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THE ECONOMIC PAMPHLETEER
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Realities of regenerative agriculture

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Regenerative agriculture is the latest phrase in the sustainable agriculture movement (Merfield, 2019). Many early advocates have become disenchanted with the concept of sustainable agriculture. Some claim it has been co-opted, misused, and essentially made useless by the defenders of industrial agriculture. However, regenerative agriculture faces the same risks if it is not defined in terms that ensure agricultural sustainability.

Others claim that sustainability is "not enough"—that we need better farming systems than we have today. They fail to recognize that farm systems that are not "good enough" are not sustainable. *Authentic* sustainability is the ability to meet the needs of the present without diminishing opportunities for the future (Ikerd, 2011). An agriculture that does not meet the needs of the present is not good enough—for present or future generations.

The concept of regenerative agriculture is cer-

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Why an ***Economic Pamphleteer?*** *In his historic pamphlet* Common Sense, *written in 1775–1776, Thomas Paine wrote of the necessity of people to form governments to moderate their individual self-interest. In our government today, the pursuit of economic self-interest reigns supreme. Rural America has been recolonized, economically, by corporate industrial agriculture. I hope my "pamphlets" will help awaken Americans to a new revolution—to create a sustainable agri-food economy, revitalize rural communities, and reclaim our democracy. The collected Economic Pamphleteer columns (2010–2017) are at https://bit.ly/ikerd-collection* tainly not new. The Rodale Institute in Pennsylvania has been researching and advocating *regenerative* organic farming practices since the 1980s (Rodale Institute, n.d.). Like sustainable farming, regenerative farming does not have a single, precise definition. In the United States, regenerative farming is typically defined as an integrated set of land management practices that utilizes plant photosynthesis to sequester carbon, restore soil health, increase crop resilience, and restore the nutrient density of foods (The Carbon Underground & Regenerative Agriculture Initiative, 2017). Lists of practices typically include reduced reliance on tillage and the use of synthetic fertilizers and pesticides, and increased adoption of cover crops, the rotation of diverse crops, and management-intensive grazing.

Internationally, regenerative farming is more likely to be defined as a system of production guided by common principles, rather than practices, toward multiple social, economic, and ecological objectives. For example, Terra Genesis International defines regenerative agriculture as "a system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services. . . . Regenerative Agriculture aims to reverse global climate change. At the same time, it offers increased yields, resilience to climate instability, and higher health and vitality for farming communities" (Terra Genesis International, n.d., p. 2).

As with sustainable agriculture, regenerative agriculture must not only meet the needs of people as consumers but also as producers/farmers and members of civil society. Regenerative farms that fail to meet these needs will not be widely adopted by farmers or sustained by the societies in which they function. A *sustainable* regenerative agriculture must be socially responsible and economically viable as well as ecologically regenerative.

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That being said, the concept of regeneration goes to the very core of agricultural sustainability. The regenerative capacity of a farm depends on its ability to transform solar energy into plants, animals, and other sources of energy that are useful to humans. Energy is essential for life, and solar energy is the only sustainable source of the biological energy essential for human life. Ultimately, the sustainability of any society depends on the regenerative capacity of its farms and food systems.

This is not some esoteric theory but is based on the laws of thermodynamics, which are among the most fundamental laws of science. The first law of thermodynamics states that energy can be neither created nor destroyed. However, whenever energy is used to do anything useful, which physicists call work, it always changes in form. Specifically, the innate tendency of energy is to change from more useful to less useful forms of energy, which also makes it potentially useful. This is the essence of the second law of thermodynamics—the law of *entropy*. No matter how efficiently we use, reuse, or recycle energy, its usefulness to humans is inevitably lost. All energy eventually returns to outer space in the form of heat.

Fortunately, the earth receives a daily inflow of new energy from the sun. Only a few life forms have the capacity to capture and use this new solar energy to counter the evitable loss of useful energy to entropy. The opposite of entropy is called *negentropy* ("Negentropy," n.d.). Life in general has the potential to be negentropic because living things can convert energy from less useful to more useful forms. Healthy natural ecosystems organize and concentrate solar energy into organisms of progressively higher levels or structure, order, and potential usefulness. Humans also can transform solar energy into more useful electrical energy—using sunlight, wind, or water. However, neither humans nor other animals can transform sunlight into food. Life on earth, including human life, ultimately depends on the ability of plants, algae, and a few other life forms to collect and store solar energy.

The entropic tendencies of energy are continually working against the negentropic tendencies of living systems. Living things inevitably lose energy to heat as they grow and renew their physical structures. They also devote a significant portion of their energy to renew, reproduce, and regenerate their species. The living ecosystems we humans depend on for food will ultimately collapse if we fail to leave other life forms with sufficient energy to continually renew, reproduce, and sustain their negentropic capacity. In reality, we humans are a part of the earth's living ecosystem, and our survival as a species depends on its sustainability.

Healthy natural ecosystems have a natural tendency to evolve toward higher levels of energy efficiency and negentropy. However, humans have the ability to either increase or decrease the negentropic capacity of living ecosystems in which they intervene. Humans have intentionality and agency, which means they can act counter to their own natural tendencies. They can choose how they relate to other people and other living and nonliving elements of their environment. Individual relationships can also at least influence how other people and other elements of the natural environment relate to each other. Human interventions and relationships affect the efficiency and regenerative capacity not only of natural ecosystems but also of human organization—farms, businesses, communities, societies. Like other living ecosystems, these organizations can be organized and managed in ways that realize their negentropic potential or can be managed in ways that accelerate the natural tendency toward entropy.

Society cannot afford to wait for all farms to be worn out to transition from industrial to regenerative agriculture.

Industrial farming systems are classic examples of human-organized and -managed entropic organizations. They mine and deplete the useful energy collected and stored by negentropic living systems over centuries—not only in fossil fuels but also in fertile living soils. This useful energy is marketed in the form of agricultural commodities for the purpose of maximizing profits for farm owners and managers. The reinvestments essential for energy regeneration might provide an economic return in some future decade, but the economic value is inherently short-run in nature. In an uncertain market economy, investments that promise future payoffs even a decade in the future have very little economic value today. As long as there is enough topsoil left to provide an inert growing medium and enough fossil energy to produce fertilizers and irrigate crops, industrial farming will continue and will accelerate the tendency toward entropy.

Regenerative farmers must confront these entropic and economic realities of sustainability. Industrial farming is not "good enough," and it will take decades of reinvestment in soil health and healthy agroecosystems to recreate regenerative farms that are good enough. Even then, there will always be an economic incentive to simply use up the useful energy that has been restored by regenerative farmers over decades or centuries—just as industrial farmers have done in the past and are doing now. Some of the farmers who have created, and are creating, regenerative farming systems today were confronted with the challenges of restoring productivity to farms "worn out" by industrial farming and no longer responsive to industrial farming practices. These farmers had an economic incentive to change. Society cannot afford to wait for all farms to be worn out to transition from industrial to regenerative agriculture.

Other regenerative farmers have been ethically or socially motivated to make non-economic long-term investments, and, perhaps most important, have been financially able to do so. Unfortunately, this is not the case of most farmers today, in the U.S. or around the world. Some consumers have been willing and able to share the economic costs of restoration by paying premium prices for products produced on regenerative farms. However, markets will never provide adequate economic incentives to create sustainable regenerative systems of farming and food production.

Thoughtful, caring people must come together in their local communities and larger societies to make it economically possible for thoughtful, caring farmers to create and sustain regenerative farming systems. This can be done through fundamental changes in local, state, and national farm and food policies. The farm and food policies that currently support industrial agriculture can, and eventually must, be shifted to support and sustain regenerative agriculture.

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The regenerative potential of communities and societies depends on their willingness and ability to make it economically feasible for farmers to create and sustain negentropic farming systems. People can increase the usefulness of energy and transform solar energy into electricity. People can also increase the efficiency of food processing and distribution. But people cannot transform solar energy into food. People, including farmers, must be willing to confront the inconvenient realities of regenerative agriculture.

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