



Organic Solutions to Climate Change and Food Security

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Changing weather patterns are already impacting agriculture in many parts of the world. As countries experience shifts in climate conditions, food security has become a matter of increasing concern. A major contributor to climate change is modern, industrial agriculture. The effort to reduce our carbon imprint must include a re-examination of agricultural methods as well as exploring new approaches to securing our food supply. The statements in this booklet highlight the key role of community supported Organic and Natural Agriculture in feeding a growing population while mitigating climate change and natural resource depletion.

Introduction

Changing the Frame of the Debate

Patrick Holden

With humankind and the planet facing the converging threats of climate change, natural resource depletion and ecosystem collapse, ensuring that global agricultural systems can feed our burgeoning population, are sustainable and can both endure and help mitigate these threats could not be more vital.

The common wisdom among governments, international development institutions, big business and “expert” advisers, is that organic agriculture – which has underpinned the growth of human civilization for thousands of years – is a ‘side issue’ and that we must employ the methods of industry and technology if we are to feed a world of 9 billion people projected of 2050.

Industrial agriculture has a high carbon footprint and is often not well suited to delivering the balanced diet and food security needs of local communities. It also depletes soil carbon, further exacerbating both its climate and food security impacts.

Organic agriculture uses no artificial fertilizers, naturally increases soil carbon and, in its ideal form, produces mixed crops that are consumed locally, resulting in a significantly lower carbon footprint, as well as increasing food security. It is also much more efficient in using and conserving water, which is becoming a critical issue worldwide.

“Fossil fuel reliance may prove to be the Achilles heel of the modern food system. Oil supply fluctuations and disruptions, could send food prices soaring overnight. Competition and conflict could quickly escalate. De-coupling the food system from the oil industry is key to improving food security.”

–Earth Policy Institute

Faced with growing evidence of the human and ecological health benefits of organic agriculture, supporters of industrial agribusiness are falling back on the flawed, but so far ascendant, argument that organic farming cannot feed the world. It is, they say, a niche product, fine for a rich Western elite but incapable of dealing with the real problems of hunger and starvation.

Their argument does not stack up. Studies of crop yields suggest that conversion to organic would significantly increase developing country yields. In fact, a growing number of agricultural experts believe that a large scale shift to organic farming would not only increase the world’s food supply, but might be the only way to eradicate hunger and protect the planet.

Industrial agriculture is not only unsuitable because of its negative impacts on food security, climate, soil, water, wildlife, animal welfare, and human health. Diminishing oil supplies and rapidly increasing demand, will push artificial fertilizers far beyond the economic reach of the majority of farmers and the costs of internationally transporting food will become increasingly prohibitive.

We are rushing headlong towards a post-oil age and yet the engine of global industrial agriculture motors on regardless, as if cheap limitless oil will be around forever. Opinions differ on when the oil will run out, but run out it will, and sooner than most of us may wish to contemplate. If we do not change our whole approach to food and farming, the effects may be catastrophic.

The Soil Association is working to build a global coalition of like-minded organizations whose combined voice may finally change the frame of the international debate and bring organic agriculture back to the heart of sustainable development.

I do hope that after reading the following essays and case studies you will join this coalition and make your voice heard in this critical debate.

The Navdanya Way

Organic Farming Mitigates Climate Change

Dr. Vandana Shiva

Over the past 20 years, I have built Navdanya, India's biodiversity and organic farming movement. We are increasingly realizing there is a convergence between objectives of conservation of biodiversity, reduction of climate change impact and alleviation of poverty. Biodiverse, local, organic systems produce more food and higher farm incomes, while they also reduce water use and risks of crop failure due to climate change. Increasing the biodiversity of farming systems can reduce vulnerability to drought. Millets, which are far more nutritious than rice and wheat, use only 200-300 mm water, compared to 2500 mm needed for Green Revolution rice farming. India could grow four times more food using millets. However, global trade is pushing agriculture to GMO monocultures of corn, soya, canola, and cotton, worsening climate vulnerability.

Biodiversity offers resilience to recover from climate disasters. After the Orissa Super Cyclone of 1998, and the Tsunami of 2004, Navdanya distributed seeds of saline resistant rice varieties as "Seeds of Hope" to rejuvenate agriculture in lands reentered saline by the sea. We are now creating seed banks of drought resistant, flood resistant and saline resistant seed varieties to respond to climate extremities. Climate chaos creates uncertainty. Diversity offers a cushion against both climate extremes and climate uncertainty. We need to move from the myopic obsession with monocultures and centralization, to diversity and decentralization.

Diversity and decentralization are the dual principles to build economies beyond oil and to deal with the climate vulnerability that is the residue of the age of oil.

While reducing vulnerability and increasing resilience, biodiverse organic farming also produces more food and higher incomes. As David Pimentel has pointed out: "Organic farming approaches for maize and beans in the U.S. not only use an average of 30% less fossil energy but also conserve more water in the soil, induce less erosion, maintain soil quality and conserve more biological resources than conventional farming does." (David Pimentel (IFOAM p20)

After Hurricane Mitch in Central America, farmers who practiced biodiverse organic farming suffered less damage than those who practiced chemical agriculture. The ecologically farmed plots had an average more topsoil, greater soil moisture, less erosion, and experienced less economic losses. (Holt. Gemenez E, 2002 "Measuring farmers' agroecological resistance after Hurricane Mitch in Nicaragua: A case study in participatory, sustainable land management impact monitoring. *Agriculture Ecosystems and Environment*, 93:87 – 105)

Organic matter in soils is decomposed under aerobic and anaerobic environments, and carbon (C) is returned to the atmosphere as CO₂ and CH₄, respectively. In soils under conventional agricultural practices, 50 Pg (1015 g) of C in the soil has already been released as CO₂ into the atmosphere (Paustian et al., 1997). A 10% reduction in the C pool in the soil and its emission into the atmosphere equals a 30-year period of the anthropogenic emissions of CO₂ by fossil fuel (Kirschbaum, 2000). Organic agriculture can contribute directly and indirectly to reduce CO₂ emissions and to mitigate the negative consequences of climate change by preserving soil resources due to reduced tillage, and increasing surface residues (thus reducing soil erosion and C losses) that will be later incorporated through the combined action of soil invertebrates and soil micro-organisms (fungi and bacteria) and therefore reduce mineralization of organic matter.

Navdanya's work over the past twenty years has shown that we can grow more food and provide higher incomes to farmers without destroying the environment and killing our peasants.

Our study on "Biodiversity based organic farming: A new paradigm for Food Security and Food Safety" has established that small biodiverse organic farms produce more food and provide higher incomes to farmers. There is an alternative. The alternative is lowering costs of production while increasing output. We have done this successfully on thousands of farmers and have created a fair, just and sustainable economy. The epidemic of farmers suicides in India is concentrated in regions where chemical intensification has increased costs of production. Farmers have become dependent on non-renewable seeds and cash crop monocultures are facing a decline in prices and incomes due to globalisation. This is leading to debt and suicides. High costs of production are the most significant reason for rural indebtedness.

**High Cost Seeds
+ Chemicals = debt
= suicides**

Biodiverse organic farming addresses all these problems of:

- Falling incomes for farmers
- Rising costs for consumers
- Increasing pollution of our food

Biodiverse organic farming creates a debt free, suicide free, productive alternative to industrialized corporate agriculture.

- It leads to an increase in farm productivity and farm incomes, while lowering costs of production.
- Fair trade and just trade lowers costs to consumers.
- Pesticides and chemical free production and processing brings safe and healthy food to consumers.

We must protect the environment, farmers' livelihoods, public health and people's right to food.

We do not need to go the Monsanto way. We can go the Navdanya way. We do not need to end up in food dictatorship and food slavery. We can create our food freedom.

Biodiverse organic and local food systems contribute both to mitigation of and adoption to climate change. Mitigation of climate change takes place because of:

- Lower emissions of greenhouse gases.
- Higher absorption of CO₂ by plants and by the soil.

Organic farming is based on recycling of organic matter, unlike chemical agriculture, which is based on chemical fertilizers emitting nitrous oxides. Further, industrial agriculture leads to dispossession of small farmers and conversion of small farms to large holdings, which need mechanization, which also contributes to CO₂ emissions. Small, biodiverse, organic farms, especially in Third World countries are totally fossil fuel free. Energy for farming operations comes from animal energy. Soil fertility is built by feeding soil organisms by recycling organic matter. This reduces greenhouse gas emissions. Biodiverse systems are also more resilient to droughts and floods because they have higher water holding capacity and hence contribute to adaption to climate change. Navdanya's study on climate change and organic farming has indicated that organic farming increases carbon absorption by up to 55% and water holding capacity by 10% thus contributing to both mitigation and adaption to climate change.

TABLE SHOWING FERTILITY BUILDS UP IN SOILS UNDER ARID AGRO-ECOSYSTEMS DUE TO ORGANIC FARMING*

Crops	% increase over control						
	Organic matter	Microbial activity	Microbial biomass	Water holding capacity	N	P	K
Pearl millet	28-55	4-25	2-10	2-3	0-2	0-1	8-15
Clusterbean	32-44	22-54	12-25	4-9	12-34	2-4	25-47
Moth bean	31-47	11-23	8-15	4-7	7-21	1-2	4-9
Mung bean	27-41	28-59	11-33	4-8	11-27	2-6	5-11

**average of 10 farms. Results are consolidated from the farms, where four or more than four years of organic farming are practiced.*

The environmental advantages of small-scale biodiverse organic farms are not a trade off with food security. Biodiverse organic farms produce more food and higher incomes than industrial monocultures. Mitigating climate change, conserving biodiversity and increasing food security, can thus go hand in hand.

The conventional measures of productivity uses only labour as an input, and ignores energy and resources inputs. This biased productivity pushes farmers off the land and replaces them with chemicals and machines, which in turn contribute to greenhouse gases and climate change.

Further, output is focused on yield of single globally-traded commodities. The focus on "yield" of individual commodities creates what I have called a "monoculture of the mind." The promotion of so-called "high yielding varieties," leads to the displacement of biodiversity. It also destroys the ecological functions of biodiversity. The loss of diverse outputs is never internalized in the one dimensional productivity calculus.

When biodiversity is taken into account, biodiverse systems have higher output than monocultures, and organic farming is more beneficial for the farmers and the earth than chemical farming.

When agro-forestry is included in farming systems, carbon absorption and carbon return increases dramatically. Neem and date palm increases the carbon density in the soil by 185 percent and 174 percent, respectively.

These results have also been observed in other countries. The FAO reports increase of carbon absorption from 2 to 9 tonnes annually, under systems of agro-forestry.

TABLE SHOWING THE INFLUENCE OF CARBON DENSITY IN THE RHIZOSPHERE OF IMPORTANT HORTICULTURAL CROPS AND TREES GROWN UNDER ARID AGRO-ECOSYSTEMS

Treatment	Organic C density (g/m ²)		% increase or decrease	Inorganic C density (g/m ²)		% increase or decrease
	Control	Rhizosphere		Control	Rhizosphere	
Gunda	328	608	+85.4	11700	11326	-3.2
Date Palm	749	2059	+174.9	11326	17176	+51.6
Amla	702	1498	+113.4	11326	20686	+82.6
Ber	1357	1638	+20.7	10904	12870	+18.0
Pomegranate	1498	2340	+56.2	17176	17924	+4.3
Bahl	1357	2293	+69.0	16380	17176	+4.8
Safeda	749	936	+25.0	16006	13244	-17.2
Khejri	702	749	+6.7	11326	8564	-24.4
Neem	936	2668	+185.0	12496	17176	+37.4
Ratanjot	796	1404	+76.4	11326	12496	+10.3

Studies carried out by the USDA National Agro-forestry Centre suggests that soil carbon can be increased by 6.6 tonnes C/ha/yr over a 15 year rotation and wood by 12.22 tonnes C/ha/yr (Edward Goldsmith, p10).

The soil and vegetation are our biggest carbon supplies. However, industrial agriculture destroys both. By disrupting the cycles of returning organic matter to the soil, chemical agriculture depletes the soil carbon. Mechanisation forces the cutting down of farm trees and hedge rows. The sacred Khajri, for which 300 people gave their lives in Rajasthan a few centuries ago, is being chopped down to make way for the tractor. Chemical/mechanical farming works against carbon sequestration, even while it adds more carbon to the atmosphere.

The alternatives to chemical fertilizers are many. Green manures such as *Sesbania aculeate* (Dhencha), *Gliricidia*, and Sun hemp, and legume crops such as pulses, which fix nitrogen through the legume – rhizobium symbiosis, earthworms, cow dung, and their composts.

Organic manure is food for the community of living beings which depend on the soil. Soils treated with farmyard manure have from two to two and a half times as many earthworms as untreated soils. Farm yard manures encourages the build up of earthworms through increasing their food

supply, whether they feed directly on it or on the micro organisms they support. Earthworms contribute to soil fertility by maintaining soil structure, aeration and drainage and by breaking down organic matter and incorporating it into the soil. The work of earthworms in soil formation was Darwin's major concern in later years. When finishing his book on earthworms, he wrote, "It may be doubted whether there are many other animals which have played so important a part in the history of creatures. The little earthworm working invisibly in the soil is actually the tractor and fertilizer factory and dam combined. Worm-worked soils are more water stable than unworked soils, and worm inhabited soils have considerably more organic carbon and nitrogen than parent soils. By their continuous movement through soils, earthworms make for the formation of channels which help in soil aeration. It is estimated that they increase soil-air volume by up to 30%. Soils with earthworms drain four to ten times faster than soils without earthworms and their water holding capacity is higher by 20%. Earthworm casts, which can be 4-36 tons dry weight/acre/year contain more nutritive material containing carbon, nitrogen, calcium, magnesium, potassium, sodium, phosphorous than the parent soil. Their work on the soil promotes microbial activity which is essential to the fertility of most soils. (*Vandana Shiva, Staying Alive, 1988, p 107-108*)

The castings of earthworms have 5 times more nitrogen, 7 times more phosphorus, 3 times more exchangeable magnesium, 11 times more potash and 1.5 times more calcium than soil. (*Principles of Organic Farming, Navdanya, 2006, p.99*)

At the Navdanya farm in Doon Valley, we have been feeding the soil organisms. They in turn feed us. We have been building soil and rejuvenating its life. The clay component on our farm is 41% higher than neighbouring chemical farms, which indicates a higher water holding capacity. There is a 124% increase in the organic matter content of the soil on our farm. Nitrogen concentration was 85% higher, phosphorus content was 10% more and available potassium was 25% more than soil samples from chemical farms. Our farm is also much richer in soil organisms such as mycorrhiza which are fungi that bring nutrients to plants. Mycorrhizal association provides food material from the soil to the plant. Our crops have no diseases, our soils are resilient to draught and our food is delicious, as any visitors to our farm can vouch. Our farm is fossil fuel free. Bullocks plough the land and fertilize it.

By banning fossil fuels on our farm we have gained real energy – the energy of the mycorrhiza and the earthworm, of the plants and animals, all nourished by the energy of the Sun.

¹Charles Darwin, *The Formation of Vegetable Mould through the Action of Worms with Observations on their Habits*, London: Faber and Faber, 1927

Shifting Our Approach to Agriculture

An Essential Component of Climate Change Action

Alan Imai

As the human community struggles to respond to the challenges of climate change and develop a more sustainable way of living, we must recognize that today millions of people are currently suffering from hunger around the world which could reach an estimated 370 million people by 2050. According to the Food and Agriculture Organization (FAO), we need to increase food production by 70 percent to feed the world's growing population over the next 40 years. This is a daunting task.

In order to face the challenges ahead, we must put agriculture at the top of the climate change agenda. Agriculture is a significant contributor to climate change and to the degradation of our environment. It is a major cause of deforestation and a significant producer of greenhouse gases. At the same time, agriculture is being adversely impacted by climate variability and extreme weather patterns. Toxins from pesticides and fertilizers damage our waterways and drain our soil of essential nutrients. We cannot hope to address climate change successfully without restoring the balance of nature, and this includes shifting our approach to the growing of food.

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) implemented the most rigorous and comprehensive assessment of agriculture to date under the sponsorship of the World Bank, FAO, UNEP, UNDP, WHO, UNESCO and GEF. They concluded that agriculture is at a crossroads and the agricultural and industrial farming sector is in urgent need of change. It is how we change that will determine the future of our planet.

We can choose to invest in more agricultural technologies, such as genetically modified organisms (GMO) with a business-as-usual approach relying heavily on non-renewable materials, such as petroleum or we can choose an alternative of locally-based, self-sufficient, sustainable agricultural development. For many in the international community and those familiar with the IAASTD report, business-as-usual is no longer an option. The greatest hope for our planet's survival lies in shifting our approach to organic solutions. We have put so much emphasis on mass production and efficiency, and lost sight of the basic values, which defined

our relationship with the natural world. Through relearning these values and creating a major shift in attitude we can begin realizing that ecosystems are living systems that have their own internal integrity, as well as the value they provide – both materially and spiritually. For us to begin to address climate change in relation to land use, the future lies with small-scale farmers and sustainable agriculture that provide true 'sustainability' through agro-ecological methods which are in harmony with nature.

For the last many decades, we have operated as if we can tamper with one part of nature, and everything else will continue to function without being affected. If we utilize chemicals in our fields, we may have more crops, and we may be more efficient in producing food up to a certain point. But eventually the system breaks down. When we examine the current approach of industrialized agricultural production, we must recognize that it is a key contributor to climate change, not just because of how it manages the land, but because of the mindset it carries with it, which is contrary to nature. Our current agricultural system promotes mass-mono-crop production and the use of numerous chemicals and additives. Although conventional farming has been successful in terms of "yields," its benefits in providing convenient or affordable food do not outweigh the financial or social costs or the long-term damage to the environment, food security and human health.

There is much scientific evidence about the impact of agrochemicals on our environment, specifically the damage it causes to soil, water and human well-being. Yet, farmers have come to rely heavily on them, because they must meet the demand of the global market. Unless policy makers, decision makers and most of all consumers, become conscious of what we eat and how we live, the existing food production system will not change. The demand for organic agriculture and food products is on the rise. However, there needs to be a greater demand for a safe and healthy food production system that supports environmental sustainability and promote values and attitudes that support the health of the environment and the whole person physically, mentally, emotionally and spiritually. A shift in values is critical to change agricultural policy and practice and this has often been overlooked. There is perhaps no more critical need than for the human community to re-establish its relationship with nature that recognizes the principles of interdependence.

The re-establishment of our relationship with nature and the natural forces is central to Natural Agriculture, which is more than a sustainable system of food production. Natural Agriculture is based on a way of living in harmony with nature that depends on a relationship of partnership and collaboration, rather than control and domination. The basis for this relationship is a true respect for nature and its natural processes. In

practicing Natural Agriculture, farmers do not utilize any agrochemicals, fertilizers or additives, including manure to grow food. Natural Agriculture farmers use unmodified, natural seeds and save seeds from each harvest for planting the following year to continue the natural growing process. This approach has been successful around the world with more than 100 farms throughout Japan, as well as in other parts of Asia, Europe, the Middle East, Africa, North America and Latin America.

As the international community discusses the state of our planet, new climate change mitigation strategies, and breakthrough technologies, we would only benefit by introducing a greater respect for the wisdom of nature into our discussions and decision making. We must acknowledge its right to exist as it is, and we must seek to understand it and work with it – to work with the soil, the air, light, trees, and other elements that contribute to healthy plant life. As human beings, we are part of a vast web of life, and we will be far better off if we understand the intricate interconnections, and understand the damage done by our interference. All natural systems are interconnected; trees, mountains, rivers and crops are connected to one another and the health and well-being of one, affects the health and well-being of the others. Carbon sequestration and carbon trading are not going to be the answer to our problems, at least not in the long-term.

All of us need to work together to make this shift in our attitude and behavior toward nature - not just those in the agriculture sector. It is our collective responsibility and the key to our survival in a world where global warming can no longer be dismissed as a myth. Pursuing short-sighted goals while ignoring long-term environmental effects will have great consequences now and for generations to come. We must take the initiative to address climate change by implementing a comprehensive and sustainable approach to agriculture. We can start by reconnecting with nature, demanding organic solutions to climate change and food security, and empowering farmers around the world to break free from the current “business-as-usual” mindset.

Case Study

Shumei Natural Agriculture in Zambia

Barbara Hachipuka Banda

In Zambia, a landlocked country in southern Africa, more than half of the population relies on agriculture for their living, growing cash crops such as maize, sorghum and cassava.

Since the 1960s, the use of chemical pesticides, fertilizers, and hybrid seeds has become increasingly common among Zambian farmers. However, despite occasional surpluses, the food supply in Zambia remains unstable and climate change is now having an adverse effect with drought, reduced rainfall and high temperatures leading to shortfalls in crop production and lower economic growth.

The Mbabala Women Farmers’ Co-operative Union (MBAWOFA) was founded in 2003 in an effort to improve women’s household status and income through their involvement in agriculture in rural Zambia. In the beginning, MBAWOFA purchased and distributed fertilizers and hybrid seeds at lower costs for members.

However, in 2004 the co-operative was introduced to Shumei Natural Agriculture, an approach to agriculture based on living harmony with nature and working with natural systems following the philosophy of Japanese naturalist Mokichi Okada, who believed that respect for the soil brings forth its potential power in yielding crops.

The practice of Natural Agriculture encourages minimum intervention in the growing process including use of indigenous seeds and seed saving; cultivation of soil in its natural state without additional elements, i.e. fertilizers or manure; and a comprehensive understanding of the role of insects, neighboring plants and weeds and how to maintain their balance without the use of any pesticides or herbicides.

Seeing the potential benefits of Natural Agriculture, the co-operative set out to re-sensitize farmers to traditional farming practices aligned with the Natural Agriculture philosophy. The project began with twenty farm families setting up demonstration farmland to grow maize, peanuts, rape, chives, onions, cabbages and tomatoes.

WBAWOFA farmers began by using seeds from native crops, including the local variety of maize. This was an attractive alternative for many of the farmers because the yields of hybrid seeds were reliant on the use of expensive fertilizers and pesticides. They also found that the native seeds were much more resilient to disease and performed well under changing weather patterns.

Soil depletion is a common problem faced by farmers in rural Zambia. Wood is the main source of fuel for the majority of households. The women farmers noticed that by removing trees, they were destroying the water catchment area. Deforestation and the subsequent increase in run off was a major contribution to water evaporation in the soil and ultimately resulted in topsoil depletion.

“In the developing world, 20% of irrigated farmland has been damaged by water-logging or salinity. In the 1980s alone an estimated 100 million hectares of irrigated land were abandoned.”

–UN Food and Agriculture Organization (FAO)

Following Shumei’s advice, the farmers focused on using local dried plant materials to cover crops. The plant cover helped to significantly decrease water evaporation by keeping the soil temperate and moist, and provided protection from ‘run-off’ in deforested areas. This approach helped

to naturally restore the soil’s intrinsic fertility and was seen as a successful alternative to fertilizers that would be detrimental to the long-term health of the soil.

Farmers noted that under ‘western culture farming’ methods they were producing 2.5 tons of maize per 10 hectares of land, while using Natural Agriculture methods they were producing between 5 and 7.5 tons per 10 hectares. Over time, an increasing number of farm families joined the Mbabala Women Farmers Co-operative Union and received training in Natural Agriculture. By the end of 2005, the program had grown over 1,000 farm families.

Zambia’s agricultural sector was recently affected by flooding. Many farmers in Zambia suffered because their crops were swept away in the floodwaters or had lower crop yields. The co-operative’s farmers found their crops were able to withstand the floods much better and had less damage. As a result more farmers are turning to Natural Agriculture as a more productive, cost-effective and resilient alternative to conventional methods.

Natural Agriculture has enabled the members of the co-operative to lead more sustainable lifestyles. They no longer have to purchase seeds and fertilizers and their crop yields are higher than ever. In addition, they are able to increase their seed supply each season. The co-operative, which now involves more than 5,000 people, is not only about increasing crop yields. It also teaches the principles of planning to farmers, who are feeding their families, selling crops to clothe and educate their children and saving seeds for the future.

“The Shumei principles of Natural Agriculture have allowed us to take farmers back to the beginning, before fertilizers and pesticides, when farmers could grow food using the natural environment. Natural Agriculture has given the farmers back their confidence and provided them with opportunity to create a sustainable and healthier life for their families.”

–Barbara Hachipuka,
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Co-operative Union*

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