

Sustainable Agriculture and Society

A Speech

By

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An Historical Perspective

I have travelled in many parts of the world, particularly the developing agrarian societies of Haiti and Guatemala. I have seen some remarkable terraced agricultural systems that have sustained generations of families and communities in the Guatemalan highlands, and I have seen the effects of unbridled population growth and deforestation on the steep tropical soils of Haiti - with a devastating effect on village families who are forced to flee to the squalid slums of Port-au-Prince. The essence and necessity of a sustainable agriculture is seen and felt the world over, be it in the third world or right here in the post-industrial U.S. Without it we face a decline in the family structure of rural peoples - something we are already witnessing here in the U.S. Is it important to talk about sustainability? It most certainly is!

The most difficult problem that I as an agricultural educator face is in convincing people that farming is very much a part of society as a whole, not just another job by which a person makes a living. What happens in the countryside in one century will affect the cities in the next, and often there is not even that much of a time gap. We've all heard the adage, "As goes the country so goes the city." I believe that it is true. Agrarian rural areas are in trouble and so too are the cities which depend on the food produced there. The current system of agriculture is by and large not sustainable either due to economics, environmental degradation or social distaste. What are we to do?

"Food is the common denominator of life; producing food is part of the biological and cultural as well as economic fabric of civilization." (1) So says Gene Logsdon in his insightful book, The Contrary Farmer, a book I highly recommend as both farming handbook and social essay. Although historians should continue to question the precise causal connections between rural and urban economies, it is a fact that a strong and vital urban society has always been supported by a strong and vital rural society. General decline in the

Roman Empire, the British Empire and the Former Soviet Union paralleled, if indeed not followed, the decline of their rural communities. The same thing is happening in the United States, in my opinion; we just don't seem to realize it yet. I feel it is my purpose to educate the community as a whole, farmer and city-dweller alike about the importance of developing a more sustainable agriculture for the betterment of the civilization we are currently so proud of.

Problems in U.S. Agriculture

There are many points to consider when discussing the problems of U.S. agriculture as currently practiced. I am going to merely touch on two aspects which have societal as well as on-farm impact; groundwater contamination and soil erosion.

Groundwater Groundwater is the source of public drinking water for nearly 75 million people. Private water wells supply water to an additional 30 million individuals. Nearly 50% of all drinking water, 97% of all rural drinking water, 55% of all livestock water, and more than 40% of all irrigation water is from underground sources. (6) Accumulating evidence indicates that a growing number of contaminants from agricultural production are now found in underground water supplies. (7) This is not to place the blame on the shoulders of agriculture alone mind you. Golf courses, homeowners, industrial runoff, and others also contribute greatly to the groundwater contamination equation. However, the impact of agriculture cannot be denied.

Increased use of nitrogen fertilizers without the benefit of nitrate quick tests and pesticides without field scouting, particularly herbicides, over the past 40 years has raised the potential for catastrophic groundwater contamination. Additionally, several of the most widely used pesticides have the potential to leach into the groundwater as a result of normal agricultural use. Indeed, pesticides have been detected in the groundwater of 26 states as a result of so-called normal agricultural practice. (8) Greater use of feedlots that concentrate animal manures also heightens this risk.

Soil Erosion Soil erosion remains a serious environmental problem in parts of the U.S., even after 50 years of state and federal efforts to control it. Common management practices such as continuous row crops, fewer rotations involving forages, and larger farms

being tilled by one operator have made it difficult to conserve soil resources in some areas.

(6) Similarly, some federal price support programs have historically encouraged high levels of production that work as a disincentive for effective erosion control practices.

Soil erosion causes off-farm as well as on-farm damage. Quantifying the economic cost to society of off-site effects of erosion is difficult and estimates vary widely depending on who wrote the report. The USDA calculated annual off-site damage at between \$2 and \$8 billion. Each year, the 350 to 400 million acres of land used for agriculture are estimated to account for more than 50% of suspended sediments deposited in surface waters.(9) Wind and water erode nearly 3 billion tons of soil from the nation's cropland each year.(9) This erosion damage can reduce the productivity of the land, labor and capital on the farm, and increase the need for more fertilizer and other inputs. Hardly a sustainable situation.

These are just two of the major issues of concern in modern agricultural production. We haven't even touched upon the effect of irrigation, surface water, loss of genetic diversity, pesticides or problems associated with antibiotics. Suffice to say that there are some serious problems here which jeopardize the sustainability of modern agriculture.

The Solution - Education in Sustainable Agriculture

The solution to these problems is the education of not only the farmers and the consumers, but also the educators themselves. In order to become a better educator one must be willing to learn. The WVU Extension Service has made a significant commitment to educate all agricultural agents about the viability and practicality of sustainable agriculture systems, techniques and philosophies. The 1990 Farm Bill included a statement to the effect that all county agriculture agents should be thus educated. Money was made available via grants to the land-grant universities. WVU responded and put together a terrific training program of which I am a part and where I am heading this afternoon. It is a five week commitment in terms of time but a career-long commitment as far as I am concerned.

This week we'll be spending some considerable time among the Amish of Ohio in search of traditional farm wisdom for a more sustainable agriculture. The low-input sustainable farming systems practiced today by Amish farmers have developed over 300 years and have sustained the Amish as one of the most persistent and successful subcultures

in North America. Amish agriculture depends on traditional elements, such as horse farming and hand labor, and therefore contrasts sharply with conventional high-input farming. However, contemporary Amish agriculture is a blend of old practices with new ideas, similar in many respects to the sustainable practices that agricultural researchers are now experimenting with and designing. This long continuous history of sustainable farming practices gives us a unique opportunity to study biological control of insect pests and diseases and nutrient cycling, which contribute to sustainability. (2) This should be an interesting week indeed.

But need we look only at a subculture here in the U.S.? Why not look closely at what was published in the 1938 USDA Yearbook of Agriculture. It is full of research reports detailing the importance of composting, cover crops, crop rotation, biological pest control, efficient use of animal manures, etc. (5) These are the very same practices now being so heavily promoted by the sustainable farming community as new information. What happened that made us put all this good information aside in favor of high-input, energy-intensive farming? In a word: World War II.

Following the war, we had a surplus of Ammonium Nitrate which had been used in the incendiary bombing of Germany and Japan - cheap fertilizer. It simply became cheaper and easier for farmers to buy their fertility in a bag rather than having to plant clovers, make compost and haul manure. Energy was cheap and available and of course, ammonium nitrate does make great fertilizer. Unfortunately, it does nothing for the soil itself and in fact is toxic to earthworms and other soil animals. The forgotten element in modern commercial fertilizers is carbon. Carbon is what holds the whole world together for the soil microbes so critical for sustaining soil health. But, yields were tremendous. People were no longer in fear of starving. In fact, the Green Revolution hybrids saved India from certain famine, but brought with them a dependence on chemical inputs and a disregard for the solid foundations of traditional agriculture: cover cropping and green manures, mulching and composting.

Unfortunately, the microbes and earthworms which had long sustained agricultural production by working their "magic" were being starved, poisoned and killed. The soil was dying and yields, in order to be maintained, required more and more fertilizer. It was a "production at all cost" mentality which drove this system; not profit which implies some

consideration of required expenses. In an increasingly monocultural system, with little to no biological diversity, came disastrous pest infestations and a heavy reliance on ever more expensive chemical insecticides. Larger machinery and spray equipment was needed to handle the yearly onslaught of high yields and pests which, in turn, brought an ever increasing debt load at the bank to the family farm.

Finally, the oil embargo of the late 70's drove the price of fuel and the chemicals derived from it through the roof. The high cost of inputs coupled with the low prices in the marketplace drove many American farm families into debt and despair. The system had crashed and there was nothing we could do about it.

Farmers couldn't make a profit. Farms which had been in the family for generations were sold to the highest bidder. The suicide rate among 40 year old males in Iowa was 3 times the national average during this period. Many feel the number should be a lot higher if one were to include the number of reported "farm and hunting accidents" for the same time period.

This was a terrible time to be in farming. Unless of course, you hadn't followed the easy path where chemicals had replaced knowledge and sound soil management practices. It was from these survivors that sprang the sustainable agriculture movement and beget such authors as Wendell Berry, Wes Jackson, Allan Savory and Gene Logsdon. These are farmers who happen to know how to write and have told us that it is high time we woke up and smelled the humus (sorry). Before them we had Aldo Leopold, Scott Neering and Louis Bromfield to remind us of the ways and wonders of country life and farming. This is not a new idea.

What is Sustainable Agriculture?

So, what is sustainable agriculture? It has and still does, go by many names: alternative agriculture, natural farming, ecological farming, biodynamic farming, holistic resource management, integrated resource management, organic farming - I, myself, look forward to the day when sustainable agriculture will, by definition, be known merely as agriculture. It must be if we want our families, communities, indeed our civilization to prosper. All these names have similarities but do not all follow the same philosophy.

Sustainable agriculture is, after all, just that: a philosophy, a goal to strive for, a way of life, and above all, a moving target. As Louis Bromfield wrote in 1950, and which we can still find relevant today: the beauty and joy of farming comes...

"in having made something great and beautiful out of nothing. The farmer may leave his stamp upon the whole of the landscape seen from his window, and it can be as great and beautiful a creation as Michelangelo's David, for the smart farmer who takes over a desolate farm, ruined by some evil and ignorant predecessor, and turns it into a paradise of beauty and abundance is one of the greatest of artists." (3)

But let us think in practical terms. Allow me to offer this as a definition of sustainable agriculture: A whole-farm approach to the management of resources which has as its goal the implementation of site-specific practices that are economically viable, environmentally sound, socially acceptable, and have the quality of life goals of the farm family firmly in place. If any one of these key elements are missing, sustainability has not been achieved. This is a lofty goal and is indeed "a moving target." However, it is the effort, the process, the journey to get there that really matters. Can you profitably produce quality, healthy food without damaging the environment, your family or your neighbors? You most certainly can if you're willing to educate yourself about the natural world, and more specifically, the world beneath our feet.

Soil Is The Source Of Life

Soil is the major resource, indeed the cornerstone, of a sustainable agriculture. To this end, ecological soil management, and in particular management of the organic matter fraction of the soil, to promote both the level and diversity of the biological activity in the soil, is essential.

What is it about organic matter that makes it such a vital link in healthy, productive soils? Without going into too great detail - organic matter aids in moisture retention, erosion prevention, water filtration and purification, it increases nutrient availability, it increases microbial activity which can lead to greater pest and disease resistance, and it increases a soil's buffering capacity. (4) The addition of organic matter to a sandy soil helps it to hold water whereas when added to a clay soil, drainage is enhanced. Such a simple ingredient in such a relatively small amount can make such a huge difference. If you will, think of

organic matter as if it were yeast in leavened bread. Without yeast, the bread would be hard, rubbery and inedible much in the same way that a soil without organic matter would be hard, infertile and unhealthy. Therefore, organic matter is to soil as yeast is to bread.

Soil health and organic matter are indivisible. A healthy soil is one that is rich in organic matter. It will yield healthy plants which are more resistant to insect and disease attack, thereby decreasing if not eliminating entirely most pesticide needs of the farmer. Therefore, it just makes good financial and agronomic sense to feed the soil and let the plant feed itself. Chemical-based farming, on the other hand, relies on feeding the plant and sees the soil merely as the root holding medium. In the long run this is not sustainable.

Increasing the organic matter fraction of a soil is simple but not necessarily easy to do. It involves time, good management and above all, patience. In practical terms it means utilizing compost and animal manures, mulches for weed control, cover crops and subsequent green manures and conservation tillage practices.

All of these are not new ideas. Remember the 1938 Yearbook of Agriculture spelled them out in vivid detail.

You'll recall that earlier I talked about carbon as the forgotten element in modern fertilizers. It is the carbon which supplies the fuel to microbes which are so important to sustaining a healthy soil. There are literally millions of microorganisms at work in our soils converting raw organic materials into stable humus - the glue which binds soil together. (4) As soil managers, sustainable farmers must endeavor to make the soil friendly to these busy decomposers. This is accomplished through the addition of organic materials and lime, limiting heavy cultivation, growing cover crops, and reducing the amount of nitrogen fertilizers which are toxic to these sensitive creatures. Bear in mind that if we kill these organisms we inherit their jobs.

And of course there is much more. We haven't begun to talk about biological pest control, encouraging beneficial insects, crop rotation, or mechanical weed control strategies. Suffice it to say that sustainable farming is a journey with many steps along the way. We must also bear in mind that despite what some may say, sustainable need not mean purely organic. Organic farming is indeed a worthy goal, one which I lean toward as a possible direction for world agriculture. But sustainable agriculture does not overlook some of the

obvious benefits of the judicious use of chemical fertilizers and specific -- not broad-spectrum, kill everything -- insecticides. If they are used in an integrated approach to crop and insect management and are deemed acceptable within the farm's economic perspective, then they too are tools in a sustainable farmer's tool box.

To summarize what I mean by ecological soil management remember these ideas: 1) Soil is the source of life and should be treated as such; 2) Feed the soil, not just the plant; 3) Diversify production, avoid monoculture; 4) Maintain optimum conditions for soil microbes; 5) Recycle crop residues; and, 6) If you take nothing else home with you today let it be this: Soil health and organic matter are indivisible.

A Systems Approach - Management Intensive Grazing

This leads me to the systems approach to sustainable agricultural production. About a month ago I was watching Sesame Street with my 4 year old, Mali. We do this a lot together. If you haven't tuned in to this wonderful program in a while, I urge you to do so. Some of the segments are pure gems: simple, insightful, humorous. One of these "gems" came on about how a little boy was able to eat the sun.

Basically, this is how the story goes: The sun shines on the grass, the grass grows, the cow eats the grass, the cow makes milk, the milk is made into cheese, the farmer sells the cheese to the store, Johnny's mom buys the cheese and makes a cheese sandwich for Johnny. Johnny eats the sun. Beautiful! How many of our children actually know where cheese comes from let alone how the sun is involved.

Let's look at the sun-grass-animal-farmer-money cycle for a moment. How do we maximize the economic, environmental and social sustainability of livestock agriculture? Simple: Let the animal, a ruminant, do what it likes to do best - eat grass. The animal becomes a huge solar collector converting grass, which we can't eat, into meat which we can eat. And as far as I know, the sun's energy is still free. Now that's a resource that all farmer's should be capitalizing on.

Research conducted by a prestigious land-grant university (not WVU) has concluded that cows like to walk around and grass likes to stand still. Why does the majority of the American farm community (though less and less of a majority as time goes on) still insist on

keeping the cows in a barn while the grass is mowed and brought to them? Does it not make more sense to allow the cow, sheep, goat, pig, rabbit, or chicken do what comes naturally - walk around and eat grass? Of course it does. By developing a grazing system which is management and animal intensive as opposed to machine intensive optimum productivity can be achieved. Such a system is known as management intensive grazing and involves a rotation of pasture.

With a rotational approach to grazing the manager lets the animal do the harvesting in a way that is best for the forage. A plant gets its growing energy from the sun. This energy is taken in through the leaves so if the leaf area is diminished too much, growth will be stunted. The key to rotational grazing is that the manager is in control. The manager decides to rotate livestock in high density in small paddocks so that they eat all the forage (grass, legumes and weeds) once without overgrazing. Once they've eaten an area down to about 2", animals are moved to the next paddock and so on. By the time you need to move them back into the first paddock, it has had a chance to adequately regrow. Simple, it's called using nature to one's advantage without destroying it. It's called sustainability.

What are the benefits: higher forage yields; an ability to graze many more animals on the same acreage; help in the establishment of legumes to increase forage quality; natural weed control; development of a deeper root system which prevents drought stress; healthier and happier animals; and often a longer grazing season - well into the winter months thus limiting hay needs. An additional benefit is that if the animal does the harvesting, then the farmer doesn't need to and can do away with some expensive machinery like mowers and balers; thus improve the bottom-line and the approach to sustainability even more.

Biological Diversity on the Farm

The greater the diversity of species on the farm, the more the various forms of life keep each other from achieving out-of-balance population relative to the other species. This is far more than merely achieving a "balance" of nature. Increasing diversity means increasing the biological dynamism which leads to an increasing amount of total food produced without increasing the amount of human labor or purchased agricultural inputs. An excellent example is growing clover. As a legume, clover works with rhizobia bacteria to

fix atmospheric nitrogen making it available to itself or subsequent crops without any human cost or involvement. A factory built to extract nitrogen from the air costs millions of dollars and society's tendency is then to use the nitrate thus extracted to make gunpowder.

To quote again from Logsdon's book, The Contrary Farmer:

"As life forms interact with each other they create effects that individually they are incapable of. For example, cow flaps draw earthworms to dine on the organic matter. Young trees that have crept into the meadow over the years from the adjoining woodlot draw the cows to their shade. The cow-manure-earthworm-tree environment draws woodcocks to the farm. These birds come for the earthworms under the cow flaps and under the moist dirt bared by tree shade and cow hooves. Not incidentally, the combination has also produced on occasion a fairy ring of edible mushrooms. And also not incidentally, the animal manure is all the while being broken down and returned to enrich the earth. All we have to do is stand and watch in awe - and pick the mushrooms." (1)

If only it were that easy. Then again, maybe it is so long as we allow nature to work with and for us. For example, maintaining a riparian buffer strip along stream banks may take away some excellent grazing land, but it will improve water quality, decrease soil erosion, and increase the biological diversity on the farm. A trade off for sure, but most farmers would agree, a fair one.

Conclusion

The decline of the Roman Empire is often attributed to a reach exceeding the grasp. Many historical scholars look deeply into the geopolitical struggles of the empire builders themselves as a way to explain the decline of this once great civilization. Political, military and economic policies have been scrutinized down to the smallest order of magnitude but still questions as to why nag us.

Allow me to offer some food for thought. It was a disregard for the source of life that did them in. Their soils and farmers were not given the respect they deserved and so both began to starve. As goes the farm so goes the city (and perhaps the civilization itself).

Agricultural anthropologists have shown tremendous soil loss and soil degradation during this era centered around the Roman Empire. Could it be that as this great civilization spread its wings and flew it forgot to make sure it had a place to land? Food ran short, famine reared its ugly head, once happy villagers began to turn on those holding the grain

storage keys, riots broke out...the implosion of a mighty regime had begun. If only they had treated the soil resource and its managers with the dignity and honor they deserved...

Is this merely ancient history, or, is history destined to repeat itself as many so often claim. Can the "American Empire" be brought down in the same way? Are we taking care of our soil resource? Do we not have hungry, indeed starving, people in this country? We are the world's bread basket and have been for quite some time - we better take good care of it or we might just go the way of the early Romans.

If you think I'm just making this all up, take a good look at topsoil losses reported around the country by the USDA. Billions of tons are being lost every year down the Mississippi, Ohio, Potomac and other rivers; wind carries tons of silt and dust high into the atmosphere where it is lost; fields and lawns alike are being over-fertilized and mismanaged!

Sustainable farming is smart farming. It involves treating the farm as a whole ecosystem utilizing the many resources found there to their maximum efficiency. It involves a certain reverence for the soil and all the life, seen and unseen, which it supports. It involves a conservation ethic, a belief that man can work with nature to improve and feed the soil for the nurturing of the many generations to come. It means becoming educated about the way of life in the soil, the sea, and amongst the many cultures which inhabit the world. It is a system which connects us all whether we farm or merely enjoy the fruits of the farm.

So, is it all lost? Sure, it may take 1000 years to make just an inch of soil, but is this really that important when we've got 10 foot deep topsoil in the Midwest? Well, for the time being we're alright. We will probably not experience wide-spread famine here in the U.S. At least not in this coming century. But how about in the next? Should we not be developing a sustainable agricultural system which treats soil as the source of life so that future generations can look back upon us with the respect and appreciation we deserve? Or will they look back at us with the blame, disgust, disbelief and nagging questions about decline that we have for the Roman Empire?

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