the centre of the story, a bioregion frames the next economy, not the dying one we have now. Because its core value is stewardship, not perpetual growth, a bioregion turns the global system on its head. Rather than drive the land endlessly to yield more food or fibre per acre, production is determined by the health and carrying capacity of the land through time – a factor which is constantly monitored. Decisions are made by the people who work the land, and know it best. Prices are based on yields the land can bear, and on revenues that assure security to the farmer. 'Growth' is measured in terms of land, soil, and water getting healthier, and communities more resilient.

The idea of a bioregion begins to heal the metabolic rift I wrote about earlier. It reminds us that the cities we live in now do not exist separately from the land they are built on. The idea of a bioregion is tremendously motivating, too, in ways that abstract words like 'sustainable' are not. The word triggers people to seek practical ways to reconnect with the soils, trees, animals, landscapes, energy systems, water and energy sources on which all life depends.

The management of bioregions and 'whole landscapes' is complex, of course. A bioregion cannot be divided neatly into the planning categories of a city: Centre, Periphery, Rural; Work, Rest,

Play. Bioregions are a mosaic of both natural and human-modified ecosystems that change constantly as ecological, historical, economic, and cultural processes interact.[24] Their size can vary enormously, too – from hundreds to tens of thousands of square kilometres. No rule books exist for the governance of a bioregion: each community has to write its own.[25]

The tools for bioregional governance are in development. Colleges across the north-western United States have developed a Curriculum for the Bioregion that transforms the ways in which tomorrow's professionals will approach place-based development. The curriculum, which is taught by experts from across the Puget Sound and Cascadia bioregions, is divided into such topics as Ecosystem Health; Water and Watersheds; Sense of Place; Biodiversity; Food Systems and Agriculture; Ethics and Values; Cultures and Religions; Cycles and Systems; and Civic Engagement.[26] A treasure trove of completed projects is further evidence that these are not just academic subjects. Multidisciplinary teams have evaluated water-quality data as indicators of the health of an ecosystem; mapped stream channels in a local watershed; learned about the geology, hydrology, soils, and slope stability of a local town; analysed the environmental costs of metal mining; studied how indigenous peoples used to inhabit their region – and discussed how best to integrate this wisdom into new models of development. The thinking behind bioregions, if not yet the name, is now shaping top-down policy, too. More than fifty governments and major institutions – from the African Wildlife Foundation, to the World Bank – have committed to pursue a so-called 'whole landscape approach' in their approaches to sustainable development.[27]

SOIL AND SOUL

Thinking and acting at the scale of a bioregion has a spiritual as well as a practical dimension. We are born with an inherited aesthetic tendency to appreciate an intimate connection with the world. But you may be wondering, as you read this, how soil health can possibly be interesting to modern people, especially if they live in cities; most urban people think far more about connecting with each other than about connecting with the soil. In a world where fewer than half of us ever see or touch the stuff, asking city dwellers to empathize with earthworms sounds like too big an ask.

For many years I harboured the same misgivings – but then I had an epiphany on an island in Sweden. Fifty designers, artists, and architects, gathered together for a summer school, were asked to explore two questions: 'What does this food system taste like?' and 'How does this forest think?' My concern that living soil would not engage these city-based designers proved unfounded. It was like pushing at an open door: our students went scrabbling around the forest of Grinda like so many voles. They found ways to catch the taste of the forest and put it in a pot. They made cookies with forest berries and bartered these with tourists. They created tactile pathways so we could feel the forest through our feet. A Latvian designer made pine-cone syrup and gave it to Teacher, who was mightily pleased. One team invented a Soil Tasting Ceremony. They made infusions from ten different berries on the island and displayed them next to soil samples taken from each plant's location; the soils were displayed in wine glasses. We were then invited to compare the tastes of the teas and soils in silence. It was a powerful moment. Systems thinking, I concluded, becomes truly transformational when combined with systems *feeling* – which is something we all crave. 'We yearn for connection with one another, and with the soul,' writes Alastair McIntosh, 'but we forget that, like the earthworm, we too are an organism of the soil. We too need grounding.'[28]