The carbon hunters: Future of Food – A Brief Essay by Walker Miller

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As a farmer (The Happy Berry in Six Mile SC), and a retired professor from Clemson University specializing in plant health I have become quite concern about the future of our food system and the possibility that it will collapse. I grew up punching cows for a local cattle farm and working for local fruit farms in Southeastern Pennsylvania.

I remember cleaning wooden spray tanks that were used to spray arsenic and Bordeaux and saw the advent of modern plant pharmaceuticals like DDT, maneb and captan. It was the days of "better living through chemistry." I went off to college to study under the inventor of maneb. I gave a seminar in graduate school on the "cancer inducing principle" associated with the crown gall bacterium before we knew what the inducing principle was.

I spent my career teaching farmers about the etiology and epidemiology of disease and integrating the efficient use of plant pharmaceuticals into pest management programs. In the latter part of that career I tried to help organic farmers because they were using products that I grew up with but they had little experience with. I developed a respect for their basic mission of sustainability.

I spent 8 years as president of a local watershed protection group and overlapped that as a director for a farm stewardship group. I am also a Certified Crop Advisor i.e. consultant.

These careers lead me to become very concerned about the sustainability of our food system as it is part of an unsustainable economic system as evidenced by the economic chaos in Europe, The Middle East and elsewhere as young people riot because of no jobs, no food and lack of upward mobility.

Basically I am worried about the world my grand child will inherit from us. That she will ask me in 20 years…"Why did you not do something?" I see it as my responsibility. It is our responsibility!

But first I would like to give some perspective. Earth is about 4.6 billion years old. If we had 46 inch long stick to represent that time, after 6 inches life emerged, 7 inches photosynthesis, 28 inches first true cells, at 34 inches multi celled creatures, 40 inches land plants and animals, at 43 inches Mammals and humans emerged at 45.88 inches. The dust I wiped off the end of stick was

when agriculture was discovered 12,000 years ago. Jared Redmond has documented cultural collapses in our history. All of these collapses were the result depletion of the natural resources that supported those cultures. In the past these were micro collapses. These cultures were isolated by some fact of geography. As explained by Mann, author of 1493: Uncovering the New World Columbus Created, the world has undergone both an ecological and economic homogenization over the past 500 years, not even a speck on the end of stick. With 50% or more of that homogenization in the last 50 years We now have a global culture. We are now looking at a situation where if there is a collapse it will be world wide.

This not a talk about how dreadful the future could be but rather an invitation to take steps towards making a nourishing and abundant future. To quote Albert Einstein "any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius - a lot of courage – to move in the opposite direction."

To establish a common link between this generation and future generations I believe our goal is happiness. So what is happiness? First it is food and home security. Second it is significant relationships with family, friends and community. And third it is the sense that you are helping the world to be a better place. I will discuss 1 and 3 with you.

Food sustainability and security ultimately is a matter of energy." A friend, John Ikerd, from whom I am borrowing liberally, points out that energy can neither be created or destroyed, the first law of thermodynamics, but it can be formulated with the input of additional energy into more useable form that can do work such as run an automobile. After the work is done the energy is more dispersed and is less useful, the second law of thermodynamics. Fossil fuels like oil and gas are the result of photosynthesis that took place eons ago and compressed under the earths crust. These fuels are finite and they will run out, shortly! This century! In 50 years! Possibly less.

Other fuels/energy sources are finite also if we do not poison ourselves first from nuclear radiation for example. The issue here is risk. If we are willing to take the risk nuclear energy could last a 1000 maybe more years. Our safety record to date is dismal between human error, climatic extremes and disruptions of our earths mantle.

Renewable fuels can only come from the sun. The sun has been powering the planet for perhaps 3 billion years through precursors of processes that we know

today as photosynthesis. It also powers our rivers through the hydrologic cycle, it is the cause of winds and it also can be captured in photo cells. Harvesting wind, falling water and photo cell energy though comes with a price of using up natural resource materials which are also finite. Finally, and importantly, energy generated from wind, water and photocells does nothing for the biosphere/ecosphere.

"Bottom line" the only truly renewable resource is the process called photosynthesis. If man is going to direct this process (farm) for his benefit he must do so in a sustainable fashion.

The vision then is of an agroecosystem, a farm, that delivers a product (food, biomass for energy and raw materials for clothes, building etc) and ecosystem services in excess of what the farmer uses to direct/manage the system. If you are looking for one term to describe these ecosystem services it would be biosphere regulation as it operates in each unique ecosphere.

These services include greenhouse gas regulation (GHG), climate regulation, water regulation and supply, erosion control (both wind and water), soil formation, nutrient regulation, waste treatment, pollination, biological control, habitat, genetic system (DNA) that enables change, as well as recreation opportunities and aesthetics. Included in GHG regulation is carbon sequestration in soils. Agriculture is currently a major contributor to 30% of global warming gases including carbon dioxide pollution. But…it need not be!

So what are our current challenges for our agroecosystem vision in terms of food and raw materials? On the DEMAND SIDE they are **First,** population growth. Each year we have 80 million more mouths to feed. We pasted 7 billion people on the planet the end of October 2011 and will have 9.5 billion in 38 more years. **Second**, 3 billion people are moving up the food chain consuming more and more animal protein. This creates a demand for grain to feed the animals they will eat. **Third**, world wide there is a massive conversion of grain, beets, sugar cane and soon other plant based products to alcohol. In the US 400 million tons of corn was harvested last year (2010) and of that 126 million went to alcohol. This quest for conveniently usable energy is about to extend itself into less arable land in the name of biomass

On the SUPPLY SIDE: **1.** Arable land is being loss to soil erosion (wind and water) and carbon oxidation. The inherent productivity of the land is being loss by 30 %; **2.** The world's aquifers are being consumed faster than they can recharge and many fossil aquifers will dry up in the next 20 years or less.

Saudi Arabia is phasing out wheat production by 2016. This water problem is being exacerbated by climate change which is melting glaciers (fossil water also) which feed the rivers that supply the irrigation systems that are used to supply irrigation water during the dry season. **3.** Climate change… The rising temperatures reduce crop yields. For each 1 degree rise in Celsius there is 10% loss in yield. The melting of the ice sheets of Antarctic and glaciers, Greenland and others are raising sea levels which could severely reduce rice harvests in the deltas of the world. **4.** Deserts are advancing around the world from overgrazing, plowing and shifting weather patterns as a result of climate change. **5.** One of the curse's of Christopher Columbus- Invasive species. This year at The Happy Berry we have 3 new invasive species that threaten our production. They are marmorated stink bug, the kudzu stink bug and the spotted wing drosophila. **6.** Urbanization is taking both cropland and water away from farmers. In the US since 1982 an area the size of Indiana has been developed. **7.** Increasing energy costs are resulting in increasing fertilizer prices. Fuels are also tied to tillage, irrigation and harvesting let alone transport of food. As oil/energy prices go up so will the price of grain. **8.** Bio energy from biomass will remove land that otherwise could be used to produce food. The 2008 Farm bill subsidies are accelerating this result and are being poorly managed by the USDA. 9. There is a declining availability of new technology that is property of the commons; hence we are losing competition in the market place. The result is a widening of the chasm between the rich and the poor as a result of corporate control of technology.

So to my way of thinking we are in a Ponzi scheme…You know… where you use the money from current investors to pay off earlier investors until the scheme collapses. We are using our natural resources, soil and water, at an unsustainable rate so that we can eat and live well now but the young people of tomorrow (or even now) are unable to continue the investment because the natural resources won't exist or they won't be able to pay for these scarce natural resources…Hence the protests/riots that are occurring around the world today.

The US National Academy of Sciences concluded "Humanistic collective demand (for natural resources) surpassed the regenerative capacity (of earth) around 1980." In 2009 it was exceeding it by 30%!

We are destined for collapse if we do not change our ways! And I believe it will be the food system that triggers it! We are sleep walking into a disastrous future. BUT… I believe that God has given us a resilient world and it is not too late! Our actions can provide a future that has abundant food, is energy

lean, time rich, less stressful, healthier and happier for future generations. When you accept the idea that there is truly a crisis you may have one or a number of responses. They are physical discomfort, bewilderment, 'grasping at straws', fear, survivalism, denial, exuberant optimism or 'told you so.' These feelings are natural and hopefully they will inspire you to take action.

But before you take action understand that there several steps you should go through. The first is pre contemplation. You gather information and evaluate it. Then there is contemplation stage where you make decisions. Then there is preparation and planning of how you are going to execute the plan. Carrying out the actions is next. There will be relapses and the need to maintain or revise action plan and refocus. Remember this a 10 or 20 year plan.

What can you do?

First! Don't believe me… do your own research. Check out the documentation you study… is it corporate sponsored papers or is it refereed scientific work?

Some books you might start with are:

Collapse by Jared Redmond,
Short history of progress by Ronald Wright
The Collapse of Complex societies by Joseph Tainter
A Return to Common Sense by John Ikerd
Consulting the Genius of Place-…Wes Jackson
The Long Emergency by James H. Kunstler
The end of Energy by Michael Graetz
The transition Handbook by Rob Hopkins
Locavesting: The revolution in local Investing and how to profit from it By Amy Cortese
The virtues of Ignorance by Bill Vitek and Wes Jackson
1493: Uncovering the New World Columbus created by Charles c. Mann

Second! Start a discussion group in the Rotary, Lions club, at church, or other community groups.

Talk about issues like but not limited to:

The ethic of "knowledge for power." Generally this ethic, which originated possibly with Francis Bacon in the seventeenth century, supports human mastery and control of nature. Basically that science can solve all problems when aligned with capitalism. Another view is the ethic "reverence

for life" conceived by Albert Schweitzer. Generally this ethic supports Knowledge based on a worldview that recognizes that all living things are connected. It affirms our will to live, others will to live and the will to not dominate or consume to extinction.

Why corporate farms will not provide ecosystem services. Corporations are required by laws to operate with a single bottom line. We can change this and enable investors to select corporations that operate with a triple bottom line

Are corporations really people? Should mega corporations be regulated? If they are not brought under control should they be nationalized?

Global trade pacts and loss of democratic control of corporations at the international level?

Small scale, family-based farms…Are they productive? The research shows they are.

Farm subsidies geared to favor industrial agriculture. Can we gear subsidies to reward sustainable practices and penalize unsustainable practices?

How can Agriculture sequester more carbon? Grow perennial grains/crops? Increase our depth of canopy? Enable carbon fixation over the entire year? Increase diversity/complexity of our production system?

Current fossil based energy/water, how long have we got? Not long!

Embrace the idea that the polluter pays? With direct taxation? Carbon tax? End fossil fuel subsidies?

Future of energy (alcohol, pyrolysis and gasification, nuclear, wind, hydroelectric, photo cells, other) is tenuous. Bottom line we are using a million years of storage in two hundred years or so. The regenerative capacity of sun driven harvestable energy may not be able to equal or may even be substantially below our current consumption rate in terms of food, raw materials, energy and maintenance of adequate ecosystem services.

Risks of centralized food and energy systems vs. decentralized. Centralized food is a food safety incident waiting to happen and if there is no fuel how does it get delivered? With centralized energy it takes enormous amount of natural resources and human capital to get it distributed.

Life style changes- are we preparing our children for how it will be?

Economic growth as we know it, is it coming to an end?

Pedestrian communities and transition culture… Communities around the world are transitioning to a new culture.

Corporatism consuming biosphere capital… Diversity for example that is once lost can not be put back.

'Clean Elections' Several states have enacted legislation. Basically a candidate collects a required number of $5 donations and signatures and then becomes eligible for a government grant. The candidate in exchange agrees to limit fundraising and campaign spending. Non participating candidates are

limited in their spending. This legislation has encountered constitutional problems that need to be resolved.

Why local industry can't compete with mega corporations - because mega corporations are leaving costs off the books (Industrial farming Illusion)?

Tax restructuring, mandates and subsidies … replace income tax with environmental taxes.

Policies that encourage diversity generate other results like local tourism, forestry and other local industries.

Buy local – On average 96 % of your food or more comes from outside county and slightly lesser degree your state or the country. If you don't buy local there is little impetus to get in business or stay in business.

Bank local – Local banks are dwindling but are still present in many communities. The mega banks are fostering regulations that make it very difficult for local banks. The situation is similar to the mega food corporations fostering regulations that small farmers just do not have the resources to implement.

A state bank for your state (consider the North Dakota example) to increase local sovereignty… A state bank is a local banker's bank. It gets it resources from state taxes and fees and pays interest to the state treasury. Its mission would be and restricted to supporting your states needs and businesses with special emphasis on agriculture with loans through local banks.

Invest local – Local investment club? Community Development Financial Initiatives (CDFI)- there are about 800 in the USA. They can be directed to invest your dollars by area or region. The 2010 American Jobs Act has 3 billion dollars in it to warrant local CDFI investments. Crowdfunding – the idea is to collect lots of small sums from lots of folks bypassing banks? 'Slow Money' a national organization made up of local chapters dedicated to finding financing solutions for food and agriculture producers. Forming local cooperative(s)? Reestablish a local stock exchange?

Assess local assets and find ways to convert them into sustainable livelihoods… like farming. Several futurists indicate that we have come to the end of the industrialization era…we are entering the knowledge base era…This era is not a lot of information but is where individuals integrate information to make smaller, more efficient, less destructive, more dispersed natural resource based enterprises. Remember that the economy is totally based on our natural resources and the economy just guides us to the most efficient use of these resources.

Imagine a global food shortage…(Read "One Second After" by William R. Forstchen)

Importance of the commons verses privatizing – like water. Should we reverse privatization and rebuild the public sphere?

What should be property of the commons? Technology? Study the concept of the commons at the local, regional, continental and the whole world level. Why are boundaries important to the concept of the commons? What is the government's role in the commons?

What is the role of religion in the food (ecological) crisis that we face? For discussion - Our governments have not reached a sufficient level of environmental sensitivity that "we the people" must provide stewardship with the same degree of concern for the environment as we do for our children.

Importance of the Land Grant System to provide unbiased information to the buyer and technology that belongs to the commons.

Third! Become part of the movement to rebuild "The American Dream of stable and resilient families and communities" … that hard work should pay…that ordinary people should be able to get some place …be able to be upwardly mobile … to be able to have food and home security, significant relationships with family, friends and the community and be able to contribute to the future of mankind… You do not need to wait on government to build a resilient community. Building a resilient community is not a position of nothing in or out of a community… but is one of enhanced resiliency by communities supporting other communities in a decentralized manner so when shocks occur there is not collapse.

Last, please talk to your legislative delegation about these issues. Explain your ideas about what they should support.

I would like to end with a vision of what I see 30 maybe 50, or 70 years down the road given the supply and demand issues mentioned above. In addition to food as a driver, the issue at hand, I see the approaching dimunition of fossil fuels that enabled mobility and the transition to biomass and sun driven energy as a driver of this vision. The advent of making useable forms of bio energy from biomass will become a slave to the energy output to energy input ratio EO/EI (first law of thermodynamics). As the ratio declines from some number more than 1 to 1 the economy will become increasingly local. The input energy is what is required to convert the biomass to a useable form or to extract fossil fuels. It will include planting to harvesting, processing and transport to the point of use/consumption (second law of thermodynamics). I can't help but to believe that the ratio associated with fossil fuels is above 1 now and declining rapidly. Policies are driving the making of bio energy now (Farm bill 2008 subsidies) but as the EOEI ratios intersect economics will drive the system eventually. And the final Driver of this vision is that scientist agree that 350 PPM of carbon dioxide is the climatic tipping point. We are at 393 ppm

now. If we develop the Canadian tar sands, an oil field the size of Saudi Arabia's Ghawar oil field which was the largest in the world, it will increase CO2 to 540ppm according to NASA scientists. And perhaps break the climatic back of our planet. Add to this the "fracking" process for natural gas…Oh my goodness.

Less the above sound to horrific, I would like to use a little history to bring hope to the future. Scientists agree that carbon and CO2 has become a major driver of the Holocene for the past 12,000 to 15,000 years or more. Man discovered the use of fire much earlier. Agriculture was discovered 12,000 years ago in the Fertile Crescent, 7,500, 3,500 and 1,500 years ago in various locations in the Americas. In Asia, Agriculture was discovered perhaps 8,500 years ago. The combination producing food allowing population increase and the use of fire to mange the landscape resulted in global warming and the development of the Holocene. All across the Americas man used fire to maintain grasslands which provide forage for grazing mammals to thrive and man to hunt. These fires contributed CO2. One of the curses of Christopher Columbus was the spread of Malaria, yellow fever, small pox, influenzas and others around the world from 1492 up through end of the 17 th century and more. These diseases reduced the populations of native people 70% and more. The invading Europeans did not understand how this fire management contributed to the climate, so the practice of burning for grassland maintenance ended and billions of acres grew up in a thick canopy layers, some times 100's of feet deep, fixing carbon dioxide. The result was the little ice age which lasted for 200 years or so to be reversed by the discovery and use of fossil fuels. The point is that if we change our paradigm again we could reverse global warming. We must develop the collective will and know how to do it.

The Vision

Our economy will be more local out of necessity. Currently supporting the local economy is the trendy thing to do! Mega stores with big parking lots, dependent on a mobile suburbia will decline with those adjacent to public rail the last to go. The local economy will be largely dependent on bicycles public transit and local rail. Towns will be largely dependent on local agriculture for food, raw materials such as timber, cotton, fuel for mobility and environmental control and ecosystem services. Agriculture will become more perennial, with deeper cnopies and diverse. The ownership of land and the arable quality of that land will become the new gold. The "new gold" will be enhanced in value by improved management of the commons to prevent exploitation of

humankind. Backyard gardens will contribute a small but significant amount of food. Local farms will become diverse. Community Supported Agriculture (purchasing your food from a farm before the season begins in return for regular delivery) CSA's will be common. Farms will not become animal driven but perhaps will grow and make their own fuel. Bio and genetic engineering done locally for local ecosystems will be important. The need for research information to be made part of the commons will be increased in importance. Local artisans will make fuel, buildings, clothes, shoes; grain based foods as well as fruit, vegetables, protein value added products and more. The sphere of the local economy will shrink to a size dependent on local bioenergy resources over time as fossil fuel cost of extraction approaches the input cost to extract it. Other local artisans will recycle resources. For example small equipment or perhaps metals to harvest energy from characteristics of place… like wind, hydroelectric and solar using photo cells. These non photosynthetic characters of place along with the photosynthetic potential of place will determine the economic sphere of place. The building of soils through stewardship and conservation will be the determinant of the local photosynthetic potential. These economic spheres will inter act at the margins till distance and/or climate change alters the comparative advantage.

Basic technology will of necessity become the property of the commons. End product patenting will still protect the entrepreneur. A portion of the energy from the economic spheres will be devoted to inter sphere communication and to the storage and access of information/technology for future generations. Education will be at the local level with emphasis on social skills beyond the family, reading, writing, arithmetic, science, history, environment and high school internships in up and coming industries/professions. Artisan skills will be taught by apprenticeship. As individuals approach the frontiers of knowledge through the communication system at the local level they will seek positions of teaching, research and extension at the regional schools focused on eco-region problems. The curse of globalization/Columbus, the movement of pests, pathogens and their vectors (human, animal and plant), will be diminished due to localization.

Government at the local, regional, continental and international level will play an important role. Basically to provide services that can not be provided at the respective levels. These services ranked here in order of importance include: Establishing ecological polices to protect natural resources from degradation and the stabilization of the holocene; social policies to protect society from exploitation and to protect the rights of future generations; and economic polices that balance between ownership of a resource (natural or technical) and

that resource being part of the commons; maintaining the integrity of a monetary system; preventing exploitation of the individual i.e. maintaining competition and preventing coercion; taxes; and providing public teaching, research and extension to provide human resources for the future.

Finally make a list of 10 or more things that you can do personally or you would recommend to your community to create a resilient community by 2030. My first attempt I had 17. Send them to me, walker@thehappyberry.com In return I will share mine as well as adding new ideas as they are submitted, to you.

That's my story and I am sticking to it! Walker