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Sociology, Organic Farming, Climate Change and Soil Science

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Contents

Chapter 1
Society Issues, Painkiller Solutions, Dependence and Sustainable Agriculture

Eric Lichtfouse

Abstract Here I tackle three major issues, climate change, financial crisis and national security, to disclose the weak points of current remedies and propose sustainable solutions. Global warming and the unexpected 2008 financial crisis will undoubtedly impact all nations. Treating those two critical issues solely by painkiller solutions will fail because only adverse consequences are healed, not their causes. Therefore, all sources of issues must be treated at the same time by enhancing collaboration between politicians and scientists. Furthermore, the adverse consequences of globalisation of markets for energy, food and other goods have been overlooked, thus deeply weakening the security of society structures in the event of major breakdowns. Therefore, dependence among people, organisations and nations must be redesigned and adapted to take into account ecological, social and security impacts. Solving climate, financial and security issues can be done by using tools and principles developed by agronomists because agronomy integrates mechanisms occurring at various space and time levels. Agriculture is also a central driver for solving most society issues because society has been founded by agriculture, and agriculture is the activity that provides food, renewable energies and materials to humans. I present a to-do list summarising the major practices of sustainable agriculture based on about 100 recently published review articles. The practices are agroforestry, allelopathy, aquaculture, beneficial microorganisms and insects, biofertilisation, biofuels, biological control, biological nitrogen fixation, breeding, carbon sequestration, conservation agriculture, crop rotation, cover crops, decision support systems, grass strips, integrated pest management, intercropping, irrigation, mechanical weed control, mulching, no tillage, organic amendments, organic farming, phytoremediation, precision agriculture, seed invigoration, sociology, soil restoration, suicidal germination, terracing, transgenic crops, trap crops, and urban agriculture.

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Mahatma Gandhi listed seven blunders of humanity: Wealth without work, Pleasure without conscience, Commerce without morality, Worship without sacrifice, Politics without principles, Knowledge without character, and Science without humanity.

1.1 Financial Crisis, Climate Change and the Painkiller Solution

Society is actually experiencing an unexpected financial crisis that will undoubtedly impact all nations (Beyond Growth 2008). It will affect in particular the poorest countries that are already suffering from hunger and diseases. Governments are attempting to heal this issue by injecting large amounts of money in banking systems and major companies. At the same time, effects of climate change are accelerating and deeply altering ecosystems (IPCC 2007). Recent alarming reports even warn that it is already too late to stop global warming, though the forecasted value of the warming in degree Celsius and the date at which it will occur are still debated (Vince 2009). Given the urgency, geoengineering – the notion that to save the planet we must artificially tweak its thermostat by, e.g., firing fine dust into the atmosphere to deflect sun rays – is even gaining cause as a rapid solution to the attempt of cooling the earth (Brahic 2009). Injecting government cash and geoengineering are both urgent actions that may indeed temporarily heal the financial market and the effects of climate change. Nonetheless, those two strategies suffer from the same drawback. Both are “fireman” or “painkiller” solutions, meaning that only adverse consequences are treated, not the cause of those effects (Lal, 2009a; Lichtfouse 2009a).

1.2 Enhancing Politician and Scientist Collaboration

Treating solely negative effects without treating sources will undoubtedly fail in the long run. Therefore, I strongly advice politicians and other policy makers to treat the source of the adverse effects. This can be done by closer collaboration with scientists. It is indeed unacceptable that almost nothing has been done to counteract global warming before 2007, knowing that the Nobel Prize winner Svante Arrhenius has clearly predicted in 1896 – more than a century ago – that temperature will rise of about +5°C as a result of fossil fuel burning (see Lichtfouse 2009b and references therein). In the next section, I discuss dependence, another critical and overlooked factor, and its implication on the security of our society.

1.3 Rethinking Society Dependence

Globalisation of the market for food, fuels and other goods has undoubtedly induced positive effects such as lowering prices and fostering collaborations among citizens and nation. However, it has also induced serious dependence problems such as a sharp increase of maize prices in Mexico following the fast-rising use of maize as biofuels in northern countries. Another striking example is the peak of petroleum prices that has impacted almost all nations. A recent failure of the European electricity grid resulting in thousands of home without current for several days further illustrates the weaknesses of global dependence. We also know that crop control with pesticides is contaminating drinking water, even many years after the ban of those pesticides (Barth et al. 2009), and so on. As a result, though we live at a time of outstanding technology, the excess of dependence created by wild globalisation has strongly weakened our society. In case of major catastrophic events, the society structures were probably more secure 100 years ago because most people were farmers, producing and consuming locally. The fundamental sources of our actual society issues are evidenced in the visionary article by Dr. Rattan Lal, entitled *Tragedy of the global commons: soil, water and air* (Lal, 2009b).

Though this is a very sensitive topic because dependence is the basis of most public and private organisations, the adverse effects of dependence have been largely overlooked because benefits such as growth and profit have predominated until now. Environmental, social and security impacts have indeed not been taken into account. Therefore, we should rethink dependence. More specifically, the production of food, fuels and other goods, their transportation and their selling should be redesigned and controlled to lower dependence among people and nations. For instance, producing and consuming food more locally will both reduce dependence and decrease the ecological footprint of long-range transportation. Switching partly to renewable, locally produced energies will also produce a similar positive effect.

Of course, less dependence does not mean no dependence and no collaboration among people and nations. The degree of dependence should be adapted to the nature of goods or energy, their transportation, selling, ecological footprint, and social impact. Some goods may be distributed globally without weakening the nations, others may not be so. Obviously, the southern, poorest nations should be at the same time supplied with food and helped to produce their own food and energy. Scientists and policy makers should therefore study, assess and enforce the relevant level of goods circulation. Here, the tools developed by agronomists to build sustainable farming systems should be particularly useful because agriculture is the foundation of society (Lal, 2009c; Lichtfouse et al. 2009a). Agronomists are indeed experts at deciphering mechanisms occurring at various scales, from the molecule to the global scale, and from seconds to centuries.

Agronomy should thus be used as a core tool to build a sustainable society. Table 1.1 gathers the major practices of sustainable agriculture, and their main benefits. It should thus help readers to build rapidly an overall vision of the current innovative tools and approaches to build a sustainable world.

Table 1.1 Practices of sustainable agriculture. Most citations are review articles published in the following books: *Sustainable Agriculture* (Lichtfouse et al. 2009b); *Sustainable Agriculture Reviews*, vol 1 Organic farming, pest control and remediation of soil pollutants (Lichtfouse, 2009c); *Sustainable Agriculture Reviews*, vol 2 Climate change, intercropping, pest control and beneficial microorganisms (Lichtfouse, 2009d*); Sustainable Agriculture Reviews*, vol 3 Sociology, organic farming, climate change and soil science (Lichtfouse, 2009e, this volume)

Practices	Benefits	References
Agroforestry Homestead agroforestry	Carbon sequestration Diversification Disease control Employment Food security Higher biodiversity Higher relative plant density Less soil erosion Mitigate climate change Nutrient recycling Pest control Water quality	Carruba and Catalano (2009) Etchevers et al. (2009) Lal (2009e) Malézieux et al. (2009) Miah and Hussein (2009) Palaniappan et al. (2009) Spiertz (2009) Zuazo and Pleguezuelo (2009)
Allelopathy Biofumigation Biopesticides Hormones Plant growth regulators and other biochemicals	Adaptation to climate change Decreasing costs Drought tolerance Food security Increase water uptake Less pesticides Weed control	Aroca and Ruiz-Lozano (2009) Biesaga-Kocielniak and Filek (2009) Farooq et al. (2009a, b) Kalinova (2009) Khan et al. (2009b) Martínez-Ballesta et al. (2009) Runyon et al. (2009) Wu et al. (2009)
Aquaculture	Diversification Food security Recycling farm wastes	Palaniappan et al. (2009)

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Table 1.1 (continued)

Practices	Benefits	References
Beneficial microorganisms and insects	Bioremediation Biosensors Cheaper fertilisation Disease control Drought tolerance Increasing nutrient uptake Increasing plant growth Pest control Phytoremediation Pollinisation	Aroca and Ruiz-Lozano (2009) Bonilla and Bolaños (2009) Deguine et al (2009) Gamalero et al. (2009) Garg and Geetanjali (2009) Ghorbani et al. (2009a) Gregoire et al. (2009) Holb (2009) Joner and Leyval (2009) Khan et al. (2009a, b) Latour et al. (2009) Saha (2009) Viebahn et al. (2009) Wrage et al. (2009) Yair et al. (2009)
Biofertilisation Biofortification Foliar sprays	Disease resistance Drought resistance Higher micronutrient levels Less malnutrition Improving human health Salt resistance	Bonilla and Bolaños (2009) Dordas (2009) Farooq et al. (2009a) Ghorbani et al. (2009a) Viebahn et al. (2009) Wrage et al. (2009) Zuo and Zhang (2009)
Biofuels	Carbon neutral Higher biodiversity Local source of energy Mitigate climate change Renewable fuels	Ceotto (2009) Lal (2009d, e) Hill (2009) Miah and Hussein (2009) Scholz et al. (2009)
Biological control (see also beneficial organisms and insects)	Cheap control Disease control Higher biodiversity Less or no pesticide Pest control Wildlife conservation	Askary (2009) Clergue et al. (2009) Deguine et al (2009) Ferron and Deguine (2009) Ghorbani et al. (2009b) Holb (2009) Latour et al. (2009) Viebahn et al. (2009) Yair et al. (2009)
Biological nitrogen fixation (see also cover crops)	Alternative fertilisation Food security Increases plant growth Increases soil N Less, no mineral fertilisers Local fertiliser Mitigate climate change Nutrient recycling	Bonilla and Bolaños (2009) Garg and Geetanjali (2009) Khan et al. (2009b) Knörzer et al. (2009) Rodiño et al. (2009) Spiertz (2009)

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Table 1.1 (continued)

Practices	Benefits	References
Breeding Recurrent mass selection	Adaptation to climate change Disease resistance Drought resistance Genetic diversity Salinity resistance	Banilas et al. (2009) Carruba and Catalano (2009) Hejnak et al. (2009) Marais and Botes (2009) Martínez-Ballesta et al. (2009)
Carbon sequestration (see also organic amendments)	Decreases erosion Higher nutrient retention Higher soil biodiversity Higher water retention Mitigate climate change Offset CO_2 emissions Prevent desertification	Anderson (2009b) Erhart and Hartl (2009) Benbi and Brar (2009) Bernoux et al (2009) Etchevers et al. (2009) Füleky and Benedek (2009) Ghorbani et al. (2009b) Lal (2009c, d, e, f) Malézieux et al. (2009) Nguyen (2009) Pati et al. (2009) Shaxson (2009) Stagnari et al. (2009)
Conservation agriculture	Air, soil and water protection Biodiversity conservation Decreases erosion Decreases pollution Higher water retention Improves soil structure Mitigates climate change Reduces farm costs Reduces flooding Reduces work time	Palaniappan et al. (2009) Stagnari et al. (2009)
Crop rotation	Biofertilisation Enhances soil organic matter Increases biodiversity Increases soil N Increases water use efficiency Plant disease control Water conservation Weed control	Anderson (2009a, b) Dordas (2009) Erhart and Hartl (2009) Ghorbani et al. (2009a) Kalinova (2009) Lal (2009e) Spiertz (2009) Stagnari et al. (2009)
Cover crops	Improves fertility Improves water availability Nutrient recycling Reduces costs Soil erosion and runoff control Weed control	Kalinova (2009) Malézieux et al. (2009) Pati et al. (2009) Runyon et al. (2009) Stagnari et al. (2009) Wu and Sardo (2009) Zuazo and Pleguezuelo (2009)

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Table 1.1 (continued)

Practices	Benefits	References
Decision support systems Farming systems Indicators Land husbandry Modelling	Assess sustainability Design sustainable practices Integrate various sciences Integrate space and time levels Forecast farming system evolution Forecast impacts Optimise ecological benefits Optimise performance	Barth et al. (2009) Bockstaller et al. (2009a, b) Clergue et al. (2009) Debaeke et al. (2009) Doré et al. (2009) Duru and Hubert (2009) Faivre et al. (2009) Handayani and Prawito (2009) Karami and Keshavarz (2009) Mir and Qadrri (2009) Roger-Estrade et al. (2009) Sadok et al. (2009) Shaxson (2009) Veldkamp et al. (2009) Wu and Sardo (2009) Zamykal and Everingham (2009)
Grass strips Buffering strips Filtering strips Artificial wetlands	Degrade pesticides Reduce soil erosion Reduce water pollution	Gregoire et al. (2009) Lacas et al. (2009) Wu and Sardo (2009)
Integrated pest management	Decreases pesticide input Decreases pollution Decreases cost	D'Addabbo et al. (2009) Deguine et al. (2009) Ferron and Deguine (2009) Holb (2009) Wu and Sardo (2009)
Intercropping Alternative crops	Aesthetic value Biofortification Diversification Decreases erosion Increases biodiversity Increases yield Increases soil nitrogen Recycles nutrients Pest control Plant disease control	Carruba and Catalano (2009) Deguine et al. (2009) Dordas (2009) Etchevers et al. (2009) Kalinova (2009) Knörzer et al. (2009) Malézieux et al. (2009) Palaniappan et al. (2009) Spiertz (2009) Zuo and Zhang (2009)
Irrigation Drip irrigation	Food security Saves water	Hillel (2008) Lal (2009e) Palaniappan et al. (2009) Wu and Sardo (2009)

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Table 1.1 (continued)

Practices	Benefits	References
Mechanical weed control Solarisation Flaming Heating	Disease control Food security Increases yield Increases plant growth Improves water availability Increases soil nutrients Less or no herbicides Weed control	Anderson (2009a) Carruba and Catalano (2009) Chicouene (2009) D'Addabbo et al. (2009) Holb (2009)
Mulching (see also Organic amendments and Carbon sequestration)	Improves soil structure Prevents frost damage Soil water conservation Soil temperature moderation Weed control	D'Addabbo et al. (2009) Kalinova (2009) Lal (2009e, f) Shaxson (2009) Wu and Sardo (2009)
No tillage Reduced tillage Conservation tillage Direct seeding	Disease control Improves soil structure Increases biodiversity Increases carbon sequestration Mitigates climate change Reduces erosion Reduces farm costs Reduces work time Water retention	Anderson (2009a, b) Bernoux et al. (2009) Deguine et al. (2009) Etchevers et al. (2009) Ghorbani et al. (2009a) Lal (2009e, f) Pati et al. (2009) Roger-Estrade et al. (2009) Scholz et al. (2009) Shaxson (2009) Stagnari et al. (2009) Wu and Sardo (2009)
Organic amendments Sewage sludge Manure Organic mulch Biochar Biosolid Compost Crop residues Wood, etc. (see also carbon sequestration)	Buffer soil temperature Cheap fertilisation Carbon sequestration Disease control Decreases erosion Increases microbial activity Increases yield Improves soil structure Mitigates climate change Recycles waste Stores soil nutrients Water retention	Baize (2009) Bernoux et al. (2009) Dordas (2009) Etchevers et al. (2009) Erhart and Hartl (2009) Füleky and Benedek (2009) Ghorbani et al. (2009a, b) Gresta et al. (2009) Holb (2009) Kalinova (2009) Lal (2009e) Palaniappan et al. (2009) Pati et al. (2009) Saha (2009) Scholz et al. (2009) Shaxson (2009) Sigua (2009) Spiertz (2009) Stagnari et al. (2009)

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Table 1.1 (continued)

Practices	Benefits	References
Organic farming	Carbon sequestration Decreases erosion Disease control Food security Increases biodiversity Increases fertility Increases soil carbon Increases soil nitrogen Higher soil quality Improves soil structure Mitigates climate change Recycles nutrients Social improvement	Erhart and Hartl (2009) Füleky and Benedek (2009) Ghorbani et al. (2009a, b) Handayani and Prawito (2009) Holb (2009) Kalinova (2009) Lamine and Bellon (2009) Saha (2009) Spiertz (2009) Winter and Davis (2007) Wu and Sardo (2009)
Phytoremediation (see also grass strips)	Aesthetic improvement Cleans soil, water and air Decreases pollutant bioavailability Decreases pollutant toxicity Decreases pollutant concentration Degrades organic pollutants Extracts metals from soils Low-cost remediation Socially-acceptable reclamation	Al-Najar et al. (2005) Babula et al. (2009) Baraud et al. (2005) Harvey et al. (2002) Joner and Leyval (2009) Khan et al. (2009b) Morel et al. (1999) Rodriguez et al. (2005) Scholz et al. (2009) Wahid et al. (2009)
Precision agriculture Robotic agriculture	Disease control Manages crop variability Manages crop conditions variability Optimises fertilisation Optimises watering Weed control	Sardo (2009) Unibots Wu and Sardo (2009) Zamykal and Everingham (2009)
Seed invigoration	Dormancy management Drought resistance Flood resistance Increases yield Low temperature resistance Salt stress resistance	Farooq et al. (2009a, b)
Sociology Indigenous knowledge	Behaviour, attitude approach Better adoption of practices Eco-protection Ecological modernisation Equity Human dimension, traditions Integrated, holistic approach Integrates economic factors Integrates people culture, religions Resource-conserving practices Tackles sources of issues	Handayani and Prawito (2009) Karami and Keshavarz (2009) Palaniappan et al. (2009) Wu and Sardo (2009)

(continued)

Table 1.1 (continued)

Practices	Benefits	References
Soil restoration	Decreases desertification Decreases poverty and hunger Decreases soil erosion Disease control Food security Increases biodiversity Increases yield Improves water quality Less pollutants	Anderson (2009b) Baize (2009) Barth et al. (2009) Bernoux et al. (2009) Changwen and Jianmin (2009) Etchevers et al. (2009) Erhart and Hartl (2009) Ghorbani et al. (2009a, b) Handayani and Prawito (2009) Knörzer et al. (2009) Lal (2009a, b, c, d, e, f) Pati et al. (2009) Roger-Estrade et al. (2009) Saha (2009) Sigua (2009) Shaxson (2009) Wrage et al. (2009)
Suicidal germination	Parasitic plant control	Runyon et al. (2009)
Terracing	Carbon sequestration Increases yield Soil erosion control	Doumbia et al. (2009) Zuazo and Pleguezuelo (2009)
Transgenic crops	Biopesticide Drugs, vaccines Easier weed control Higher income Increase yield Insect management Less pesticide treatments Reduced tillage	Bonny (2009) Deguine et al. (2009) Devos et al. (2009) Graef (2009) Marvier (2009) Sanchis and Bourguet (2009) Torres et al. (2009)
Trap crops	Pest control	Deguine et al. (2009) Kalinova (2009) Runyon et al. (2009) Torres et al. (2009)
Urban agriculture Local agriculture	Food security Lower prices Less environmental footprint Less transportation Local production and use Mitigates climate change Recycles wastes Provides employment	De Bon et al. (2009) Miah and Hussein (2009)

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Chapter 2
Sociology of Sustainable Agriculture

Ezatollah Karami and Marzieh Keshavarz

Abstract Sustainability is the core element of government policies, university research projects, and extension organizations worldwide. Yet, the results of several decades of attempt to achieve sustainable agriculture have not been satisfactory. Despite some improvement conventional agriculture is still the dominant paradigm. Pollution of water, soil, and air, degradation of environmental resources, and loss of biodiversity are still the by-product of agricultural systems. In light of these crises, based on review of current literature, it is argued that in promoting sustainable agriculture our perception should shift from a technocratic approach to a social negotiation process that reflects the social circumstances and the power conditions. Agriculture should be regarded as an activity of human; therefore, it is social as much as it is agronomic and ecological. Therefore, here we explore the contribution of sociology toward achieving agricultural sustainability. The review reveals that agricultural sustainability can no longer ignore the human dimension and social dynamics that are the core elements of agricultural development. Although the agricultural and ecological sciences are vital, social sciences must play their role to analyze the human dimension, which is central to understanding and achieving agricultural sustainability. The contributions of sociology of sustainable agriculture are exploring the relationship between farmers' attitudes and their sustainable farming practices, understanding the gender impact, offering different sustainability paradigms, providing different models of predicting adoption of sustainable practices, and finally informing decision makers regarding the social impacts of their sustainability decisions. Major findings are discussed and appropriate recommendations are provided.

Keywords Sociology • Sustainable agriculture • Climate change • Attitude • Human dimension • Social construct • Culture • Behavior • Adoption

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2.1 Introduction

Even though agriculture has made great progress in feeding the ever-increasing population, still it faces serious problems and challenges. Some of these challenges such as food production to feed the undernourished and increasing demand for poverty alleviation have been with us for a long time and will continue to be in foreseeable future. Food production will have to increase, and this will have to come mainly from existing farmland. Many predictions are gloomy indicating that gap between demand and production will grow. Population growth, urbanization, and income growth in developing countries are fueling a massive global increase in demand for food.

Sustainability, climate change, and replacing fossil fuels with renewable energy are relatively new challenges for agriculture. Overuse and inappropriate use of agrochemicals have led to contamination of water, loss of genetic diversity, and deterioration of soil quality (Rasul and Thapa 2003). Sustainability is not only a challenge in itself, but also a new worldview, a paradigm, which has changed our understanding of agriculture. This new paradigm seriously questions our conventional ways of solving agricultural problems and challenges. High external input or "modern agriculture," which once was the promising approach to agricultural production, is now considered to be unsustainable. There is consensus that modern agriculture has diminished the importance of farming as a way of life, and creates certain problems such as ecological degradation (Alhamidi et al. 2003). There is also a growing skepticism about the ability of modern agriculture to increase productivity in order to meet future demand. Sustainable agriculture as a concept has emerged to address the challenges that are facing modern agriculture (Karami 1995).

Some researchers define sustainable agriculture primarily as a technical process. Altieri (1989) defined sustainable agriculture as a system, which should aim to maintain production in the long run without degrading the resources base, by using low-input technologies that improve soil fertility, by maximizing recycling, enhancing biological pest control, diversifying production, and so on. The technological and to a lesser extent economic dimensions of sustainable agriculture have tended to be privileged while the social dimension has been neglected. As a result sustainable agricultural has suffered from limited adoption. This paper argues that the way out of current crisis of promoting sustainable agriculture is to shift our perception from a technocratic approach to a social negotiation process that reflects the social circumstances and the power conditions in a specific region at a specific time (Blaschke et al. 2004). If one accepts the argument that the concept of sustainability is a "social construct" (Webster 1999) and is yet to be made operational (Webster 1997; Rasul and Thapa 2003), then sociology has a great deal to offer toward achieving agricultural sustainability. Understanding what agriculture and sustainable agriculture are, is a prerequisite to understand the sociology of sustainable agriculture.

2.2 Definition of Agriculture

The first point to clarify is: "What is agriculture?," of course, there is general agreement about the sorts of things, people, plants, and animals that can be called agricultural, but this is not good enough if we are seriously interested in topics such as the role of science in agriculture, the role and importance of agriculture in the world, and how agricultural efficiency can be improved (Speeding 1988). Not many attempts have been made to be more precise and it is quite difficult to arrive at a definition that is both useful and specific. One of the useful definitions is phrased by Speeding (1988, 1996) as follows: "agriculture is an activity *of Man*, carried out primarily to produce food, fiber and fuel, as well as many other materials by the deliberate and controlled use of mainly terrestrial plants and animals."

The terms "agriculture" and " agricultural system" are used widely to encompass various aspects of the production of plant and animal material of food, fiber, and other uses. For analysts with a narrow vision, these terms are limited to the cultivation of soil and growth of plants. But for others, the terms also include financing, processing, marketing, and distribution of agricultural products; farm production supply and service industries; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system (CAESS 1988). Since agriculture involves economics, technology, politics, sociology, international relations and trade, and environmental problems, in addition to biology it can be concluded that agriculture is social as much as agronomic and ecological. Taking a broad interpretation, agriculture is a system of processes that take place within a threefold environmental framework, biophysical environment, socio-political environment, and economic and technological environment. Together, these three sets of factors set the broad constraints within which individuals, groups, and governments engage in production, distribution, and consumption components of agriculture. These three sets of constraints for agriculture also provide a means of assessing conditions for sustainable agriculture (Yunlong and Smith 1994).

Agricultural sciences can no longer ignore the human intentionality and social dynamics that are the roots of our predicament. Although the natural sciences, and especially the earth and life sciences, remain of vital importance, not least to monitor and analyze the dynamics of "nature" so as to inform normative frameworks for sustained land use (De Groot 1992), social sciences must play their role among the agricultural sciences to analyze human activity as emergent from intentionality and greed, economic systems, human learning, and agreement (Roling 1997). We acknowledge that agricultural systems are human systems, so that "what is sustainable" will also be value laden. Agricultural systems are distinctive in those changes in values and attitudes of farmers, managers, and other stakeholders, and externally imposed risk, e.g., climate interaction (Karami and Mansoorabadi 2008).

2.3 The Human Dimension of Agricultural Sustainability

The human element is not one third of sustainability; it is central to its implementation (Pearson 2003). The challenge of sustainability is neither wholly technical nor rational. It is one of the change in attitude and behavior. Sustainability therefore must include the social discourse where the fundamental issues are explored collaboratively within the groups or community concerned. We do not do that very well, partly because of increasing populations, complexity, distractions, and mobility, but more because of certain characteristics of the dominant paradigm that are seen as desirable (Fricker 2001).

Social constructionists and philosophers have shown that we can never truly "know" nature, as our understandings of nature are shaped by the social and cultural lenses through which we see the world. This is not to argue that "there is no real nature out there," but instead that our knowledge of nature will always be, at least partly, social (see Cronon1996; Escobar 1996). In opening nature to public attention specialists have relinquished their authority over the constitution and meanings of nature and allowed nature to be contested by a much wider variety of stakeholders (McGregor 2004). After all, the construct of a sustainable future may look very different to cultures and individuals with a tradition of a "be all you can be" philosophy as compared with those who ascribe to a "live and let live" philosophy (Goggin and Waggoner 2005). Environmental imaginaries are highly contested and can be thought of as the ways in which a society collectively constructs, interprets, and communicates nature (McGregor 2004).

It is clear that rural sustainability is being undermined by agriculture, particularly as agriculture is the dominant user of rural land. However, in discussing sustainable agriculture, the ecological dimension has tended to be privileged while the social dimension has been neglected. The current economic and ecological crisis for agriculture has, therefore, opened up the space for a discussion of what sustainable agriculture might be, and how it might be operationalized. Social sustainability in much of rural areas is still to be sought through productivity agriculture. Thus, there continues to be a trade-off between ecological priority areas and the productivity pressures of the agricultural treadmill (Ogaji 2005).

Many research works underlined the importance of social and institutional factors for facilitating and achieving sustainable agriculture. Pretty (1995) had considered that local institutions' support and groups dynamics are one of the three conditions for sustainable agriculture. Roling (1994) has used the concept of platforms to emphasize the role of collective decision-making process in the ecosystems sustainability. Sustainable agriculture must be socially constructed on the basis of different perspectives and through stakeholders' interaction. As Roling and Jiggins (1998) observed, "ecologically sound agriculture requires change not only at the farm household, but also at the level of the institutions in which it is embedded" (Gafsi et al. 2006).

It is culture, which ultimately reproduces the heterogeneous pattern of farming and the meaning and shape of locality. There is a tendency to assume that as long as the proposed systems benefit the environment and are profitable, sustainability will be achieved and the whole of society will be benefited. However, what is produced, how, and for whom, are important questions that must also be considered if a socially sustainable agriculture is to emerge (Ogaji 2005).

Ikerd et al. (1998) explained that most farmers have not integrated the economic, ecological, and social aspects of sustainability into a holistic concept of sustainable agriculture. For den Biggelaar and Suvedi (2000), farmers may have a lack of information and awareness about sustainable agriculture and its multiple-dimensions (Gafsi et al. 2006).

The social dimension of sustainability addresses the continued satisfaction of basic human needs, food, and shelter, as well as higher-level social and cultural necessities such as security, equity, freedom, education, employment, and recreation (Altieri 1992). The provision of adequate and secure agricultural products (especially food), supplied on a continual basis to meet demands, is a major objective for sustainable agriculture (Altieri 1989). In the case of developing countries, more imperative demands are often basic household or community needs in the short term in order to avoid hunger. This is known as food sufficiency or carrying capacity problem. In developed countries, meeting demands more often means providing both a sufficient quantity and variety of food to satisfy current consumer demands and preferences, and to assure a safe and secure supply of food (Yunlong and Smith 1994).

The social definition of sustainability commonly includes the notion of equity, including intragenerational and intergenerational equity (Brklacich et al. 1991). The former refers to the affair and equitable distribution of benefits from resource use and agricultural activity among and between countries, regions, or social groups (Altieri 1989). The latter refers to the protection of the rights and opportunities of future generations to derive benefits from resources which are in use today (Crosson 1986). Agricultural production systems, which contribute to environmental deterioration are not considered to be sustainable as they pass on to future generations increases in production costs, together with reductions in income or food security. The two types of equity are sometimes related. For example, many subsistence farmers are forced to employ farming practices that provide immediate rewards, but also degrade the environment and thereby impair future generations' opportunities for sustainability (Yunlong and Smith 1994).

2.4 Achieving Sustainable Agriculture: Role of Sociology

Sociologists and other social scientists have played a significant role in the emergence, institutionalization, and design of sustainable agriculture. Sociologists and other social scientists have done particularly significant research on the adoption of resource-conserving practices. They have also made major contributions through their research into identifying user needs and implementation strategies relating to sustainable agriculture technology (Buttel 1993). For many scholars, sustainable agriculture lies at the heart of a new social contract between agriculture and society (Gafsi et al. 2006).

This paper argues that sociology and the other social sciences play an equally important and constructive role in understanding and achieving agricultural sustainability. Buttel (1993) suggests that this kind of application of sociology may be referred to as the sociology of agricultural sustainability. The major contribution of the environment-development debate is the realization that in addition to or in conjunction with these ecological conditions, there are social conditions that influence the ecological sustainability or unsustainability of the people–nature interaction (Lele 1991). Sometimes, however, sustainability is used with fundamentally social connotations. For instance, Barbier (1987) defines social sustainability as "the ability to maintain desired social values, traditions, institutions, cultures, or other social characteristics." This usage is not very common, and it needs to be carefully distinguished from the more common context in which social scientists talk about sustainability, viz., and the social aspects of ecological sustainability.

Sustainability as a social vision is, on the one hand, not only potentially acceptable, but does, in fact, meet with correspondingly broad approval across all societal groups and political positions, nationally and internationally. On the other hand, sustainability's conflict potential cannot be overlooked. As soon as relatively concrete goals or even strategies of societal action for attaining sustainability are put on the agenda – at the latest – it becomes obvious that the usual antagonistic societal values and interests are lurking behind the programmatic consensus (Grunwald 2004).

Despite the diversity in conceptualizing sustainable agriculture, there is a consensus on three basic features of sustainable agriculture: (i) maintenance of environmental quality, (ii) stable plant and animal productivity, and (iii) social acceptability. Consistent with this, Yunlong and Smith (1994) have also suggested that agricultural sustainability should be assessed from ecological soundness, social acceptability, and economic viability perspectives. "Ecological soundness" refers to the preservation and improvement of the natural environment, "economic viability" to maintenance of yields and productivity of crops and livestock, and "social acceptability" to self-reliance, equality, and improved quality of life (Rasul and Thapa 2003). Sociology of sustainable agriculture deals with the following issues:

- Paradigms used to interpret sustainability
- Sociological models developed to explain attitudes and behaviors toward sustainability
- Adoption of sustainable agriculture practices
- Gender and sustainable agriculture
- Social impact assessment and sustainable agriculture

These issues will be briefly dealt with in the following sections.

2.4.1 Sustainable Agricultural Paradigms

There are many different schools of thought about how to interpret sustainability (Colby 1989). Sustainable development incorporates the idea of transformations of relationships among people and between people and nature. Batie, however, believes that considerable tension exists between those schools of sustainable development thought that draw their strength from the ecological science paradigm and those from an economic science paradigm (Batie 1991). In her view the assumptions of the two main paradigms have the following differences. First, economic and ecological paradigms differ in their assumption as to relative scarcity. Economics incorporates a belief in almost unlimited possibility of substitution of human-made capital for natural resource capital, while ecologists tend to incorporate the idea of absolute scarcity and hence real limits to economic growth as a key assumption in their respective paradigms. The second major difference between the two paradigms stems from their perspectives of the economic and natural system (Karami 1995).

Another major school of thought can be termed "eco-protection" and is preservationist in nature, that is, it has an objective, the maintenance of the resource base, and it draws heavily from the ecological sciences (Batie 1991). In contrast to the economics of the driving paradigm of "resource management" that works with the world and its values as they are found, the eco-protectionists strive to change the world to be what they desire. Thus, within this perspective there is heavy emphasis on changing people's values, limiting population growth, and on redistribution of society's income and wealth. While the resource managers' goal may be to lift the poor closer to the rich through the adoption of nonpolluting, efficiency-enhancing technology, the eco-protectionist is more likely to advocate pulling the rich toward the poor through land tenure reform, redistribution of income, and adoption of appropriate small-scale technology (Batie 1991; Karami 1995).

Across all literatures, two broad paradigms of sustainability are identifiable: one supporting a systems-level reconstruction of agricultural practice to enhance biological activity, and the other adopting a technological fix, in which new technologies inserted into existing systems can improve sustainability outcomes (Fairweather and Campbell 2003).

Rezaei-Moghaddam et al. (2006) analyzed Ecological Modernization theory and the De-Modernization theory to provide a conceptual framework for sustainable agricultural development. They argue that Ecological Modernization and De-Modernization theories could be used to develop conceptual frameworks for sustainable agricultural development. The two approaches reviewed provided very different explanations of environmental change and they point in very different directions. The conceptual path based on De-Modernization theory has great concern for environmental protection and less attention to increased production. Agricultural development theory based on Ecological Modernization breaks with the idea that environmental needs are in conflict with agricultural production. It argues instead that agricultural productivity and growth and resolution of ecological problems can, in principle, be reconciled. Thus, it assumes that the way out of the negative environmental consequences of agriculture is only by going into the process of further modernizing agriculture. Evans et al. (2002) state that observed trends in agriculture could be viewed as part of a move toward Ecological Modernization and many of the trends with regard to food quality and safety and environmental management fit well into the Ecological Modernization. Contrary to conventional agriculture, an Ecological Modernization agricultural development theory emphasizes on introducing ecological criteria into the production and consumption process. It assigns an important role to science in the production process. Clean technology or what is known as "precision agriculture" is the key to achieve sustainable agricultural development. In contradiction with the De-Modernization agricultural development perspective, sustainable agricultural development under the Ecological Modernization perspective does not mean having less agricultural growth and production.

Rezaei-Moghaddam et al. (2006) emphasize that there is a growing consensus over the need for a shift in paradigm if sustainable agriculture is to be realized. A paradigm shift in agriculture is a change from one way of thinking about agriculture to another. It is a revolution, a transformation, and a sort of metamorphosis in the soft side of agriculture, which eventually will result in changes and the transformation of hard side of agriculture. Ecologically sound agriculture is a complex system, not only in terms of complex interactions among soils, crops, animals, and farming practices (hard system), but also in terms of human knowledge and learning, institutions, and policies (soft system).

2.4.2 Attitudes, Behaviors, and Sustainable Agriculture

Attitudes are defined as a disposition to respond favorably or unfavorably to an object, person, institution, or event. An attitude is (a) directed toward an object, person, institution, or event; (b) has evaluative, positive or negative, elements; (c) is based on cognitive sustainable agricultural attitudes and behaviors beliefs toward the attitude object (i.e., the balancing between positive and negative attributes of an object leads to an attitude); and (d) has consequences for behavior when confronted with the attitude object (Bergevoet et al. 2004; Karami and Mansoorabadi 2008).

Attitude is a predisposition to act in a certain way. It is the state of readiness that influences a person to act in a given manner (Rahman et al. 1999). Therefore, attitude surveys in agriculture could lead to a more adequate explanation and prediction of farmers' economic behavior and have been used on conservation and environmentally related issues focusing on the influence of attitude variables as predictors of conservation behavior (Dimara and Skuras 1999). Dimara and Skuras (1999) concluded from their research that a significant relationship was found between behavior and the goals and intentions of farmers. This relationship is even stronger when statements on attitudes, social norms, and perceived behavioral control are included (Bergevoet et al. 2004)

Calls for the study of farmers' behavior and what motivates that behavior are not new (Gasson 1973). However, the number of studies that have considered farmers' attitudes toward conservation (MacDonald 1984) is small. Fewer still have studied farmers' conservation actions. Potter (1986) points out that a very limited number have tried to link farmers' actions to their underlying motivations, notwithstanding the discourses on the conservation issues in the countryside (Beedell and Rehman 2000). Almost all studies related to the motivational elements of behavior have stressed that the decision to act in a certain way is affected by a "balancing" or weighing of a number of influences. Lemon and Park (1993) concluded that farmers, when