Growing A Finer Future

L. Hunter Lovins

Excerpt from *A Finer Future: Creating an Economy in Service to Life*[1]

Regenerative agriculture methods treat the farms, farmers, and customers as holistic systems, where the relationship between all inputs is considered. In best cases, farmers use only what is produced onsite, e.g., manure from livestock, as a fertilizer, supplanting synthetic fertilizer derived from natural gas. Such sustainable practices restore soil structure, build healthy topsoil, nurture soil microbes, and promote biological activity, all of which contribute to long-term productivity and nutritious crops. Water use is optimized, and the best practices in irrigation are applied. Farm worker safety and investment in local businesses sustain farming communities. Additionally, higher soil fertility also sequesters vast amounts of atmospheric CO2.

Demand for foods produced by sustainable agriculture methods is growing throughout the world.[2] Because more people are needed to do the work that the chemicals previously did, regenerative farming increases employment, helping meet demand for jobs.

Carbon Farming

Regenerative agriculture (shifting agricultural practices to emit less carbon and engaging in active biosequestration practices that suck carbon out of the air and put it back in the soil where it belongs) may be the only way to save humanity from climate chaos. Ratan Lal, professor of soil science of the Ohio State University's College of Food, Agriculture and Environmental Science, believes that since the beginning of agriculture as much as 486 gigatons of carbon have been lost from the terrestrial biosphere and emitted to the atmosphere. Agricultural lands have lost 80 gigatons, he estimates. "So we have a potential to put back almost 500 gigatons of carbon into the terrestrial biosphere through management and land use conversion and of course through adoption of best management practices."[3]

There are three known ways to put carbon back into the soil.

Biochar

Carbon-based waste in the developed world tends to be burned or thrown away — sent to landfills where it rots, releasing methane, an even more destructive greenhouse gas than the original carbon content. In the developing world, it is sometimes returned to the soil, but typically it piles up, especially in cities. Efforts to compost these flows so that the nutrients can be returned to the soil are beginning, but humanity needs to use the ability of plants to draw carbon from the air, then get it back into the soil on a massive scale. One answer is to convert the wastes into a product called biochar.

Biochar is essentially charcoal. Charcoal is an important energy source; globally nearly three billion people worldwide rely on burning it, along with wood (usually from local forests) for cooking.[4] Charcoal production, however, results in deforestation and is wasteful of the wood and the carbon. Inefficient use of charcoal also contributes to indoor air pollution and greenhouse gas emissions.

Biochar production is quite different. Created through "pyrolysis," the woody material is heated at low temperatures with little oxygen until it is carbonized. This produces energy (heat and power), but unlike fossil fuels, biochar production is a carbon-neutral process; it neither adds nor subtracts carbon from the atmosphere. Done intelligently, it delivers useable energy in the form of charcoal, a bio-oil, and syngas. The syngas can be used much like petroleum-based oil or natural gas to fuel transportation or as another substitute for charcoal.

This approach turns only part of the woody material into fuel. The other 50 percent or more of the biomass's carbon becomes biochar. That carbon, when placed in soil, stays there, representing a near-permanent carbon sink that has actually reduced overall atmospheric CO2.[5]

In the soil, biochar increases water retention and supports healthy soil, reducing fertilizer requirements and increasing crop yields. Enhancing plant growth, it thus removes even more CO2 from the atmosphere. Because it can be made in simple homemade devices, and on a small scale, biochar production represents a startup opportunity to create rural jobs.[6]

Tim Flannery, one of Australia's most eminent scientists and author of The Weathermakers, states, "Biochar may represent the single most important initiative for humanity's environmental future. Biochar provides a uniquely powerful solution, for it allows us to address food security, the fuel crisis, and the climate problem, and all in an immensely practical manner."[7]

Flannery explains,

> Now if you used these agri-char based technologies and you have your aggressive reaforestation projects for the world's tropics, you could conceivably be drawing down in the order of 10 to 15 gigatonnes of carbon per annum by about 2030. At that rate we could bring ourselves down below the dangerous threshold as early as the middle of this century.

An exciting prospect, but, Flannery warned, "Whether the world can actually get its act together and do that is another matter.[8]

In the future, we will not be afforded the luxury of waste," says Jeff Wallin, co-founder of the Biochar Company, the first company producing commercial biochar. He adds:

> The business case is sustainable and profitable without depending on tax subsidies or CO2 credits, but they will help in finding interested financial partners. The environmental future is upon us and nature does not negotiate.[9]

Despite this, sales of biochar are growing very slowly, and the industry remains an infant. This means that it would take massive government intervention to get biochar production to the scale needed to offset the climate crisis.

Compost-based Organic Agriculture

The second route to return carbon to the soil is organic food production. The Rodale Institute[10] (one of the original centers of scientific research into organic agriculture), the Soil Association of the UK,[11] the Agroecology Lab at UC Davis,[12] and the Leopold Center at Iowa State University[13] are a few of the thousands of organizations around the world building biodiverse systems that can meet the needs of humanity while reintegrating into nature's cycles. Such agriculture takes a longer view of production, seeking not "to maximise yield in an optimum year, but to maximise yield over many years by decreasing the chance of crop failure in an bad year."[14]

Studies conducted over many years by University of California, Davis, the Rodale Institute, and others have shown that compost-based organic production practices increase (not just maintain) the quantity of soil-held carbon through a variety of mechanisms.[15]

Farming operations that use more natural agricultural practices that do not rely on chemical inputs like artificial fertilizers, pesticides, and herbicides have higher levels of beneficial soil organisms. Protozoa, bacteria by the billions, algae, and mycorrhizae fungi complement such recognizable species as ants and earthworms, nematodes, and springtails. All of these work together in the soil to build organic (carbon) matter. Operations that do not use chemical pesticides support more diverse habitats. Farms using crop rotations and animal manure deliver better biodiversity than fields farmed with industrial agricultural practices. Organic fields reduce nitrogen runoff and the release of nitrous oxide.[16] Systems that integrate livestock with vegetable production and use perennial pastureland and organic production (e.g., long crop rotations, leguminous crops and cover crops, manure produced by livestock as fertilizer) deliver higher profitability while creating the circular economy of the soil, taking carbon from the air and sequestering it in the soil.[17]

The good news is that, although it is not easy to wait out the three years that it takes to become a certified organic farmer, there is a business case for farmers to convert to organic production. Organic is the fastest-growing food sector. The UK-based Soil Association's Organic Market Report 2016 found

> continued steady growth of 4.9 percent in 2015. This is the third year of consecutive growth for the UK organic sector, now worth £1.95 billion. Sales of organic have continued to outperform the non-organic grocery market which decreased by 0.9 percent in the same period.[18]

The Association's 2017 report announced the fifth consecutive year of increased growth. The 2016 number was 7.1 percent, almost double the growth rate of 2016.[19]

In the US, the growth rate is nearly 11 percent. It has been in double digits nearly every year since the 1990s, when organic sales were $3.6 billion a year. They now top $43 billion a year. In contrast, the general food market is growing at a little over 3 percent each year.[20] Globally the sector is projected to grow at over 9 percent annually, reaching a market of nearly $63 billion by 2020.[21] Organic produce is available in three of every four supermarkets, but the industry remains at only 4 percent of US food sales.[22]

Holistic Management

The practice that might scale sufficiently to be useful is put crisply in the title of Judith Schwartz's book Cows Save the Planet.[23] It profiles the work of soil scientists and the increasing number of practitioners around the world who are using grazing animals to repair soil health, reverse desertification, and fight climate change.

The approach Schwartz is touting was developed by Allan Savory. His Savory Institute[24] (SI) seeks to impact a billion hectares by 2025 through the teaching and practice of Holistic Management and Holistic Decision Making. The goal is to enable practitioners to turn deserts into thriving grasslands; restore biodiversity; bring streams, rivers, and water sources back to life; and combat poverty and hunger, all while reversing global climate change.[25] Holistically managed grazing animals are, it claims, one of the best ways to reclaim depleted land. Savory's approach mimics how vast herds of grazing animals coevolved with the world's grasslands: dense-packed because of predators, moving as a herd, eating everything, fertilizing the land, tilling the manure and seeds into the soil with their hooves, and then moving on, not returning until the grass is lush again. This interaction is one of the more important ways to create healthy communities of soil microorganisms. They, in turn recarbonize the soil and restore natural nitrogen cycles.

Savory, in his many writings and a TED talk viewed by four and a half million people, argues that even achieving zero emissions from fossil fuels would not avert major catastrophe from climate change. Grassland and savanna burning would continue, and desertification would accelerate as soils become increasingly unable to store carbon or water.[26] Averting disaster, he says, will require a global strategy to cut carbon emissions, substitute benign energy sources for fossil fuels, and implement effective livestock management practices to put the carbon already in the atmosphere back into the soils. Profitable Holistic Management is the only way, he argues, to reduce biodiversity loss and biomass burning and reverse the desertification that is not caused by atmospheric carbon buildup.[27]

Awarded the 2010 Buckminster Fuller Challenge prize for decades of work, Savory's Africa Centre for Holistic Management in Zimbabwe and Savory Institute show how to transform degraded grasslands and savannahs into lush pastures with ponds and flowing streams. It shows that this approach to climate protection enhances African agricultural livelihoods. The Challenge celebrates a "comprehensive, anticipatory, design approach to radically advance human wellbeing and the health of our planet's ecosystems."[28] The Fuller award recognized Savory's work to accelerate development and deployment of whole-systems solutions to climate change and sustainable development.

Savory Institute is scaling the approach by creating Hubs[29] around the world to serve as regional centers to teach the approach. SI is using the Hubs as the basis for certifying practitioners as "Regenerative," based not on the processes used but on its Ecological Outcome Verification protocol. Developed with Jason Rountree at Michigan State University, this measures the increases in soil carbon, water retention, and biodiversity and a variety of ecological metrics on each piece of land that is being holistically managed.[30] Savory Institute offers portfolios of photos showing fence-line contrasts between land that is conventionally managed and land that is holistically ranched, using cattle to mimic the way native herds built up carbon in the soil. In the latter, the land shows increased biodiversity, rebuilt water tables, and enhanced endangered species habitat and greater profitability for the landowners.[31]

Will Harris used Holistic Management to convert White Oak Pastures,[32] his family's commodity farm in South Georgia, to a successful operation raising, slaughtering, and selling five kinds of poultry and producing five kinds of red meat — all pasture raised — eggs, and vegetables. The products are sold online to high-end restaurants as far away as Miami and to Whole Foods markets across the Eastern US. Will employees 137 residents of the once-decaying town of Bluffton. His commodity farmer neighbor, with the same acreage, employs four.[33] White Oak Pastures features agritourism, a restaurant, and a general store and serves as the Savory Hub for the region.

Will manages his chickens holistically, leaving them free to roam his pastures, cleaning out the bugs left in animal manure.[34] Six years ago, he noticed a pair of endangered bald eagles. There are now more than 80 of the raptors who winter with Will, wreaking $1,000 a day in predation on his flocks. Will's response? "You're supposed to give 10 percent to the church, and we don't really do that, but we're giving 10 percent to nature."[35]

More holistic agriculture, with fewer chemicals and better management of the soils and ecosystems, will bring more jobs.[36] It will also reduce consumption of unhealthy foods and reduce damaging emissions from agricultural runoff.

A 2012 study by M+R Strategic Services found that organic agriculture creates 21 percent more jobs than conventional agriculture, with 28,000 jobs for every $1 billion in sales. A similar study in the UK found that the number is 32 percent more jobs than conventional.[37] Studies by the Worldwatch Institute found that organic farming is the only segment of global agriculture that is expanding.[38] Organic farms need more people to work the operation, tend to be smaller, and trade more locally, increasing the economic multiplier.[39] A study of sustainable agriculture as an economic development strategy in Missouri found that a shift to sustainable farming would create more than 165 additional farm households per county and more than 300 additional farm and non-farm households in total. "Few community leaders," the study stated, "would ignore the potential for creating 165 new self-employment opportunities and the means of supporting 300 new households in total in their counties."[40]

It's Happening

The approach is growing because it works.[41] In the 1990s, Hunter Lovins undertook to rehabilitate almost 1,000 acres of degraded western rangeland. Taken out of cattle production for 20 years, the land had suffered erosion and been overrun by noxious weeds. Its prior owners believed the conventional wisdom that removing grazing animals from land would increase its health. This may be true of intact wilderness, where intact predators still drive native grazing herds to pack up and move across the land. But most of the planet's agricultural land is rapidly releasing stored carbon, nitrogen, and other greenhouse gasses, so the approach that nature is somehow spiritual and will heal itself is clearly wrong.

Working with Allan Savory, Hunter restored cattle to the ground and managed the land based on the principles of Holistic Management. Within two years, the water table rose and wetland plants returned.(The seeds had always been there, just waiting for the right conditions.) Endangered species not seen in two decades returned. Even skeptical government officials acknowledged the evidence of an ecosystem returning to health. The value of the property also rose.

Many others are experiencing the success of Holistic Management. In the Australian desert, SLM Partners has doubled the carrying capacity of cattle on what had historically been desertified rangelands. They achieve superior weight gain while buying no feed, have doubled plant diversity, and restored the grasslands even in a drought. The company is attracting foreign investment to a region of Australia typically struggling to achieve economic development and is rehabilitating the local economy.[42]

From Montana to New Zealand, the company Grasslands LLC[43] has used Savory's approach to heal grazing land and rural communities. This approach enabled conservation buyers to save historic ranches like the charismatic Hana Ranch on Maui from becoming luxury housing.[44]

In 1961, Joel Salatin began farming what he describes as the Shenandoah Valley's most worn-out, eroded, abused property. He used Savory's approach of Holistic Management to turn the destitute farm into a prosperous operation supporting 35 farm-based ventures. Joel speaks often about his success in moving cows daily using portable electric fencing to mimic how predators naturally controlled overgrazing.

Joel is creating what he calls the “Farm of the Future.” His system, profiled in the “Meet the Farmer” series,[45] is based on mobile infrastructure instead of stationary facilities. Portable, nimble, and not capital intensive, it allows operators to separate the farm from the infrastructure. It does not even require a user to own the land. Because it is modular, farmers can invest in small components. If successful, they can scale up without borrowing money. Like many regenerative operations, it is management intensive, substituting people and intelligence for capital (concrete, energy, drugs, vehicles). The equity is created in information, management, and customers, not infrastructure. This shifts the economic profile of the farm, giving landless, cashless, equity-less young people the ability to get a start in agriculture.[46] Selling high-end meat, eggs, vegetables, and forest products within a 100-mile radius, Polyface Farm is a profitable enterprise that achieves the Salatin family’s mission to develop emotionally, economically, and environmentally balanced agricultural practices that honor nature’s cycles.

Meet Gabe Brown.[47] He began farming his 2,000 acres near Bismarck, North Dakota, in 1993. A commodity corn and soybean farmer, he converted to regenerative agriculture to cut costs that were threatening his business. His soil quality was poor, with shallow topsoil that required annual inputs of fertilizer, pesticides, and herbicides to produce a crop. In 1995, Gabe implemented no-till production. In the ensuing years, he diversified into a variety of cash crops and began rotating his fields. In 1997, he added the use of a wide variety of multi-species cover crops. In 2006, he introduced Savory-style grazing practices, adding different livestock species, so that he now raises cows, sheep, broiler hens, and bees as well as corn and soybeans. His system has allowed him to stop using chemical inputs, dramatically cutting his costs and increasing his profitability. For example, in 2014, it cost him $1.35 to produce a bushel of corn, which he sold for more than $3.50. He cannot keep up with demand for his grass-finished beef and lamb, and his fields have never been healthier.

Gabe has compared the capacity of his acreage to cycle nutrients,[48] including carbon, with neighbors who farm organically but without animal impact on the land and with two no-till Operations that use varying amounts of synthetic fertilizers. Soil samples from Gabe’s and his neighbors’ operations show that he is able, solely through maintaining a healthy soil through animal impact, to increase concentrations of nitrogen (N), phosphorus (P), and potassium (K) dramatically. This drives his productivity and profitability. The water-extractable organic carbon (WEOC) is, however, the most amazing number. Gabe is recarbonizing his soils at a profit.

Management	N lbs.	P lbs. (ppm)	K lbs. (ppm)	WEOC
Organic	2	156 (9)	95 (14)	233
No-till, low diversity	27	244 (14)	136 (19)	239
No-till, MD, high syn.	37	217 (12)	199 (28)	262
No-till, HD, NS, livestock	281	1,006 (56)	1,749 (250)	1,095

Tested by Dr. Rick Haney, ARS, Temple, TX

Note: Gabe Brown, whose ranch is shown in the bottom row of numbers, provided a 2007 soil test from his ranch showing these results: N = 10 lbs. in the top 24 inches, P (Olsen test) = 6 ppm, K = 303 ppm. Gabe says he has not used any fertilizers on his home ranch since 2007. The ppm numbers are a Graze conversion (with help from Gene Schniefer, University of Wisconsin-Extension) from the original lbs. listed in this soil test.

Credit: Gabe Brown: Keys to Building a Healthy Soil.

When he bought his farm in 1993, it had shallow soils with 1.3 percent soil organic matter (soil carbon). By 2013, he had some plots with more than 11 percent soil organic matter. As Gabe puts it, if your soil is healthy you will have clean water, clean air, healthy plants, healthy animals, and healthy people. You will have a healthy ecosystem.

How Much Carbon Can We Sequester?

This approach, now called "carbon farming," has become popular. New articles on it emerge almost daily.[49]

California gives carbon credits for such practices;[50] Australia does as well, and Kenya, through the World Bank's $600,000 Biocarbon Fund, rewards smallholder farmers for such practices.[51] But how much carbon can be sequestered in properly managed grasslands and how fast?

In some California experiments, manure from dairy and beef operations is blended with green waste that would otherwise go to landfill, impose costs, rot, and release methane. The mix is composted and spread on pastures. Scientists from the University of California, Berkeley, take annual soil cores a meter deep and test whether that soil has soaked up additional carbon. The answer? One application of compost to rangeland doubled grass growth and increased carbon sequestration by up to 70 percent.[52] Every year the carbon increases. The study found that this can achieve total greenhouse gas (GHG) mitigation rates, over a 30-year time frame, of more than 18 tons of CO2-equivalents per acre of land treated with organic amendments.[53]

The researchers noted,

Sequestration of just 1 Mg C ha^{1} y^{-1} (or one metric ton per hectare — a hectare being 2.2 acres — per year) on half the 23 million hectares of rangeland in California would offset 42 million metric tons of CO_2e, an amount equivalent to all of the annual GHG emissions from energy use for commercial and residential sectors in California.[54]

David Johnson, director of the Institute for Sustainable Agricultural Research at New Mexico State University, has developed a similar approach. His research has shown that[55]

Promoting beneficial interactions between plants and soil microbes increases farm and rangeland's efficiency for capturing carbon and storing it in soil. These same interactions increase soil microbial carbon-use efficiencies reducing the rate at which soil carbon, as CO_2, is respired from the soil. When this bio-technology is promoted in agroecosystems, it is feasible to capture and sequester an average of >11 metric tons of CO_2 per hectare per year in rangeland soils[56] and >36.7 metric tons CO_2 per hectare per year in transitioning farmland soils[57] all for less than one-tenth the cost of EPA's recommended Carbon Capture Utilization and Storage (CCUS) technologies.

Can all this roll climate change backwards?

Here are some illustrative calculations. Published, peer-reviewed case studies and projections from Ohio State soil scientist Ratan Lal show that the technical potential for carbon sequestration in the terrestrial biosphere is about five gigatons of carbon per year (GtC/yr).[58] This is in addition to the three GtC/yr that nature already adds to the soil. Humans emit about ten GtC/yr, but if the energy efficiency and renewable energy measures described in Chapter 11 are implemented, this will be substantially reduced.

A team from Tufts University[59] wrote,

> Soil carbon restoration is emerging as a potential strategy to mitigate global warming while also enhancing food and water security. The Paris Agreement, although a laudable achievement for the international community, is insufficient to meet its basic goal of 2ÅãC warming by 2100, while scientists have warned that, in fact, 1.5ÅãC is the maximum that should be permitted to avoid catastrophic impacts. In order to close the emissions gap between nationally determined contributions under the Paris agreement and necessary carbon reductions to avoid the most extreme climate disruptions, extensive sequestration of carbon dioxide from the atmosphere is required.
>
> Globally, soils have the potential to sequester up to 3.4 GtC per year, just enough to close the "emissions gap." If combined with other atmospheric CO_2 removal efforts, such as reforestation, yearly additional carbon capture in soils and forests could be as high as 5 GtC per year. When combined with deep cuts in fossil fuel emissions, this could lead to a substantial overall reduction in atmospheric carbon dioxide.

Texas A&M soil scientist Richard Teague, chronicling what he calls Adaptive Multipaddock (AMP) essentially Holistic management grazing in east Texas, has measured sequestration of 3 tons of carbon per hectare per year over a decade (tC/ha/yr).[60] Soil scientist Megan Machmuller measured the increase in carbon in a conversion from row cropping to management-intensive grazing achieving as high as 8 tons per hectare per year in Georgia, or almost three times the mount measured by Teague.[61]

Put all of these numbers together and what does it add up to? Current emissions from fossil fuels are about 10 GtC/yr. Teague and his colleagues calculated that almost a gigaton could be soaked up just in North American soils.[62]

The world's permanent pasture and fodder lands amount to roughly 3.4 billion hectares. Back-of-the-envelope calculations with Seth Itzkan of Soil4Climate show that multiplying Teague's carbon capture findings of 3 tC/ha/yr (conservative when compared with the 8 tC/ha/yr values

Machmuller identified) by the global hectares of pastureland gives 10.2 GtC/yr potential soil carbon capture via grazing. That, alone, would offset all human emissions.[63]

Clearly, it is a big "if " to say that Holistic Management will be practiced on all of the world pastureland, but coupled with the composting approaches of David Johnson, the organic cropping practices of Rodale Institute, the perennial wheat of the Land Institute, and the reductions in carbon emissions possible and profitable. it is clear that we can solve the climate crisis and do it in ways that are profitable.

Daniel Riordin, in his book Averting Global Collapse, described the numbers necessary to scale this approach. Using current global livestock numbers of 2.24 billion standard animal units, rangeland and crop/ pasture land could carry 10.33 billion livestock. Doing this would require a minimum of 2.5 million herders (assuming 1,000 head/ herder). Like most sustainable agriculture, Holistic Management is more labor-intensive, not a bad thing in a world needing jobs.[64]

Precisely how much can be sequestered depends exquisitely on the piece of ground, the practices used, climactic conditions, and a host of other variables.[65] As Bill Becker, executive director of the Presidential Climate Action Project, wrote in his series on biosequestration:[66]

> Variables like these have resulted in widely different estimates in the past. DOE and several of its national laboratories estimated in 1999 that natural carbon sinks worldwide were removing about 2 gigatons of carbon annually from the atmosphere. The labs concluded that an ambitious international effort could remove five times that much carbon from the atmosphere, more than 10 gigatons each year. "It seems reasonable to assume that advanced science, technology and management can double the capacity (of biological carbon sequestration) at low additional costs," DOE's experts said in another report. "TBCS (terrestrial biological carbon sequestration) offers potential for sequestering more than 50 percent of projected excess CO2 that will have to be managed over the next century."

In 2016, scientists began to consider these arguments. A very conservative study published in Nature showed that soil already holds 2.4 trillion tonnes of carbon. The article felt there is room for only an additional 8 billion tonnes.[67] Given that humans emit at least 40 tonnes annually,[68] that is not a lot. The key, said the scientists, is to ensure that intact ecosystems remain that way. Forests and grasslands store carbon efficiently until disturbed for agriculture. Restoring them and implementing sustainable agriculture, they felt, could soak up four-fifths of annual human emissions of greenhouse gasses from burning fossil fuels and sequester them in the soil.[69]

Carbon farming advocates say that the number could be far higher. Both Carbon Underground[70] and Soil4Climate believe that regenerative agriculture can displace all of the carbon emitted by humans each year and begin rapidly reversing global warming. A wealth of videos on the Soil4Climate site show the extent to which soil can sequester carbon and reverse climate change.[71]

Such claims scare climate change activists, who for years have struggled to get energy efficiency and renewable energy accepted as the way to deal with what they rightly see as the existential crisis of global warming.

In 2015, an Esquire article[72] neatly summed up what they're facing:

> The physical evidence becomes more dramatic every year: forests retreating, animals moving north, glaciers melting, wildfire seasons getting longer, higher rates of droughts, floods, and storms — five times as many in the 2000s as in the 1970s. . . . US temperatures have gone up between 1.3 and 1.9 degrees, mostly since 1970 — and the change is already affecting "agriculture, water, human health, energy, transportation, forests, and ecosystems."[73] Arctic air temperatures are increasing at twice the rate of the rest of the world — a study by the US Navy says that the Arctic could lose its bsummer sea ice by next year, eighty-four years ahead of the models — and evidence little more than a year old suggests the West Antarctic Ice Sheet is doomed, which will add between twenty and twenty-five feet to ocean levels. The one hundred million people in Bangladesh will need another place to live, and coastal cities globally will be forced to relocate, a task complicated by economic crisis and famine — with continental interiors drying out, the chief scientist at the US State Department in 2009 predicted a billion people will suffer famine within twenty or thirty years. And yet, despite some encouraging developments in renewable energy and some breakthroughs in international leadership, carbon emissions continue to rise at a steady rate, and for their pains the scientists themselves — the cruelest blow of all — have been the targets of an unrelenting and well-organized attack that includes death threats, summonses from a hostile Congress, attempts to get them fired, legal harassment, and intrusive discovery demands so severe they had to start their own legal-defense fund, all amplified by a relentless propaganda campaign nakedly financed by the fossil-fuel companies.

But it is critical that these legitimate concerns do not destroy the one real shot that we have to counter the climate crisis. According to Allan Savory, Global climate change and land degradation have to be put on a war footing internationally — meaning that all nations need to pull together and treat this threat as we would a war. . . . Only through uniting and diverting all the resources required to deal with climate change and land degradation can we avert unimaginable tragedy. We have all the money we need. All we cannot buy is time.[74]

Perhaps heeding Allan's call, the French government in 2015, in the lead-up to Paris, announced the 4 per 1000 Initiative[75] to demonstrate that agriculture, and agricultural soils in particular, can play a crucial role where food security and climate change are concerned. The Initiative[76] invites all partners to declare or to implement practical programmes for carbon sequestration in soil and the types of farming methods used to promote it (e.g., agroecology, agroforestry, conservation agriculture, and landscape management). It is bringing together willing contributors in public and private sectors (national governments, local and regional government, companies, trade organizations, NGOs, research facilities, and others) under the framework of the Lima-Paris Action Agenda (LPAA).

The goal is to engage stakeholders in a transition toward a productive, resilient agriculture, based on a sustainable soil management and generating jobs and incomes, hence ensuring sustainable development. Global restoration of grasslands, forests, wetlands, seagrasses, and other biological carbon sinks can reestablish soil integrity and biodiversity as it sequesters massive amounts of carbon. Regenerative agriculture can stabilize local and, eventually, global weather patterns; restore a balanced hydrological cycle; create meaningful jobs, particularly in developing countries; produce high-quality animal protein without synthetic soil supplements and destructive factory farming; and support local communities worldwide in sustainable living.

Not a bad idea.

Savory's approach to land management contradicts accepted practice and theories of removing animals from land. The vitriol leveled against him is daunting.[77] Despite this, Holistic Management is now successfully practiced on more than 40 million acres around the world, growing rapidly because it works. Reestablishing the symbiotic balance between plant growth and herd animals is helping land managers bioremediate barren land back to thriving grasslands. It is increasing crop yields and ensuring food security for millions of people.[78]

To anyone who realizes how dire the climate crisis is, regenerative agriculture is exciting. The possibility that respecting and using the services of intact ecosystems might save us is almost a miracle.

In his book Gardeners of Eden: Rediscovering Our Importance to Nature,[79] Dan Daggett profiles a dozen small grazing operations that are reclaiming land by managing cattle in harmony with the ecology that is there, not against it. He shows that while humans have come to behave as an alien species in recent years, rapaciously taking from the land what they want, for most of our history, we lived on land as natives, working with place and the natural cycles in ways that enhanced our homes, and us. As Daggett argues, we all need to become native again in the places that support us.

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