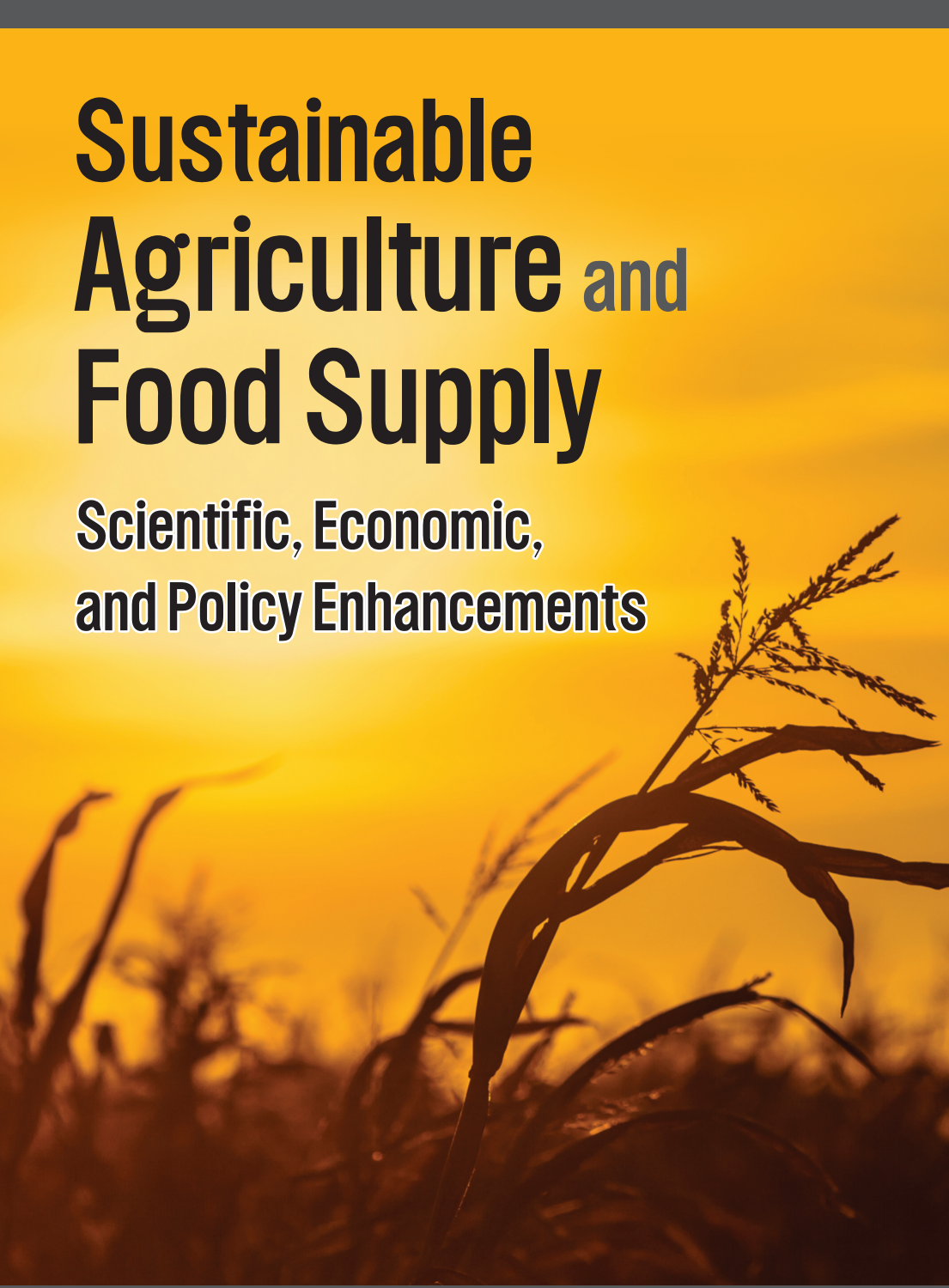
Sustainable Agriculture and Food Supply

Scientific, Economic, and Policy Enhancements



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Scientific, Economic, and Policy Enhancements

Edited by
Kim Etingoff

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Kim Etingoff has a Tufts University terminal master's degree in Urban and Environmental Policy and Planning. Her recent experience includes researching with Initiative for a Competitive Inner City, a report on food resiliency within the city of Boston. She worked in partnership with the Dudley Street Neighborhood Initiative and Alternatives for Community and Environment to support a community food-planning process based in a Boston neighborhood, which was oriented toward creating a vehicle for community action around urban food issues, providing extensive background research to ground the resident-led planning process. She has worked in the Boston Mayor's Office of New Urban Mechanics, and has also coordinated and developed programs in urban agriculture and nutrition education. In addition, she has many years of experience researching, writing, and editing educational and academic books on environmental and food issues.

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Acknowledgment and How to Cite

The editor and publisher thank each of the authors who contributed to this book. The chapters in this book were previously published in various places in various formats. To cite the work contained in this book and to view the individual permissions, please refer to the citation at the beginning of each chapter. Each chapter was read individually and carefully selected by the editor; the result is a book that provides a nuanced look at sustainable agriculture. The chapters included are broken into five sections, which describe the following topics:

Part 1: What Is Sustainable Agriculture?

- Chapter 1 provides an overview of sustainable agriculture, including similarities and differences in various actors' definitions.

Part 2: Sustainably Connecting Producers and Consumers

- Chapter 2 uses qualitative methods to investigate consumers' attitudes to organic food outlets in two different countries.
- Chapter 3 explores the determinants of both the production and consumption aspects of organic agriculture in South Africa in order to promote more effective relevant public policy.

Part 3: Localizing the Food System

- Chapter 4 outlines potential consumer information systems that enhance the ability of "citizen-consumers" to make healthy and sustainable choices.
- Chapter 5 uses a case study in the UK to highlight important food relocalization initiatives, namely greater governmental support of short food supply chains and intermediaries that can expand markets for producers.
- Chapter 6 argues for the need for localizing plant breeding to account for regional differences in food culture, and proposes farmer-breeder-chef collaborative models as possible methods for achieving this goal.
- Chapter 7 examines the effects of deciding to engage in local selling on the earned income of organic farms.

Part 4: Organic Food and the Human Element: Consumers & Farmers

- Chapter 8 looks at cost-effective alternatives to organic certification—specifically the Brazilian model of Participatory Guarantee Systems—and their effect on consumers interested in purchasing organic food.
- Chapter 9 compares multiple dimensions of sustainability of a case organic farm system in the UK with two model organic food supply systems, using energy accounting and Life Cycle assessment.
- Chapter 10 discusses the challenges that face organic grain production in Canada, including agronomic, environmental, and economic factors.

Part 5: The Future of Sustainable Agriculture

- Chapter 11 identifies twenty-six priority "knowledge needs" in the UK concerning the the creation and maintenance of environmentally sustainable agricultural systems based on input from practitioners and scientists.
- Chapter 12 provides a look at Swedish perceptions of sustainability in the food supply chain and the potential of biotechnology to increase food production and promote agricultural sustainability within that system.
- Chapter 13 argues for a clarified understanding and definition of climate-smart agriculture, which would include indicators and metrics that more easily measure sustainable food systems over time.

Introduction

Sustainable agriculture is an increasingly crucial concept and practice as we realize the ways in which our food systems contribute and respond to climate change. The sustainability of agriculture is a complicated, multi-dimensional issue, which should be considered from a variety of angles. This book engages with sustainable agriculture from the necessary perspectives of science, economics, sociology, and policy in order to move farming forward into a more promising and healthy future.

Part 1 tackles the deceptively difficult task of defining sustainable agriculture. Although there are many global initiatives that seek to increase the sustainability of farming and food chains, there is not always agreement on goals or methods. In chapter 1, Mary Gold discusses the meaning of the term "sustainable agriculture." She attempts to answer important questions such as, "In such a quickly changing world, can anything be sustainable?" "What do we want to sustain?" "How can we implement such a nebulous goal?" "Is it too late?" Her discussion forms a cogent and necessary foundation for the following chapters.

Part 2 considers both sides of sustainable agriculture: the producers and the consumers.

The purpose of chapter 2 is to elicit UK and Albanian consumers' perceptions of food outlets in order to understand their views on supermarkets and farmers' markets as outlets for organic food. Qendro chose a qualitative research methodology was chosen as the best way to get an in-depth understanding of how consumers of these two different countries understand and evaluate buying organic food from two different food outlets. This exploratory research is a first step to find out how and why organic food is being bought in supermarkets and farmers' markets. The results show that respondents associated organic with vegetables and fruit, that taste good, are healthy, and are free of pesticides and hormones. The importance of motives varies between the outlets they prefer for buying organic food. An interesting finding is the fact that Albanian respondents refer to the farmers' markets as the villagers' market.

The objective of chapter 2 is to provide, through an exploratory analysis of data from farm and households surveys, empirical insights into determinants of organic farming adoption, differentiating between fully-certified organic,

partially-certified organic and non-organic farmers; eliciting farmers risk preferences and management strategies and; exploring consumer awareness, perceptions and consumption decisions. By exploring a combination of adoption relevant factors in the context of real and important land management choices, Kisaka-Lwayo and Obi provide an empirical contribution to the adoption literature and provides valuable pointers for the design of effective and efficient public policy for on-farm conservation activities. Similarly, achieving awareness and understanding the linkage between awareness and purchasing organics is fundamental to impacting the demand for organically grown products. Consumer awareness of organic foods is the first step in developing demand for organic.

In Part 3, the prominent topic of localizing food systems is addressed. Local agriculture is a visible and key part of the discussion surrounding sustainable agriculture.

In chapter 5, Levidow and Psarikidou outline key short-, medium-, and long-term initiatives to facilitate the citizen-consumer phenomenon and better support consumers in their efforts to promote health and sustainability in the Canadian food system. Both health and sustainability are stated public policy objectives in Canada, but food information rules and practices may not be optimal to support their achievement. In the absence of a stated consensus on the purposes of public information about food, the information provided is frequently determined by the marketers of product. No institution or agency has responsibility for determining the overall coherence of consumer food messages relative to these broader social goals of health and sustainability. Individual firms provide information that shows their products to best advantage, which may contradict what is provided about the product by another firm or government agency. Individual consumers do not have the resources to determine easily the completeness of any firm's messages, particularly in light of the size of food industry advertising budgets. Government rules confound this problem because there is also little coherence between the parts of government that have responsibility for point of purchase, advertising rules, and labelling. The healthy eating messages of health departments are often competing with contradictory messages permitted by the regulatory framework of other arms of government. Investments in programs that successfully promote environmental stewardship in agriculture are undercut in the market because consumers cannot support those efforts with their dollars. This problem exists despite the emergence of "citizen-consumers" who have a broader approach to food purchasing than individual maximization. Only recently have some health professionals and

sustainable agriculture proponents turned their attention to these factors and designed interventions that take them into account.

The rapid growth and co-option of the local agriculture movement highlights a need to deepen connections to place-based culture. Selection of plant varieties specifically adapted to regional production and end-use is an important component of building a resilient food system. Doing so will facilitate a defetishization of food systems by increasing the cultural connection to production and consumption. Today's dominant model of plant breeding relies on selection for centralized production and end-use, thereby limiting opportunity for regional differentiation. On the other hand, end-user-driven selection of heirloom varieties with strong cultural and culinary significance may limit productivity while failing to promote continued advances in end-use quality. Farmer-based selection may directly reflect local food culture; however, increasing genetic gains may require increased exchange of germplasm, and collaboration with trained plant breeders. Participatory farmer–breeder–chef collaborations are an emerging model for overcoming these limitations and adding the strength of culturally based plant breeding to the alternative food movement. These models of variety selection are examined in chapter 6 within the context of small grain and dry bean production in Western Washington.

The primary purpose of chapter 7 is to examine the factors that influence earned income of organic farmers explicitly incorporating farmer decisions to engage in local selling. The stochastic frontier model identifies role model producers who are the most technically efficient in achieving the maximum output that is feasible with a given set of inputs along with farm and demographic factors that enhance efficiency. Organic earnings equations that control for producer and farm characteristics reveal that organic farmers who are involved in local sales achieve lower earnings. Producer involvement in local sales has little impact on observed technical efficiency on organic farms.

Part 4 addresses another important aspect of this topic, the role of organic farming along the producers and consumer dimensions.

Regulatory standards and certification models are essential tools guaranteeing the authenticity of organic products. In particular, third-party certification is useful to consumers since it provides guarantees regarding production processes and food quality. In an attempt to cope with the costs and bureaucratic procedures related to the adoption of such certification, groups of small producers have begun to rely upon alternative quality assurance systems such as Participatory Guarantee Systems (PGS). Chapter 8 contextualizes and analyzes the PGS scheme and describes the Brazilian Rede Ecovida de Agroecologia

network. Sacchi and her colleagues then investigate the effect of various factors on Brazilian consumers' purchasing behavior for organic products guaranteed by PGS. The results show that employed and older consumers who live in rural.

In chapter 9, resource use and environmental impacts of a small-scale low-input organic vegetable supply system in the United Kingdom were assessed by emergy accounting and Life Cycle Assessment (LCA). The system consisted of a farm with high crop diversity and a related box-scheme distribution system. Markussen and colleagues compared empirical data from this case system with two modeled organic food supply systems representing high- and low-yielding practices for organic vegetable production. Further, these systems were embedded in a supermarket distribution system and they provided the same amount of comparable vegetables at the consumers' door as the case system. The on-farm resource use measured in solar equivalent Joules (seJ) was similar for the case system and the high-yielding model system and higher for the low-yielding model system. The distribution phase of the case system was at least three times as resource efficient as the models and had substantially less environmental impacts when assessed using LCA. The three systems ranked differently for emissions with the high-yielding model system being the worst for terrestrial ecotoxicity and the case system the worst for global warming potential. As a consequence of being embedded in an industrial economy, about 90% of resources (seJ) were used for supporting labor and service.

Demand for organically produced food products is increasing rapidly in North America, driven by a perception that organic agriculture results in fewer negative environmental impacts and yields greater benefits for human health than conventional systems. Despite the increasing interest in organic grain production on the Canadian Prairies, a number of challenges remain to be addressed to ensure its long-term sustainability. In chapter 10, Snyder and Spaner summarize Western Canadian research into organic crop production and evaluate its agronomic, environmental, and economic sustainability.

Finally, Part 5 provides chapters that consider the future of farming and the aspects missing from sustainable agriculture today.

Increasing concerns about global environmental change and food security have focused attention on the need for environmentally sustainable agriculture. This is agriculture that makes efficient use of natural resources and does not degrade the environmental systems that underpin it, or deplete natural capital stocks. In chapter 11, Dicks and her colleagues convened a group of 29 "practitioners" and 17 environmental scientists with direct involvement or expertise in the environmental sustainability of agriculture. The practitioners included

representatives from UK industry, non-government organizations and government agencies. The authors collaboratively developed a long list of 264 knowledge needs to help enhance the environmental sustainability of agriculture within the UK or for the UK market. The authors then refined and selected the most important knowledge needs through a three-stage process of voting, discussion and scoring. Scientists and practitioners identified similar priorities. Finally, the authors present the 26 highest priority knowledge needs. Many of them demand integration of knowledge from different disciplines to inform policy and practice. The top five are about sustainability of livestock feed, trade-offs between ecosystem services at farm or landscape scale, phosphorus recycling and metrics to measure sustainability. The outcomes will be used to guide ongoing knowledge exchange work, future science policy and funding.

Researchers have put forward agricultural biotechnology as one possible tool for increasing food production and making agriculture more sustainable. In chapter 12, Björnberg and her colleagues investigated how key actors in the Swedish food supply chain perceive the concept of agricultural sustainability and the role of biotechnology in creating more sustainable agricultural production systems. Based on policy documents and semi-structured interviews with representatives of five organizations active in producing, processing and retailing food in Sweden, an attempt is made to answer these three questions: How do key actors in the Swedish food supply chain define and operationalize the concept of agricultural sustainability? Who/what influences these organizations' sustainability policies and their respective positions on agricultural biotechnology? What are the organizations' views and perceptions of biotechnology and its possible role in creating agricultural sustainability? Based on collected data, the authors conclude that, although there is a shared view of the core constituents of agricultural sustainability among the organizations, there is less explicit consensus on how the concept should be put into practice or what role biotechnology can play in furthering agricultural sustainability.

Finally, agriculture is considered to be "climate-smart" when it contributes to increasing food security, adaptation and mitigation in a sustainable way. This new concept now dominates current discussions in agricultural development because of its capacity to unite the agendas of the agriculture, development and climate change communities under one brand. In the opinion piece in chapter 13, authored by scientists from a variety of international agricultural and climate research communities, Neufeldt and his colleagues argue that the concept needs to be evaluated critically because the relationship between the three dimensions is poorly understood, such that practically any improved agricultural practice

can be considered climate-smart. This lack of clarity may have contributed to the broad appeal of the concept. From the understanding that we must hold ourselves accountable to demonstrably better meet human needs in the short and long term within foreseeable local and planetary limits, we develop a conceptualization of climate-smart agriculture as agriculture that can be shown to bring us closer to safe operating spaces for agricultural and food systems across spatial and temporal scales. Improvements in the management of agricultural systems that bring us significantly closer to safe operating spaces will require transformations in governance and use of our natural resources, underpinned by enabling political, social and economic conditions beyond incremental changes. Establishing scientifically credible indicators and metrics of long-term safe operating spaces in the context of a changing climate and growing social-ecological challenges is critical to creating the societal demand and political will required to motivate deep transformations. Answering questions on how the needed transformational change can be achieved will require actively setting and testing hypotheses to refine and characterize our concepts of safer spaces for social-ecological systems across scales. This effort will demand prioritizing key areas of innovation, such as (1) improved adaptive management and governance of social-ecological systems; (2) development of meaningful and relevant integrated indicators of social-ecological systems; (3) gathering of quality integrated data, information, knowledge and analytical tools for improved models and scenarios in time frames and at scales relevant for decision-making; and (4) establishment of legitimate and empowered science policy dialogues on local to international scales to facilitate decision making informed by metrics and indicators of safe operating spaces.

PART 1
What Is Sustainable Agriculture?

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CHAPTER 1

Sustainable Agriculture: The Basics

Mary V. Gold

Some terms defy definition. "Sustainable agriculture" has become one of them. In such a quickly changing world, can anything be sustainable? What do we want to sustain? How can we implement such a nebulous goal? Is it too late? With the contradictions and questions have come a hard look at our present food production system and thoughtful evaluations of its future. If nothing else, the term "sustainable agriculture" has provided "talking points," a sense of direction, and an urgency, that has sparked much excitement and innovative thinking in the agricultural world.

The word "sustain," from the Latin *sustinere* (*sus-*, from below and *tenere*, to hold), to keep in existence or maintain, implies long-term support or permanence. As it pertains to agriculture, sustainable describes farming systems that are "capable of maintaining their productivity and usefulness to society indefinitely. Such systems... must be resource-conserving, socially supportive, commercially competitive, and environmentally sound." [John Ikerd, as quoted by Richard Duesterhaus in "Sustainability's Promise," Journal of Soil and Water Conservation (Jan.-Feb. 1990) 45(1): p.4. NAL Call # 56.8 J822]

"Sustainable agriculture" was addressed by Congress in the 1990 "Farm Bill" [Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA), Public Law 101-624, Title XVI, Subtitle A, Section 1603 (Government Printing Office, Washington, DC, 1990) NAL Call # KF1692.A31 1990]. Under that law, "the

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term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- satisfy human food and fiber needs;
- enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- sustain the economic viability of farm operations; and
- enhance the quality of life for farmers and society as a whole."

1.1 SOME BACKGROUND

How have we come to reconsider our food and fiber production in terms of sustainability? What are the ecological, economic, social and philosophical issues that sustainable agriculture addresses?

The long-term viability of our current food production system is being questioned for many reasons. The news media regularly present us with the paradox of starvation amidst plenty—including pictures of hungry children juxtaposed with supermarket ads. Possible adverse environmental impacts of agriculture and increased incidence of food-borne illness also demand our attention. "Farm crises" seem to recur with regularity.

The prevailing agricultural system, variously called "conventional farming," "modern agriculture," or "industrial farming" has delivered tremendous gains in productivity and efficiency. Food production worldwide has risen in the past 50 years; the World Bank estimates that between 70 percent and 90 percent of the recent increases in food production is the result of conventional agriculture rather than greater acreage under cultivation. U.S. consumers have come to expect abundant and inexpensive food.

Conventional farming systems vary from farm to farm and from country to country. However, they share many characteristics: rapid technological innovation; large capital investments in order to apply production and management technology; large-scale farms; single crops/row crops grown continuously over many seasons; uniform high-yield hybrid crops; extensive use of pesticides, fertilizers, and external energy inputs; high labor efficiency; and dependency on agribusiness. In the case of livestock, most production comes from confined, concentrated systems.

Philosophical underpinnings of industrial agriculture include assumptions that "a) nature is a competitor to be overcome; b) progress requires unending evolution of larger farms and depopulation of farm communities; c) progress is measured primarily by increased material consumption; d) efficiency is measured by looking at the bottom line; and e) science is an unbiased enterprise driven by natural forces to produce social good." [Karl N. Stauber et al., "The Promise of Sustainable Agriculture," in Planting the Future: Developing an Agriculture that Sustains Land and Community, Elizabeth Ann R. Bird, Gordon L. Bultena, and John C. Gardner, editors (Ames: Iowa State University Press, 1995), p.13. NAL Call # S441 P58 1995]

Both positive and negative consequences have come with the bounty associated with industrial farming. Some concerns about contemporary agriculture are presented below. They are drawn from the resources compiled at the end of this chapter. While considering these concerns, keep the following in mind: a) interactions between farming systems and soil, water, biota, and atmosphere are complex—we have much to learn about their dynamics and long term impacts; b) most environmental problems are intertwined with economic, social, and political forces external to agriculture; c) some problems are global in scope while others are experienced only locally; d) many of these problems are being addressed through conventional, as well as alternative, agricultural channels; e) the list is not complete; and f) no order of importance is intended.

1.2 ECOLOGICAL CONCERNS

Agriculture profoundly affects many ecological systems. Negative effects of current practices include the following:

Decline in soil productivity can be due to wind and water erosion of exposed topsoil; soil compaction; loss of soil organic matter, water holding capacity, and biological activity; and salinization of soils and irrigation water in irrigated farming areas. Desertification due to overgrazing is a growing problem, especially in parts of Africa.

Agricultural practices have been found to contribute to non-point source water pollutants that include: sediments, salts, fertilizers (nitrates and phosphorus), pesticides, and manures. Pesticides from every chemical class have been detected in groundwater and are commonly found in groundwater beneath agricultural areas; they are widespread in the nation's surface waters. Eutrophication

and "dead zones" due to nutrient runoff affect many rivers, lakes, and oceans. Reduced water quality impacts agricultural production, drinking water supplies, and fishery production.

Water scarcity in many places is due to overuse of surface and ground water for irrigation with little concern for the natural cycle that maintains stable water availability.

Other environmental ills include over 400 insects and mite pests and more than 70 fungal pathogens that have become resistant to one or more pesticides; stresses on pollinator and other beneficial species through pesticide use; loss of wetlands and wildlife habitat; and reduced genetic diversity due to reliance on genetic uniformity in most crops and livestock breeds.

Agriculture's link to global climate change is just beginning to be appreciated. Destruction of tropical forests and other native vegetation for agricultural production has a role in elevated levels of carbon dioxide and other greenhouse gases. Recent studies have found that soils may be sources or sinks for greenhouse gases.

1.3 ECONOMIC AND SOCIAL CONCERNS

Economic and social problems associated with agriculture cannot be separated from external economic and social pressures. As barriers to a sustainable and equitable food supply system, however, the problems may be described in the following way:

Economically, the U.S. agricultural sector includes a history of increasingly large federal expenditures and corresponding government involvement in planting and investment decisions; widening disparity among farmer incomes; and escalating concentration of agribusiness—industries involved with manufacture, processing, and distribution of farm products—into fewer and fewer hands. Market competition is limited. Farmers have little control over farm prices, and they continue to receive a smaller and smaller portion of consumer dollars spent on agricultural products.

Economic pressures have led to a tremendous loss of farms, particularly small farms, and farmers during the past few decades—more than 155,000 farms were lost from 1987 to 1997. This contributes to the disintegration of rural communities and localized marketing systems. Economically, it is very difficult for potential farmers to enter the business today. Productive farmland also has been

pressured by urban and suburban sprawl—since 1970, over 30 million acres have been lost to development.

1.4 IMPACTS ON HUMAN HEALTH

As with many industrial practices, potential health hazards are often tied to farming practices. Under research and investigation currently is the sub-therapeutic use of antibiotics in animal production, and pesticide and nitrate contamination of water and food. Farmer worker health is also a consideration in all farming practices.

1.5 PHILOSOPHICAL CONSIDERATIONS

Historically, farming played an important role in our development and identity as a nation. From strongly agrarian roots, we have evolved into a culture with few farmers. Less than two percent of Americans now produce food for all U.S. citizens. Can sustainable and equitable food production be established when most consumers have so little connection to the natural processes that produce their food? What intrinsically American values have changed and will change with the decline of rural life and farmland ownership?

World population continues to grow. According to recent United Nations population projections, the world population will grow from 5.7 billion in 1995 to 9.4 billion in 2050, 10.4 billion in 2100, and 10.8 billion by 2150, and will stabilize at slightly under 11 billion around 2200. The rate of population increase is especially high in many developing countries. In these countries, the population factor, combined with rapid industrialization, poverty, political instability, and large food imports and debt burden, make long-term food security especially urgent.

Finally, the challenge of defining and dealing with the problems associated with today's food production system is inherently laden with controversy and emotion. "It is unfortunate, but true, that many in the agriculture community view sustainable agriculture as a personal criticism, or an attack, on conventional agriculture of which they are justifiably proud. <I guess that the main thing people get defensive about when you say sustainable,' explained one agent, 'is that it implies that what they've been doing is not sustainable. And that's the biggest issue.'" [Judy Green, "Sustainable Agriculture: Why Green Ideas Raise a Red Flag," Farming Alternatives Newsletter (Cornell) (Summer 1993).

1.6 A SAMPLING OF PERSPECTIVES

"It's easy to understand why key individuals and organizations in agriculture have flocked to this term. After all, who would advocate a 'non-sustainable agriculture?'" [Charles A. Francis, "Sustainable Agriculture: Myths and Realities," Journal of Sustainable Agriculture (1990) 1(1): p.97. NAL Call # S494.5.S86S8] Despite the appeal of a sustainable agriculture philosophy, however, discussions about how best to define and achieve sustainability present some controversy. Supporters of sustainable agriculture come from diverse backgrounds, academic disciplines, and farming practices. Their convictions as to what elements are acceptable or not acceptable in a sustainable farming system sometimes conflict. They also disagree on whether sustainable agriculture needs defining at all.

"Wes Jackson, geneticist and co-founder of the Land Institute, was probably the first to use the term 'sustainable agriculture' in recent times (Jackson, 1978) ["Toward a Sustainable Agriculture," Not Man Apart, p. 4-6. Friends of the Earth, 1978]. Since natural ecosystems have stood the test of time, Jackson argued, they should serve as models for sustainable agriculture." [Greg McIsaac, Sustainable Ag. Definition (SANET-mg post, March 1994). Available at SANET-mg Archives Website: http://www.sare.org/sanet-mg/archives/html-home/4-html/0101.html (8/23/07)]

"Sustainable agriculture is a philosophy based on human goals and on understanding the long-term impact of our activities on the environment and on other species. Use of this philosophy guides our application of prior experience and the latest scientific advances to create integrated, resource-conserving, equitable farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and long term, and maintain stable rural communities and quality of life." [Charles Francis and Garth Youngberg, "Sustainable Agriculture — An Overview," in Sustainable Agriculture in Temperate Zones, edited by C.A. Francis, C.B. Flora and L.D. King (New York: Wiley, 1990), p.8. NAL Call # S494.5.S86S87]

"Sustainable agriculture does not mean a return to either the low yields or poor farmers that characterized the 19th century. Rather, sustainability builds on current agricultural achievements, adopting a sophisticated approach that can maintain high yields and farm profits without undermining the resources on

which agriculture depends." ["Frequently Asked Questions About Sustainable Agriculture," in Sustainable Agriculture–A New Vision (Union of Concerned Scientists, 1999). Available at UCS Website: http://www.ucsusa.org/food_and_environment/sustainable_food/questions-about-sustainable-agriculture.html (8/23/07)]

"A systems approach is essential to understanding sustainability. The system is envisioned in its broadest sense, from the individual farm, to the local ecosystem, and to communities affected by this farming system both locally and globally… A systems approach gives us the tools to explore the interconnections between farming and other aspects of our environment." [University of California Sustainable Agriculture Research and Education Program (SAREP), What Is Sustainable Agriculture? (SAREP, 1998). Available at SAREP Website: http://www.sarep.ucdavis.edu/concept.htm (8/23/07)]

"Environmental sustainability implies the following:

- meeting the basic needs of all peoples, and giving this priority over meeting the greeds of a few
- keeping population densities, if possible, below the carrying capacity of the region
- adjusting consumption patterns and the design and management of systems to permit the renewal of renewable resources
- conserving, recycling, and establishing priorities for the use of nonrenewable resources
- keeping environmental impact below the level required to allow the systems affected to recover and continue to evolve.

"An environmentally sustainable agriculture is one that is compatible with and supportive of the above criteria." [Stuart B. Hill, Environmental Sustainability and the Redesign of Agroecosystems (Ecological Agriculture Projects (EAP), McGill University, 1992). Available at EAP Website: http://eap.mcgill.ca/publications/EAP34.htm (2/24/2009)] Dr. Hill goes on to explain: "To help recognize these real issues I distinguish between shallow (short-term, symbolic) and deep (long-term, fundamental) sustainability. Shallow sustainability focuses on efficiency and substitution strategies with respect to the use of resources. It usually accepts the predominant goals within society without question, and aims to solve problems by means of curative solution. Deep sustainability, in contrast, re-evaluates goals in relation to higher values and redesigns the systems involved in achieving these goals to that this can be done within ecological limits." [Ibid.]

Sustainable agriculture is "a way of practicing agriculture which seeks to optimize skills and technology to achieve long-term stability of the agricultural enterprise, environmental protection, and consumer safety. It is achieved through management strategies which help the producer select hybrids and varieties, soil conserving cultural practices, soil fertility programs, and pest management programs. The goal of sustainable agriculture is to minimize adverse impacts to the immediate and off-farm environments while providing a sustained level of production and profit. Sound resource conservation is an integral part of the means to achieve sustainable agriculture." [USDA Natural Resource Conservation Service (NRCS) General Manual (180-GM, Part 407). Available at USDA Website: http://www.info.usda.gov/default.aspx?l=176 Select Title 180; Part 407 - Sustainable Agriculture; Subpart A - General. (10/20/09)]

"Today, sustainable farming practices commonly include:

- crop rotations that mitigate weeds, disease, insect and other pest problems; provide alternative sources of soil nitrogen; reduce soil erosion; and reduce risk of water contamination by agricultural chemicals
- pest control strategies that are not harmful to natural systems, farmers, their neighbors, or consumers. This includes integrated pest management techniques that reduce the need for pesticides by practices such as scouting, use of resistant cultivars, timing of planting, and biological pest controls
- increased mechanical/biological weed control; more soil and water conservation practices; and strategic use of animal and green manures
- use of natural or synthetic inputs in a way that poses no significant hazard to man, animals, or the environment.

"This approach encompasses the whole farm, relying on the expertise of farmers, interdisciplinary teams of scientists, and specialists from the public and private sectors." [Paul F. O'Connell, "Sustainable Agriculture, a Valid Alternative," Outlook on Agriculture (1992) 21(1): p.6. NAL Call # 10 Ou8]

From NGO Sustainable Agriculture Treaty, Global Forum at Rio de Janeiro, June 1-15, 1992:

- "Sustainable agriculture is a model of social and economic organization based on an equitable and participatory vision of development which recognizes the environment and natural resources as the foundation of economic activity. Agriculture is sustainable when it is ecologically sound,

economically viable, socially just, culturally appropriate and based on a holistic scientific approach.

- "Sustainable agriculture preserves biodiversity, maintains soil fertility and water purity, conserves and improves the chemical, physical and biological qualities of the soil, recycles natural resources and conserves energy. Sustainable agriculture produces diverse forms of high quality foods, fibers and medicines.
- "Sustainable agriculture uses locally available renewable resources, appropriate and affordable technologies and minimizes the use of external and purchased inputs, thereby increasing local independence and self sufficiency and insuring a source of stable income for peasants, family and small farmers and rural communities. This allows more people to stay on the land, strengthens rural communities and integrates humans with their environment.
- "Sustainable agriculture respects the ecological principles of diversity and interdependence and uses the insights of modern science to improve rather than displace the traditional wisdom accumulated over centuries by innumerable farmers around the world." [These excerpts are from NGO Sustainable Agriculture Treaty (Global Forum at Rio de Janeiro, June 1-15, 1992). Available at Information Habitat Website: http://habitat.igc.org/treaties/at-20.htm (8/23/07]
- "Sustainable agriculture does not refer to a prescribed set of practices. Instead, it challenges producers to think about the long-term implications of practices and the broad interactions and dynamics of agricultural systems. It also invites consumers to get more involved in agriculture by learning more about and becoming active participants in their food systems. A key goal is to understand agriculture from an ecological perspective—in terms of nutrient and energy dynamics, and interactions among plants, animals, insects and other organisms in agroecosystems—then balance it with profit, community and consumer needs."

[Sustainable Agriculture Research and Education (SARE), Exploring Sustainability in Agriculture: Ways to Enhance Profits, Protect the Environment and Improve Quality of Life." (SARE, 1997). Available at SARE Website: http://www.sare.org/publications/exploring.htm (8/23/07)]

"Sustainable agriculture: A whole-systems approach to food, feed, and other fiber production that balances environmental soundness, social equity, and economic viability among all sectors of the public, including international and

intergenerational peoples. Inherent in this definition is the idea that sustainability must be extended not only globally, but indefinitely in time, and to all living organisms including humans.

"Sustainable agroecosystems:

- maintain their natural resource base
- rely on minimum artificial inputs from outside the farm system
- manage pests and diseases through internal regulating mechanisms
- recover from the disturbances caused by cultivation and harvest."

[Stephen R. Gliessman, "An Ecological Definition of Sustainable Agriculture," Principles of Agroecology and Sustainability (1998). Available at Agroecology Home Website: http://agroecology.org/Principles_Def.html (6/9/08)]

"Consumers can play a critical role in creating a sustainable food system. Through their purchases, they send strong messages to producers, retailers and others in the system about what they think is important. Food cost and nutritional quality have always influenced consumer choices. The challenge now is to find strategies that broaden consumer perspectives, so that environmental quality, resource use, and social equity issues are also considered in shopping decisions. At the same time, new policies and institution must be created to enable producers using sustainable practices to market their goods to a wider public." [University of California Sustainable Agriculture Research and Education Program (SAREP), What Is Sustainable Agriculture? (SAREP, 1998). Available at SAREP Website: http://www.sarep.ucdavis.edu/concept.htm (8/23/07)]

"… I think the community has reached about as explicit, useful, concrete a definition of sus ag [sic] as now possible, or possible at any given time, given the differences of opinion, world view, etc., that exist. At any point in time, in any society, the definition of any concept like sus ag is going to be a compromise among differing world views, sets of values, etc. no one of which has any way to prove the other wrong, or illegitimate. So the sus ag tent is now relatively stable; its shape and innards perhaps fully pleasing to no one, but I am certain there is no real point in debating the fine points anymore because we will simply document more crisply the differences that are out there, and have been all along…. One of the other realities is that the 'definition' of something like sus ag is going to remain fluid, driven by changes in politics, ideology, science, community values, etc." [Charles Benbrook, More Soil Quality and Def. (SANET-mg post,

Feb. 1995). Available at SANET-mg Archives Website: http://www.sare.org/sanet-mg/archives/html-home/7-html/0080.html (8/23/07)]

"I concluded some time ago that we didn't need to spend much more time and effort attempting to define sustainability. We have sufficient commonality among our different understandings of it to continue moving in the right general direction, even if we are not yet all moving toward precisely the same destination by the same route. More recently, I have come to the conclusion that we may never have a generally accepted definition of sustainability, and perhaps, we don't need one." [John Ikerd, On Not Defining Sustainability (SANET-mg post, May 1998). Available at SANET-mg Archives Website: http://www.sare.org/sanet-mg/archives/html-home/25-html/0203.html (8/23/07)]

"'Sustainability' is at once extremely important and practically useless. It consists of a set of concepts which are fundamentally different in nature. That is why there has been no success in attempt to identify THE definition of sustainability. There can be no satisfactory definition which is not multifaceted. This poses serious difficulties for the practical application of sustainability as an objective in real decision-making. We have suggested here that these difficulties be addressed by focusing on the particular aspects of sustainability which the decision maker considers to be important, and presenting information about the trade offs between these aspects within a multiple criteria decision making formula." [David J. Pannell and Steven Schilizzi, "Sustainable Agriculture: A Matter of Ecology, Equity, Economic Efficiency or Experience?" Journal of Sustainable Agriculture (1999) 13(4): p.65. NAL Call #: S494.5 S86S8]

1.7 THE FUTURE OF THE SUSTAINABLE AGRICULTURE CONCEPT

Many in the agricultural community have adopted the sense of urgency and direction pointed to by the sustainable agriculture concept. Lack of sharp definition has not lessened its authenticity. Sustainability has become an integral component of many government, commercial, and non-profit agriculture research efforts, and it is beginning to be woven into agricultural policy. Increasing numbers of farmers and ranchers have embarked on their own paths to sustainability, incorporating integrated and innovative approaches into their own enterprises.

This just-do-it attitude is the real force carrying the issue of sustainability into the next century. "The best way to communicate the meaning of sustainable agriculture is through real-life stories of farmers who are developing sustainable farming systems on their own farms," says John Ikerd, describing the 1,000 Ways to Sustainable Farming project funded by USDA's Sustainable Agriculture Research and Education Program. The project sought to explore and refine the definition of sustainable agriculture by profiling successful sustainable farmers and ranchers." SARE continued the project, renaming it The New American Farmer. "In addition to describing successful farming practices, the features in The New American Farmer detail the effects of those practices on farm profitability, quality of life, rural communities and the environment." [see The New American Farmer: Profiles of Agricultural Innovation, 2nd ed. (SARE, 2005). Available at SARE Website: http://www.sare.org/publications/naf.htm (8/23/07)]

Critical discussion of the sustainable agriculture concept will and should continue. Understanding will deepen; answers will continue to come. On-going dialog is important for another reason: with more parties, each with its own agenda, jumping into the sustainable agriculture "tent," only a continued focus on the real issues and goals will keep sustainable agriculture from becoming so all-encompassing as to become meaningless.

Youngberg and Harwood's 1989 statement still holds true: "We are yet a long way from knowing just what methods and systems in diverse locations will really lead to sustainability... In many regions of the country, however, and for many crops, the particular mix of methods that will allow curtailing use of harmful farm chemicals or building crop diversity, while also providing economic success, are not yet clear. The stage is set for challenging not only farm practitioners, but also researchers, educators, and farm industry." [Garth Youngberg and Richard Harwood, "Sustainable Farming Systems: Needs and Opportunities," American Journal of Alternative Agriculture (1989) 4(3 & 4): p.100. NAL Call # S605.5.A3]

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