Standing in the Anthropocene: Where Am I? How Did I Get Here? Where Am I Going?

Colloquium on Learning to Think in the Anthropocene,

Learning Development Institute
Villanova, PA, USA, 25 to 29 July 2018

Jerry A. Moles, NeoSynthesis Research Centre, Sri Lanka;
Blue Ridge Plateau Initiative, USA

ABSTRACT: Climate change, depletion of fossil fuel resources, loss of soils, contamination of water, limited genetic diversity of crop plants, social disruptions and dislocation, and increasing corporate control ignoring the consequences of current agriculture practices threaten the food security of many if not most *H. sapiens*. Industrial agriculture with applications of chemical fertilizers and biocides, genetic engineering, and increased mechanization produces a large part of the world food supply and is expected to continue on its present course meeting the needs of nine billion by 2050. Yet, the costs of this brave new agriculture with a history of little more than a century must now be evaluated in terms of its sustainability and the resilience of the landscapes and watersheds where it is practiced. Given the complexity of Life on Earth, there are no "one size fits all" answers and solutions must be found locally in each landscape and watershed. Example responses are offered from developing and developed economies and questions for the future posed.

Humankind is in a new place, a new epoch. We've never been here before. The challenge is to recognize this place, so familiar yet so strange. Where are we in both natural and human history? How must we behave as members of the species *Homo sapiens* if we are to survive and thrive to the extent that our physiologies and minds[1] allow? We are learning animals reflecting on the past as we decide on benefits to be gained immediately and over the longer term. Yet in this very moment, we experience eternity, the eternal now. And it is only in this eternal now that we can make a difference. The remainder, past and future, only exists in our minds and to our minds we must turn in deciding who we are, here and now.

As humankind has continued to exert its will on the Planet, we've recognized the importance of the interconnectedness of living things, that we exist as parts of larger wholes, parts of a living Earth. Gaia to the ancients, She exists composed of complex systems beyond our capacity to comprehend and thrives through dynamics operating on different scales in time and space with the possibilities of multiple causalities. Each place,

[1] Following Bateson (Harries-Jones:74-75), mind is not inside the head but rather ". . . a synonym for a systemic combination of pattern, information, communication, and ideas." While the complexities are beyond our understanding, we can detect bits and pieces to the point where meaningful exchanges are possible about how we know things and the implications of trusting that knowledge to direct human actions.

each community, each food producer and distributor, and each consumer deals with a series of unique events, moment to moment, making sense of things through the manipulation of technologies and power expressed through the exchanges of currencies and the benefits received through those exchanges. Costs and benefits of these exchanges are spread unequally whether measured in environmental impacts, security of livelihoods, or the presence or absence of hunger. Given the diversity across landscapes, watersheds, and continents, answers must be found where we stand in the moment focusing on our surrounding and then expanding our gaze outward interpreting the causes and effects that impact our lives.

All life is dependent upon photosynthesis.

The industrial model of "intensive agriculture" emerged in the early 20th Century in Germany when Fritz Huber and Carl Bosch discovered an artificial nitrogen fixation process producing ammonia fertilizers to stimulate plant growth. Then in the USA from the 1940s to the 1970s, agriculture changed dramatically with fossil fuel powered tractors and combine harvesters, chemical fertilizers, high yielding varieties, pesticides, weed management, and water control. Adopted and elaborated upon by other industrial nations, these changes pursued two efficiencies, greater production per unit of land and hour of labor.

With the application of fossil fuel energy and chemicals controlling plants and animals competing with agriculture crops, landscapes and watersheds were environmentally simplified. Rivers and streams were redirected and aquifers holding fossil waters were drained.

A "green revolution" with financial support from the Mexican government and the Ford and Rockefeller foundations emerged. The International Maize and Wheat Improvement Center was established in 1943 and served as a base for international agriculture research and technology. Successful in producing bumper crops of maize, wheat, and beans with new varieties, fertilizers, and pesticides, the model was set. In 1960, the International Rice Research Institute was created and demonstrated similar increases in production. In the early 1970s, the Consultative Group on International Agriculture Research (CGIAR) was formed creating other research centers around the world pursued similar approaches.

But the green revolution was not benign. Rachel Carson's *Silent Spring* (1962) sounded a warning bell as to the dangers of the indiscriminate use of pesticides upon wildlife, birds, bees, farm animals, domestic pets, and even people. She accused the chemical industry of spreading disinformation and government agencies of accepting industry claims without questioning. Often credited with inspiring the environmental movement, she called on humans to be informed and act responsibly as stewards of the Earth.

Genetically modified (GM) crops are the latest addition to intensive agriculture methods with the first field tests in 1986 (James and Krattinger, 1996). Engineering techniques are used to introduce new traits in plants not occurring naturally in a specific species to create resistances to certain pests, diseases, or environmental conditions. Beyond this, genetic

modification is used to increase shelf life by reducing spoilage, genetically create resistance to herbicides and other chemical treatments and improve nutrient values. In twenty years, genetically modified crops increased over 100 fold from 17,000 km^2 (4.2 million acres) to 1,797,000 km^2 (444 million acres) and employed by 17 to 18 million farmers. The USA leads the way in adoption with 70.9 million hectares (39 percent globally) with over 90 percent adoption for the principal crops of maize (92 percent), soybean (94 percent), and cotton (94 percent) (Ibid).

The ability to predict the occurrence and long-term environmental effects when non-native organisms enter into an ecosystem is beyond the capacities of contemporary agencies and research laboratories. When gene sequences are introduced via hybridization or horizontal gene transfer, uncertainty reigns because the level of risk cannot be calculated. Ongoing research focuses on making the technologies more efficient and effective rather than exploring the broader impacts on health and environment or non-GM crops, chemical, and mechanical alternatives. Further, the long-term consequences for farm communities in terms of both health and livelihood are seldom considered.

There is evidence that the increasing dependence on industrial agriculture comes at a cost to our nutritional wellbeing. Intensive chemically dependent agriculture has stripped away increasing amounts of soil nutrients with each harvest being less beneficial than the previous. A USDA study comparing nutrient values in 43 different fruit and vegetable crops in 1950 and 1999 found declines in protein, calcium, phosphorus, iron, riboflavin (vitamin B2) and vitamin C over the past half century (Davis, et. al., 2004).

While genetic manipulation is ongoing, we should not forget that we are dependent upon the genetic diversity that evolved over the centuries in the "land races" based upon the selection of plants that served human needs in specific local circumstances. In response to climate change, producing crops in previously uncultivated locations, and in cases of diseases, alternatives are limited to the remaining genetic materials available. Each single commercially grown plant is a clone of one of only a few specially selected genetic strains reducing genetic diversity to a bare minimum and leaving crop species exposed to any stress that can destroy that single strain. With corn, wheat, and rice being grown worldwide, the concern is that a newly mutated strain of fungus could wipe out an entire world crop, and cause massive food shortages. To protect existing generic resources, more than 1,060,987 samples of seeds of 5,798 species are stored in the Svalbard Global Seed Vault (2018) in Norway, a backup for 1,750 seed banks around the world. The very survival of *H. sapiens* is tied to and limited by these genetic resources.

Without Water There is no Photosynthesis.

Agriculture accounts for 70 percent of extractions from water sources worldwide and is a major contributor to water pollution. We're now using twice as much water for irrigation as in the 1960s (Kirschenmann:56, 2009). With large quantities of agrochemicals, organic matter, drug residues, sediments and saline in our water supplies, the impacts on native species, landscapes, and human health are beyond the capacity of humankind to monitor and take corrective action. This coupled with 80 percent of the discharge of untreated

municipal wastewater into bodies of water globally (UNDP, 2016) is but another example of *H. sapiens* threatening Life as we know it on the Planet.

Water has an additional influence on the capacity of humankind to feed itself in terms of soil erosion and sedimentation. Coupled with the wind, the soil removed is deposited in rivers, streams, irrigation ditches, reservoirs, and the surrounding countryside impacting both human communities and remaining native flora and fauna.

Pimentel (2008) found that over the past 40 years, 30 percent of the arable land globally has become unproductive. He also found in the USA that soil is being lost at a rate 10 times the natural replenishment rate and, in China and India, the rate is 30 to 40 percent. In the European Union in 2015, it was estimated that 11.4 percent of the territory is affected by moderate to high rates of erosion (5 tons per hectare per year). With growing global population, either more land must be cultivated or existing agriculture intensified, which is dependent on the life giving capacities of soils.

Climate Change and Food Availability.

Worldwide, the past 50 years likely have been the warmest in at least the last 1,300 years (Intergovernmental Panel on Climate Change:9, 2007), and 10 of the 11 warmest years on record have occurred since 2001 (NOAA NCDC 2011).

Climate change is already influencing agriculture with changes in rainfall patterns, temperatures, extreme weather events, and changes in outbreaks of pests and diseases (Milius, 2017). Agriculture contributes to climate change both by emissions of greenhouse gases and by the conversion of forests and other non-agricultural lands for food production. In 2010, it was estimated that agriculture, forestry and land-use changes contributed around 20 to 25 percent to global annual CO_2 (carbon dioxide) emissions. The Unites States Department of Agriculture (USDA:1,2012) noted, "Agricultural systems depend upon reliable water sources, and the pattern and potential magnitude of precipitation changes is not well understood, thus adding considerable uncertainty to assessment efforts." Projections into the future suggest an increased variability of temperature and precipitation and while limited in accurately projecting the occurrence and timing of individual extreme events, emerging patterns suggest increased incidence of droughts and periods of more intense precipitation."

If CO_2 emissions continue unabated, it is estimated that southern Africa could lose more than 30% of its main crop, maize, by 2030 and, in South Asia, there could be losses of staple crops up to 10 percent (Lobell, et. al., 2008). Further, there is concern that nutrient values of foods are dropping. Experiments have shown with increases in CO_2, proteins in rice, wheat, barley, and potatoes sink by 7.6%, 7.8%, 14.1%, and 6.4%, respectively. Other experiments have shown drops in critical trace minerals, e.g., iron, selenium, zinc (Medek, et al., 2017).

Understanding where we stand – what to pay attention to?

In becoming aware of our presence in the Anthropocene, we realize we're walking on different ground where our capacities to predict based upon the past are significantly

limited. Major corporations now control most of the food consumed through supermarket chains stretching across nations and prepared by packagers and processors providing meals for millions. Still along hillsides and down in valleys in Africa, Latin America, Asia, and places in rural Europe, farmers continue to produce much as did their recent ancestors. But even in these places, shops selling fertilizers, herbicides, pesticides, and two-wheel tractors can be found with transportation provided to local markets and to packagers and processors for export markets. Further, there is the great displacement of people due to wars, mining, and the construction of dams, industrial zones, highways, etc., with limited means to feed themselves.[2]

With the publication of Lovelock's (1979) *Gaia:*[3] *A New Look at Life on Earth*, visions expanded with the realization that with photosynthesis capturing energy from the Sun creating the atmosphere we breathe and with rainfall and oceans providing the liquid for mobility, we are parts of a living larger whole. The climate, the composition of the rocks, the air, and the oceans as experienced in the moment are the consequence of the ceaseless activities of living organisms over the past 3.6 billion years. With the exception of one percent of inert gases[4] in the air, the remaining 99 percent of gases are the products of surface and ocean living organisms (Lovelock, 32:1999).

The food on our tables is produced, processed, packaged, and delivered by many and we often know little of the care or disregard employed in its delivery. While governments have created inspection and certification programs to protect our wellbeing, the U.S.A. Center for Disease Control and Prevention (2018) reports that each year one in six (48 million) Americans become ill from contaminated foods while 128,000 are hospitalized and 3,000 die (Ibid, 2017). The World Health Organization estimated 420,000 deaths worldwide in 2010 from food-borne illnesses (WHO, 2015).

In response in the 1960s and 70s, organic agriculture gained attention. "Can we build and support smaller-scale, locally oriented food systems that are more likely to be just, ecologically appropriate, accessible, and resilient than food systems of larger scales (Ackerman-Leist:23, 2013)?"

While there have been steady increases in land devoted to organic agriculture globally from 1999 to 2016, 11 million to 57.8 million hectares, the total was from only 0.3% to 1.2% of the total farmed (Willer and Lernoud:47,2018). Further, the market for organics is driven by the more affluent in developed countries and, while other countries produce organic products, much is devoted to export markets

Beyond this, the capital required to develop alternatives is in the hands of those who benefit from the *status quo* and this is unlikely to change, quickly if at all. In introducing

[2]The United Nations High Commission Refugees reports that there are 65.6 million people forcible displaced worldwide with 22.5 million listed as refugees. Ten million of these are stateless (UNHCR,2017).

[3] The oldest and greatest of the pre-classical Greek pantheon of gods, she was at once gentle, feminine, and nurturing but could be ruthlessly cruel to any failing to live in harmony with Her.

[4] The chemically inert noble gasses, helium, neon, argon, krypton, and xenon (Lovelock:32, 1999).

Capital in the Twenty-First Century, Thomas Piketty (2014:1) wrote, "When the rate of return on capital exceeds the rate of growth of output and income, as it did in the nineteenth century and seems quite likely to do again in the twenty-first, capitalism automatically generates arbitrary and unsustainable inequalities that radically undermine the meritocratic values on which democratic societies are based." Collaboration among the private interests and government controlling finance, intellectual property, occupational licensing, and land use exaggerates the inequality (Lindsey and Teles, 2017). Hedge funds are now investing in agriculture lands envisioning ". . . a doomsday scenario catalyzed by a weak dollar, higher-than-you-think inflation and an uncertain political climate here and abroad (Kramer, 2011)." Even the most vital resource, water, is being taken over by corporations. Investors are being solicited, "A 'watershed moment' has arrived!…Literally. One of the most dynamic and profitable themes for the rest of this decade will be investing in water. Purifying, filtering, transporting, storing and bottling water will become increasingly important global businesses (Denning and Mayer, 2006)."

There are examples of the concentration of wealth expressed through major corporations in the "food industries." The reach of these corporations is global. Hess (2014) noted that with revenues in the tens of billions of dollars in 2013, five held at least US$50 billion in assets while four had more than US$6 billion in profits. Together, the ten largest companies directly employed more than 1.5 million people and contracted with many more. Their brands are well known because of their expenditures on advertising. Nine of these ten of these companies were among the 100 largest media spenders in the world in 2012.

While FAO (2017) recognizes there is enough food produced on Earth to feed everyone, estimates suggest that in developed nations more than half is wasted (Koba, 2013). The number of undernourished people increased from 777 million in 2015 to 815 million – one in nine -- in 2016. Even more – one in three – suffer from some form of malnutrition (World Food Programme, 2018). Ultimately, wealth matters— those with money seldom go hungry. Even in developed countries, poverty makes a difference. USDA reports an estimated one in six people, some 50 million USA citizens, are unable to buy sufficient food to stay healthy. Of these, nearly 17 million are children (USDA ERS, 2017).

Living mindfully as children of Gaia in the 21st Century -- Setting the Context

To understand Gaia, it is necessary to look from afar to gain a holistic perspective. Viewing the functioning of the Earth as a single superorganism composed of both living and non-living matter capturing energy from the Sun, the Earth maintains its internal conditions relatively constant despite changing external conditions.

The recognition of the Anthropocene questions the contributions of *H. sapiens* to present circumstances and the likely consequence of proceeding within the same trajectory as we have for the past 350,000 years – greater capture of solar energy to serve our own ends and, more recently, supplemented by ever declining supplies of fossil energy. From the perspective of Gaia's health, Lovelock (1991:153-156) views humans on Earth as analogous to a pathogenic microorganism. Agriculture and deforestation render the

greatest damage. "We have grown in numbers and in disturbance to Gaia, to the point where our presence is perceptibly disabling, like a disease (Ibid:153)." To Lovelock, there are four possible outcomes, (1) destruction of the invading disease organism, in this case *H. sapiens*, (2) chronic infection where the likelihood of survival remains a question, (3) destruction of the host or death of Gaia as a living system, or (4) symbiosis[5] – a lasting relationship of mutual benefit to the host and invader.

Assuming that the current industrial approach to agriculture is the answer, the United Nations Food and Agriculture Organization (2009) estimates that an annual investment of US$ 210 billion is required to meet the food needs by 2050.

Cruz de Carvalho (199:1974) warned of the blind spots of those with only knowledge of an industrial approach. "One of the greatest dangers in the evaluation of development schemes lies in the comparisons made between the extant situation and the projected future. The proposed change is often justified by consciously or unconsciously describing the present largely in terms of its defects, problems, and difficulties, while the future is forecast in purely positive terms."

Kassapu (45:1979) called out the scientists, "The lack of interest in a systematic study of traditional farming methods that would reveal how they work in order to deduce the scientific "laws" behind them is in itself an unscientific attitude."[6] Unsurprisingly, 35 years later, Padoch and Sunderland (2014, p. 6) make a similar observation in that "many types of integrated landscape approaches have not been studied by scientists . . . and the lack of rigorous research is concerning and needs to be addressed."

Natural systems serve as models for designing agriculture to maintain the ability of landscapes to control their climates and chemistry. It has been proposed that the most rational agricultural systems for the tropics are those that mimic the structure and energy flow of natural tropical ecosystems (Altieri et. al., 1978; Dickinson 1972; Hart 1980; Holdridge, 1950). Agricultural systems that are analogs to the natural systems substitute plants useful to humankind in the place of less useful plants while maintaining the structural features (biological morphology; chemical, hydrological and biological interdependences; microclimates, architecture, etc.) of native plant communities (Senanayake, 1986). Less overall energy (human, animal, or fossil fuel) is expended if an agroecosystem mimics the original ecosystem and can serve as an important baseline for comparison as management improves with continued experience (Gliessman, 2000).

---

[5] Symbiosis is the living together in physical contact of organisms of different species. Partners in symbiosis literally touch each other and sometimes live within each other. The concept has been expanded to give new insights into the mechanisms of genetics and consequent evolutionary changes (see Margulis, 1998). The interesting idea is that cohabitation, long-term living together, results in symbiogenesis – the appearance of new bodies, new organs, and new species. On a human in landscape scale, we must think of new relationships among ourselves and surrounding natural resources.

[6] The UN supported International Assessment of Agricultural Knowledge, Science and Technology for Development (IAAKSTD) (2008) demonstrated that ecologically appropriate organic agriculture could produce more and safer food at a lower cost than either industrial agriculture with or without genetically modified organisms (GMOs).

Aware of the benefits and liabilities of industrial agriculture and gleaning from the examples of both traditional agriculture and the functioning of natural systems, agriculture systems to serve the needs of communities worldwide must be put in place. Bohlen and House (6-7:2009) suggest that there are three fundamental land uses required for a sustainable human landscape: (1) the natural ecosystem providing critical life-support processes (including nutrient cycling, soil formation, air and water purification, flood control via biologically rich watersheds, etc.), (2) food energy for both humans and animals, and (3) support for human industry, commerce, and habitation.

Moving from present circumstances to sustainable landscape requires an appreciation of Nature and human communities operating at different scales in space and time. The challenges are overlaid with various claims to ownership of lands and access to water and capital when environmental sensitivity is required and quality livelihoods for all who produce and eat are included. While the natural ecosystems must be protected or replaced with ecosystems that provide the same environmental services of nutrient cycling, soil formation and clean safe air and water; those who control landscapes and the markets that determine what is produced are often ignorant of what is required. Unless the people living on the land are empowered to see to its wellbeing, we exist in a world with limited feedback to those who are determining the course of history and the resilience of Galia to the assaults by *H. sapiens*.

The Complexity of Complexity, Knowing Where We Stand

In organizing the means to get things done, a starting point – a worthy or noble reason –so people join together for mutual benefits. It's about organizing inquiry and response at the local level empowering people to protect their most precious asset, their natural resource endowment. Given that biological evolution is always a local, solutions must be found from the ground up.

I wish to share two experiences, the first in Sri Lanka and the second in the Central Appalachians in the USA.

In Sri Lanka along with Upali Senanayake who organized 640,00 school children to weed the paddy fields and increase national rice yields by five bushes per acre and his son Ranil with a doctorate in systems ecology from the Davis campus of the University of California, we organized the NeoSynthesis Research Centre (NSRC) to serve as a catalyst in protecting natural resources and improving the livelihoods of rural villagers. It seemed critical to understand the present, "being realistic in where we are headed with an understanding of the forces that maintain the present as experienced (Moles, 2018)." We went to the ground as an experimental station in the Village of Mirahawatte. Addressing complexities in real life surrounded by forest gardens, rice paddies, swidden plots, and vegetable gardens; we became partners with the villagers integrating our understandings drawn from scientific theory and inquiry with farmer knowledge and practices. As more was learned, a farmer handbook was published in Sinhala, Tamil, and English outlining a management approach to increase productivity and incomes while improving the

resilience of landscapes and protecting the remaining native biodiversity (Melvani, 2012). Rather than laying out precise management techniques, farmers are directed to evaluate their land and other resources and select next steps that reflect family needs. At the same time, ongoing demonstrations on the ground provide evidence of the viability of alternatives. We were there with the farmers to solve their livelihood challenges while maintaining vital environmental services.

Key wasn't the knowledge that we arrived with or discovered from a particular disciplinary or theoretical orientation, even though these perspectives were useful. Rather what made a difference were the relationships established through exchanges of information, materials (seeds, plants, tools), and energy (capital, food, and fossil fuels) on an ongoing basis in real time on the ground. In evaluating the resulting experiences, reflecting on our histories and sharing with others, the learning process is never ending. While conclusions are drawn, the latest experiences provide additional insights and directions. In a sense, we are parts of a larger ongoing symbiogenesis as catalysts while other life forms including *H. sapiens* determine outcomes.

While agendas were being set in the villages, we were in touch with various government ministries, international agencies, businesses, universities, clergies, NGOs, etc., and, with each, explored how we might cooperate in improving circumstances in villages and surrounding landscapes. In a sense, we were players in a giant multiple dimensioned puzzle engaged with others with whom we shared goals. Funding from USAID, AusAid, and other international agencies has allowed us to proceed for more than 35 years.

Results through managing vegetation include increasing incomes of farmers by over 500 percent, removing nitrates from water supplies protecting the health for more than 1.5 million people, and, after a devastating tsunami, returning agriculture to an even more productive condition than prior to the tragedy (Moles, 2018).

Returning to SW Virginia in the Central Appalachians in 1999, I became involved in an effort to protect farmland, forests, and other open spaces through the establishment of a land trust. The returns to farmers had to increase so better management practices could be adopted. The Landcare movement in Australia offered a useful example of community participation and the people in Grayson County, Virginia formed a non-governmental organization (NGO) in 2006, declaring themselves Grayson LandCare.

Under the banner of "whole farm planning," programs to view farms holistically and as parts of larger landscapes have been underway for 30 or more years in Australia. In the State of Victoria (AgricultureVictoria, 2017), a unified approach of land classification with attention to soils, water supply, biodiversity, pest plants and animals, pastures, succession planning, grazing, and drought management was created. With this information, work is prioritized, threats and assets identified, and realistic action plans created. Rooted in the Potter Farm Experiments, the principles of ecology in interpreting environmental dynamics were used to guide in the reducing environmental degradation, increasing healthy soils, protecting native biodiversity, and increasing farm profits. Both

state and national governments invested at the farm level under the name of Landcare[7] and now more than 6,000 local groups are participating.

Of particular importance was the adoption by Landcare leaders in Australia of the triple bottom line. To the people in Grayson County, thinking in terms of a better quality of life through (1) higher incomes and improved economic security, (2) improved community services meeting shared needs, and (3) a vibrant and healthy environment; the triple bottom line defined their mission (Moles, 2009).

A livestock committee was formed to pursue the dream of increasing incomes to farmers. Reaching beyond the community, a member of Congress, governor of Virginia, dean of agriculture at the land grant university. deputy director of Virginia Farm Bureau, an agricultural economist and staffs from federal and state agencies responded and a plan for an abattoir was created. A five-year whole farm planning study demonstrated that watersheds could be protected, labor reduced, and profits increased with investments in soil improvement and fencing. Planning for an abattoir making possible the finishing of animals locally rather than selling to feedlots was initiated. A survey of eight counties in Virginia and six in North Carolina demonstrated enough farmer interest and animals available to make an abattoir successful.

In March of 2015, the Agriculture Speaks to Power Workshop reported on the progress to date and visions of a stable, sustainable, and profitable agriculture future. The audience included representatives of congressional offices, members of the Virginia General Assembly, university administrators, potential investors, personnel from state and federal agencies, and other interested in agriculture opportunities. Grayson and Carroll counties and the City of Galax had declared that their future is agriculture in the founding of the Blue Ridge Crossroads Economic Development Authority. Recognized the need for coordination in planning next steps, people from several counties formed a new NGO, the Blue Ridge Plateau Initiative.

Carroll County provided a 20 acres site for the abattoir within one mile of Interstate 77, a major north-south highway and a local contractor is preparing the site at cost. A local company built a meat processing facility to add additional value added steps locally. In creating new opportunities, all of the links from the pastures to the plate must be established. In asking farmers to change routines, it must be shown that the alternatives offered are real and financially beneficial. Untold numbers of phone conversations, meetings, farmer field days, proposals, etc., by an active leadership in pursuit of the triple bottom line have led to this point.

Reflecting back on the two experiences, both started with engagements with specific local communities, a farming village and a rural county. Facilitation was key in organizing, gathering information, and reflecting back what was being learned. As agreements were reached on interpretations of available resources and opportunities, agendas and proposals

[7] A useful introductory video on the beginning of the Potter Farm Experiments can be found at https://www.youtube.com/watch?v=H9MWDwnd5Ak

for future collaboration and cooperation were set. Ultimately, success is based upon benefits experienced. In establishing local groups and NGOs as learning organizations, benefits and challenges are continually monitored and responded to on a timely basis. In terms of the Anthropocene, the people are continually adapting to changing circumstances. The success of their responses is based upon the validity and reliability of the information produced.

From an educational perspective, "curriculums" were created through the analysis and feedback by facilitators. Over time, as relationships were established both with the local communities and with markets, agencies, and organizations beyond; more people engaged expanding understandings of present circumstances and building confidence that other beneficial changes were possible.

This approach of engaging at ground level to address agriculture challenges stands in sharp contrast with creating solutions, e.g., developing plant species and varieties, companion planting systems, soil treatments, designed to serve existing markets and related food needs through centralized research centers. For example, Clark, et. al., identified "boundary problems" as a limiting factor in the adoption of technological and cultural practices at ground level as developed by the research centers linked to the Consultative Group on International Agriculture Research (CGIAR). The products of the centers often did not benefit farmers in developing countries. The reason given was the lack of effective communication across different disciplinary, agency, and extension boundaries. The assumption was that the research centers had in hand appropriate solutions and it was simply a matter of letting farmers know.

The authors were addressing a challenge in terms of developing knowledge to empower everyone that influences outcomes including international and local researchers, policy makers, and funders plus those at ground level whose behavior must change if landscapes and watersheds are to be protected and productive capacities increased. The boundaries among and between the various players were seen as the arena where performances must improve. Missing was any sense of the circumstances and challenges of rural people across many landscapes, watersheds, and nations. At ground level, greater precision is possible in raising the questions to be resolved as opposed to the generation of information guided by discussions within professional journals and among researchers and policy makers tinged with financial and political ambitions and obligations.

At issue here is context, the interpretation of the "playing field," the assumption of where one is standing in the process of solving problems. For Clark, et.al., the world is formed by the international agriculture research centers and the identification of problems that justifies their research and the sharing of what has been learned and developed. To Farmer Tennakoon standing in his forest garden in a Sri Lanka village, the world and challenges to be addressed are quite different.

In a detailed study of the forest gardens of Sri Lanka, Melvani (2018) demonstrates the complexity of management in serving household food, fuel, fodder, medicine, and fiber needs while providing financial incomes. Too frequently, the changes required in

adopting recommendations from afar ignore many of these family needs while suggesting participation in markets that may yet to be developed. With the NSRC engagement with villagers, the contexts of their farming operations and family lives were recognized and the changes in management were designed and selected by them. Rather than offering specific solutions, we facilitated solutions that served multiple ends including participating in worthwhile markets.

The same holds true with the activities along the Blue Ridge Plateau. The bottom-line is whose values are to be represented in improving the production and distribution of food?

While these examples are personally known, there is a larger movement of people creating agricultures mindful of sustainability and the resilience of the relationships forming the systems of which they are a part. Maybe self-conscious symbiogenesis would be an appropriate terms while aware that any complete understanding of the life forces that maintain our presence is beyond our capacities to understand. We must continually monitor and learn.

Paul Hawken (2007) refers to the impetus behind such movements as "blessed unrest," the growing awareness that understandings and practices of the past must change in recognition of our existence in the Anthropocene. As he started to explore the number of groups engaged in progressive changes protecting the environment, improvements in health, safer goods, recognition of indigenous rights, etc., etc., he recognized that evolution rises from the bottom up, that evolution is optimism in action (Ibid, 25).[8]

The Slow Food Movement, founded in Italy in 1986 by Carlo Petrini, promotes regional and traditional cuisine and the maintenance of local plants and livestock with a history in local ecosystems. The Movement has expanded internationally into 160 countries with more than 100,000 members and 1,000,000 supporters (Slow Food International, 2018). At the personal level, Petrini and his supporters argue that the industrialization of food has resulted in the standardization of taste and results in the loss of unique food flavors and varieties.[9]

Globally, changes in agriculture production, processing, and distribution have caused extensive changes as the demand for foods and other products continue to spiral to meet ever growing demands with increasing capital encroachment on the rural status quo (Bernstein 2006; McMichael 2006; Akram, Lodhi and Kay 2008). In response, "agrarian movements" have emerged across the globe with some remaining local while others have organized nationally and internationally. "In recent years, Transnational Agrarian Movements – or TAMs, for short – (taken here in a loose definition to mean 'movements',

[8] Hawkens makes an interesting observation concerning the differences between locally initiated efforts and control from centralized authority. "One of the differences between the bottom-up movement now erupting around the world and established ideologies is that the movement develops its ideas based on observations, whereas ideologies act on the basis of belief or theory – the same distinction that separated evolution from creationism in the time of Charles Darwin and William Paley . . . (Hawkens, 2007:141)."

'organizations', 'coalitions', 'networks' and 'solidarity linkages' of the 'rural poor') and some of the national peasants' and farmers' groups directly linked to these transnational movements have gained considerable power and political influence (and in some quarters, perhaps notoriety) (Borras, et.al., 2008)." The Landcare movement initiated in Australia has now spread to 18 countries with three international coordinating centers, two in Australia and one in Kenya. Of particular importance in the rapid growth of organizations representing rural and agricultural communities are the NGOs that serve as facilitators and brokers on issues of human and indigenous rights, environmental protection, and trade negotiations (Borras, et.al., 2008). Suffice to say, everyone must eat, things aren't going well for many, and lots of people are active in the search for solutions.

At the same time, as awareness of the concentration of wealth and control over infrastructure, social, and environmental resources by corporations has increased. People are organizing to redirect investments in support of local enterprises. When governance decisions are transferred from governments to corporations, which serve only the interests of their shareholders, people are no longer able to address their own financial, social, and environmental needs (Korton, 26:1996) and must seek other alternatives. For example, the Slow Money Movement declares its mission is "bringing money back down to Earth (Tasch:2008)." In investing in agriculture, the returns aren't those expected by the major players on Wall Street. But, as Carlo Petrini, founder of the Slow Food Movement, suggested, there are other returns by reorienting ". . . capital away from endless cycles of consumption and a relentless focus on markets, towards a new economy that is focused on quality and human relationships, on our relationships to one another and to the land. After all, what is at the base of the economy? At the base of the economy is soil fertility (Ibid., ix)." We all eat. Since 2010, US$ 57 millions have passed through the non-profit SlowMoney to agricultural enterprises (SlowMoney, 2017).

Movements are underway locally in SW Virginia. Organic farmer and now candidate for the U.S. Congress, Anthony Flaccavento (2016), has recently share examples from Central Appalachia and beyond creating a framework for moving from bottom up strategies through collaboration and cooperation. It's a matter of organizing, of finding financing and markets, and education through setting in place successful examples.

Evaluation of Where We Stand, Setting Context to Judge the Present and Find a Path with Heart.

Evaluating where we're standing isn't a global question but rather concerns where we actually stand, here and now, in the moment. It's about how we acquire our food and drink, our clothing and shelter, where we deposit our waste, the nature of that waste, and the consequences of our lifestyles. Solutions must be local. While the search is for clarifying our species specific responsibilities for Life itself, to Gaia Herself of whom we're individually but a miniscule and momentary part, the focus must be upon what we can do in our lifetimes for our personal benefits. And in interpreting personal benefits, we must speak to a higher moral order serving all of those living entities beyond ourselves, knowing our existence comes at costs to other people and species.

The battle is against ignorance, ignorance of the consequences of our actions and the refusal to acknowledge those consequences while in pursuit of personal advantage or gain. And to combat this ignorance, we must come to understand the dynamics of Gaia and what is required to maintain Her health. And in understanding the dynamics, the focus must be on the exchanges of information, energy (including capital), and materials that define our presence in the here and now. Starting with the things that are parts of our daily lives and how we acquire the basic necessities, we can extend consideration, step by step, beyond the immediate to the exchanges that influence our existence.

Even with the most diligent exploration of the factors that influence our lives, a complete set of answers is beyond our capacities to grasp. Wendell Berry (411:1996) even wonders if we should consider the likelihood that humans are not intelligent enough to work on the scale that our technological and financial capacities make possible.

Edward Goldsmith (501:1995) summarizes well the present circumstances:

> Finally, the point must be literally brought home, into our houses and communities, that the process of globalization and development has also been the process of removing from the local economy, the community, and the family the abilities to sustain themselves free of state and corporate domination. Cooperative interactions and services, once performed freely and successfully within communities, have been monetized and removed from any semblance of local control, thus making all people vulnerable to distant interests. The same can be said of the natural world's ability to sustain itself without human transformation and management as the functions it once fulfilled for free have been taken over and commodified by the state and the corporations. To reverse this grim process, which is leading to nothing but social and environmental devastation, we need to identify the ways that corporations and the state have usurped all aspects of our lives and reestablish viable local communities and participatory democracy.

"The question 'what shall we do about it?' is only asked by those who do not understand the problem. If a problem can be solved at all, to understand it and to know what to do about it are the same thing (Watts, 75)." Further, *Prudens quæstio dimidium scientiæ* – to know what to ask is to already half know. In short, for each person in each community in each watershed, in each political subdivision, in each nation on the Earth; questions must be formed based upon interpretations of the present as experienced attending to the exchanges of information, energy, and materials that support or threaten and Gaia's enduring presence.

Finally, I've reached the point of thinking about *H. sapiens* education given all that has gone on before. I will come to Villanova University in Philadelphia with these things on my mind. How is all of this to be reduced to a curriculum, a culture, the growing up in a specific place in time, the tying of languages to experiences, the ongoing dance of our species, etc., is beyond me at the moment.

References

Works Cited

Ackerman-Leist, P. (2013). *Rebuilding the Foodshed: How to Create Local, Sustainable, and Secure Food Systems*. White River Junction, VT: Chelsea Green Publishing.

Agriculture Victoria (2017). Whole Farm Planning. http://agriculture.vic.gov.au/agriculture/farm-management/business-management/whole-farm-planning (assessed May 17, 2018).

Akram- Lodhi, H., S. M. Borras, C. Kay (2007). *Land, Poverty and Livelihoods in an Era of Globalization*. London: Routledge.

Altieri, M. A., C. A. Francis, A. Van Schoohoren, J.D. Doll, (1978). A Review of Insect Prevalence in Maize (Zeamays L.) and Bean (Phaseolus vulgaris L.) polycultural Systems. *Field Crops Research* 1:33-49.

Bernstein, H. (2006) Rural Livelihoods in a Globalizing World: Bringing Class Back In. *Journal of Chinese Agriculture University*. 2 (1):40-51. accessed June 16, 2018).

Berry, W. (1996). Conserving Communities. In: Mander and Goldsmith, *The Case Against the Global Economy and for a Turn Toward the Local*. San Francisco: Sierra Club Books, pp-407-417.

Bohlen, P. J. & G. House (2009). Agro-ecosystem Management for the Twenty-First Century: Sustaining Ecosystems, Economies, and Communities in a Time of Global Change. in Bohlen, P. J., G. House (eds.) *Sustainable Agroecosystem Management: Integrating Ecology, Economics, and Society*. Boca Raton, FL: CRC Press, 1-9.

Borras, S. M., M. Edelman & C. Kay (2008). Transnational Agrarian Movements: Origins and Politics, Campaigns and Impacts. *Journal of Agrarian Change*. 8 (2-3) https://onlinelibrary.wiley.com/doi/full/10.1111/j.1471-0366.2008.00167.x (accessed June 16, 2018).

Carson, R.(1962). *Silent Spring*. New York: Houghton Mifflin.

Center for Disease Control and Prevention (2018). Food Safety. https://www.cdc.gov/foodsafety/index.html (accessed April 29, 2018).

Clark, W.C., T.P. Tomich, M. Van Noordwijk, D. Guston, D. Catacutan, N.M. Dickson, & E. McNie (2016). Boundary Work for Sustainable Development: Natural Resource Management at the Consultative Group on International Agriculture Research (CGIAR). Proceedings of the National Academy of Sciences of the United States. http://www.pnas.org/content/pnas/113/17/4615.full.pdf (accessed May 30, 2018).

Cruz de Carvalho, E.(1974). "Traditional" and "Modern" Patterns of Cattle Raising in Southwestern Angola: A Critical Evaluation of Change from Pastoralism to Ranching. *The Journal of Developing Areas* 8(2):199-226.

Davis, D. R., M.D. Epp & H.D. Riordan (2004). Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999. *Journal of the American College of Nutrition*, Vol. 23 (6) 669–682.

Denning, D., C. Mayer, (2006).Investing in Water. *Daily Reckoning*. https://dailyreckoning.com/investing-in-water/

Dickenson, J. C. (1972). Alternatives to Monoculture in the Humid Tropics of Latin America. *Professional Geographer* 24:217-222.

Food and Agricultural Organization (FAO). (2003) *Trade Reforms and Food Security: Conceptualizing the Linkages. FAO, UN (accessed June 16, 2018)*

Food and Agricultural Organization (FAO). (2017). How Close are We to Zero Hunger: The State of Food Security in the World 2017. FAO, UN http://www.fao.org/state-of-food-security-nutrition/en/ *(accessed June 16, 2018).*

Goldsmith, E. (1993). *The Way: An Ecological World-view*. Boston: Shambhala. The Last Word, Family, Community, Democracy. Mander, J. and E. Goldsmith (Eds.), *The Case Against the Global Economy and for a Turn Toward the Local*. San Francisco: Sierra Club Books.

Hart, R.D.(1980). A Natural Ecosystem Analog Approach to the Design of a Successional Crop System for Tropical Forest Environments. *Tropical Successions* 73-80.

Hawken, P. (2007). *Blessed Unrest: How the Largest Movement in the World Came into Being and Why No One Saw it Coming.* New York: Viking Penguin.

Hess, A.E.M.(2014). Companies That Control the World's Food. *24/7 Wall Street*, https://247wallst.com/special-report/2014/08/15/companies-that-control-the-worlds-food/ (accessed May 30. 2018)

Holdridge, L. R. (1959). Ecological Indications of the Need Approach to Tropical Land Use. *Economic Botany* 13:271-280.

IAAKSTD (2008). Can traditional knowledge contribute to agriculture? The Executive Summary of the IAASTD Synthesis Report. https://www.greenfacts.org/en/agriculture-iaastd/l-2/8-traditional-knowledge.htm#0 (accessed May 15, 2018).

James, C., and Krattiger, A.F. (1996). Global Review of the Field Testing and Commercialization of Transgenic Plants: 1986 to 1995. http://www.isaaa.org/kc/Publications/pdfs/isaaabriefs/Briefs%201.pdf (accessed April 24, 2018).

Kassapu, S. (1979). Technology That Won't Take Root. *CERES* 12(1):41-46.

Kirschenmann, F. L.(2009). Potential for a New Generation of Biodiversity in Agroecosystems. in Bohlen, P. J., G. House (eds.), *Sustainable Agroecosystem Management: Integrating Ecology, Economics, and Society*. Boca Raton, FLA. CRC Press.

Koba, M.(2013). A Hungry World, Lots of Food in Too Few Places. https://www.cnbc.com/id/100893540 (accessed June 18, 2018).

Korten, D.C. (1996). The Failure of Bretton Woods. in Mander and Goldsmith, *The Case Against the Global Economy and for a Turn Toward the Local*. San Francisco: Sierra Club Books, pp. 20-30.

Kramer, F. (2011). Hedge Farm! Hedge Funds Buying Up Farms for Doomsday Foodprice Scenario. *New York Observer* (May 21) https://www.infowars.com/hedge-farm-the-doomsday-food-price-scenario-turning-hedgies-into-survivalists/. (accessed April 28, 2018)

Lindsey, B., S.M. Teles (2017). *The Captured Economy: How the Powerful Enrich Themselves, Slow Down Growth, and Increase Inequality*. Oxford: Oxford University Press.

Lobell, D.B., Burke, M.B., Tebaldi, C, Mastrandrea. M.D., Falcon, EW.P., and. Naylor, T.L., (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*. **319** (5863): 607–10.

Lovelock, J. E. (1979). *Gaia: A New Look at Life on Earth*. Oxford: Oxford University Press.

Lovelock, J.E. (1991). *Healing Gaia: Practical Medicine for the Planet*. New York: Harmony Books.

Margulis, L.(1998). *Symbiotic Planet: A New Look at Evolution*. New York: Basic Books.

McMichael, P. (2006). Reframing Development: Global Peasant Movements and the New Agrarian Question. *Canadian Journal of Development Studies*, **27** (4): 471–86.

Medek, D.E, Schwartz, J., and Myers, S.S. (2017). Estimated Effects of Future Atmospheric CO_2 Concentrations on Protein Intake and the Risk of Protein Deficiency by Country and Region. Environmental Health Perspectives. Vol. 25 (8) https://ehp.niehs.nih.gov/ehp41/ (accessed April 29, 2018)

Melvani, K. (2012). *Handbook for Regenerative Agriculture*. Polgasowita, Sri Lanka: NeoSynthesis Research Centre, (ISBN 978-955-0939-00-8). Available in English at http://www.silc.com.au/2012/09/19/handbook-for-regenerative-agriculture-by-kamal-melvani/ (accessed April 10, 2018).

Milius, S. (2017). Worries Grow That Climate Change Will Quietly Steal Nutrients from Major Food Crops. *Science News*, https://www.sciencenews.org/article/nutrition-climate-change-top-science-stories-2017-yir (accessed May 3, 2018).

Moles, J. (2009). Is Conservation Enough? *SavingLand*. Fall 2009, pp. 18-23.

NOAA NCDC (2011). *State of the Climate: Global Analysis for Annual 2011*. NOAA National Climatic Data Center http://www.ncdc.noaa. gov/sotc/global/2011/13.

Padoch, C., and. Sunderland, T. (2014). Managing Landscapes for Greater Food Security and Improved livelihoods. *Unasylva, 64*(241), 3-13.

Piketty, T. (2014). *Capital in the Twenty-First Century*. Cambridge, MA: Belknap Press of Harvard University Press.

Pimentel, D. (2w006). Soil Erosion, A Food and Environmental Threat. *Journal of the Environment, Development and Sustainability* (Vol. 8:).

SlowMoney (2018). How We Work. https://slowmoney.org/about (accessed June 26, 2018)

Svalbard Global Seed Vault (2018). Safeguarding Seeds of the Future. http://www.seedvault.no (assessed June 18, 2018)

Tasch, W.(2008). *Inquiries into the Nature of Slow Money*. White River Junction, VT: Chelsea Green Publishing.

United Nations Environment Program (2016). *A Snapshot of the World's Water Quality: Towards a Global Assessment.* Nairobi, United Nations Environment Programme (UNEP).

United Nations High Commission for Refugies (2017). Figures at a Glance. United Nations Refugee Agency. Statistical Yearbooks. http://www.unhcr.org/en-ie/figures-at-a-glance.html

United States Department of Agriculture (2012) *Climate Change and Agriculture in the United States: Effects and Adaptation*. USDA Technical Bulletin 1935. Washington, DC. 186 pages.

United States Department of Agriculture (2017). Food Value Chains and Food Hubs. https://www.ams.usda.gov/services/local-regional/food-hubs (assessed June 14, 2018)

United States Department of Agriculture (2017a). Organic Market Overview. https://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview.aspx (assessed April 23, 2018)

United States Department of Agriculture (2017). Food Security in the US. https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us.aspx#.UelqMdLVBQg (accessed June 18, 2018)

Valuing Forest Gardens in Sri Lanka. (2018). Doctoral Dissertation, Research Institute for the Environment & Livelihoods. Charles Darwin University, Darwin, Australia.

Watts, Alan W. (1951). *The Wisdom of Insecurity*. New York, Vintage Books.

Whitehead, A.N. (1958). *Science and the Modern World*. (The 1925 Lowell Lectures), New York: Mentor`.

Willer, H. and Lernoud, J. (2018). *The World of Organic Agriculture: Statistics and Emergent Trends 2018*. Research Institute of Organic Agriculture Bonn: (FiBL), Frick, and IFOAM – Organics International. https://shop.fibl.org/CHen/mwdownloads/download/link/id/1093/?ref=1

World Health Organisation (2015). World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. *PLOS Medicine* http://journals.plos.org/plosmedicine/article/file?id=10.1371/journal.pmed.1001923&type=printable (accessed April 25, 2018)

World Food Programme (2018). Zero Hunger. http://www1.wfp.org/zero-hunger (assessed June 18, 2018)