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Biodynamic Agriculture: A Valuable Alternative to the Industrial Farming System

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Part 1: INTRODUCTION TO BIODYNAMIC AGRICULTURE

Due to innovations born of the Industrial and Green revolutions, global gross domestic product has steadily increased since the 17th century (McNeill 7). In 1820 the world's GDP amounted to $695 billion, but by 1900 after the economic boom of the Industrial Revolution, this figure increased to $1.98 trillion. During the Green Revolution, agricultural industrialization intensified and global GDP rose to $5.37 trillion, a figure that has only continued to grow (7). Movement towards agricultural industrialization began with Justus von Liebig's *Chemistry in the Application to Agriculture and Physiology* in 1840, which examined the possibility of using synthetic fertilizers in farming to decrease labor and improve yields (Kirschenmann 5). Before these advances were implemented into the farming system, eighty two percent of the population in developed countries lived in rural areas (Kimbrell 8). In 2000, after technology had begun to replace human laborers, this number decreased to sixty percent. Although seen as economically beneficial, increasing industrialization creates issues that permeate the ecological, economic, and ideological factions of society (Berry 48). Wendell Berry, renowned environmental author and activist, sums up what many environmentalists today agree is a dire problem. He contends that the societal shift from an agrarian lifestyle to industrial farming has presented a crisis to our modern world. If we have any hope of solving this global dilemma, an alternative methodology must replace our current system (48).

Industrial agriculture is characterized by an increase in productivity, which although seemingly positive for the economy, has led to many ecological problems including soil degradation, pollution, loss of biodiversity, and health consequences

(Kimbrell 28). The transformation in productivity since the Green Revolution is exemplified by a sevenfold increase worldwide in the use of nitrogen fertilizers between 1960 and 1995. This presents environmental problems as only thirty to fifty percent of nitrogen applied to crops is absorbed (Tilman et al. 673). As a result of over-fertilization, a plethora of toxins pollute ecosystems surrounding agricultural areas, proving detrimental to wildlife, as well as human health. Furthermore, industrial agriculture has adverse effects for land within farming zones including erosion, reduced microbial activity and loss of healthy soil structure. Since 1945 about 17% of vegetated land has undergone soil degradation, generally due to industrialization of agriculture (674).

On top of ecological degradation associated with conventional farming, economic issues are also of concern as the industrial agriculture system presents more costs overall than small, natural farming operations. This problem is perpetuated by government policies that support industrial agriculture through subsidization programs. Although large-scale monocultures have more productive single crop yields, smaller farms that utilize intercropping techniques have higher overall yields due to efficient use of space and soil replenishment techniques (Kimbrell 21). This point is illustrated by government studies that indicate higher efficiency on smaller farms as compared to industrial agriculture plots (29). On top of their efficient processes, small, alternative farms are more economical in that they do not invest in large machinery and chemical fertilizers as conventional farms do.

Additionally, industrial agriculture does not internalize environmental and health costs, resulting in a net loss for society and the government (Kimbrell 21). For example, it has been estimated that the United States spends about $45 billion on soil restoration

due to erosion from industrial farming every year (Pimentel et al. 573). Here we see that conventional agriculture does not only cause issues for small farmers, but also proves economically inefficient for taxpayers (Kimbrell 21). While industrial farms escape these monumental costs, major competition is spurred upon small farmers who account for environmental and health expenses. As a result, small-scale farms appear more costly, when in fact industrial agriculture proves more economically inefficient when considering the system as a whole (21).

Our world is also experiencing an ideological crisis stemming from the reductionist perspective born of the Scientific Revolution, a mindset that promotes our industrial agriculture system (White 1203). Society has come to compartmentalize and disregard the human relationship to nature and in blind pursuit of modernization, environmental damage has ensued (1203). Pre-industrial agriculture emphasized a relationship between the farmer and land, but with an increase in mechanization, our mentality changed. This shift is exemplified by our fossil fuel dependent technologies, which do not consider ecological or human health (Kirschenmann 3). Today, agriculture demonstrates a focus on yield and ignores the environmental costs associated with synthetic fertilizers and monocultures. By separating spirituality from fact, the Scientific Revolution created a society that emphasizes human control over nature through technology and science (White 1203).

The societal shift towards agricultural industrialization did not progress undisputed. Daniel Jay Brown's *Field Book of Manures*, published in 1858, underlined the importance of manure-compost for increased humus production (Kirschenmann 6). In 1881 Charles Darwin published *The Formation of Vegetable Mould, Through the Action*

of Worms, With Observations on Their Habits, which outlined the necessity of earthworms for healthy soil structure (6). Sir Albert Howard's *An Agricultural Testament* written in 1943 disputed the use of synthetic fertilizers and explored alternative composting practices, specifically focusing on the importance of manure as a natural fertilizer (Heckman 144). As a spiritual response to industrialization, radical environmental philosophies such as deep ecology and ecofeminism emerged, challenging industrial agriculture practices (Devall 65). Inspired by the teachings of Aldo Leopold, Rachel Carson, and other early environmental leaders, these practices focus on cultivating a spiritual relationship with nature and integrating humans into natural processes, similar to animistic ideology (65). Many challenges to industrial agriculture such as these instigated the growing popularity of the modern organic movement.

Yet, in spite of its original goals, the organic movement has increasingly come to resemble the conventional agriculture sphere (Klonsky 238). Escalating popularity of natural foods led to the rise of big organic. This method introduced larger plots of farming land, a limited crop variety and an increased production of organic processed food by mega-corporations (241-242). As of 2006 almost 40% of organic foods were sold through large-scale conventional retailers (Johnson 1-4). Local economies have been especially devastated by this transformation. The nature of organic has quickly changed from a movement concerning environmental and social implications to one aiming for globalization and consolidation. Michael Pollan explains that big organic, although only a small fraction of the $400 billion business of American industrial food production, has become a $7.7 billion business and continues to grow rapidly (Pollan 1). Roger Blobaum, a major player in the passing of a USDA organic program through congress, interprets

statistics such as these as a demonstration that the organic movement has fallen prey to exactly what it was designed to fight against (Pollan 2).

The negative environmental, economic, and spiritual problems associated with conventional agriculture are detrimental. Unfortunately, the same problems become apparent in the industrial organic sphere as it begins to adopt similar practices (Klonsky 238). Advocates such as Wendell Berry, Michael Pollan, and Roger Blobaum recommend an alternative system, one that promotes ecological, economic, and human health. An agricultural method that emphasizes these goals is Rudolf Steiner's biodynamic system, which provides more sustainable and socially aware agricultural practices (Demeter International). This paper aims to examine the crisis associated with agricultural industrialization and investigate whether biodynamic agriculture effectively provides a solution to the problems inherent in both conventional and industrial organic agricultural methods.

The primary part of this paper will outline the basics of biodynamic agriculture, describing the practices and ideologies embraced by its followers. Second, it will evaluate the biodynamic system in order to discover the possible value of these processes in today's agriculture sphere. Within this section I will focus on the biological implications for soil in biodynamic agriculture, which will utilize scientific studies that compare conventional, organic, and biodynamic soil structure. The paper will then outline environmental implications of biodynamic agriculture and examine the ways in which it promotes ecological health. An overview of the economic benefits of biodynamic agriculture will then be presented, investigating the efficiency of small scale farming as compared to large-scale monocultures. The last section will outline spiritual implications

of biodynamic farming, elaborating on the biodynamic preparations and practices, the effects they have on the human psyche, and whether they contribute to today's environmental ideology. The conclusion will sum up the findings and aim demonstrate how the ecological, economic, and spiritual advantages of biodynamic agriculture outweigh those found in conventional and industrial organic farming practices.

1.1 The Foundation of Biodynamic Agriculture

Rudolf Steiner (1861-1925), an Austrian philosopher, educator, and mystic, devoted the majority of his adult life to the development of anthroposophy, a philosophy that he defined as a science of the spiritual realm (Lachman 172). His emphasis on connecting the spiritual world with scientific fact is what distinguished Steiner from other educators, philosophers, and theorists of his time. As the leader of a worldwide movement that embraced both science and mysticism, Steiner pioneered what is known today as the Waldorf Steiner education system, as well as the biodynamic agriculture methodology (194).

Steiner was a pioneer of the spiritual ecology movement and based anthroposophy off of two main schools of thought: transcendentalism and theosophy (Sponsel 65). Transcendentalism values spirituality and a connection with nature over the consumerism flourishing in our modern world. Its followers oppose organized religion, believing that individuals must come to their own conclusions about personal spiritual realities. Theosophy focuses on finding a middle ground between science and theology, using belief systems inherent in many indigenous religious practices. Subsequently, Steiner's anthroposophy emphasizes spirituality within natural processes, understands the importance of scientific thought, and utilizes traditional wisdom theories (65).

Through a series of eight lectures entitled "Spiritual Foundations for the Renewal of Agriculture" delivered in 1924, Rudolf Steiner defined the biodynamic system of agriculture (Demeter International). The foundation of his methodology is a set of principles that would later be enforced by the Demeter certification program. This organization started in 1928 and evolved to become today's Demeter International, a

nonprofit founded in 1997 to create "closer co-operation in the legal, economic and spiritual spheres" of biodynamic agriculture. Demeter International controls biodynamic certification, official definitions of the modern day biodynamic practices, and distribution of information about biodynamic farming (Demeter international).

The Demeter standards strive to embody Steiner's vision of agriculture as a holistic system, emphasizing a closed loop nutrient cycle, crop variety and native plantings (Leiber, Fuchs and Spiess 141). The basis of Steiner's methodology is an awareness of the relationship between the pedosphere, ecosphere and atmosphere in order to more efficiently and sustainably run a farmstead. Biodynamic farmers believe that both the crops and livestock on a farm are deeply connected with surrounding ecosystems and envision a farm as a living organism, created by many interconnected systems (141). The Demeter International website outlines the importance of creating a holistic system stating:

> It is…important that you are open to a holistic view of the natural world, which goes beyond the knowledge gained purely from natural science. The sun, moon and stars, or the Biodynamic preparations are not the only influences to be considered. Working with the Biodynamic method will result in new experiences arising from interactions with the plant and animal kingdoms (Demeter International).

This quote not only demonstrates the importance of a holistic mindset in biodynamic agriculture, but also specifically emphasizes the way in which Demeter International promotes the health of surrounding ecosystems.

Steiner's processes seek to create vibrant ecosystems within the farmstead while stressing a spiritual awareness (Leiber, Fuchs and Spiess 141). Mystical processes, which take the form of eight compost fermentation preparations, are a defining component of biodynamic methodology and speak to the emphasis biodynamic agriculture places on connecting farms with neighboring ecosystems (Demeter International). Additionally, recognition of the importance of astrological patterns and moon cycles is key, facilitating a truly holistic farming system (Steiner *Agriculture Course* 23). In essence, biodynamic ideology recognizes and encourages a contribution to nature through sacred processes and sustainable agricultural practices (Leiber, Fuchs and Spiess 141).

1.2 Biodynamic Principles

Integrated Crop-Livestock System

In order to create an independent nutrient cycle, Steiner specified the necessity of both crops and livestock on a farmstead (Leiber, Fuchs and Spiess 142). Essential to healthy soil is animal manure, a fundamental component of the composting process. Since artificial nitrogen fertilizers are strictly forbidden on certified biodynamic farms, manure as well as plant fertilizers are used to naturally boost nitrogen in the soil. These composting methods are not specific to biodynamic agriculture, being an elemental feature of conventional organic ideology and a mainstay of agriculture in pre-industrial times (142). In this way, Steiner used this aspect of traditional farming as a basis for his farming methodology.

The psychological and physical well being of livestock on biodynamic plots is a pivotal feature not necessarily emphasized on other organic farms. Biodynamic livestock husbandry is based on the belief that animals have souls and should therefore be handled with the upmost respect (Leiber, Fuchs and Spiess 143). The method for treatment of livestock is yet another principle associated with Steiner's spiritual views, outlined strictly in his lecture series. Examples of these practices include the prohibition of both dehorning and isolated breeding because of the cruel and inhumane implications (Baars, Spengler, and Spengler 10). Steiner explained that the purpose of breeding is to maintain lifelong yields and create a system of longevity within a farmstead (Leiber, Fuchs and Spiess 143). Therefore, maximum yields and economic gains should not be a farmer's main focus; an emphasis should instead be on the welfare of the animals within a cohesive farming system.

Since biodynamic agriculture aims to create a sustainable and closed-loop system that maintains surrounding landscape conditions, crop varieties are methodically chosen to serve specific ecological purposes (Leiber, Fuchs and Spiess 142). Farmers only breed plant types that are conducive to maintaining the biodiversity of local ecosystems and that contribute to soil health. Therefore, biodynamic farms often produce native crops and practice companion plantings that take the surrounding biosphere into consideration. Moreover, seeds from plants are generally saved to limit resource use outside of the farmstead (143).

Fertilization and Pesticide Principles

In order to maintain soil health, systematic rotations of crops are essential to biodynamic farming systems. The use of cover crops and intentional crop plantings enable farmers to fix nitrogen as well as incorporate additional nutrients into the soil without industrial fertilizers (Leiber, Fuchs and Spiess 142). In his lectures, Steiner highlights specific crops and the roles they play in soil nutrition. He taught that legumes replenish nitrogen, fodder plants increase and decrease humus in the soil, and root length can determine soil properties. All certified biodynamic farms must grow legumes for nitrogen-fixing green manure, which can also be used for animal feed (142).

In addition to these techniques, natural plant and manure-based fertilizers are an essential component of soil health maintenance. Similar to small-scale organic agriculture, biodynamic farmers utilize intensive manure and composts in varying forms to produce maximum nutrient outcomes (Leiber, Fuchs and Spiess 142). Diverse methods of fertilization are used depending on the crop needing nutrient enhancement. For

example, potatoes are given manure as fertilizer, while other vegetables are sprinkled with "well rotted composts" (142).

Steiner's fertilization methodology also uses unique processes that reflect mystical and superstitious elements (Conkin 185). For example, he emphasizes the importance of spraying homemade herbicides on the outer leaves of crops to ensure plant health. In one of his lectures, Steiner recommended horsetail tea to prevent a fungal blight (Steiner *Agriculture Course* 118). Additionally, to deal with pest management, Steiner promoted the burning of parasitic insects that harm crops. He went on to say that this process should be carried out according to specific cosmic cycles and that the finished product, or "insect pepper," can be sprinkled on leaves to deter other insects of the same species (115).

Using and Respecting the Landscape

As biodynamic agriculture was created as a holistic approach to farming, incorporating landscapes surrounding the farmstead is essential to the success of the system. In his seventh lecture, Steiner states, "To improve our stock of animals in a farm or in a farming district, we shall often do well to plant in the landscape bushes or shrub-like growths" (Steiner *Agriculture Course* 132). He goes on to explain that it is important to take precautions such as this because "all things in Nature are in mutual interaction" (132). Steiner's support of native plantings and general maintenance of surrounding landscapes is a testament to his understanding of the importance of biodiversity in natural farming systems.

Social Implications

Although soil and ecosystem health are vital to biodynamic farming, Steiner also stressed the importance of social issues. He states, "It is infinitely important that agriculture should be so related to the social life" (Steiner *Agriculture Course* 149). Steiner argued against working solely towards economic gain and conceptualized agriculture as a living system in which humans, organisms, and landscape make up a cohesive habitat. Therefore, maintaining human relationships is essential (19). An example of this can be seen in the unique concept of land-ownership presented on modern biodynamic farms (Leiber, Fuchs and Spiess 144). Today, biodynamic farms are often not considered private property, but are instead owned by charitable businesses or community-supported organizations. Farms such as these might provide a space of rehabilitation therapy for people serving parole and those with mental or physical handicaps. These opportunities allow for citizens to take part in the farming process and learn important skills within a supportive community (144). Wholesome and social, this component distinguishes biodynamic agriculture from conventional organic farming.

Biodynamic Preparations

The most obvious differences between biodynamic agriculture and mainstream organic farming are Steiner's unique preparations and his emphasis on cosmic rhythms. In order to maximize the soil nutrient base, Steiner invented eight preparations, each playing a special role in crop fertilization (Steiner *Agriculture Course* 76). These preparations were a main component of his lecture series and are essential for planting, fertilizing and harvesting processes on biodynamic farms (Leiber, Fuchs and Spiess 143).

In his fourth lecture, Steiner details two homemade field sprays, both of which are buried in cow horns and left to decay during the summer (Steiner *Agriculture Course* 74).

After being dug up, the manure is mixed rhythmically with water and sprinkled on crops. Steiner explains the process as such:

> You see, by burying the horn with its filling of manure, we preserve in the horn the forces it was accustomed to exert within the cow itself, namely the property of raying back whatever is life-giving and astral…And so, throughout the winter…the entire content of the horn becomes inwardly alive (74).

This quote demonstrates a fundamental element of Steiner's preparations: that spiritual power can be transferred from something once living to a new life form. It also illustrates his assertion that spiritual processes are essential to biodynamic methodology in that they play an important role in the closed loop nutrient cycle.

Other biodynamic preparations include plant-based composting methods. Mixtures made from medicinal plants that are fermented in animal organs such as intestines and bladders are sprayed on plants during specific cosmic cycles (Leiber, Fuchs and Spiess 143). Not only do these composts ensure plant health, but they can also be used as natural herbicides and pesticides:

> The compost preparations consist of herbs such as chamomile, nettle, oak bark, yarrow or valerian, most of which are filled into particular animal organs, hung in the summer sun or placed in the soil for some months where they collect cosmic forces during this time (Demeter International).

Steiner emphasized the importance of these composts because he believed that astrological powers could be transferred into the soil, ultimately promoting healthy crop growth.

Cosmic Cycles

Another aspect of biodynamic agriculture that differs from conventional organic ideology is an emphasis on celestial and astrological patterns. Steiner explains the importance of this concept when he states, "we shall never understand plant life unless we bear in mind that everything which happens on the Earth is but a reflection of what is taking place in the Cosmos" (Steiner *Agriculture Course* 23). According to Steiner's sixth lecture, plantings, maintenance and harvests are all to be done in accordance with planetary cycles. His lectures emphasize that plants and animals are directly affected by these patterns: "Everything connected with the inner force of reproduction and growth—everything that contributes to the sequence of generation after generation in the plants—works through those forces which come down from the Cosmos to the Earth…" (225). This quote demonstrates the importance of celestial patterns and spiritual awareness in Steiner's agriculture method (Leiber, Fuchs and Spiess 143).

1.3 Biodynamic Farming Today

Biodynamic agriculture plays an important role in the alternative agriculture sphere, especially in Europe and the wine industry on a global level. At present, approximately 8,000 biodynamic farms in fifty-three countries are certified by Demeter International (Demeter International). This does not include the plethora of farms that follow the same procedures and policies, but have not undergone the official certification process. The popularity of biodynamic agriculture is growing because of an interest in the holistic values associated with the specific and strict methodology (Scollan 34). Ecological degradation and economic inefficiencies associated with conventional and industrial organic farms play an important role in a farmer's choice to implement biodynamic farming methodology.

Part 2: EVALUATION OF BIODYNAMIC AGRICULTURE

2.1 Assessment of Soil Health in Biodynamic Agriculture

Soil is arguably the most endangered resource in the world. Since the end of World War II, it has been estimated that industrial agriculture damaged enough topsoil to equate thirty eight percent of all farmland in existence today (Horrigan, Lawrence, Walker 447). A major reason for this problem is the emphasis on conventional farming methodology, which utilizes synthetic fertilizers, monocultures and mechanical farming equipment (McMahon, Kofranek and Rubatzky 68-69). Soil erosion, loss of organic matter, salinization, water logging, and soil compaction are all associated with industrial agricultural systems as they override natural processes and impede healthy soil structure (68). Although farmers using conventional methodology may synthetically supplement soil, small, holistic approaches promote healthy soil structure, high nutrient counts, and microbial activity to perpetuate the wellbeing of soil (57-93). Principles created to uphold these soil standards were key in Steiner's original lectures and are required today by the Demeter International certification process (Demeter International). As such, biodynamic agriculture offers an alternative to conventional farming methods. It holds farmers accountable for maintaining soil integrity and results in the preservation of this endangered resource.

Biodynamic Versus Conventional Farming Methods

Multiple studies have compared the soil health of industrial farming plots to those using biodynamic fertilization methods and found that Steiner's system promotes higher quality soil. Research conducted in Austria, Australia, and New Zealand demonstrate these trends (Reganold 67-70). The study conducted in Austria indicated that biodynamic

farms had a higher microorganism count. This is important as microorganisms bind soil together by decomposing organic matter and forming a glue-like material similar to humus (Reganold 67; Altieri *Agroecology* 352). Microscopic bacteria are also essential to the nitrogen fixing process, which transforms nitrogen to a form readily useable by plants (McMahon, Kofranek and Rubatzky 67). In addition, humus content was higher in biodynamic plots, which is important as humus hosts most of the cation exchange capacity found in organic matter (Altieri *Agroecology* 355).

A study conducted in Australia by Terrence Foreman in 1981 examined biodynamic and conventional plots in the Breeza Plains of New South Wales (Reganold 67). Both the biodynamic and conventional plots used consistent farming techniques for over seven years to ensure steady soil structure (67-68). Results showed that the biodynamic farm had higher organic matter, the decomposition of which improves biological, chemical, and physical properties of soil. Organic matter also introduces a plethora of nutritional substances to the soil, which are absorbed by root systems and ultimately used by entire ecosystems (McMahon, Kofranek and Rubatzky 67). Additionally found in this plot was a high amount of phosphorus, considered one of the three primary elements necessary for crop growth (67).

John Reganold, professor of soil science and agroecology at Washington State University, has investigated biodynamic agriculture techniques for over fifteen years (Scollan 43). On the North Island of New Zealand a study by Reganold compared seven biodynamic farms that were each compared to one or two conventional farms in the same area (Reganold 69). The farms included vegetable plots, orchards and livestock-intensive areas. The soil on the biodynamic farms had all been managed using Demeter

International's certification standards for at least eight years. Results showed that the biodynamic soil had higher microbial activity, better cation exchange capacity and more organic matter. Soil structure, or the way that particles are arranged within a soil sample to shape aggregate, was also better on the biodynamic farms (McMahon, Kofranek and Rubatzky 60; Reganold 69). To promote healthy plant and organism life, aggregate pores must be big enough to allow soil drainage and small enough to hold water, similar to soil texture (69). Conclusions of this study showed better soil quality in these biodynamic plots when compared to conventional soil.

This compilation of research is representative of many other studies, which indicate healthier soil on biodynamic farms when compared to conventional plots (Reganold 67-70). The general consensus of these studies indicates that more microbial activity, higher nutrient counts, and better soil structure are associated with biodynamic agriculture (67-70). Case studies such as these prove biodynamic farming to be a viable solution to soil degradation problems such as erosion and loss of biodiversity, which are products of industrial agriculture practices.

Biodynamic Versus Organic Farming Methods

Biodynamic and other organic agriculture systems share many practices and ideologies including a dependence on natural fertilization methods. However, Steiner's emphasis on fermentation and spiritual preparations distinguishes his method from organic techniques (Carpenter-Boggs et al. "Organic and Biodynamic Management Effects on Soil Biology" 1651). Interestingly, the comparison between organic and biodynamic soil quality remains surprisingly unexplored, especially in English (Reganold 65). Nevertheless, soils that have undergone mystical and cosmic preparations have been

analyzed scientifically for effectiveness in order to justify the use of biodynamic agriculture today (Reganold 65). Some studies show better soil quality on biodynamic farms, while many studies have found no trend that differentiates organic from biodynamic. In this way, results are seemingly inconclusive and thus cannot indicate a preferable farming methodology.

John Reganold has conducted multiple studies comparing biodynamically and organically fertilized soil. His report outlines two studies that exemplify higher quality in biodynamic plots. A study in Germany, conducted in 1987 compared conventional, organic, and biodynamic farming methods during a four-year experiment using garden vegetable beds (Reganold 67). Synthetic fertilizers were sprayed on conventional farming plots, composted manure was used for the organic plots, and manure having undergone biodynamic preparations was applied to the biodynamic plots. Results showed that nitrogen rates were higher in the biodynamic soil than both the conventional and organic plots. Furthermore, the biodynamic plots had higher rates of microbial biomass and dehydrogenase activity, which indicates the amount of microbial activity present in the soil (Reeve et al. "Influence of Biodynamic Preparations on Compost Development and Resultant Compost Extracts on Wheat Seedling Growth" 5660).

A study conducted in the state of Washington by Walter Goldstein in 1986 also looked at conventional, organic, and biodynamic farming methods. Similar to the studies mentioned previously, Goldstein compared crop growth and soil properties in conventional, organic and biodynamic farming systems (Reganold 70). Goldstein's results showed more microbial biomass, higher amounts of organic matter, and additional

microbial respiration in biodynamic samples. The biodynamic soil also generated more root growth during the winter than did the organic and conventional test plots (70).

Similar results were found in a study in California, which looked at the effect of biodynamic preparations on the development of compost, using wheat as the test subject (Reeve et al. "Influence of Biodynamic Preparations on Compost Development and Resultant Compost Extracts on Wheat Seedling Growth" 5659). The study's purpose was to investigate the quality of compost produced using biodynamic methodology and to test the effects of said compost on wheat seedlings. Results confirmed that the highest dehydrogenase activity was found in the biodynamic compost, an indication that these plots possessed better quality soil (5660).

Although some studies demonstrate healthier soil on biodynamic plots when compared to organic samples, others produced findings that do not support the same conclusions. John Reganold took part in three other studies comparing organically produced soil to plots that underwent biodynamic preparations. The first was published in 2000 and examined organic and biodynamic agriculture and their effects on soil biology (Carpenter-Boggs et al. "Organic and Biodynamic Management Effects on Soil Biology" 1651). This study looked at the "soil biotic biomass, activity, or community fatty acid methyl ester (FAME) profiles" (1652). The research concluded that both organic and biodynamic systems had increased microbial activity. Furthermore, no differences in the soil structure were found (1657).

Another study was conducted at the Palouse Conservation Farm of the Agricultural Research Service and the Spillman Research Farm maintained by the Department of Crop and Soil Sciences at Washington State University. It looked at the

short-term effects of biodynamic composts on crops, soil, and weeds (Carpenter-Boggs et al. "Biodynamic Preparations: Short-term Effects on Crops, Soils, and Weed Populations" 111). Both biodynamically prepared composts and those treated organically were used in the study. The research showed no significant differences between the two types of fertilizer in any portions of the study (116). Plant growth, soil composition, and weed populations were all similar in both research plots. The study concluded that further research should to be conducted in order to adequately compare biodynamic and organic soil quality (117).

Additionally, a long-term study on a vineyard in Mendocino County, California analyzed organic and biodynamic wine production (Reeve et al. "Soil and Winegrape Quality in Biodynamically and Organically Managed Vineyards" 368). It focused on soil depth, thickness, gravel content, structure, and color (369). The nutrition of the vine and health of the grapes were also examined. Results of the study showed no significant difference between the vines that were treated with biodynamically prepared compost and vines using organic fertilizers (371). Interestingly, the study did not find differences in the microbial activity, indicated by the dehydrogenase activity, CO2 respiration, and the microbial biomass. Moreover, both the biodynamic and organic plots demonstrated similar yields, cluster size, and berry weight (373).

Reganold concludes that biodynamic farms tend to "have better soil quality…and equal or higher net returns per hectare than their conventional counterpart" but are overall comparable to organic farms (Reganold 65). Although studies examining soil chemistry generally indicate the benefits of biodynamic soil when compared to conventional samples, the same cannot be said about the results of the studies comparing organic and

biodynamic fertilization. In these studies, either no significant differences between biodynamic and organic practices are indicated or they are not significant enough to justify the use of biodynamic over organic composting (Reganold 67-70). This however, is not necessarily the case when looking at the soil quality of organic agriculture on an industrial scale. While organic farming originally presented an alternative to industrial agriculture and focused on the promotion of soil health like biodynamic agriculture does, this characteristic is increasingly changing.

The majority of studies conducted to compare organic and biodynamic plots only observed small-scale organic farms. Although no differences can be seen in the chemical composition of the soil samples in these studies, many other factors must be taken into account when analyzing the findings in the context of our modern crisis. Organic agriculture on an industrial scale causes soil degradation by utilizing methods such as a lack of crop rotations, monocultures, extensive farming properties, and in some instances, the use of chemical fertilizers (Klonsky 241-242). Biodynamic methodology presents an option that promotes healthier soil because of a focus on natural farming systems, small plot sizes, and mixed crop plantings.

2.2 Ecological Impacts of Biodynamic Agriculture

The increasing industrialization of agriculture has resulted in copious ecological problems, illustrating the necessity of a new farming methodology. Commercial farming systems create environmental disasters such as pollution, loss of biodiversity, and soil degradation because there are fewer short-term economic rewards for farming methods that sustain ecosystem health (DeLind 201). The organic movement was created to fight this system, but today corporations that manage extensive organic operations also employ methodologies that deplete soil nutrients, disregard the ecological importance of crop rotation, and turn a blind eye to surrounding ecosystems (202). Biodynamic agriculture presents a method that ensures a closed nutrient cycle, limits resource use and cannot operate successfully under unsustainable conditions. In this way, the Demeter certification system provides a solution to the environmental problems posed by conventional and industrial organic agriculture.

Internalizing the Costs of Industrial Agriculture

To conceptualize ecological problems associated with industrial organic food production, one must understand the environmental implications through an economic perspective. In a capitalist economy, a market is defined as a place where a free transaction between a buyer and a seller occurs in which one party agrees to provide a set amount of goods for a set price paid by the other (Squires 102). However, within a market, it is impossible to internalize, or take into consideration, all costs created by the two agents. Subsequently, a cost is produced for a third party uninvolved in the original transaction. Taking into account these extra costs is the full cost, which is what the corporate world tends to ignore. The costs presented to a third party are called

externalities, and generally have negative implications for the environment as well as the health of minority or socioeconomically disadvantaged demographics (105). Because those with political power are generally unaffected by externalities, corporations are not forced to internalize these costs.

Erosion is an example of an externality not internalized by industrial farming corporations, which causes enormous environmental damage. According to Marc Ribaudo of the United States Department of Agriculture Economic Research Service, erosion due to monocultures has caused billions of dollars of damages including polluted water and destruction of natural habitats (Holmes 1894). However, since a price tag is not put on biodiversity or soil health, these costs are not calculated as part of a farmer's expenses (1894). Subsequently, farmers are not held accountable for environmental damage caused by erosion.

Disregard for externalities has also led to escalated carbon dioxide emissions, which contribute to environmental issues including global climate change (Klonsky 241). Long-distance shipments, increased processing and storage time of natural foods, and use of machinery on a large-scale cause more fossil fuel emissions, which ultimately leads to atmospheric pollution. Proponents of small organic farming systems often oppose globalization of the organic marketplace as it counteracts the environmental ideals inherent to sustainable agriculture (241).

Large-scale farming relies upon machinery and chemical fertilizers, which destroy healthy soil structure, kill important microorganisms, and ultimately lead to loss of biodiversity (Horrigan, Lawrence, Walker 3). The efficiency of a farm as well as the stability of pests and diseases is reliant on biodiversity. Thus, when industrial agriculture

promotes a biological simplification, farmland suffers (Altieri *Agroecology* 106; Altieri "The Ecological Role of Biodiversity in Agroecosystems" 19). Systems that reflect pre-industrial farming practices are generally more stable in this regard because natural fertilization practices and a lack of heavy equipment allow for diverse plant and animal species to thrive (106). An example of dwindling biodiversity can be seen in the United States where about 60-70% of land used for bean production has only two types of beans and 72% of the land used for potato cultivation only uses four varieties (20).

The ecological issues associated with industrial farming are perpetuated by governmental policies and programs, which aim to maintain the economic growth of industrial agriculture. Promoted by entities such as the U.S. National Organic Program, corporate farms are using methodologies that degrade soil and cause other environmental damage. Regulations such as the Organic Food Production Act of 1990 aim to create low standards because they focus on industrial growth and disregard environmental degradation (Johnson 3-4). According to the USDA organic labeling guidelines, only 95% of a certified organic farm is required to cultivate organic produce. For grocery store products that posses a "made with organic" label, just 70% of the product must be organically produced (1-4). These examples demonstrate that organic certification standards are not concerned with environmental health. Instead, government regulations present a way for the organic industry to grow economically and promote unsustainable practices.

Biodynamic as a Solution to Ecological Damage

In contrast to environmentally problematic industrial agriculture, the Demeter International system guarantees a set of standards that is committed to sustainable

processes. In this way, biodynamic farming presents a valuable alternative to industrial farming, both organic and conventional. According to the Executive Director of Demeter International, Jim Fullmer, many small farmers are dissatisfied with the organic foods market adopting industrial farming practices. As a result, numerous farmers have questioned their involvement in nationally certified organic agriculture (Scollan 43). The Demeter system has presented a satisfactory alternative methodology because it enforces extremely stringent rules for certified farmers, which the organic movement cannot provide (Demeter International). Even if small organic farmers are not at ease with the spiritual preparations associated with Steiner's methodology, their disappointment with the transformation of organic and passion for environmentally holistic methodology is often enough to instigate a transfer to biodynamic practices (Scollan 43).

Steiner's lectures promote the creation of a completely independent farming cycle, what he considers "a self contained individuality" by utilizing resources that come exclusively from the farm (Steiner *Agriculture Course* 29). Steiner explains "whatever you need for agricultural production, you should try to posses it within the farm itself" (29). Essentially, Steiner promoted farms that operate as individual organisms. A self-perpetuating farm cycle such as this contributes less waste to surrounding landscapes and waterways as it does not employ synthetic fertilizers. Thus, biodynamic farms contribute less to environmental abuse than conventional and industrial organic agriculture.

Biodynamic systems also focus on nurturing neighboring flora and fauna, which integrates farm zones into surrounding ecosystems. While conventional agriculture causes destruction and loss of biodiversity, biodynamic farms cater to natural landscapes. A perfect farm, in Steiner's view, is one that considers all things in nature as being in

mutual interaction (Steiner *Agriculture Course* 132-133). Steiner believes that one cannot master farming without a complete understanding of the connection between a farmstead and surrounding ecological systems (132-133). Biodynamic farmers believe that their work towards maintaining surrounding landscapes will in turn produce a healthier farmstead. This environmental awareness is overseen by the Demeter International regulations, which ensure that stipulations are followed by all biodynamically certified farms (Demeter International).

2.3 Economic Benefits of Biodynamic Agriculture

The United States government supports industrial agriculture because it is considered beneficial to the economy, however conventional farming practices often impose more expenses than the benefits they bring. Ecological and social expenditures not internalized by the government cost much more than would be spent in an alternative farming system (Pimentel et al. 573). Moreover, industrialization promotes consolidation and increased imports and exports, which has been detrimental to local economies (Klonsky 241). Biodynamic agriculture offers a solution to this problem. As a supporter of affordable methods, efficient systems, and local economies, Steiner's methodology internalizes environmental externalities and presents a solution to the problematic economic system that is industrial agriculture (Demeter International).

Affordability of Biodynamic Agriculture

A chief reason for the continuation of industrial agriculture is federal support of farm subsidies, which pay farmers to use fertilizers, spray pesticides, and plant expansive monocultures (Holmes 1895). The large impact of lobbyists and corporations in the United States Government has made these specific cash crops essential to the economy (Windham 13-14). Each year taxpayers spend about $659 million dollars to support subsidies for industrial agriculture—much of which is misused. Andrew Kimbrell found that $1.6 million of this money ends up paying for McDonald's advertisements (18). Subsequently, industrial agriculture has become extremely expensive for both the government and taxpayers.

Government subsidies contribute to environmental and health costs, which make industrial agriculture a much less productive system than alternative farming methods.

Many agree that this system is backwards in that the costs of these programs outweigh the benefits (Kimbrell 15). Since the Green Revolution the human race has been degrading soil seventeen times faster than the earth can naturally replenish it. The issues associated with excessive use of chemical fertilizers and pesticides have cost taxpayers billions of dollars annually for environmental damage directly caused by agriculture (16). The health expenses linked to agricultural toxins are also huge. According to the EPA, approximately 300,000 farm workers in the United States suffer from pesticide poisoning every year (Lòpez 130). Furthermore, the fossil fuels associated with machinery, processing, and transportation of food have caused billions of dollars of health and environmental costs. Michael Pollan explains that every five calories of food energy bought takes an average of 435 calories of fossil fuel to get to our plates (9). This statistic demonstrates the degree to which our conventional agriculture system is economically inefficient.

Biodynamic agriculture offers an economically viable system because it takes environmental and health externalities into consideration. Demeter certification presents a way for farmers to maintain small-scale organic farms that are based on sustainable ideology, which in turn saves money (Scollan 34). Steiner's method recognizes the correlation between environmental health and economic prosperity when he states:

> It is no true economy to exploit the surface of the earth to such an extent…in the hope of increasing our crops. Your large plantations will become worse in quality, and this will more than outweigh the extra amount you gain by increasing your tilled acreage at the cost of these other things (Steiner *Agriculture Course* 132-133).

Here, Steiner asserts that conventional farming methods, which exploit large amounts of land and degrade soil are causing economic damage to farmers in the long run.

Efficiency of Biodynamic Agriculture

Industrial agriculture actually proves less efficient than small-scale organic. Although corporate farming is seemingly more productive and beneficial for a growing economy, this is not necessarily the case. A study conducted in 1989 by the U.S. National Resource Council examined whether industrial food production is more efficient than alternative methods (Kimbrell 20). The study stated:

> Well-managed farming systems nearly always use less synthetic chemical pesticides, fertilizers, and antibiotics per unit of production than conventional farms. Reduced use of these inputs lowers production costs and lessens agriculture's potential for adverse environment and health effects without necessarily decreasing, and in some cases increasing, per acre crop yields and the productivity of livestock management systems (Altieri *Agroecology* 182-183).

On top of this, additional government studies indicated that farms smaller than twenty seven acres are more than ten times as productive than conventional agriculture zones and farms four acres or less are over 100 times more productive (Kimbrell 29).

Other studies that compared the yields of biodynamic farms to conventional plots showed that biodynamic agriculture presents similar yields and higher revenues. Furthermore, these studies illustrate increased earnings and steadier revenues for biodynamic farmers. For example, a study conducted in Germany by Schlüter in 1985 indicated that although single crop yields were lower in biodynamic farms as compared to conventional agriculture, gross revenues were higher due to price premiums charged

for top quality produce (Reganold 70). In another study conducted in New Zealand by Reganold in 1993, conventional and biodynamic farms were compared economically (71-72). The statistics demonstrated that variability each year did not change as much for biodynamic farms. This indicated a correlation between biodynamic practices and economic stability, which is extremely important in such a volatile domain as agriculture (72).

Effects of Biodynamic Farming on Local Economies

Additionally problematic are consequences of extended import and export systems imposed by industrial systems, which present hardships for farming communities (Klonsky 241). Imports cause competition within local communities, which can put farmers' livelihoods and other small businesses in jeopardy. Exports cause the local community to suffer as the highest quality food leaves the region (241). Consequently, between 1987 and 1992 the United States lost about 32,500 farms, most of which were family-owned (Kimbrell 17).

Furthermore, smaller, organic organizations are dealing with threats of consolidation. An example of this can be seen in the progression of Whole Foods Market, which bought out ninety-five stores including Bread and Circus, Fresh Fields, Mrs. Gooch's and many other small manufactures (Klonsky 240). Businesses such as Whole Foods Market put pressure on small farmers because they are often unable to compete with these large markets (236). Although it is hard to put a price tag on small businesses and local economies, the U.S. Office of Technology attempted to do so in a study of 200 communities. It found that as farm sizes increase, the overall poverty in the region does as well (Kimbrell 18). Furthermore, in these circumstances, social situations deteriorate,

small businesses close, and crime increases. In this way, since the 1900s issues associated with farmer dislocation have cost taxpayers tens of billions of dollars (18).

Biodynamic agriculture presents a solution to consolidation and increasing import and export trends by emphasizing a localized economic system, often through barter and trade (McMahon 109). Because of an overarching disapproval of the modern economic system, biodynamic farming communities aim for self-sufficiency, with a goal to support only farms they believe to be sustainable and ethically run. A reorganization of the social structure within these small communities helps to support local agriculture and other businesses. One biodynamic farmer from Ireland explained that her local community structure keeps her from becoming connected to material goods, which she considers unsustainable, spiritually unhealthy, and detrimental to the local economy. Economic growth that promotes materialistic ideals is opposed in biodynamic communities where farmers emphasize societal reorganization value local economy (109).

2.4 Spiritual Aspects of Biodynamic Agriculture

The problems associated with conventional farming can also be attributed to an ideological transformation during the Industrial Revolution. According to Lynn White Jr., our modern ecological issues are rooted in the destruction of a pre-industrial, animistic belief system (White 1203). "Human ecology is deeply conditioned by beliefs about our nature and destiny" and our society will continue to exploit the environment unless we reject our fundamentally Judeo-Christian stewardship mentality (1205; 1207). This philosophy intensified during the Scientific Revolution when the "Baconian creed" dramatically altered our relationship to the land and humans began using scientific innovations to justify domination over nature (1203). Today, the dualistic relationship between humans and the land continues and is exemplified in the increasingly industrial agriculture system. Biodynamic farming presents an ideological solution to our technological and science-oriented society. Steiner's preparations ensure that farmers interact spiritually with the land, a component lacking in conventional agriculture techniques.

Impact of Reductionism on Environmental Ideology

Previous to European occupation and colonization of indigenous lands, religious practices of most native people on a global level resembled what anthropologists today call animism, or the belief in the omnipotent power of the natural world (Sponsel 9). This doctrine does not recognize a separation between the spiritual and natural and views the intricacies of ecosystems as sacred; all living and non-living beings are thought to possess souls. With a focus on processes of the natural world, animism emphasizes the role of humans within Earth's cycle, not as a controlling power. Fundamentally holistic,

animism promotes cooperation between humans and nature in order to maintain ecosystem health (12). Although not recognized as a prominent belief system in current society, aspects of animism are reflected in major religions today such as Christianity, Judaism, Islam, Hinduism, and Buddhism (10).

Animism differs from the Judeo-Christian ecophilosophy of stewardship, which teaches that it is the human responsibility to care for the world that God created (Swartz 106-107). A dualistic approach, stewardship distinguishes between humans and the natural world (White 1207). Alternatively, animism emphasizes that humans belong to and are controlled by the land and as a part of this system have a responsibility to maintain natural functions as other organisms do (Sponsel 11-12). Unfortunately, as compared to stewardship, animism struggles to achieve reputability in our modern society; because of its historical context it is generally disregarded as archaic. Nevertheless, relatively modern ecophilosophies argue that a movement towards an animistic mindset may be essential in the transformation to a more sustainable world (11).

Historically, an animistic belief system has not prevented societies from reshaping natural environments. Native Americans, for example, burned and cleared forest spaces in order to maintain natural cycles conducive to their nomadic lifestyles (Cronon 12). By removing portions of the forest underbrush, they promoted biodiversity and thriving ecosystems, which in turn provided food to hunt. Traditional societies in the Amazon created hunting restrictions for animals such as the harpy eagle, jaguar, and dolphin because an extinction of these species would be a detriment to specific food chains and ultimately the human population (Sponsel 15). These practices are fundamentally

different than European manipulation of the environment in that there is a focus on maintaining natural cycles, not taking advantage of resources to the point of depletion. Although many indigenous groups altered the earth's ecosystems, they did so in a way that closed the nutrient cycle because "ecological diversity, whether natural or artificial meant abundance, stability and a regular supply of the things that kept them alive" (Cronon 53).

Colonization and westernization of indigenous land and culture led to a fundamental change in the human perspective of nature. Among many reasons for the transformation to a technology and science-based society, the Scientific Revolution in the 17th century and the Industrial Revolution of the 18th century are monumental (White 1203). Scientific and philosophical progress during these eras reshaped society to cultivate a materialistic, reductionist, and fragmentation-based mindset that dominates mainstream culture today (Kirschenmann 2).

The Scientific Revolution is generally attributed to great minds such as Galileo, Descartes, Newton, and Bacon (Kirschenmann 2). By changing the way we viewed science, these men indirectly transformed the human relationship with the land to a dualistic approach, which separated society from the natural world. Scientists such as Francis Bacon considered ecology to be a waste of time and René Descartes taught that in order to find truth one must understand the human mind as a purely mechanical system. Furthermore, Descartes' theory of reductionism pioneered the concept that the whole is merely a sum of its parts, which ideologically separated humans from nature (3). These theories shifted societal values and promoted fragmentation; instead of seeing the world as a series of relationships, we learned to dissect concepts that are inherently part of a

system. This can be seen in Western education, business practices, and mainstream farming methodology (3).

Changes in agricultural theory due to an industrial transformation can be traced back to 1840 when scientists such as Justus von Liebig explored the use of synthetic fertilizers to cater to the increasing population (Kirschenmann 5). These innovations, along with genetic crop improvements attributed to Gregor Mendel, eliminated the natural processes inherent in pre-industrial agriculture and undermined holistic farming methods (Borlaug 1). From this school of thought came the industrialization of agriculture, more specifically the mechanization of the labor force, increased plot sizes, disappearance of crop rotation systems, and synthetic fertilization as a means to boost yields and ultimately raise revenues (Kirschenmann 5).

Importance of Spirituality in Biodynamic Agriculture

A large portion of Rudolph Steiner's ideology stems from his studies with Johann Wolfgang von Goethe. Goethe disputed the reductionist ideals of Descartes and Bacon and believed that a whole could not be reduced to the sum of its parts (Sponsel 66). He understood nature as a holistic and dynamic entity and viewed environmental processes through a spiritual lens. Steiner was interested in Goethe's theories, which partially inspired his own philosophy: anthroposophy. This mindset was reflected in his agriculture lecture series, an anomaly in a time when "materialist" science prevailed and industrial agriculture was gaining popularity (Kirschenmann 5). Steiner argued that agriculture should be rooted in natural systems twenty years before the modern organic agriculture movement began (5).

Steiner's biodynamic farming theory presents a component not present in conventional organic farming methodology. In seeing nature as a sacred entity and humans as members of the natural cycle, biodynamic farms strive to create healthy ecosystems, respond to Earth's needs, and find the human niche in nature. Steiner explains that "We are really so closely linked to the world that we cannot take a step into nature without falling under the direct influence exercised on us by our intimate relationship with everything" (Steiner *Spiritual Ecology* 89). His interpretation of "everything" included not only all organisms on earth, but also the cosmos and spiritual surroundings. Biodynamic preparations focus on mystical elements because Steiner understood spirituality as an important aspect in a field dominated by scientific and capitalistic motives (89). This specific farming system reflects ideologies found in indigenous wisdom, deep ecology, ecofeminism, and other radical ecophilosophies; it invites farmers to embrace their role in nature and contribute to ecological processes on a much deeper level than found in conventional and often organic farming methodology (Sponsel 11).

Naoimh McMahon's case study in Ireland outlines this sense of place emphasized by interviews with six Irish biodynamic farmers (McMahon 98). The farmers noted the significance of human interactions with nature, arguing that the use of machinery and synthetic chemicals is ineffective. One interviewee explained how the biodynamic preparations synched her psyche to the processes of the farm, giving her a near spiritual experience. McMahon argues that these farmers view their lifestyle as a religion and their participation in cosmic processes and mystic preparations as spiritual encounters (101).

Important to these farmers is building a relationship with a land, possessing a sense of place, and contributing positively to environmental processes (Demeter International).

Part 3: Conclusion

Wes Jackson, founder and president of The Land Institute, explains that a large-scale shift towards sustainable agriculture can only begin with a reversal of our cultural ideology (Jackson 75). He argues that the crisis brought by industrial agriculture will end when we begin "emphasizing nature's wisdom over human cleverness" (75). Jackson stresses the importance of cultivating the connection between humans and the land that existed in the pre-industrial agrarian lifestyle (Jackson 65). The practices stemming from our industrial mindsets are problematic, especially in the agricultural realm where soil depletion, pollution, and economically inefficient systems are steadily becoming the norm. Steiner's biodynamic system presents a more sustainable and economically viable agriculture methodology that promotes a change in society's pervasive and unsustainable ideology.

Ecological issues associated with industrial agriculture, both conventional and organic, transpire because environmental externalities are not internalized by corporate and government authorities (Kimbrell 21). Consequently, increasing industrial control over the agriculture sphere has had drastic implications for farmland, neighboring ecosystems, and human health. This, however, is not the case for biodynamic agriculture, which is rooted in the recognition of environmental externalities (Leiber, Fuchs and Spiess 141). Inherent in the biodynamic system is an aim to close the nutrient loop, a goal not emphasized in conventional agriculture. In this way, Steiner's methodology offers an alternative to the ecological destruction promoted by corporations and government policy.

As our society does not internalize ecological externalities, industrial agriculture practices are often less cost efficient and productive than alternative farming methods (Altieri *Agroecology* 182-183). Billions of taxpayer and government dollars go towards subsidies that cause ecological damage, which is then remediated with additional funds (Kimbrell 18). Moreover, studies have shown that alternative farming methods are actually more productive in terms of overall yields than conventional farming practices (21). As a result, biodynamic agriculture offers a system that is not only economically viable, but also economically preferable to industrial techniques that increasingly define our agriculture system.

Our modern crisis is also of an ideological nature, a problem for which biodynamic farming may have the cure. Many indigenous belief systems and radical ecophilosophies understand the environment as inherently connected the human race; people are a part of natural cycles and therefore have a responsibility to promote thriving, healthy ecosystems (Sponsel 11). A reversal of this thought took place during the Scientific Revolution, shifting the mainstream mindset towards reductionism, which psychologically divided humans from nature (White 1203). Reclaiming this holistic belief system is what biodynamic agriculture aims to do. With a focus on spiritual cycles and sacred preparations, Steiner's followers embody a deep sense of connection to the land. Biodynamic agriculture offers something that cannot be recreated in industrial farming or even on many small, natural farms.

In William Cronon's article "The Trouble with Wilderness; or Getting Back to the Wrong Nature" he argues that the pervasive conception of nature in modern society is fundamentally flawed (69-90). In order to create the parks preserved as "wilderness"

humans had to redefine nature as being pristine or "humanless." This disconnect, Cronon explains, has come to define our modern culture (79). We see this dualism specifically in agriculture where machinery has come to replace the human labor force and surrounding ecosystems are separated from farming sites by property lines. Biodynamic agriculture offers a method superior to both conventional and big organic agriculture because it combats this mindset and thus prevents ecological damage and economic instability. Steiner's ideology incorporates surrounding landscapes and understands humans as part of the system. It offers something new, something wholesome and something imperative. If society hopes to combat daunting environmental issues such as global climate change, we have to start small-scale with systems such as biodynamic farming that systematically instigate ecological, economic, and ideological sustainability.

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