

## Rethinking the First Principles of Agroecology: Ecological, Social, and Economic<sup>1</sup>

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Agroecology suggests an integration of the concepts of agriculture and ecology, but the integration has a specific purpose. Agroecology is commonly defined as the application of ecological science in the design and management of sustainable agroecosystems.<sup>1,2</sup> The Wikipedia dictionary summarizes the definition of agroecology as “the science of sustainable agriculture.”<sup>3</sup> Thus, the explicit purpose of integrating ecology and agriculture is to enhance the sustainability of agriculture.

Sustainable agriculture is defined in different ways by different people, at times to accommodate individual scientific, political, or economic agendas. However, there is no serious disagreement regarding the basic principles of sustainability, at least not among those who have studied the issue in depth. Ben Stinner, for example, had a vision of sustainable agroecosystems that preserve environmental quality, sustain healthy social connections among people, and efficiently recycle natural and social capital rather than, rely on commercial inputs.<sup>4</sup> Stephen Gliessman defines sustainable agriculture as a whole-systems approach to production that balances environmental soundness, social equity, and economic viability.<sup>5</sup> Miguel Altieri considers sustainable agriculture to be a useful concept, in spite of conflicting definitions and interpretations, because it captures a set of growing concerns about agriculture, which have resulted from the co-evolution of socioeconomic and natural systems. Authentic advocates of sustainability agree that a sustainable agriculture must be ecologically sound, socially responsible, and economically viable.

However, little consideration is given to questions of *why* a sustainable agriculture must be ecologically, socially, and economically sustainable. Even among those who stress the logical linkage between ecology, sociology, and economics and the sustainability concepts of permanence or intergenerational equity, few seem to address the question of *why* sustainability should be an important priority for human society. Much of the resistance to the pursuit of sustainability today obviously arises from a lack of concern for the future. Many people apparently believe that since those of current generations are expected to take care of themselves, those of future generations should expect to do likewise. Others share the neoclassical economic belief that the pursuit of short run, individual self-interests is the best means of ensuring the long run well-being of society in general. Differences in priorities between the apathetic and the advocates do not arise from differences in information or intellect, but instead from differences in fundamental beliefs, in the *first principles* upon which all logic and reason ultimately must rest.

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Sustainable agriculture will not become widely accepted until its proponents can answer the questions of why the ecological and social dimensions of agriculture are as important as its economic dimension, why it is critical to design and manage sustainable agroecosystems, and finally, why permanence, intergenerational equity, and thus sustainability, should be given priority over our individual, short run self-interests. Most scientists today avoid such questions because the answers ultimately rely upon first principles rather than upon logic or reason. The Wikipedia dictionary defines first principles as “a set of basic, foundational propositions or assumptions that cannot be deduced from any other proposition or assumption.”<sup>6</sup> Since first principles are the most fundamental and general concepts of thought, action, and reality, they are inherently philosophical rather than scientific in nature. Philosophy differs from science in that its questions cannot be answered empirically – by observation or experiment.<sup>7</sup> Ironically, many scientists proudly accept the title of “doctor of philosophy,” but refuse to address most important philosophical questions of their academic disciplines. Why should we expect society to embrace the concept of agricultural sustainability if scientists will not address the philosophical principles of agroecology?

First principles are sometimes called Laws of Nature. “Laws of nature are the ‘principles’ which govern the natural phenomena of the world. That is, the natural world ‘obeys’ the Laws of Nature.”<sup>8</sup> Philosophers refer to this as Necessitarian Theory, in that such principles are considered to be necessary for nature to fulfill its purpose. An alternative theory defines Laws of Nature as statements or descriptions of the regularities in the world; the way the world works, period, denying any purpose for the principles of nature. Regardless of necessity, first principles represent the ultimate truths or pure knowledge from which all other truth is derived.

Plato argued that one could never gain *pure knowledge* through observation because anything that can be observed is always changing whereas *pure knowledge* must be unchanging.<sup>9</sup> He argued that we can observe examples of the *form* of pure knowledge and we can visualize ideas of this true *form* in our minds. But we can never actually observe true *form* or fully grasp pure knowledge, because it exists only in the abstract. Using Plato's terminology, first principles constitute the form or architecture of pure knowledge. We can see evidence of the existence of first principles in the world around us, but our observations have meaning only insofar as we have some intuitive understanding of the underlying, unchanging principles, which guide the ever-changing phenomena we observe. Our understanding of first principles requires reliance on our insight, our intuition, or more precisely, on our common sense.

First principles also determine the morality of actions – whether something is right or wrong or good or bad.<sup>10</sup> In the case of ethics and morality, first principles are called Natural Law rather than Laws of Nature. According to Natural Law, the moral standards that govern appropriate human behavior can be traced to the basic nature of human beings, to a supreme being, or to the nature of the cosmos in general.<sup>11</sup> Regardless, Natural Law exists independently of any given religion, culture, society, political order, or nation-state. They apply to all people of all times. Belief in the existence of Natural Law is expressed, explicitly or implicitly, in such historic documents as the Magna Carta and American Declaration of Independence, where rights are described as being *inherent* or *self-evident*.

As Thomas Reid, nineteenth-century philosopher wrote, “All knowledge and science must be built upon principles that are self-evident; and of such principles every man who has common sense is competent to judge.”<sup>12</sup> These self-evident principles provide a starting point, and lacking a starting point, all logic and reasoning eventually become circular and thus useless. For example, first principles of algebra, called axioms or laws, are the foundation for all mathematical proofs. One such axiom is,  $a$  times  $b$  equals  $b$  times  $a$ . This may seem obvious, but that's the nature of first principles. First principles are common sense, of which everyone is competent to judge. Without the first principles or axioms of algebra, however, proof of any mathematical proposition would be impossible.

Relying on common sense does not imply rejection of science as a means of understanding the nature of things; it's just that all science must be rooted in common sense. Thomas Huxley, a noted English biologist, once wrote, “All truth, in the long run, is only common sense clarified.”<sup>13</sup> When Albert Einstein wrote, “Common sense is the collection of prejudices acquired by age eighteen,”<sup>14</sup> he obviously was referring to prejudices, customs, or conventional wisdom rather than Reid's philosophical concept of common sense. Einstein also wrote, “The whole of science is nothing more than a refinement of everyday thinking.”<sup>15</sup> Science can be used to clarify and refine our common sense, but not to replace it.

“Common sense” admittedly has become an overused, often abused colloquialism, but the concept has deep philosophical roots. The eighteenth-century philosophy of common sense, sometimes called Scottish philosophy, arose in response to John Locke's “doctrine of ideas,” which he had adopted from the earlier work by Descartes. Berkeley's related theory of “pure idealism” attempted to explain reality solely in terms of ideas.<sup>16</sup> On the other hand, David Hume had argued that if reality existed only as ideas, there was no logical basis for assuming the existence of any mental substance capable of receiving ideas, the mind being nothing more than a succession of experiences. Between these two propositions, both ideas and reality disappeared, leaving nothing, and thus, degenerating in complete skepticism.

In an effort to resolve this dilemma, Thomas Reid set out to vindicate common sense, meaning the natural judgment of common people, as the ultimate judge of reality.<sup>17</sup> He concluded that ideas and the mind are both real, simply because people know they exist. He argued that the ultimate understanding of reality can be found only in human consciousness or human knowledge of reality, and thus neither needs to be proven nor can be proven because human understanding must provide the grounds for all proof. Other Scottish philosophers, including Thomas Brook, William Hamilton, and James Mackintosh added refinements to Reid's philosophy of common sense and extended it to deal with direct knowledge of human *morality* as well as *reality*. According to this eighteenth-century philosophy, common sense is our inner sense of first principles – both Laws of Nature and Natural Law – which is common to all people, and by which people must test the truth of knowledge and the morality of actions.

The concept of *deep ecology* is rooted in similar philosophical thinking. Deep ecology was first brought to public attention in 1973 by Norwegian philosopher, Arne Naess.<sup>18</sup> He argued that the “shallow” environmental movement was concerned primarily with social welfare issues such as pollution and depletion of natural resources, while the “deep” ecology movement was more concerned with the deeper philosophical questions of how humans *should* relate to their natural

environment. Naess argued that Western philosophers hold an outdated view of humans as separate from each other and from their natural environment, whereas a deeper understanding reveals that humans are not truly separate beings, but instead, are integrally interconnected with each other and with the world around them. Equally important, he believed there are right and wrong ways for humans to relate to the world around them.

“For each species of living being there is a corresponding ecology.”<sup>19</sup> Naess considers human ecology to be a “genuine part” of “general ecology,” and thus, considers human relationships to nature to be a genuine part of deep ecology. As a means of differentiating between the two, he contrasts the typical slogans of shallow environmentalism, for example, “natural diversity is valued as a resource for humans,” with alternative slogans of deep ecology, “natural diversity has its own intrinsic value.” However, he carefully points out that deep ecology actually *questions* both sets of slogans and provides no unique set of right or wrong answers or conclusions. Deep ecology frames the questions, but the answers ultimately must arise from the common sense of ordinary people.

The first principles of agroecology must be logically derived from the first principles of agriculture and ecology. Agriculture, by its basic nature, is a *purposeful* human activity. The basic purpose of agriculture is to shift the ecological balance of nature in favor of humans relative to other species. The rightness or legitimacy of agriculture is determined by its purpose, by *why* humans attempt to tip the ecological balance in their favor, and concurrently, *how far* they are willing to tip it. The ethical legitimacy of agriculture is determined by its first principles.

The first principle of agroecology is the first principle of agriculture: *life has purpose*. If there is not purpose for life, there is no purpose for human life, and thus no purpose for agriculture – agriculture becomes a senseless activity. Most people probably never question whether life has purpose, just as they never question whether *a* times *b* equals *b* times *a*, but scientists do. Most scientists are philosophical materialists, at least in the practice of their professions. In his classic 1919 book, *Modern Science and Materialism*, Hugh Elliott, states, “The age of science is necessarily an age of materialism; ours is a scientific age, and it may be said with truth that we are all materialists now.”<sup>20</sup> Elliott emphasized three main principles of materialism. The first principle is the uniformity of law: When the conditions at any moment in time are precisely the same as those prevailing at some earlier moment, the results also will be identical to the earlier results. Thus, science can link effects with their causes.

The second principle is a denial of “teleology” or purpose. He writes, “Scientific materialism warmly denies that there exists any such thing as purpose. It asserts that all events are due to the interaction of matter and motion, acting by blind necessity in accordance with those invariable sequences to which we have given the name laws.”<sup>21</sup> Elliott refers to the human species as a “mere incident of the universal redistribution of matter and motion.” Eighty-five years later, physicist Brian Green wrote, “Newton and Einstein agree, you can, in principle, use the laws of physics to predict everything about the universe arbitrarily far into the future or figure out what it was like arbitrarily far in the past.”<sup>22</sup> Quantum physics casts some doubt on the precise predictability of events, but does nothing to suggest that events unfold for any particular purpose. Modern science treats the unfolding of a human life as nothing more or less than the natural consequences of physical actions and reactions, without any particular purpose or meaning.

The third principle of materialism is the denial of any form or existence other than that having some kind of palpable material characteristics and quality, which “stands in direct opposition to a belief in any of those existences which are vaguely classed as ‘spiritual.’”<sup>23</sup> Among those things, he included not only gods and souls, but also such imaginary entities as intellect, will, feelings, insofar as they are supposed to be different from material processes.

Throughout human history, most people have believed that life has purpose and meaning. Aristotle used the word *telos* to refer to the ultimate goal, final-end, or purpose of life.<sup>24</sup> He suggested that one couldn't fully understand or describe anything without referring to its purpose. For example, the purpose of a knife is to cut something. Aristotle was most interested in the purpose of people. He believed the purpose of human life was happiness; that all people were meant to be happy. He further believed that human happiness required a life of virtue; that a person who was not living a moral life could not actually be happy, no matter what he or she might think at the time. Someone who chose to do the right thing because it was the right thing to do was living a life that *flourished*; he suggested, in that such a person was using their human capacities to the fullest by living according to their purpose. Since each person is confronted with a unique set of life's choices, each person has a unique path to follow in their pursuit of happiness.

Most people seem to agree with Aristotle rather than the “scientific materialists.” Most people do not consider their choices and actions to be predetermined acts of blind necessity or the inevitable consequences of ongoing interaction of matter and motion. They believe they have a degree of autonomy in their choices, that they can affect the future by choosing one course of action rather than another. They understand they cannot change everything but believe they can change some things. They believe their actions have meaning, that their decisions can be right or wrong and good or bad. Lacking purpose, right or wrong and good or bad are indistinguishable. This belief in purpose of life is expressed in the social norms and customs of every civilized society and in the constitutions, laws, and regulations of every government in the world.

Human societies clearly define what they consider to be acceptable and unacceptable behavior and assign the associated consequences. It matters if some people choose to kill, steal, and rape. Such things are not consistent with the purpose of life; they do not further human well-being and happiness. It matters if people keep their promises, if they show compassion for other people and respect for other living things. These things are consistent with the purpose of life; they promote human happiness and well-being. The common sense of ordinary people is that life has purpose and the ultimate purpose of human life is the pursuit of happiness.

If life has purpose, then the purposeful activity of agriculture might seem to be a legitimate human pursuit. However, many thoughtful people, including deep ecologists, question the rightness of agriculture, because it explicitly shows a preference for humans over other species. They question whether it is right and good that humans pursue the interest of their species at the obvious expense of other species. Since humans appear to pursue their self-interests by nature, either Natural Law or the Laws of Nature, the question becomes whether human as a species, and thus human life, is inherently good or evil.

However, humans act no differently from other species in this regard, in that all species act in their individual and collective human self-interest. All species, including humans, constantly degrade their natural environment by depleting resources upon which other species also must rely.<sup>25</sup> All organisms live by consuming the dead carcasses of other organisms, and many species, including humans, don't wait for members of other species to die. So the fact that agriculture is inherently anthropocentric does not necessarily mean that agriculture is ethically wrong. It simply means that in their pursuit of self-interests, humans are no different from other species.

However, there is no common sense among ordinary people regarding the rightness of agriculture, particularly animal agriculture. Some people choose vegetarian diets for purely ethical reasons, while others suggest that humans should abandon agriculture altogether and return to hunting and gathering. Far larger numbers of people question the legitimacy of today's industrial paradigm of agriculture, which seems to show little if any respect for any other living species or even for the future of humanity. Other species appear to be limited in their pursuit of self-interest and thus are unable to do lasting damage or eliminate other species entirely. Humans, on the other hand, clearly are capable of exploiting other species to the level of extinction and might even be capable destroying all other life on earth. A common sense consensus concerning the good or evil of agriculture seems to rest with the question of how far humans are willing to tip the balance.

At this point in the thought process, the integration of ecology with agriculture becomes particularly insightful. The first principle of ecology is that all of life is interconnected. Evolutionary scientists, such as Alfred Wallace and Charles Darwin, pointed the way to a new understanding of biological communities as being inherently systemic and interconnected. Ecology eventually emerged as a sub-discipline of biology in which species were studied within the context of their physical environment. A century later, Arne Naess's deep ecology went farther in proclaiming that not only biological communities but all local and global communities, biological, human, non-human – in the past as well as in the present – are interconnected.<sup>26</sup> While some ecologists might disagree about the relevance of connections among past, present, and future, ecologists in general agree that all of life is interconnected. While ordinary people may disagree about the relative importance of specific connections, the general consensus or common sense of people seems to be in agreement with this first principle of ecology.

Thus, the second principle of agroecology is the first principle of ecology: *all life is interconnected*. The third principle of agroecology comes from both agriculture and ecology: *all life is good*. If all life is evil, neither agriculture nor ecology makes sense. It would make no sense to be concerned with the health, vitality, or survival of living communities, species, or ecosystems if the continuation of life on earth were not inherently good. Obviously, the death of individuals is an inevitable and natural aspect of life, but communities, species, and ecosystems are capable of renewal and regeneration, and thus, life is capable of sustaining life. While individuals, communities, and species of living organisms may appear to pursue their self-interests, within the larger ecosystems of which they are parts, individuals naturally function in ways that enhance the long run sustainability of life. Nature, including both Laws of Nature and Natural Law, is biased in favor of life. For many people, this bias of nature in favor of life may be sufficient reason to justify accepting the inherent goodness of life.

Many others base their belief in the goodness of life on an innate or inherent goodness of all things of nature. They reject the third principle of *scientific materialism*, which denies all “existences which are vaguely classed as ‘spiritual.’”<sup>27</sup> Many logical, reasonable, thoughtful people believe that intellect, will, feelings are more than material processes. They believe in an intangible, unknowable higher order of things, within which all aspects of reality, including all life, have purpose and meaning. Their belief may be expressed philosophically, in terms of the *necessity* of Laws of Nature, in Natural Law, or in terms of spirituality, but they believe in the inherent goodness of reality and of all life. Very few people believe that reality and life are inherently evil, and those who do are generally labeled as sociopaths. It doesn't matter whether the principle of goodness arises from the natural bias or nature of the goodness of some higher order; both arise as matters of faith. Such is the nature of first principles; they cannot be proven, but require no proof. They exist because people know they exist. Without first principles, life simple makes no sense.

The question of the rightness or goodness of agriculture then can be derived from the first principle of goodness of life. An agriculture that is good for all life, including human life across generations, is good. An agriculture that diminishes life, including the quality of human life, is bad. An agriculture that enhances life is right and an agriculture that diminishes life is wrong. Aldo Leopold expressed much the same conclusion when he wrote, “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”<sup>28</sup> He proposed a “land ethic” that would lead us to “examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient.” All science must be rooted in such common sense principles.

The ecological, social, and economic principles of agroecology must be interpreted within the context of the first principles of agroecology: purpose, connectedness, and goodness. In other words, the ecology of agroecology is ecology with a purpose. The sociology of agroecology is a sociology that includes human ecology. And the economics of agroecology is an economics of goodness that facilitates purposely-positive relationships among people and between people and their natural environment. The first principles of agroecology are unifying principles for ecology, sociology, and economics.

For example, the fundamental principles of ecology include holism, diversity, and interdependence. An ecological whole is more than the simple sum of its parts, the relationships among those parts matter. As relationships change, either spatially or sequentially, the essence of the whole is changed. Living organisms are inherently holistic; they cannot be dissected into their individual parts or processes without destroying their essence, their life. The purpose of individual parts must be derived from the purpose of the larger whole, which in turn gains its purpose from some still larger whole.

Diversity among parts gives purpose and meaning to relationships within wholes. Diversity among distinct elements, across both space and time, is essential in sustaining all living processes. Distinct cells, organs, organisms, communities, and ecosystems are defined by selective boundaries. These boundaries, whether in cell membranes, connective tissue, skin, social relationships, or natural topography must be semi-permeable or selective in nature. When

this selectivity is lost, diversity disappears, and life is no longer sustainable. Biological diversity provides the potential for renewal, productivity, resistance, resilience, and regeneration, and thus for the sustainability of life.

Interdependent relationships are necessary to transform ecological potential into positive ecological reality. Relationships among diverse elements within wholes can be independent, dependent, or interdependent. Independence implies complete isolation, which is incompatible with life. Even partial isolation limits the positive potential of relationships. Dependence relationships are inherently exploitive, as the life of the parasite is inextricably linked to the life of the host, and thus, either exploits or becomes exploited. Interdependent relationships are mutually beneficial. In natural ecosystems, relationships are beneficial by nature. Interdependent human relationships are relationships of choice among otherwise independent individuals. *Interdependent* relationships among diverse elements are necessary for renewal and regeneration of resistant, resilient, productive wholes.

The social aspects of *sustainable* agroecosystems must reflect these same ecological principles. The essence of human families, communities, and cultures must be something more than the simple collections of their individual members. The capability of any human organization depends as much on the nature of relationships among its members and on the capabilities of the individuals involved. Diversity among individuals within and among families, communities, and cultures creates the potential for renewal and regenerations of resistant, resilient, productive human society. Realization of this potential requires mutually beneficial relationships across selective social boundaries, relationships of choice rather than relationships of necessity. Human relationships must reflect the principles of biological communities.

The economic aspects of *sustainable* agroecosystems likewise must reflect these same ecological principles. Sustainable enterprises, entrepreneurs, and organizations must function as interrelated components of economies as wholes. The sustainable economy is far more than the simple summation of individual economic enterprises, proprietorships, and corporations. Diversity within farming systems, business organizations, and economies provide potential stability, resilience, productivity, and economic viability. However, the potential for economic sustainability can be realized only through mutually beneficial relationships among people and between people and natural resources. Economic extraction and exploitation, which characterize today's capitalistic economies, are not sustainable.<sup>29</sup>

The same line of reasoning is valid for the social principles of agroecology. For example, integrity, empathy, and courage are basic principles of social relationships. True social principles must transcend religion, philosophy, race, nation, and culture. Different groups of people obviously have different values, but the same principles are common to all groups. The Institute for Global Ethics, for example, has conducted surveys, interviews, and focus groups with diverse groups of people around the world, asking, "What do you think are the core moral and ethical values held in the highest regard in your community?"<sup>30</sup> Responses varied widely, as would be expected, but five values consistently ranked high in virtually every inquiry: honesty, fairness, responsibility, compassion, and respect.

The core values of honesty, fairness, and responsibility, together define the social principle of integrity. Integrity suggests wholeness, completeness, and soundness, in addition to honesty or truthfulness. A person of integrity must not only be honest and truthful, but also must be fair and equitable in their treatment of others, and willing to accept and fulfill their fair share of responsibilities. Relationships of integrity are relationships of trust and trustworthiness. As relationships grow in trust, they grow stronger – they build “social capital.” When trust is lost, they grow weaker -- social capital is depleted. When the social capital is lost, relationships are no longer sustainable.

The core values of respect and compassion define the principle of empathy. Empathetic people must be willing and able to visualize themselves in the places of others, and then, to treat the other people as they would have liked to be treated, if they were the other people. Empathy is ultimately rooted in respect, in respecting others, as they would like to be respected by others. Empathy goes beyond integrity, at times requiring people to be more than fair or less than *brutally* honest – if necessary, in treating others as they would like to be treated. Emphatic relationships are not exploitative or destructive; they are relationships of caring and kindness.

The principle courage requires self-confidence, discipline, and perseverance. Integrity and empathy are necessary but accomplish little without action. It takes courage to form meaningful relationships with other people and to stay committed to those relationships through times of inevitable misunderstanding and disappointment. People must have confidence in themselves or they will not be willing to confide in others, but they cannot allow self-confidence to compromise their integrity or empathy. They must have the discipline to persevere in relationships that are *right*, the courage to abandon those that have become irretrievably *wrong*, and the wisdom to know when to do which. Sustainable relationships require *moral* courage.<sup>31</sup>

In agroecosystems, the principles of relationships between humans and their environment, meaning human ecology, must be derived from the principles of relationships among humans. People hold very different values concerning the rightness or wrongness of relationships between humans and nature. Older societies, including Native Americans, gave a great deal of thought to such relationships and quite likely held many values in common. Modern industrial societies, however, have abandoned these ancient values, labeling them as primitive superstitions. Today, some people see nature as purely material, a realm over which humans have absolute dominion and the right to do whatever they choose. Others see nature as inviolably sacred, a realm into which humans have no right to intrude. Society is left with no common values or principles to guide human relationships with the other living and nonliving things of nature.

However, Laws of Nature and Natural Laws, if valid, cannot be in conflict with each other. Thus, if relationships of humans with nature are consistent with the principles of human relationships, they cannot be in conflict with the principles governing human relationships with nature. Alternatively, if human relationships with nature violate the principles of relationships among humans, they cannot be consistent with the principles of ecological relationships. So, the principles of right relationships of humans with their natural environment may be derived from the principles of right relationships among people. Thus, human relationships with *nature* should reflect integrity, empathy, and courage in terms of their effects on other *people*, including people of past, present, and future generations.

For example, people who degrade the land, deplete non-renewable resources, pollute the natural environment, destroy biological diversity, or simply assume those of future generations will have adequate ecological resources for their needs are not acting with integrity and empathy toward other people. They are not being fair, responsible, compassionate, respectful, or even honest, in their relationships with other people, including people of past and future generations.

Whenever people exceed the natural regenerative capacity of nature, they invariably diminish the quality of life, and may even threaten the life, of other people. On the other hand, when they respect the ability of natural ecosystems to assimilate and recycle wastes, they rarely, if ever, create a health or environmental risks either for themselves or for others. The carrying capacity of the earth is limited. When people ignore this fact, they are violating one or more ecological principles that are consistent with the social principles of agroecology. Finally, people must find the courage to act on their convictions; crimes against nature are essentially crimes against other human beings and must be treated as such. Those show no respect for the things of nature, show no respect for other people, for humanity, or for life.

In agroecosystems, economic relationships must reflect the same social principles of integrity, empathy, and courage. If markets are to function with maximum efficiency, economic relationships must be strictly impartial, meaning strictly impersonal. Social relationships are inherently personal. Thus, those who manage sustainable agroecosystems must understand that the short run value of economic efficiency may well be less than the long run value of sustaining relationships. They must act with integrity – honest, fair, and responsible – even when doing so is not required by law and is not economically expedient. They must treat others, as they would like to be treated, even if doing so requires short run economic sacrifice. They must be willing to cooperate and to share in the costs and responsibilities of joint economic endeavors, rather than relying on competitiveness to ensure fairness and equity. Those who manage sustainable agroecosystems must understand that long run economic viability depends upon trust, kindness, and courage.

Finally, the fundamental principles of economics also must be reflected in sustainable agroecosystems. The basic principles of economics include value, productivity, and sovereignty. Economic value is determined by its scarcity, the quantity of something available relative to how much people are willing and able to give up to get it. Economic value differs from intrinsic value in that the economy may place little value on things of great intrinsic value, such as air and water. Most people can get all the air and water they want without having to give up anything else to get them. Scarcity exists only in situations where people have to make choices among alternatives. Thus, air and water have economic value. Money is a common measure of scarcity, because money can be traded for many things. If people choose to trade or spend their money for one thing, they can't spend it for another. So if they can get all they want of something without spending money for it, it isn't scarce, and thus, has no economic value. As more of a thing is made available, it becomes less scarce, and the value of each additional amount diminishes. Thus, only those things that are scarce have economic value, and the greater the scarcity, the greater the value.

Production may be defined as “creation of value.” Production results from the combination of different productive resources, the most basic of which are land, labor, capital, and management. Different combinations of resources can be used to achieve the same level of production and different levels of production can be achieved by varying the amount of any given resource – resources are imperfect substitutes in production. So productivity also is a matter of choices – choosing how much of which resources to use in the production process. The productivity capacities of resources are always limited by their natural environment. Thus, as production is increased, beyond some point, each additional unit of production requires more resources. Thus, the *marginal* costs of production rise, as production is increased.

As production of a thing is increased, the costs of producing an additional amount rise and the value of that same additional amount declines. Eventually production reaches a point where additional cost to the producer is just equal to the additional value to the buyer. At this point, a willing seller finds a willing buyer and at an agreeable price. This is how market value is determined, by the economic laws of supply and demand.

The economic principle of sovereignty receives less attention than do value and productivity, but is no less important. Without sovereignty, without the freedom to choose, a market economy cannot function effectively. Buyers must be free to choose. They must have adequate information about alternative choices, and must be free of coercion or persuasion. Producers must be free to choose. They must have access to markets, without unnecessary requirements for entry, or intimidation from other producers. When choices are restricted, when people are not free to choose, market economies simply cannot function effectively, not even for the individual, material well-being of society.

In sustainable agroecosystems, economic principles must be expressed in ways consistent with the ecological and social principles of agroecosystems. The economy actually produces nothing; all economic capital either is extracted from nature or is provided by humans, arising from either natural or social capital. Economies simply facilitate individual, material relationships among people, and between people and their natural environment, in complex societies. Economic relationships that are extractive of nature or exploitative of people are simply not sustainable, as indicated previously. The ecological and social principles of agroecosystems, likewise, must function in ways that reflect fundamental economic principles.

For example, individual species within ecosystems become more ecologically valuable as they become rare or endangered. The ecological value of specific kinds of ecosystems also become more valuable to overall ecological integrity, as such ecosystems become more scarce; meaning as fewer such ecosystems are left in a region or in the world. As a single species becomes more abundant or less scarce in a particular ecosystem, at some point, the species becomes less ecologically valuable, as it begins to threaten the integrity of the ecosystem. Thus, the principle of value and productivity relate to decisions affecting ecological as well as economic decisions.

Economic principles also are reflected in social relationships. All people need positive relationships with other people, but some need more, closer relationships than do others. However, as people establish more relationships, as some point, additional friendships become

less important and less valuable. Also, as the number of relationships decline, at some point, the remaining relationships become more important and more valuable. Relationships also have costs, in terms of time, energy, emotional capital, and even money required to maintain them. And as relationships are added, at some point, the cost of each additional relationship increases, particularly in relation to its value. Finally, the principle of sovereignty is particularly important in social relationships. People must be sovereign, must free to choose, if they are to sustain interdependent relationships of mutual benefit. Relationships of necessity are typically labeled as unhealthy co-dependencies. The basic principles of economics clearly are relevant and important in sustaining social relationships.

Agroecology integrates ecological, social, and economic aspects of reality for the explicit purpose of sustaining the goodness of all life. Agroecology is firmly rooted in first principles: life has purpose, life is interconnected, and life is good. For some people, the rightness of integrating agriculture and ecology to develop sustainable agroecosystems just makes common sense, and common sense may be sufficient to justify its acceptance. Others obviously have not yet accepted the necessity of agroecology or agricultural sustainability.

Perhaps the skeptics would see the value of agroecology more clearly, if they understood its importance in terms of human happiness. Aristotle believed that the purpose of human life was happiness, and thus, that all people could be happy. He believed that human happiness is inherently social, that it depended upon having positive relationships with people. He believed that human happiness is also inherently moral or ethical, that it requires relationships of virtue or rightness. The first principles of sustainable agroecosystems are completely consistent with Aristotle's principles of human happiness.

A multitude of recent studies by scholars at the Positive Psychology Center at the University of Pennsylvania have concluded that human happiness still depends upon a sense of material well-being, social relationships, and moral sense of purpose in life.<sup>32</sup> Happiness is related to income and wealth, but only up to a fairly modest level needed to meet life's basic necessities. Beyond some point, economic success adds little if anything to happiness. They have concluded that happiness really does depend on positive relationships, including both close and casual friendships. Most people who have no friends admit to being unhappy, regardless of their economic circumstances. Finally, they have concluded that happiness requires a sense of purpose and meaning in life, a sense that a person is living a moral, ethical, and thus worthwhile, life.

The first principles of agroecology appear to be essentially the same as the first principles of human happiness. Life has purpose, life is interconnected, and life is good. Perhaps other principles are more important or maybe other principles need to be added. Perhaps better ways can be found for defining or explaining the first principles of agroecology. Certainly much still remains to be done in exploring the implications of unifying the principles of economics, sociology, and economics through agroecology. But rethinking first principles seems the logical place to start. Life has purpose, life is interconnected, and life is good seems. This seems to be a nice beginning. Rethinking the first principles of agroecology might help encourage society in general to rethink the first principles of happiness.

## End Notes

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- <sup>2</sup> Steve Gliessman, 1998-2006, Agroecology Research Group, available at <<http://www.agroecology.org/>> accessed, July 2006.
- <sup>3</sup> Wikipedia, *the free dictionary*. "Agroecology," <<http://en.wikipedia.org/wiki/Agroecology>> accessed, July 2006.
- <sup>4</sup> The Ben Stinner Endowment for Healthy Agroecosystems and Sustainable Communities, 2006, available at <<http://www.oardc.ohio-state.edu/entomology/news.asp?strID=504>> accessed, July 2006.
- <sup>5</sup> Gliessman, <<http://www.agroecology.org/principles/ecosustdef.htm>>
- <sup>6</sup> Wikipedia, "First Principles," <[http://en.wikipedia.org/wiki/First\\_principles](http://en.wikipedia.org/wiki/First_principles)> accessed, July 2006.
- <sup>7</sup> *Penguin Dictionary of Philosophy*, 1998, "Philosophy."
- <sup>8</sup> *The Internet Encyclopedia of Philosophy*, "Laws of Nature," <<http://www.iep.utm.edu/l/lawofnat.htm#H1>>.
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- <sup>11</sup> Wikipedia, "Natural Law," <[http://en.wikipedia.org/wiki/Natural\\_law](http://en.wikipedia.org/wiki/Natural_law)>
- <sup>12</sup> Thomas Reid, *Works of Thomas Reid*, ed. William Hamilton, Thoemmes, (Bristol, England: Continuum Press, 1863), 422.
- <sup>13</sup> Thomas Huxley, *On A Piece Of Chalk*, (New York: Scribners, 1967, 1st Edition, 1869).
- <sup>14</sup> Albert Einstein, *Mathematics, Queen, and Servant of the Sciences*, quoted by E. T. Bell, in (Washington, DC: Math Association of America, 1987, original copyright, 1937).
- <sup>15</sup> Chemistry Coach, "Common Sense, Albert Einstein," Bob Jacobs, Bobsalsa@comcast.net, <[http://www.chemistrycoach.com/common\\_sense.htm](http://www.chemistrycoach.com/common_sense.htm)>.
- <sup>16</sup> *Catholic Encyclopedia*, "Philosophy of Common Sense," <<http://www.newadvent.org/cathen/06035a.htm>>.
- <sup>17</sup> *Catholic Encyclopedia*.
- <sup>18</sup> W. Devall and G. Sessions, *Deep Ecology, Living as if Nature Mattered*, (Salt Lake City, Utah: Peregrine Smith Books, 1985), 63-77.
- <sup>19</sup> Arne Naess, 1988, "Identification as a Source of Deep Ecological Attitudes," in *Deep Ecology*, ed. Michael Tobias (San Marcos, CA: Avant Books), 256.
- <sup>20</sup> Hugh Elliott, "Materialism," in *Readings in Philosophy*, eds. John Herman Randall, Jr., Jestus Buchler, and Evelyn Shirk (New York Harper and Row, Publishers, Inc., 1972), 307.
- <sup>21</sup> Elliott, "Materialism," 309-310.
- <sup>22</sup> Brian Green, *The Fabric of the Cosmos: Space, Time and the Texture of Reality* (New York: Random House, Inc.), 79.
- <sup>23</sup> Elliott, "Materialism," 309-310.
- <sup>24</sup> *The Internet Encyclopedia of Philosophy*, "Aristotle (384-322 BCE.): Politics," by Edward Clayton, <<http://www.iep.utm.edu/a/aris-pol.htm#H5>>, accessed July 2006). Aristotle himself discusses it in Book II, Chapter 3 of the *Physics* and Book I, Chapter 3 of the *Metaphysics*.
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- <sup>30</sup> Rushworth M. Kidder, *Moral Courage* (New York: William Morrow, HarperCollins Publishers, 2005), 43.
- <sup>31</sup> Kidder, *Moral Courage*.
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